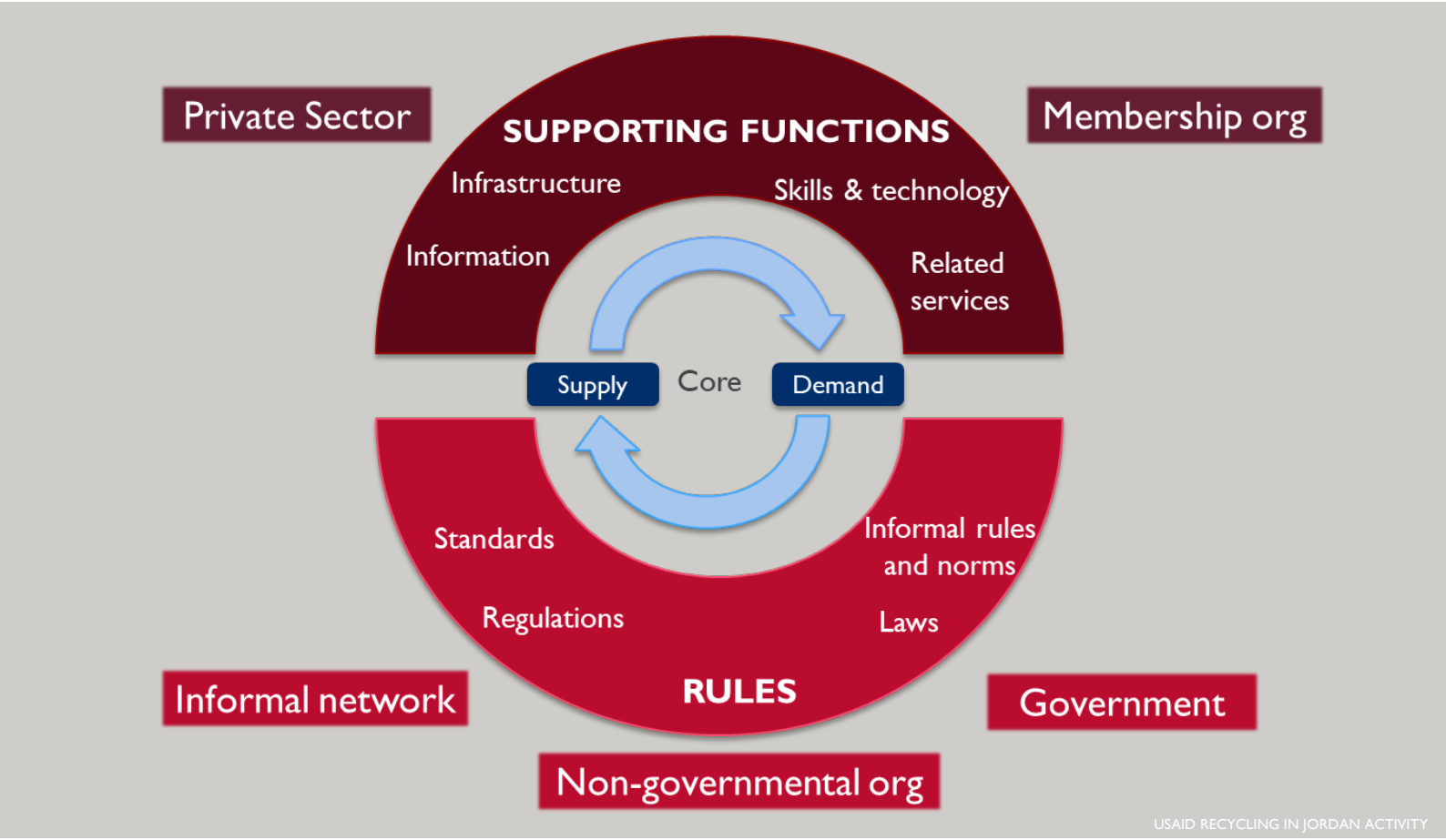

USAID RECYCLING IN JORDAN ACTIVITY

USAID RECYCLING IN JORDAN

MARKET SYSTEMS ANALYSIS

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CONTENT

1 INTRODUCTION

The Recycling in Jordan Activity is a five-year program funded by the United States Agency for International Development (USAID). The Activity is working together with Amman's commercial sector waste generators, private sector recycling service providers, the Ministry of Environment (MOENV), the Greater Amman Municipality (GAM), and relevant business associations to increase the commercial sector's demand for and use of recycling services in Amman through implementing innovative and sustainable solutions and models. Applying a Market Systems Development[1] approach, the Activity has three strategic objectives as follows:

- Expand the private sector-led recycling markets in Amman and improve performance and profitability of private sector service providers,
- Increase demand for recycling services by the commercial sector in Amman (non-residential waste generators), and
- Improve the business enabling environment for recycling services and markets in Amman.

These objectives were operationalized and embedded in a very detailed Market Systems Assessment (MSA) conducted during Year1 of the Activity. The findings and conclusions drawn from this assessment process have both defined the parameters within which the Activity has been working to date as well as informing its intervention priorities and design considerations through helping to identify and inform:

- Sectors (are we working in the right sectors): ranking and selecting priority sectors best of their alignment with Activity objectives.
- Constraints (what should we be working on): identifying and prioritizing 'binding' constraints impeding sector performance in respect of Activity objectives and results framework.
- Opportunities (how should we be working): using 'root cause' analysis to generate insights into underlying systemic barriers used to inform innovation need and intervention design.
- Partnerships (who should we be working with): applying a highly 'inclusive and participatory' approach to the MSA to help inform 'who' the Activity might seek to work with, and 'how' the Activity might best structure any engagement.

2 OBJECTIVES AND OUTPUTS

After two and a half years of implementation the Activity has determined to revisit the original MSA and to repeat a similar level of market assessment. Ultimately, this work aims to respond to the following leading questions:

- **Are we 'doing the right things', through reflection of:**
  - Are we still working in the right sectors, and
  - Are we still working on the right constraints and stakeholder priorities?
- **Are we 'doing things right', through reflection of:**
  - Intervention design: are we innovating the right things?
  - Intervention management: are we managing for sustainability and scale?

This is expanded on further in **Figure 1**:

[1] https://beamexchange.org/market-systems/video/

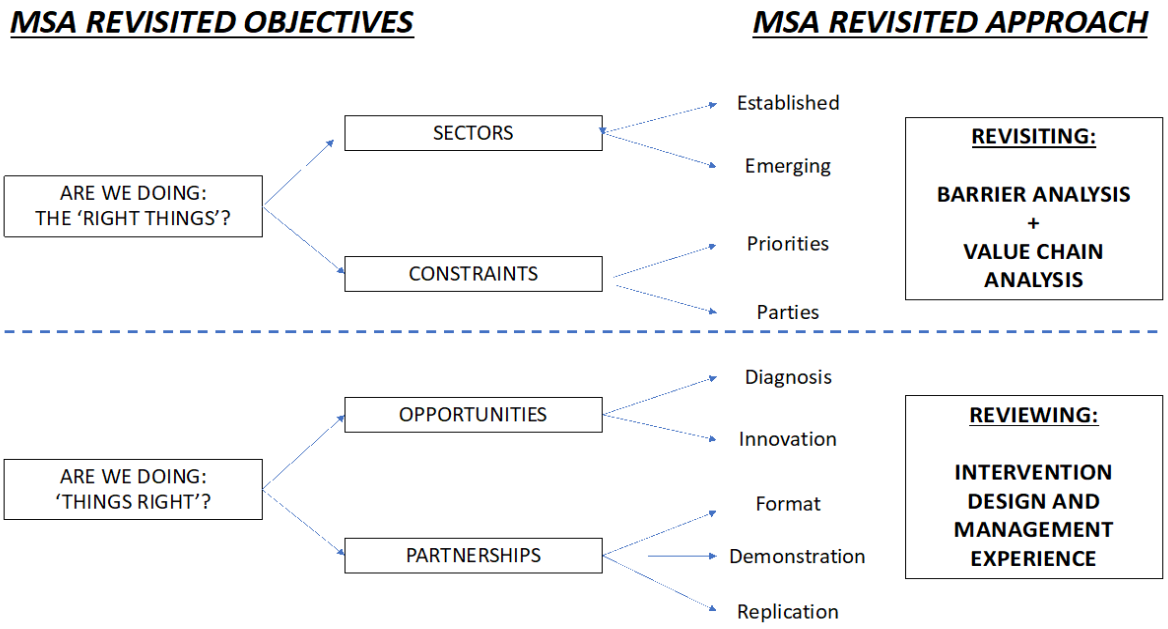

Figure 1: MSA Revisited Objectives and Approach Summary

As shown above, there are three primary outputs associated with this MSA Revisited exercise:

- **Summary Report:** This report serves the purpose of addressing the key questions outlined above. It takes a retrospective approach, reflecting on the analysis and actions that have been undertaken thus far. Furthermore, it assesses the need for updates and improvements to the leading questions as we move forward. The report aims to provide an indicative rather than exhaustive overview and serves as input and guidance for the Activity's upcoming work planning processes.
- **Stakeholder Identification and Mapping:** this presents the findings of the stakeholders' identification and mapping exercise the Activity conducted for the SWM and recycling sector in Jordan as a part of updating the original 2020 MSA. The purpose of this report is to have a clear understanding of each stakeholder in terms of category, role, interest, influence, or power, and to assess their interactions and relationships. Please see **Annex I** for more details.
- **Value Chain Analysis (VCA):** this is a mid-line update to the VCA undertaken as integral research to the original MSA and associated Activity planning. Like the Barrier Analysis report, it serves as both a technical annex to this Summary Report and a stand-alone foundational resource containing rich data which can be referred to as needed by the team for various purposes moving forward. Please see **Annex II** for more details.
- **Barrier Analysis:** this is a mid-line update to the barrier analysis undertaken as integral research to the original MSA and associated Activity planning. It serves as both a technical annex to this Summary Report and a stand-alone foundational resource containing rich data which can be referred to as needed by the team for various purposes moving forward. Please see **Annex III** for more details.

Consistent with its purpose the remainder of this Summary Report is structured in two parts as follows:

- Part 1: Are we doing the right things?
- Part 2: Are we doing things, right?

Each Part will consider issues of approach and method and present emerging findings and conclusions.

3 PART 1: ARE WE DOING THE RIGHT THINGS?

As shown in **Figure 2**, this part of the report seeks to answer the following questions:

- Are we still working in the right sectors, and
- Are we still working on the right constraints and stakeholder priorities?

It draws on data and insights emerging from the mid-line repeat of the Value Chain Analysis and Barrier Analysis research.

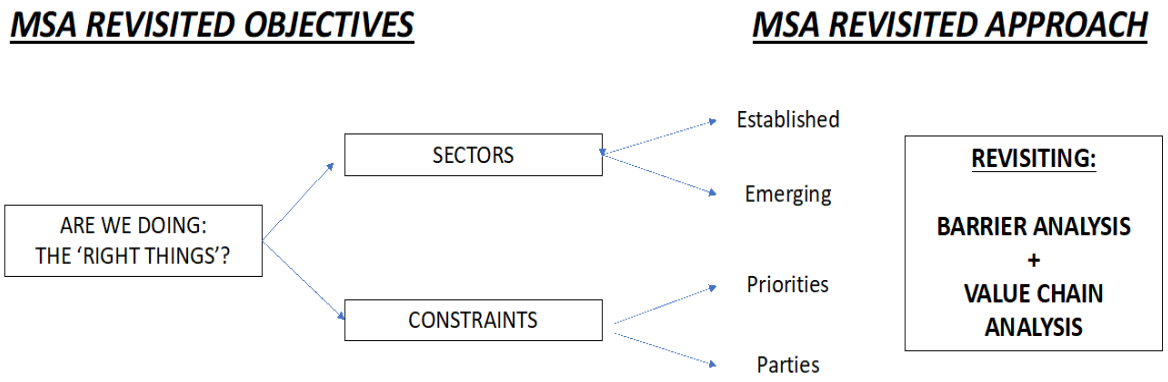

Figure 2: Objective and Approach to Doing the Right Thing

3.1 Approach and Methods

The methods used for both the VCA and Barrier Analysis are totally consistent with the methods used in the original MSA but were applied in slightly different ways as confirmed below.

Value Chain Analysis (VCA)

Following best practices in value chain analysis, this study utilized some data tools (i.e., key informant interviews).

These tools and investigative process were carefully structured to offer detailed insights and perspective on the following dimensions and dynamics:

- Vertical relationships: looking to understand the processes – or value-added functions – through which products flow from input markets (i.e., raw materials and generation) to output markets (i.e., final products and consumption). What are they? Who is involved? What does transformation look like? What are the differentials between input and output prices, and value addition? This also offers a focus on end-markets / buyers and issues of alternatives / competition as well as competitiveness against these.
- Horizontal relationships: looking within each function in the value chain helps to understand the nature of cooperation between different firms involved in the same type of activity. It also helps to distinguish between different business models used by those performing similar tasks (i.e., technologies, organization, skills, etc.).
- Wider system of supporting functions and rules: firms within the value chain also exist within a wider system of supporting markets – those that add value to the performance of firms in any given value chain and those that create policies, regulations, customs, and norms that influence participation and incentivize performance.
- Assessment of leverage potential: the purpose of value chain analysis is not just to understand what is happening and why. It is also to inform thinking about realizing latent potentials. In this

sense the process was focused also on identifying 'where' interventions might be required, and 'who' might support such interventions.

The original MSA considered a total of 16 distinct value chains across different sectors as confirmed in **Table 1**. These were all revisited under the Revisited MSA. A 'shallower' assessment was conducted across the Primary Sectors to consider any obvious comparative changes / developments since the original MSA was conducted. A deeper assessment was undertaken across the Secondary Sectors to consider opportunities for expanding the areas of Activity operation (see **Annex II** for the full report and findings).

Table 1: Primary and Secondary Order Value Chains of Interest

Primary Sectors - first order prioritization		Secondary Sectors – second order prioritization	
Plastics sector	High-Density Polyethylene (HDPE)	**Other waste Sectors**	PET
	Polyvinyl Chloride (PVC)		Used Cooking Oil
	Low-Density Polyethylene (LDPE)		Old tires and Rubber
	Polypropylene (PP)		E-waste
	Polystyrene (PS)		Wood/Furniture
	All plastics except PET		Textile
Paper/ Cardboard sector	Paper		Organic and Food Waste
	Cardboard		
Metals sector	Ferrous metals		
	Non-ferrous metals		

A representative sample of respondents from across each of these sectors were engaged through a series of Key Informant Interviews (KIIs). As shown in **Table 2**, a total of 22 KII's were conducted with respondents across the Primary Sectors, and 28 KII's with new respondents from the Secondary Sectors.

Table 2: VCA KIIs by Sector

Waste Sectors	KIIs
Plastics sector	10
Paper/ Cardboard sector	6
Metals sector	6
PET waste sector	6
Used Cooking Oil sector	3
Old tires and Rubber waste sector	4
E-waste sector	5
Wood/Furniture waste	3
Textile waste	5
Organic and Food Waste	2

The value chain research was undertaken by Activity staff, with the support and guidance of the Market Systems Development Expert. The main report (including primary value chain assessment summaries) is presented in **Annex II**.

Barrier Analysis

Whereas the VCA looks more 'widely' across the 'structure of economic organization' in the value chains of interest to the Activity, the Barrier Analysis looks more 'narrowly' and 'deeply' into a particular part of the value chain – commercial waste generators, recycling service providers (formal and informal) and the relationship between them.

The Activity is solely focused on commercial, rather than household-level waste generators. There are different types of commercial waste generator, displaying different levels of understanding and adoption of alternative waste disposal and recycling practices. If the recycling industry is to grow, and the volume of waste sent to landfill is to decrease, then these waste generators will need to improve their understanding, change their behaviors, and adopt the three R's principles; Reduce, Reuse and Recycle. To understand these challenges better, the Activity commissioned an assessment by Magenta (a delivery partner to Chemonics on this Activity) using their COM-B methodology. The COM-B model, shown in **Figure 3** below.

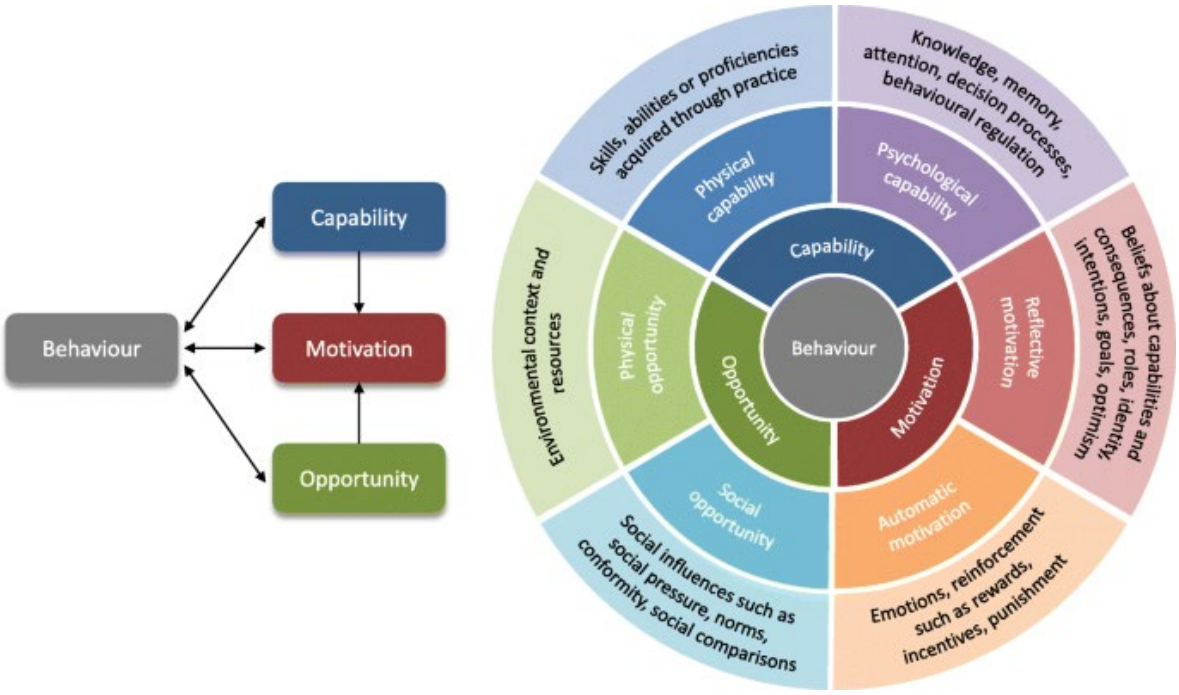

Figure 3: COM-B Behavioral Assessment Model

Similarly, to the original MSA, the revisited MSA targeted hypermarkets, restaurants, hotels, and malls. A total of eight respondents comprising both 'doers' and 'non-doers' (i.e., those who do some form of recycling and those who don't) from each sector were targeted as shown in **Table 3**.

Table 3: KIIs – Commercial Sectors

Sector	Number	Doers/Non-doers
Hotels	6	4 Doers, 2 Non-doers
Hypermarket	8	3 Doers, 5 Non-doers
Restaurants & Café	9	2 Doers, 7 Non-doers
Malls	9	3 Doers, 6 Non-doers

A total of 32 KIIs were conducted via telephone with the above sample respondents. These interviews targeted managers or staff members responsible for waste disposal in hotels, restaurants, cafes, malls, and hypermarkets in Amman, Jordan. Semi-structured discussion guides were used to assess behavioral determinants, intentions, potential barriers, and existing knowledge related to solid waste recycling. Furthermore, the aim was to gain insights into the experiences of commercial waste generators concerning the availability of recycling services, both formal and informal.

The Barrier Analysis research was outsourced to Magenta and overseen by Activity staff with the support of the Market Systems Development Expert. The main report is presented in **Annex III**.

3.2 Sectors – are we working in the right sectors?

In this section we consider the overall structure of the recycling market in Jordan and consider performance of specific value chains in respect of the three key Activity objectives of:

- Volume – sectors offering the largest 'diversion dividend'.
- Value – sectors offer the best market returns.
- Inclusion – sectors offering the strongest opportunities for participation and promotion particularly for more socially/economically excluded groups.

Following some narrative reflection on these points we revisit and reaffirm sector selection (made through applying a balanced scorecard appraisal of potential against Activity objectives as confirmed above).

3.2.1 Market Structure

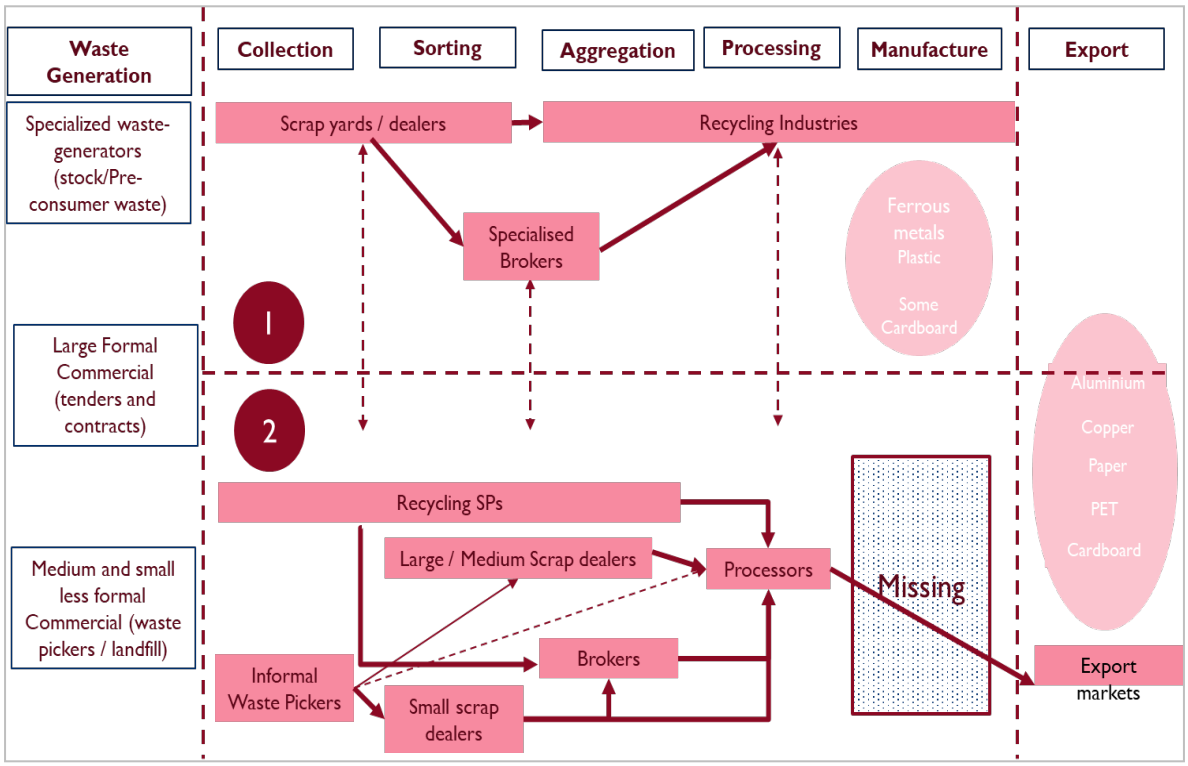

Figure 4: Overarching value chain map for prioritized sectors

As shown in **Figure 4**, there are still two primary channels in the recycling sectors of focus. These are:

1. **Domestic Channel:** This concerns ferrous metals, plastics (except PET), old tires, wood/furniture, and some paper/cardboard. This channel involves more domestic value addition, and hence is more quality conscious than the export channel. In response to such quality drivers, this channel is relatively more vertically integrated, formal and relationship based. Recycling industries is the term used to refer to manufacturers who also engage in processing and aggregation functions (see below). Through their relationships with scrap yards, middlemen, and dealers they source the bulk of their material inputs as 'off-cuts' from industrial manufacturing plants; and

through tenders / contracts for specialist clearance from large waste generators / demolition sites. This channel is not highly inclusive of informal waste pickers and/or itinerant buyers, and their role is minimal as individual suppliers for the collectors and sorters (i.e., small scrap yards and dealers) upstream of this domestic channel.

2. **Export Channel:** This concerns paper and cardboard, non-ferrous metals (e.g., aluminum, copper, precious metals), used cooking oil, E-waste, PET waste and processed textile waste. Value chains for which there is no domestic advanced processing or manufacturing capacity for higher value addition. These processes typically demand high volumes and intensive use of energy and water – all factors that Jordan is less competitive in compared to other countries in the region (e.g., Saudi Arabia and Egypt) or wider afield. This means that such products undergo only limited value addition – such things as sorting, grading, cleaning, shredding, bailing, and packaging, etc. – prior to being exported. However, the competitiveness of these value chains lies in more efficient sorting, cleaning, grading and aggregation functions further down the value chain and closer to (ideally 'at') the level of the waste generator. The cost of sorting large volumes of contaminated mixed waste is both inefficient and erodes 'quality' and hence the price of some products (e.g., paper). This channel is described as more of a 'networked' organization of looser and much wider sets of relationships. The sector is reliant on thousands of informal waste pickers (including many from more marginalized groups), who sell mixed waste to scrap yards or brokers they know. This network of scrap yards and brokers collaborate as they sort, grade, and sell to / buy from each other, in order to both specialize and aggregate as the product moves up through the value chain towards processing and ultimately export.

   The map and general descriptors given above have not changed from the original MSA. However, what is different is the greater understanding of the dynamics 'within' these given structures that the Activity is now more aware of and is being responsive to. For example, in the non-ferrous value chain, local processors have recognized the limited potential for heavy industries in Jordan. As a result, they have made significant investments in improving the quality of their recycled aluminum waste, aiming to gain a competitive edge in the global market. Within the PET value chain, numerous manufacturers have identified PET as a potential growth opportunity for expanding their businesses. They have embarked on initiatives to collect, sort, and process PET material for export purposes. However, intense competition from neighboring countries like Turkey and Egypt has prompted them to explore high-tech solutions to increase value addition and operational efficiency.

   According to the KIIs, new market entrants have emerged in the cooking oil and e-waste sectors. Their participation has the potential to enhance value addition in these respective value chains. Additionally, the sustained increase in global plastic prices has encouraged domestic processors and manufacturers to make greater investments in the plastic recycling sector.

   - **Relationships:** networking tends to be stronger between actors working within particular 'nodes' but this is not yet translating into increased levels of cooperation in response to clearly recognized common constraints. Relatively, networking across different 'nodes' tends to be weaker and is reflected in still low levels of formalization and integration. However, more formalization and integration are observed in those value chains that are bigger, more quality driven, and where growth (prices and volumes) opportunities are stronger and less volatile.

   - **Functions:** whilst the general categories of value-added functions remain valid, the Activity has learned much more the 'detail' of exactly how these functions are performed. This is allowing it to respond in two ways. Firstly, looking for 'differences and deviants' helping to spot 'best practices' and use these to improve intervention design and targeting. Secondly, through looking at how progressive changes in larger/faster growing value chains can inform and motivate changes in smaller and more emergent value chains (which are increasingly of interest to the Activity in the next two years).

   - **Actors:** understanding more about who are the 'leaders vs laggards' in various respects. For example, who tends to be more innovative and progressive, and who others tend to see

as 'key influencers' within their sector. Improved understanding here is helping the Activity to be more targeted and purposeful in their partner engagement and selection processes.

- **Inclusion:** as some chains are starting to formalize and integrate more there is both an opportunity and threat to inclusion interests. A threat is the potential displacement of waste pickers from certain value chains as more professional recycling service firms move 'downstream'. The opportunity (which the Activity is focused on) is twofold. Firstly, through helping to upskill and formalize waste pickers to a level where they could be included (as workers / subcontractors) by recycling service firms. Secondly, through helping to 'match' with job opportunities being created 'upstream' in growing processing/manufacturing enterprises.

3.2.2 Volumes

Whilst not linear or constant the volume of recycling material has been maintained and, in some cases, increasing since the original MSA. This is mainly driven by price inflation and opportunities created by the restarting of the global economy post-COVID. Whilst this is positive in the short term, continued growth is still being constrained by factors including:

- Value Addition: relatively low levels of value addition and customization.
- Technology: relatively low introduction of new / improved technologies.
- Closer End Markets: limited development of closer / local end markets (which can reduce volatility through exposure to global markets, and support integration and specialization through the value chains).

Some highlights of performance and changes in respect of volume in key value chains of interest include:

- **Plastics:** The research results showed increased volumes in plastics during the last two years indicating growing trends. About 70,000 tons/year of plastics locally recovered compared to 50,000 ton/year in 2020. This increase is attributed to increase in the material flow because of the prolonged increase of global oil prices and high prices of the virgin plastics.
- **Paper/cardboard:** The findings showed that the paper/cardboard has extremely growing trends during the last two years. The export amounts jumped from 100,000 tons/year to 180,000 tons/year due to considerable increase in the global prices.
- **Metals:** This sector has shown an increase in the volumes during the last two years but less than the plastics and Paper/cardboard because the domestic chain is well-developed and require for quantities more than the local supply. Imports of ferrous metals (iron and steel) noticeably increased in the last two years although no new industries entered the market. The imports increased from 70 thousand tons in 2019/2020 up to 150 thousand tons. For the non-ferrous metals, the exports also increased due to the extreme increase in global prices. Aluminum exports increased from 9,000 tons in 2020 up to 25,000 tons a year in 2022 while copper decreased from 14,000 tons to 4,500 tons a year. This is attributed to the strong global competition as Jordan have limited value additions as well as the low copper consumption due to COVID-19 shutdowns and restrictions.
- **PET waste sector:** The market estimates showed around 600 tons/year of post-consumer PET waste is being collected from unsegregated waste stream while around 3,000 tons of pre-consumer PET is collected from industrial sources. Most of these amounts are exported. The sector showed a progressive increasing in terms of volumes, but it is still limited due to lack of value addition and infrastructure.
- **Used Cooking Oil sector:** Although the sector is relatively small, market estimates showed around 4,000 tons of used cooking oil per year are collected and exported.

- **Old tires and Rubber waste sector:** The energy valorization of old scrap tires helped this value chain to grow. The market estimates showed that energy recovery facilities absorbed around 40,000 tons in last year, and the material recovery facilities handle about 4,000 tons per year, while the local used tire dressing or re-tread industry handle around 10,000 tons per year, most of it is imported.
- **E-waste sector:** The market estimates showed that around 1,500-2,000 tons of E-waste and about 500 tons of used batteries entered this value chain last year. This value chain indicated slight increase in volume due to the global increase in the price of the precious metals.
- **Wood/Furniture waste:** despite this value chain is very small, the results indicated that around 600 tons of wood/furniture scrap is being yearly recovered from the commercial and industrial sectors.
- **Textile waste:** There are 2,000 -3,000 tons of pre-consumer textile waste recovered last year as grinded fabrics/textiles for export markets. However, this amount varies from season to season and showed a slight growth in recent years, but quantities were bigger prior to outbreak of the COVID in 2020.
- **Organic and Food Waste:** This value chain is staying in the same situation with no solution provided yet. However, the research indicated there are few numbers of technology suppliers, researchers, community initiatives, entrepreneurs are testing new solutions mainly in animal feeding and composting. The Activity continues to engage and monitor this situation and is ready to act in support of emerging potential.

3.2.3 Values

Detailed price information is recorded in the main VCA Report in Annex 11. In general terms prices in the primary value chains (plastics, paper/cardboard/ metals) have increased and can be attributed to rises in global prices. These sectors are all export focused and prices are sensitive to the competition with virgin raw materials.

Likewise, those secondary sectors that are primarily export-oriented showed a positive price increase. In many cases the incentives of higher prices did drive the increase in volumes of recyclables. However, despite high prices the quantities in some secondary value chains (i.e., e-waste, used cooking oil, PET) did not increase at the same pace due to constraints in supply and collection functions.

Prices particularly favor higher quality products, especially for plastics and paper/cardboard. This is an important finding as improved competitiveness will be driven by a push for higher quality and higher value addition (as referenced above) where the costs of upgrading will need to be covered through additional 'quality' price premiums.

The revisited MSA has focused more on really understanding the process of value addition within key value chains. An example from the Plastics Value Chain is shown in **Table 4** below. Such information and monitoring are enabling the Activity to consider issues such as:

- **Process:** what processes are generating value addition?
- **Spread:** what is the price spread within different 'nodes' and what explains this?
- **Efficiencies:** how competitive are prices and different 'nodes' relative to other baselines?
- **Opportunities:** where and what size of opportunities are there for improving returns to different nodal operations? In particular, opportunities for increasing returns to labor for poorer and more marginalized groups.

Insights into such issues are being used to shape and improve intervention design and management. Notably, the research findings have shed light on the increasing significance of PET recycled materials in the market, with a high demand observed in the global market. This presents substantial potential

for growth and investment. Similarly, the findings indicate that used cooking oil holds promising prospects for future growth. These insights enable strategic decision-making and proactive measures to harness the opportunities presented by these emerging trends.

Table 4: Value Addition in the Plastics Value Chains Except PET

Functions across value chains	No. of active actors in the current local market	Volume Estimate (ton/month)	Estimate Price 2023 (JOD/ton)
Domestic industries or manufacturers	150 – 200 Plastic manufacturers/Industries in Amman and Zarqa Governorates	6,000 – 7,000	350 – 480
Processors	• 10 – 20 Plastic Processors (pelletizers) • 40 – 80 Plastic Processors (crushers/washers)	6,000 – 7,000	250 – 350
Aggregators	• 50 – 60 specialized waste brokers • 80 – 100 Large scrap yards, middlemen, and brokers • 150 – 200 Medium scrap yards, middlemen, and brokers	6,000 – 7,000	180 – 220
Collection and Sorting	250 – 300 Small plastic yards, middlemen, and brokers	6,000 – 7,000	140 – 180
	Large Formal tenders and contracts (pre-consumer)	150 – 250	150 – 200
	5 – 8 specialized recycling collection companies (post-consumer sorted from source)	350 – 500	100 – 140
	• 1,000 – 1,500 Itinerant buyers • 1,500 – 2,000 Informal Street waste pickers	3,500 – 4,500	80 – 120
	Landfill contractors /waste scavengers (off-grade)	300 – 500	50 – 80

3.2.4 Inclusion

In general terms the revisited MSA has simply reinforced what was found initially, that:

- The highest representation of more marginalized groups is in waste collecting and sorting functions in the primary sectors of interest;
- In secondary sectors of interest marginalized groups are found more as employees in upstream processing and manufacturing facilities; and
- Women remain generally under-represented across the sector and where they are found tends to be more administration roles in larger enterprises.

The higher prices stimulating increased recycling volumes as reported above did offer additional income earning opportunities for more self-employed waste pickers. Arguably this was particularly welcome given the economic stresses domestically caused by global responses to the COVID pandemic.

3.3 Sector Selection and Prioritization

The above considerations and commentary all factor into answering the leading question: **"Are we working in the right sectors?".** The same assessment criteria and framework were used to assess the new and emerging data. The findings are presented in **Table 5**.

Table 5: Traffic Light System of Sector Prioritization in Recycling Sector in Jordan

	Order of Primary Sectors			Order of Secondary Sectors						
	Plastics	**Paper/ Board**	**Metals**	**PET waste**	**Cooking Oil**	**E-Waste**	**Old Tires and Rubber**	**Textile**	**Wood/ Furniture**	**Organic and Food Waste**
Relevance:										
Waste volumes										
Jobs										
GESI Representation										
Potential:										
Commercial growth prospects										
Market stability										
Job quality										
Feasibility:										
Alignment with GAM / GoJ										
Alignment with USAID										
Instruments / skills										
Partnerships / leverage										
Trends of Growth for 2023 as per the updated MSA Study (2023)	✓ Growing	✓ Growing	✓ Growing	✓ Growing	✓ Potential for Growth	✓ Potential for Growth	✓ Potential for Growth	✗ Shrinking	✗ Shrinking	✗ Shrinking
Trends of Growth previously (2020) as assessed in the original MSA Study	✓ Growing	✓ Growing	✓ Growing	✗ Shrinking	✗ Shrinking	✗ Shrinking	✗ Shrinking	✗ Shrinking	✗ Shrinking	✓ Potential for Growth

As shown in **Table 5**, the Activity will:

- **Continue to build** on its work in the plastics, paper and cardboard and metals sectors;
- **Work more dynamically** in the PET sector;
- **Work cautiously** in the additional new sectors of e-waste, cooking oil and old tires and rubber;
- It still sees **little opportunity** to engage in textiles and wood / furniture; and
- Although there are a couple of initiatives the Activity is working on to address the organic/food waste but has now downgraded its expectations given there is no immediate viable route to market has been found.

Detailed assessments and justifications are presented in **Annex 11**, but some summary highlights underpinning the ranking and selection include:

- **Plastics** is the top domestic value chain by volume during last two years and specifically PET that have separate sub value chains and therefore we deal with it as a separate sector because it is still export-oriented. This value chain has potential to grow and divert more volumes in the upcoming years.
- **Paper/cardboard**, whilst volatile and unstable to some degree showed higher exports due to the prolonged high prices over the last two years. It is the second growing chain by volumes, value, and inclusion.
- **Metals** is the most developed and stabilized chain, and it is growing and become more reliant on imports because the local supply is mostly covered. The number and performance of waste pickers increased in the three primary sectors.
- **PET** has demonstrated big changes occurred during the last two years where several numbers of actors entered this market and collect PET for export. The increasingly global demand in recent years created opportunities to collect PET and several investors are thinking about investment in this sector. Most of the pre-consumer PET is locally recovered while the post-consumer PET is exported. However, the EPR system is not working yet in Jordan which will make the difference in the collection. Lack of law enforcement hinders the expansion of source segregation from commercial sector.
- **Used Cooking Oil** showed a growing trend in the quantities and new actors entered the chain. The global demand increased the performance. However, the sector is not well organized and no even legal instructions in place yet.
- **E-waste** where additional actors licensed their business from Ministry of Environment and the market reported slight increase in volumes due to the high price of the precious metals in the last period. Lack of collection system, Recycling Service Providers lack for proper business models to collect, and lack of incentives for the commercial generators to sort e-waste impacted the market.
- **Old Tires and Rubber waste** market of the energy recovery has increased in the last two years where larger volumes are reported. However, the chain is weakly structured and reliant on informal collection.
- **Wood/Furniture scraps** remains a very small and limited market where the main actors are the processors who collect, process, and produce new products. However, it will not contribute to high volumes in case of development and growth.
- **Organic and Food Waste** Remains a strategic value chain, and although some efforts such as black soldier fly and animal feed are proposed solutions, it will take a long time before those efforts lead to a significant change in the market. Structural changes in the collection system and policy support to create feasible opportunities for the private sector is needed.

3.4 Constraints – Are we working on the right constraints?

Having reviewed and reaffirmed those sectors where the Activity considers it can achieve the best results the next question is to confirm that it is working on the right priority constraints binding the desired growth and inclusion outcomes.

The original MSA identified a host of constraints inhibiting market performance throughout the respective value chains. This is re-shown in **Figure 5** below.

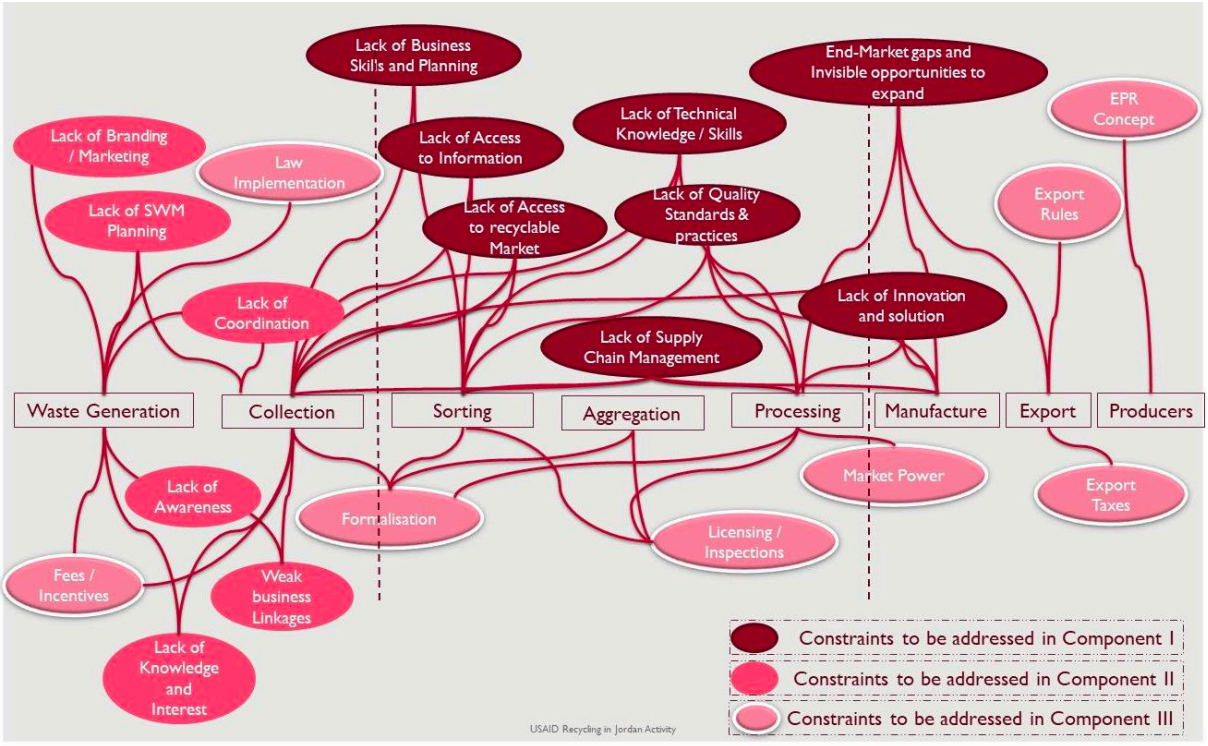

Figure 5: Causes of underperformance through the Recycling value chains in Jordan

These constraints were prioritized and grouped according to the different objectives of the Activity as follows:

Primary constraints related to the objective of: Private Sector Recycling Markets Improved and Expanded

- Informal, unregulated, and highly disintegrated horizontal linkages amongst the value chain.
- Lack of integrated supply chain management practices.
- Low level of knowledge at the collection and sorting levels of the value chain on good sorting and handling practices.
- Inefficient and overpriced aggregation functions.
- The lack of quality standards and associated grading practices is inhibiting sector growth and performance in a range of different ways.
- The export of intermediate products is largely driven by a lack of key domestic industries that could make use of such inputs.
- Weak business enabling environment.

Primary constraints related to the objective of: Demand for and Utilization of Recycling Services within Amman's Commercial Sector Increased

- Low level of general awareness, knowledge and understanding of recycling
- Low level of awareness of the Waste Management Law and other key policy and regulatory mandates.
- Low level of awareness of existing financial incentives offered by GAM.
- Lack of business linkages and connections between waste generators and potential recycling service providers.
- Lack of regulations that incentivize key waste generators to engage with recycling practices.
- Weak regulatory frameworks around building and planning requirements (e.g., size and layout of waste collection areas among key waste generators, such as malls, hypermarkets, etc.).
- Lack of incentives to seek out such recycling services (linked to low awareness / understanding; and lack of business formalization on the side of recycling service providers which undermines service quality, pricing, and marketing).
- Competition from GAM waste disposal services.
- Low awareness and limited practice in waste management planning generally amongst commercial waste generators.

Primary constraints related to the objective of: A More Enabling Environment for Recycling

- A need to strengthen national regulatory policy and enforcement for SWM and recycling.
- Improved engagement of the private sector in the development of responsive policy development and implementation by MOENV and other agencies.
- Sharpening of tax and trade incentives across the different value chains.
- Improve GAM engagement with private sector recyclers and waste generators.
- Reduce license fees and standardize process for registering recycling companies.
- Provide legal recognition to certified waste pickers.
- Increase and standardize GAM's waste collection fees to commercial sector.
- Discount or exempt SWM fees for adopters of private sector recycling.

The above constraints were discussed and revalidated through Focus Group Discussions (FGDs) held under the Revisited MSA research. Thematically most of these constraints relate to issues of:

- **Formalization:** the lack of formalization is manifest in all aspects of value chain performance. At the business level in terms of skills and professionalization. The low levels of integration and cooperation is evident throughout the value chains. Low levels of investment and use of specialist services. Weak organization and advocacy.
- **Volatility:** the lack of access to and integration with stable local and regional markets means most businesses are exposed directly to the volatility and dynamics of highly competitive global commodity markets. This causes shorter term and more tactical thinking and responses which explains the relative lack of evidence of vertical and horizontal cooperation and coordination and skews longer term investment in improved and upgraded practices throughout the value chains.

Overall, the answer to the question is, **yes, the Activity is working on the right constraints in general terms. More specifically encouraging greater formalization and managing**

volatility are critical strategic challenges-cum-objectives for the Activity across much of its work.

4 PART 2: ARE WE DOING THINGS RIGHT?

As shown in **Figure 6** this part of the report seeks to answer the following questions:

- Intervention design: are we innovating the right things? and
- Intervention management: are we managing for sustainability and scale?

It draws on data and insights emerging from a moderated self-assessment reflection process and is underpinned by findings from both the mid-line report of the VCA and Barrier Analysis research.

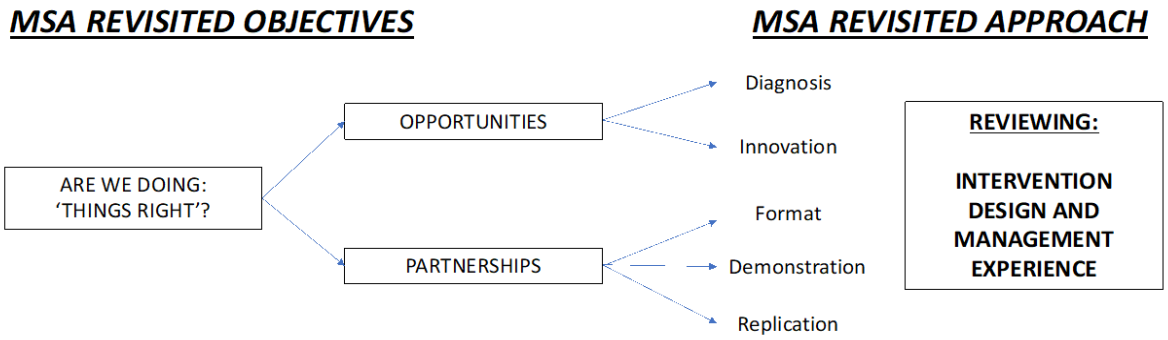

Figure 6: Objective and Approach to assessing if Doing Things Right

4.1 Approach and Methods

In seeking to answer the above questions an internal self-assessment and reflection process was agreed. This was an extension and deepening of previous such processes that were conducted during the work planning in 2021 and 2022. It involved three integrated elements:

- **Impact Logic models:** generating impact logic models which show the expected causality between activities, outputs, outcomes and impacts at the individual intervention level.
- **Adapt-Adopt-Expand-Respond (AAER) Assessment Framework[2]:** the AAER Framework is a structured approach for managing and measuring systemic change processes in Market Systems Development (MSD) programs. It offers development programs, organizations, and initiatives a systematic process to assess, plan, and scale their activities effectively.
- **Self-Assessment / Reporting Template:** translating the AAER Assessment Framework into a simplified self-assessment-cum-reporting template to be used by Activity intervention teams.

Given timing constraints this approach was initially applied to the following priority intervention areas:

- **Component 1: Expand and improve private sector led recycling services.**
  - Intervention Area C1.1: Demonstrating Integrated and Innovative Recycling Business Models with the Commercial Sector (Separation at Source).
  - Intervention Area C1.2: Technical Assistance and Upgrade Capacity.
- **Component 2: Demand and utilization of recycling services within Amman commercial sector increased.**

[2] Adopt-adapt-expand-respond (beamexchange.org)

- Intervention Area C2.1: Awareness of recycling and recycling services among the commercial sectors increased.
- Intervention Area C2.2: Linkages between commercial sector and recycling service providers strengthened.

Just as the process is not (yet) exhaustive across all Activity's interventions it is also not designed to be exhaustive in its application to those intervention areas reviewed. Its primary purpose at this point is to take stock of where the Activity is in respect of the leading questions being posed. In doing so to identify areas where deeper reflection might be needed and ultimately 'course corrections' made – all of which will be done in the context of the subsequent annual work planning process.

4.2 Intervention design: Are we innovating the right things?

In posing this leading question the review focused on exploring the following issues:

- Is our intervention design responsive to our constraints analysis? if it is…
- As a market systems program, are we working on both supply and demand sides? if we are…
- Are we working in a sufficiently integrated way across different intervention areas to bring supply and demand together and building market systems?

Different MSD thinking and tools were used to explore and address each of these issues in depth. Being a moderated self-assessment process the approach was more one of 'framing and discussing' issues collaboratively across the team. A summary of this process is shown below.

Is our intervention design responsive to our constraints analysis?

To explore this issue the Anatomy of a Transaction model was applied to assess if intervention design was in fact responsive to the more generalized constraints analysis presented in the previous section of this report.

As shown in **Figure 7**, the first assessment focused on constraints inhibiting demand at different points in the transaction cycle – awareness, understanding, use and retention.

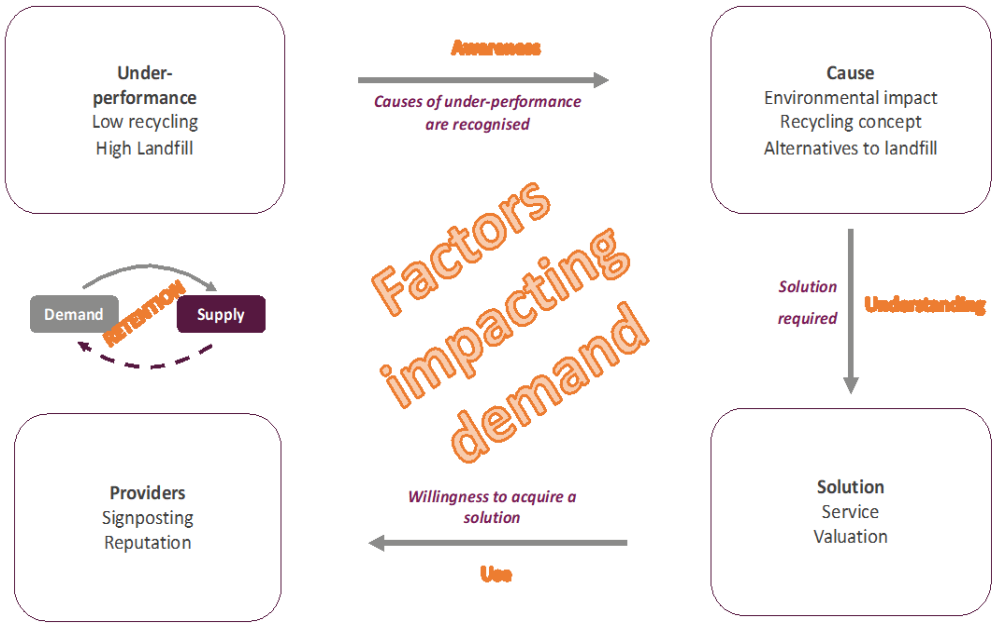

Figure 7: In depth assessment of constraints to effective demand of the recycling services

A similar assessment was done on whether the Activity was also being responsive to supply side constraints in its intervention design. This is shown in **Figure 8.**

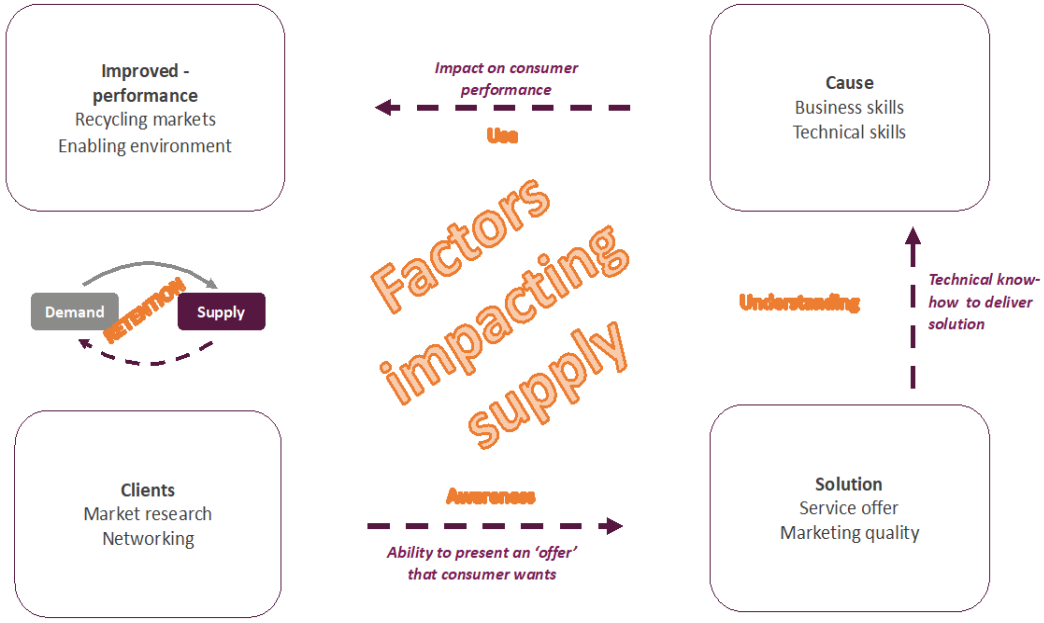

Figure 8: In depth assessment of constraints to effective supply of the recycling services

Again, whilst not exhaustive or necessarily representative of the 'whole of approach' across the Activity the above assessment provides clear evidence that the Activity did go beyond more general 'headline' constraints into really assessing deeper 'under-lying' and binding constraints inhibiting the emergence of effective supply and demand in recycling markets. **Consistent with the MSD approach it can be reasoned therefore that intervention design was targeted as close to identified underlying constraints as possible.**

As a market systems Activity are we working on both supply and demand sides?

In addressing this question, the review sought to explore the extent to which the Activity was organizing in response to and working across both demand and supply side constraints. Findings here are summarized in **Figure 9** below.

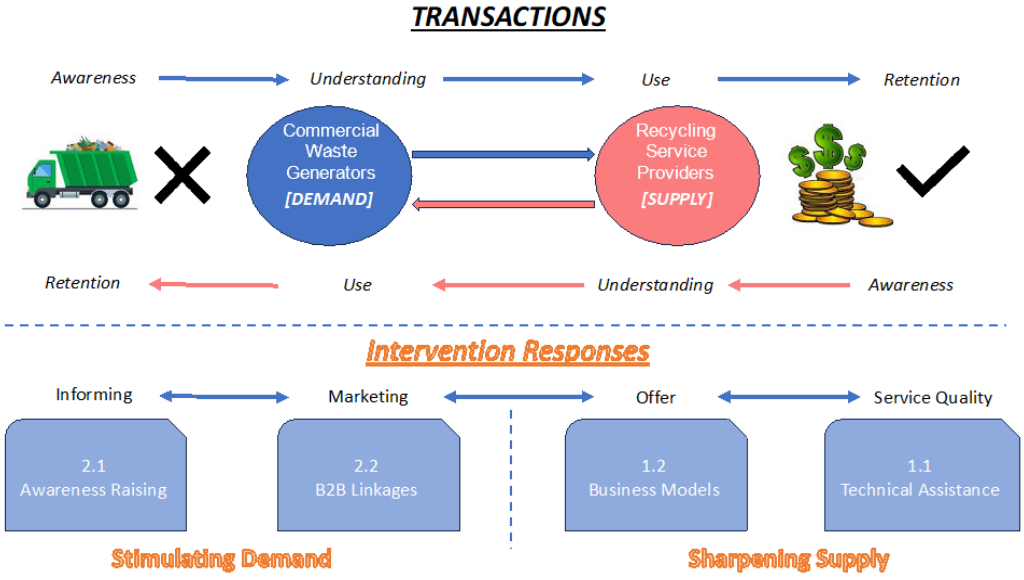

Figure 9: Working across both supply and demand side constraints for the recycling services

The above provides clear evidence that the Activity is organizing explicitly in response to working on both supply and demand side constraints to market development.

Are we working in a sufficiently integrated way across different intervention areas to bring supply and demand together and build market systems?

The Activity is using deeper constraints assessments to better target interventions closer to the underlying problem, and it is organizing to work purposefully across both the supply and demand side. This final question explores the extent to which they are working in an integrated way across the different intervention areas.

The assessment focus here was on issues of 'graduation' and 'connection'. Specifically,

- **Graduation:** is there evidence as to how/how well those targeted under the Awareness Raising intervention 'graduate' into the B2B Linkages intervention; and those firms benefitting from Technical Assistance (TA) took this enhanced capacity into the Business Models intervention work; and
- **Connection:** is there evidence of how supply and demand side interventions connected with each other. For example, firms engaged under Business Models involved in B2B Linkages and Awareness Raising work; and firms under these two intervention areas seeking out the services of firms engaged under the Business Models intervention area.

The assessment did identify some weaknesses in respect of the above issues. Interventions are being well managed 'vertically' but are not sufficiently focused on 'graduation or connection' opportunities 'horizontally'. Reflecting on **Figure 9** and for example:

- It is not clear how lessons on effectiveness of marketing (under B2B Linkages) are informing programming under Awareness Raising. What messages are 'cutting' through, who is more 'open' to such messaging, and 'how' are such messages most effectively delivered?
- It's not clear the extent to which TA being delivered is focused on service delivery specifically (rather than just business efficiency improvements) and how these ties in directly to the marketing and delivery of an improved service offer.

The Activity should review such issues further during the next work planning process and explore the potential for greater synergy and leverage between the different intervention areas in respect of 'clearer and cleaner' graduation and connection opportunities.

4.3 Intervention Management: Are we managing for sustainability and scale?

Again, given the nature of this self-assessment review process, this section is looking more strategically at whether the Activity is actively managing for sustainability and scale. It is looking across interventions to draw lessons rather than deeply into interventions to look at detailed recommendations on specific management improvement responses.

As commented on above under Approach and Methods, the assessment here involved developing impact logics and over-laying these with an application of AAER informed questions. Findings were reported in a simple self-assessment template.

This was applied across all four intervention areas outlined above. However, for the purposes of this report, one intervention is used to confirm the self-assessment process (which is the Awareness Raising), but the findings presented in Section 5 cut across all four areas reviewed.

Component 2.1: Awareness Raising

The following impact logic was developed in **Figure 10**:

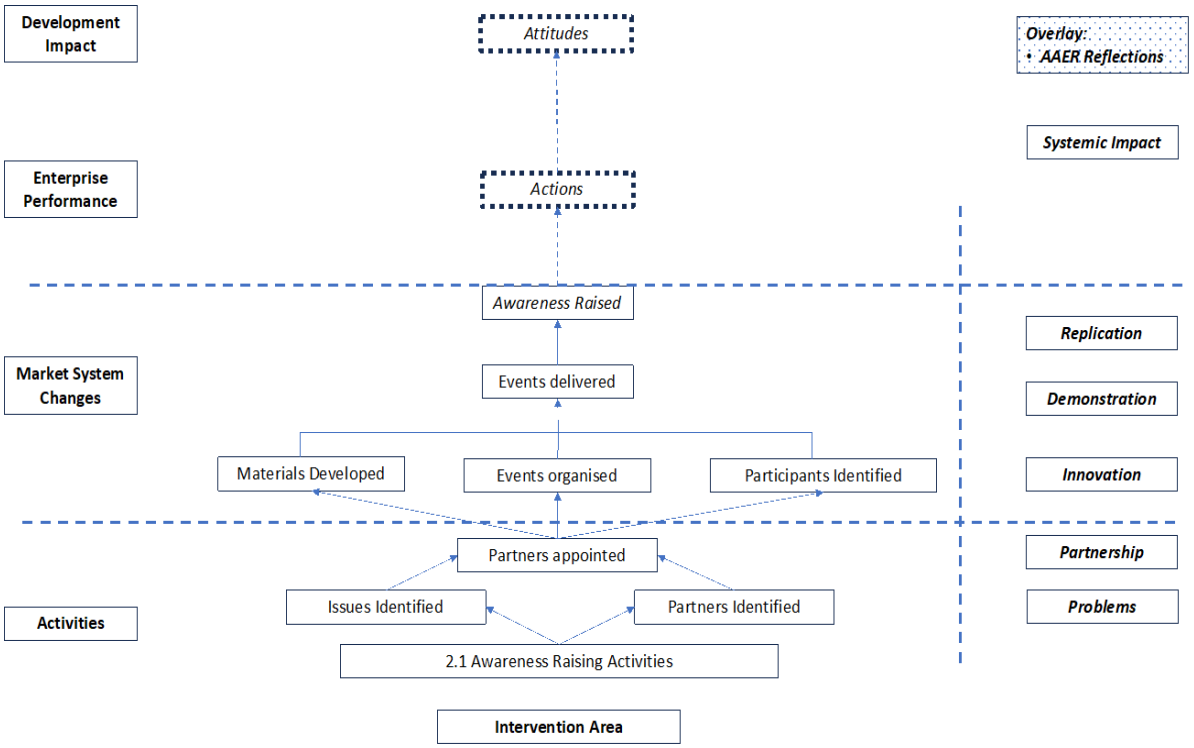

Figure 10: Impact Logic for Awareness Raising

This was then overlaid with the applied AAER Framework exploring different elements of problems, partnerships, innovation, demonstration, replication, and systemic impact. This is shown in **Figure 11**.

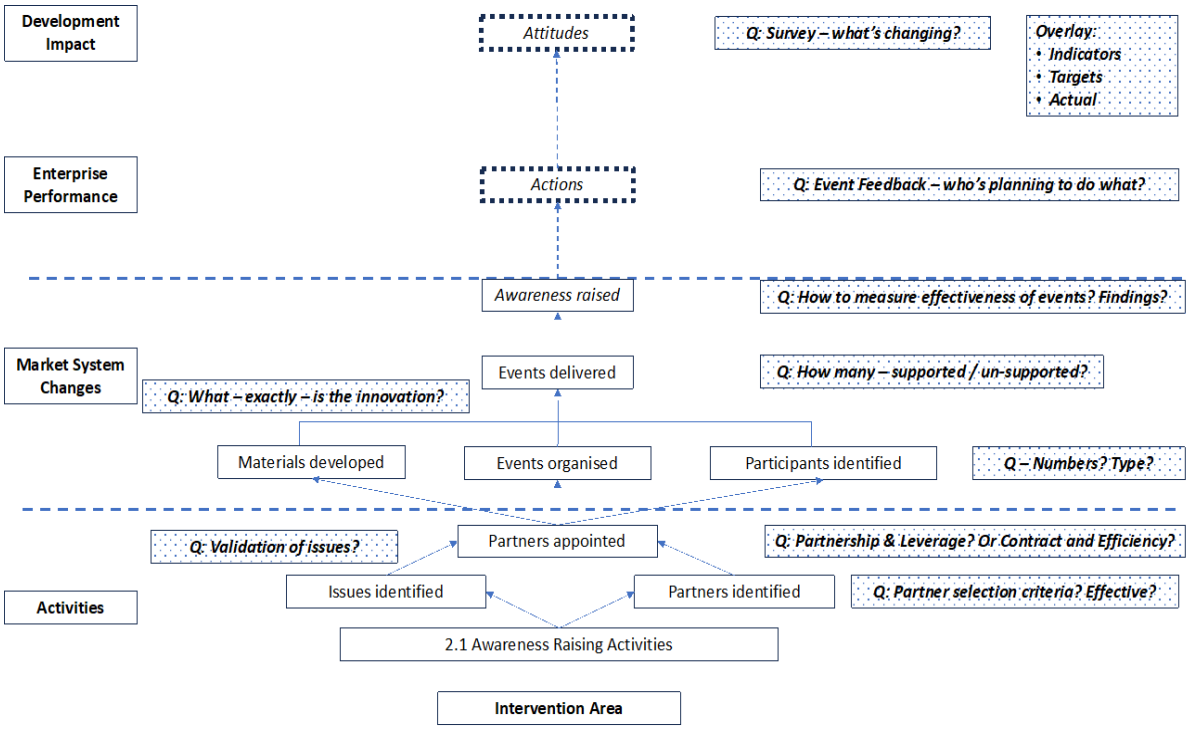

Figure 11: AAER Framework applied to Awareness Raising Impact Logic

Finally, a self-assessment reporting template was developed and used by the intervention teams for reporting back into the review process. This is shown in **Figure 12**.

Figure 12: Self-reporting template for the AAER assessment

5 EMERGING FINDINGS

Through reviewing the emerging self-assessment reporting, the following themes/issues are emerging across the AAER Framework:

- **Problems:** These are well understood. They are identified through the quality of diagnostic work undertaking by the Activity and as confirmed above. However, from the perspective of stakeholders the problems we are identifying, and prioritizing are just 'some' of the problems these stakeholders are facing in a day-to-day business sense. The business problems related to 'informality' and wider market problems related to issues of 'volatility' are manifest and priorities can change at short notice in response to immediate business challenges. This can affect the Activity in different ways. Firstly, gaining initial interest and traction through demonstrating priority problems; and secondly, through maintaining interest and focus on identified problems over time.
- **Partnerships:** The team is clear on the different kinds of relationship they wish to establish with different partners in pursuit of different kinds of activity and outcome. The nature of the agreement underpinning these different relationships/purposes seem sufficiently flexible and appropriate. Supportive evidence here includes: 1) Delivery – a high proportion of agreements deliver to their stated ambition; 2) Evolution – there is evidence of agreements responding actively to issues and experience emerging over time; and 3) Satisfaction – anecdotally the approach taken by the teams seems to be highly valued by partners and collaborators.
- **Innovation:** There is clear evidence that intervention design is responsive to constraints analysis. But within this it is not always clear 'exactly' what the innovation – or change –that is being introduced. What is innovative, who is it innovative for, and confirming the relevance of any innovation to 'others' beyond the specific partnership (i.e., thinking scale and wider uptake).

- **Demonstration:** Generally, it seems that interventions are demonstrating both relevance and utility for partners. Ideas introduced are reported as being relevant and interesting. Practice changes being promoted are accessible and appropriate. Performance improvement at the business level resulting from adopted practice changes is positive and persuasive. In this sense the 'sustainability' of 'solutions' being introduced seems to be high with partners reporting a continuing value and utility of the knowledge and practices introduced.
- **Replication:** there are some signs of demonstration driving scale and replication. But the evidence is partial on it happening in practice, and it is not clear that the Activity is managing to its scale ambitions as well as it might. Innovation: Not being clear exactly what this always is, will inhibit thinking as to 'what innovation' exactly we are seeking to scale? Pathway: It is not always clear 'how' any innovation might be scaled (at least earlier in the intervention design) and hence partner choice and non-partner interested parties are not always informed by scale pathway thinking.
- **Systemic Impact:** Not all interventions lead directly to systemic impact (as defined by the Activity objectives and results framework). Whilst this is entirely legitimate and reasonable, they 'do' need to lead 'somewhere'. It is not always clear where. This observation connects closely with the critique made above about the need to manage 'horizontally' across interventions rather than just 'vertically' within them.

Again, as mentioned, these findings are not exhaustive. The point is to demonstrate the value of the assessment process so it can be further applied and deepened over time, and to identify some relative 'blind-spots' where the Activity might wish to look further and seek to improve.

6 IMPLICATIONS/CONSIDERATIONS

With the above-mentioned caveats in mind, there are a number of implications and considerations that can be drawn from these initial and indicative findings that the Activity will be considering building on as it moves forward with its work planning process. The implications relate to both "process" and practice", and the considerations relate to Dealing with Informality and managing volatility as confirmed below.

6.1 Process

There are several processes which the Activity might consider building on moving forward:

- **Develop Impact Logics:** The teams are good at initial diagnostic and intervention design work. They are clearly good at defining and managing partnerships. However, the risk is that these become the 'end' rather than the 'means' to delivering market system change. Partnerships need to be managed within a wider strategic context. Impact logics can help to achieve this. This can help both in managing 'up' interventions from pilot to scale levels of impact but also in better managing 'across' different interventions in support of improved 'graduation and connection' (as argued above).
- **Apply AAER:** AAER helps to operationalize and test intervention design and management against different dimesons of systemic change. This can help to identify, define, and test for change at different levels through intervention management over time. Manage more purposefully and transparently towards systemic ambitions of sustainability and scale.
- **Use Data for Decision Making:** Populate impact logics with key data points and integrate this more with the monitoring and results function of the Activity. Data is used well for compliance and reporting purposes but can be used better for performance management purposes. Using data to help test assumptions and expectations in the impact logics will help teams to be more responsive and more adaptive to emerging findings.

- **Regular Reflection:** Build improved processes for more regular and adaptive impact monitoring and management. This helps set the incentive framework for teams to review impact logics and data findings and to use these to review plans and react accordingly.

6.2 Practices

The above processes can help the team be more reflective and adaptive moving forward and as it seeks to build on its successes and move from pilot to scale ambition. Reflecting on certain practices can help also. Some examples here include:

Link Innovation to Objectives

The critique is that innovation is not always sufficiently defined and that this is confusing thinking about just what is potentially scalable. Tying innovation more explicitly to the Activity's objectives, can help in tackling specific barriers and constraints, please refer back to Figure 9:

- **Informing:** Work here should explicitly help graduate those reached towards some kind improved understanding and readiness for change (use). Can we track forwards through thinking about who we are inviting and what we are seeking to build understanding in support of? Can we track backwards from our reflections in 'marketing' and 'offer' to use evidence to sharpen and better target our messaging and approach to 'informing'?
- **Marketing:** This is where we seek to connect interested parties and see 'deals' happening. Are we learning what the exact barriers are to 'use' that we're seeking to overcome through improved' understanding'? Can we get tighter in understanding 'what works' – both in terms of the message and the messenger?
- **Offer:** Are we clear on the exact service features we are trying to promote and how from experience these are the ones actually driving value?
- **Service Improvement:**
    - Efficiency: what types of upgrading are we seeing the best returns from. Skills? Technology? Improved cooperation/coordination models? Can we now start to narrow and focus on areas delivering most business performance impact?
    - Value Addition: what are the opportunities for adding new/improved value within our markets of focus? Who are innovators who are/might be more likely to test these? Are we sure we are focused on value addition above and beyond just improved business efficiencies?

6.3 Be more responsive to prevailing 'nature of market' considerations

As mentioned earlier in this report there are two critical strategic challenges facing the recycling sector in Jordan. These are:

- Dealing with Informality; and
- Managing Volatility

These are discussed in turn:

6.3.1 Dealing With Informality

The issue of informality has considerable implications for intervention design and management. Through considering informality more deeply as a 'thematic' nature of market issues, could help in various ways and across different interventions. For example:

- **Legitimacy:** Informality can undermine legitimacy in the eyes of authorities, but also in the eyes of potential collaborators, clients, and recycling service providers. Barriers here might be both explicit (rules) and implicit (attitudes). Do we understand such barriers sufficiently and is our intervention design sufficiently responsive to such factors?
- **Networks:** The nature of informality explains (in part at least) observations of extremely limited horizontal cooperation and vertical integration in all value chains of interest. This implies limited knowledge and network quality. How does this affect thinking on issues such as innovation diffusion and pathways to scale? Have such factors/dynamics been sufficiently considered in intervention design and moving from pilot to scale considerations?
- **Specialization:** Smaller and more informal businesses will tend to lack functional specialization in various key areas of business performance. For example, the Barrier Analysis demonstrates that those responsible for recycling and waste management in commercial waste generators encompasses staff from engineering, finance, procurement, warehousing, operations, and general management. This can make it hard to identify both the right 'person' and the 'right' level of capacity which can usefully be built in support of business improvement aims. How are we responding to the lack of specialization, particularly in smaller owner managed businesses?
- **Formality of Service Provision:** We are often focused on more formal 'fee-for' types of services and solutions. Is this always realistic in smaller informal markets? Are we being equally open to less formal and more partial solutions that might be found embedded within existing business relationships; more 'public' type services (often piggybacked on other services); or more 'barefoot' or 'moonlighting' type services offered less formally/regularly?
- **Government Policy:** When engaging with Government on policy and regulatory issues are we sufficiently focused on priorities for improving formality across the sector?

6.3.2 Managing Volatility

Most value chains are subject to the dynamics of international commodity markets. These can be highly volatile. Dealing with such volatility is particularly challenging and can represent a significant risk and cost to business. This can partly explain the low levels of trust, integration and cooperation observed within value chains, and the limited use of professional services and low investment in technology and value addition processes. Through considering volatility more deeply as a 'thematic' nature of market issue could help in various ways and across different interventions. For example:

- **Strategic Nodes:** Focusing on a smaller number of key actors in strategic nodes within value chains can (in principle) offer more significant leverage/network efforts of intervention. Unblocking key constraints or building additional key capacity in strategic nodes can spill-over into opportunities for others (up / downstream). For example, the Activity is working with Al-Oula, one of the largest and most influential players in upstream recycling. However, are we working with them on areas which cannot just improve their business operations but unlock significant latent potential across certain value chains more widely? Do the Activity targets incentivize TA support across more businesses versus projects of deeper significance with a fewer number of firms?
- **End Markets:** Can we do more to build domestic end market operations to help promote deeper integration, insulate suppliers from the volatility of global markets and encourage higher investment and specialization?
- **Value Addition:** Are we sufficiently balanced between improving the efficiency of existing operations vs innovating new and improved value addition in different parts of the value chain? This might open new market access, support diversification, and help manage current volatility challenges.
- **Government Policy:** When engaging with Government on policy and regulatory issues are we sufficiently focused on priorities for managing sector volatility?

7 ANNEX I: STAKEHOLDERS' IDENTIFICATION AND MAPPING REPORT

Please scroll down for the complete Stakeholders' Identification and Mapping report or click here to view or download as a separate document.

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Recycling in Jordan Activity

Annex 1: Stakeholders' Identification and Mapping Report

June 2023

Submission Date: June 30, 2023

Contract Number: 72027820C00007
Contract Period: August 7, 2020- August 6, 2025
COR Name: Haithem Ali

Submitted by: Maher Hamdan, Chief of Party

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CONTENTS

ACRONYMS

USAID	United States Agency for International Development
BMZ	German Federal Ministry for Economic Cooperation and Development
GIZ	The Deutsche Gesellschaft für Internationale Zusammenarbeit
UNDP	The United Nations Development Programme
FCM	Federation of Canadian Municipalities
AFD	The United Nations Development Programme
EU	European Union
UNRWA	The United Nations Relief and Works Agency
MoENV	Ministry of Environment
MoLA	Ministry of Local Administration
MoPIC	Ministry of Planning and International cooperation
MoH	Ministry of Health
MoL	Ministry of Labor
MoTA	Ministry of Tourism and Antiquities
MoA	Ministry of Agriculture
MoI	Ministry of Interior
MoIN	Ministry of Investment
GAM	Greater Amman Municipality
ASEZA	The Aqaba Special Economic Zone Authority
PDTRA	Petra Development and Tourism Region Authority
JEF	Jordan Environment Fund
SSC	Social Security Corporation
JSMO	Jordan Standards and Metrology Organization
JIEC	Jordan Industrial Estates Corporation
JFDZ	Jordan Free & Development Zones Group
JEDCO	Jordan Enterprise Development Corporation
JREEEF	Jordan Renewable Energy and Energy Efficiency Fund
JNFW	The Jordanian National Forum for Women
JIC	Jordan Chamber of Industry
JCC	Jordan Chamber of Commerce
ACC	Amman Chamber of Commerce
ACI	Amman Chamber of Industry
JHA	Jordan Hotels Association
JEA	Jordan Export Association
JHPTA	Jordanian Handicrafts Producers & Traders Association
JTB	Jordan Tourism Board

ZCI	Zarqa Chamber of Industry
EJABI	Euro-Jordanian Advanced Business Institute
BPWA	Business and Professional Women Association
JES	Jordan Environment Society
JEU	Jordan Environmental Union
APN	Arab Group of the Protection of Nature
RSCN	The Royal Society for the Conservation of Nature
JGBC	Jordan Green Building Council
SWM	Solid Waste Management
MSW	Municipal Solid Waste
PET	Polyethylene Terephthalate
HDPE	High Density Polyethylene
PVC	Poly Vinyl Chloride
LDPE	Low Density Polyethylene
PP	Polypropylene
PS	Polystyrene
PC	Personal Computer
WEEE	Waste Electrical and Electronic Equipment
JSC	Joint Service Council
JOD	Jordanian Dinar
RE	Renewable Energy
SMEs	Small Medium Enterprises
TA	Technical Assistance
POP	Persistent Organic Pollutants
MSA	Market System Analysis
SPs	Service Providers
WGs	Waste Generators
CBO	Civil Based Organization
CSO	Civil Society Organization
NMIS- MSW	National Monitoring Information System for municipal solid waste
PRO	Producer Responsibility Organization
VCA	Value Chain Analysis
PSP	Private Sector Participation

EXECUTIVE SUMMARY

This report outlines the results of a stakeholder identification and mapping effort conducted while updating the original Market System Analysis (MSA) Study, initiated by the USAID Recycling in Jordan Activity in Year 1 (2020). It also captures noteworthy changes within the recycling ecosystem over the past two years (2021 and 2022). The report highlights the outcomes of identifying and examining primary and secondary stakeholders in Amman's recycling sector, based on their roles and levels of interest and influence.

In Jordan, there are legislative and legal frameworks in place to regulate waste management. Within this context, cities and municipalities are responsible for operating public systems designed to handle Municipal Solid Waste. Additionally, a local recycling market, driven by the private sector (both companies and individuals), plays a crucial role. This market encompasses various products and value chains that depend on primary and secondary waste streams. The government has recently introduced several laws to enhance waste management in Jordan. One of the most significant is the Framework Law for Waste Management (No. 16/2020) and its associated By-Laws. Article 10 of this law outlines the roles and responsibilities of the relevant authorities and stakeholders involved in waste management in Jordan.

Because of the wide variety of solid waste types, characteristics, and sources, the Solid Waste Management (SWM) and Recycling sector in Jordan encompasses a broad spectrum of stakeholders, each with distinct roles, authorities, impacts, and concerns. Stakeholders who hold significant power and have a strong interest are the ones who are likely to have the most impact on what is achieved and how things turn out.

The current stakeholders in the recycling sector are divided into public and private groups. The public category consists of three main segments: 1) government bodies with legal roles and official responsibilities, 2) chambers, professional associations, unions, universities, and similar entities, and 3) municipalities as local public institutions. The private category is also divided into three main segments: 1) significant commercial waste producers or clients of recycling service providers, 2) those who offer Recycling Services through both formal and informal market routes, including industries and manufacturers using the recycled materials, and 3) Non-Governmental Organizations (NGOs), cooperatives, and other Civil Society Organizations (CSOs), along with Community-Based Organizations (CBOs), which encompass social partners, initiatives, and more.

The central government, including its various authorities and ministries—specifically, the Ministry of Environment—holds the highest degree of influence over the waste management (SWM) and recycling sector. Beyond ensuring adherence to laws, they play a key role in setting regulations that shape the import/export dynamics within the recycling market. Moreover, they oversee compliance and adherence to these regulations. Notably, the Ministry of Environment is empowered by two significant laws: The Environmental Protection Law No. 6 of 2017 and the Waste Management Framework Law (No.16/2020). This ministry takes charge of formulating waste management policies, governing the waste sector, and overseeing compliance through monitoring and enforcement.

The Ministry of Industry, Trade and Supply (MoITS) stands as the second impactful ministry in the recycling sector. It bears the responsibility of regulating economic and investment activities in Jordan, with a focus on optimizing commercial and industrial performance. MoITS administers the registration of companies and business profiles through the Companies Control Department (CCD). It further organizes and regulates both internal and external trade activities, carrying out monitoring and control efforts. After the central government, local municipalities emerge as significant public stakeholders with a considerable impact on the waste management (SWM) and recycling sector. They hold the responsibility for managing municipal waste collection within cities and oversee the issuance of vocational licenses for businesses and companies operating within their jurisdiction.

The Greater Amman Municipality (GAM) is a key stakeholder in the USAID Recycling in Jordan Activity, standing out from other municipalities in the country. Unlike its counterparts, GAM doesn't report to the Ministry of Local Administration (MoLA), but is directly linked to the Prime Minister due to its distinct position embedded in Jordan's legal framework. While local municipalities are governed by the Municipal Law (No. 41/2015) and the Local Administration Law (No. 22/2021), GAM operates under its own law, known as the "Amman Municipality Law (No. 18/2021)." This unique arrangement establishes GAM as a civil institution with both administrative and financial autonomy. In contrast, MoLA is responsible for regulating all Municipal Solid Waste (MSW) management services, overseeing and controlling the performance of local municipalities and Joint Service Councils (JSCs).

According to Article 13 of the "Amman Municipality Law (No. 18/2021)," GAM is responsible for managing Municipal Solid Waste (MSW) and ensuring public cleanliness within its jurisdiction, which includes (1) waste collection, (2) transfer, (3) treatment, and (4) disposal. The management of solid waste within GAM's boundaries is also guided by local regulations, with the most significant being By-law 150 of the year 2016, named "Nuisance Prevention and Waste Collection Fees." This regulation outlines GAM's responsibility for collecting fees related to waste collection, transportation, disposal, and treatment. Presently, GAM is in the process of developing a new Solid Waste Management (SWM) by-law aimed at consolidating roles and responsibilities concerning solid waste management and addressing public health nuisance concerns within a single regulatory framework.

Among the public stakeholders are non-governmental entities, such as Chambers, Professional Business Associations, Affiliations, and Unions, which collectively represent the business community. Notably, professional chambers emerge as the most influential among these entities. They derive their authority and responsibilities from the laws governing public chambers and mandatory business memberships. Specifically, industry chambers are regulated by The Industry Chamber Law (No. 01/2005), while commerce chambers operate under The Commerce Chamber Law (No. 70/2003).

This category of public stakeholders significantly impacts the sector by engaging in regular dialogues with the government, advocating for changes, providing feedback, and contributing to the refinement of policies and regulations that shape business practices.

The research findings reveal that there is no apparent conflict in the legal and institutional frameworks governing the competent authorities involved in Municipal Solid Waste (MSW) management in Jordan. However, practical challenges arise in terms of actual service provision, particularly concerning defining service areas and handling mixed waste streams. These mixed waste streams often involve overlapping jurisdictions and ambiguous governance structures. Furthermore, the existing roles and responsibilities of these authorities do not encompass the entirety of MSW management activities, particularly aspects related to treatment and recovery (such as recycling and waste-to-energy processes).

The research findings also reveal that a majority of recycling businesses are situated to the east and south of the Amman Governorate's capital city. However, these businesses are not located within the geographical scope of the Greater Amman Municipality (GAM), specifically areas like Sahab, Muwaqqar, and Al-Jizah, which fall under the administration of other local municipalities. A substantial portion of the recycling sector is concentrated in Zarqa, Russeifa, Ain-Albasha, and the eastern part of Madaba as well.

While GAM oversees the operation of the Ghabawi Landfill to cater to Amman's waste disposal needs, the landfill's catchment area extends beyond GAM's municipal boundaries. It also serves neighboring municipalities such as Sahab, Muwaqqar, Zarqa, Russeifa, and supports significant development projects and establishments within the governorate, including the Industrial State in Sahab, among others.

The central hub of the recycling sector is primarily located within the following municipalities: 1) Greater Amman Municipality, 2) Zarqa Municipality, 3) Sahab Municipality, 4) Muwaqqar Municipality, 5) Um-Al Basateen Municipality, 6) Al-Jizah Municipality,7) Russeifa Municipality, 8) Ain Al-Basha Municipality and 9) Greater Madaba Municipality. The main legislative frameworks that govern and oversee both public and private engagements within the Solid Waste Management (SWM) and Recycling Sector in Amman include the following:

- The Waste Management Framework Law (No.16/2020)
- The Environmental Protection Law No. 6 of 2017
- The Local Administration Law No. 22/2021
- The Municipal Law No. 41/2015
  The Greater Amman Municipality Law (18/2021)
- The Vocational Licensing Law in GAM No. 11/2022
- The Monitoring and Inspection of Economic Activities Law No. 33/2017, and amendments
- The National Production Protection Law No. 21 of 2004
- The Companies Law No. 22 of 1997 and its amendments
- The Industry and Trade Law No. 18 of 1998 and its amendments
- The Import and Export Law No. 21 of 2001 and its amendments
- The Public Health Law No (47) for year 2008 and its amendments
- The Investment Environment Law No. 21 of 2022
- The Agriculture Law No. 2 of 2020 and its amendments
- The Nuisances Prevention and Waste Collection Fees within Boundaries of GAM By-Law No. (150) of 2016
- The Instructions for Waste Services Fees, Transportation, Treatment and Disposal of 2014 and its Amendments
- The Environmental Classification & Licensing Regulation By-Law No. 69 of 2020
- The non-hazardous solid waste management system By-Law No. 44 of 2022
- The Environmental Information and Control System for Waste Management By-Law No. 85 of 2020
- The Biodegradable Plastic Shopping Bags By-law and its amendments No. 45 of 2017

The private sector's engagement is broad and includes formal entities engaging in diverse tasks across the value chains. Additionally, there exists an informal sector, which is composed of two categories. The first consists of individuals and families engaging in activities for subsistence. The second encompasses small businesses that operate similarly to registered counterparts, yet lack official registration. This informal sector spans various roles including street waste pickers, itinerant waste buyers, small-scale metal and plastic recyclers, and marginalized groups seeking income opportunities in urban settings.

As per the data provided by GAM for the year 2022, there has been an increase in the number of registered commercial businesses in Amman, with the count reaching approximately 102,181. This marks a rise from the 98,995 businesses recorded in 2020. Among these registered businesses, approximately 5,000 entities are classified as small to large commercial waste generators, producing 100 kg of waste per day or more. Furthermore, there are approximately 1,000 large commercial entities generating around 100 tons of waste per year (equivalent to about 274 kg per day). Notably, a smaller subset, fewer than 20 entities, are categorized as the largest generators due to producing 1,000 tons of waste per year or more.

In terms of waste disposal, the Al-Ghabawi landfill receives around 3,200 tons of waste daily from various districts within GAM. From this total, around 30-40% is generated by commercial sources.

USAID Recycling in Jordan focuses on businesses that produce 100 tons per year or more, which is equivalent to 274 kg per day or above.

In Amman, the recycling sector is still in its early stages of development. Currently, less than 5-10% of recyclable materials are being reclaimed, with the majority of post-consumer waste typically being disposed of in landfills. Within the local market, distinct market value chains have been established for various materials such as plastic, ferrous metals, separated paper, mixed paper/cardboard, electronic waste (e-waste), used cooking oil, and tires. These materials are recuperated through either domestic processes or by means of export.

The existing recycling sector in Amman encompasses approximately 500 companies, not counting the larger manufacturers and end-market industries. Among these companies, the majority fall into the micro and small enterprise categories. Although exact figures are not officially available, the informal sector engaged in the Solid Waste Management (SWM) and Recycling Sector comprises an estimated 5,000 to 7,000 street-based informal waste pickers. Additionally, there are around 600-700 itinerant buyers who employ collection trucks or pick-ups to gather recyclable materials that hold value within the established value chains.

This informal sector primarily operates within Amman, with a significant portion residing in middle to low-income areas located outside the city. Notable areas include Zarqa, Russeifa, Marka, Ain-Al-Basha, Qwismeh, Sahab, Muwaqqar, and similar locales.

The established waste value chains in the downstream segment involve a range of participants such as scrap yard dealers, aggregators, intermediaries, sorters, processors, specialized waste brokers, exporters, and recyclers. These actors are involved in value-adding activities, and a number of them also operate within the informal sector. Additionally, there are notable recycling plants and industries that have a significant presence at more advanced stages within the value chains.

The research findings indicate that there are currently (22) distinct recycling services being offered within the sector, encompassing various points along the recycling value chains.

Community-Based Organizations (CBOs) have the potential to actively engage in service provision, which may encompass tasks like operations, maintenance, and even facility construction. As representatives of the individuals or members they involve, CBOs hold a significant position in the development of waste management systems. Within the legal framework of Jordan, environmental Civil Society Organizations (CSOs) and cooperatives are officially registered by the Ministry of Social Development. Furthermore, their professional activities are licensed by the Ministry of Environment (MoENV).

In Amman, there are over (20) Community-Based Organizations (CBOs), Civil Society Organizations (CSOs), Non-Governmental Organizations (NGOs), and Cooperative entities actively involved in various pilot projects, initiatives, and campaigns centered around solid waste recycling and sorting. Many of these organizations collaborate with the Greater Amman Municipality (GAM) to facilitate their pilot initiatives and projects, with a specific focus on activities like paper and cardboard recycling and reuse. GAM views these partnerships as a valuable means to enhance public awareness among the city's residents, contributing to overall improvement in waste management practices.

This report encompasses a comprehensive list of pertinent NGOs and CBOs along with their specific mandates tied to Solid Waste Management (SWM) and recycling within Amman. Additionally, the report presents a quick overview of the efforts undertaken by international donors to support solid waste management in Jordan, with a particular focus on the city of Amman.

The key conclusion drawn from the report is that the central government, especially the Ministries, notably the Ministry of Environment (MoENV) and the Ministry of Industry, Trade and Supply (MoITS), holds the most significant influence over the growth and expansion of the recycling market. This influence arises from the existing institutional and regulatory frameworks established in the country. Furthermore, the Greater Amman Municipality (GAM) exerts a substantial impact on the SWM and Recycling Sector due to its distinct status entrenched within Jordan's legal structure through the Amman Municipality Law No. 18/202 and its direct link with the Prime Minister.

The report also highlights the presence of numerous legislative pieces that regulate and oversee the business activities within the SWM and Recycling Sector. Additionally, it emphasizes the indispensable role played by the informal sector in supplying recyclable materials to the recycling value chains.

1 INTRODUCTION

1.1 Background

The Recycling in Jordan Activity is a five-year program (2020-2025) funded by the United States Agency for International Development (USAID). The Activity is working together with Amman's commercial sector waste generators, private sector recycling service providers, the Ministry of Environment (MoENV), the Greater Amman Municipality (GAM), and relevant business associations to increase the commercial sector's demand for and use of recycling services in Amman through implementing innovative and sustainable solutions and models. The Activity is utilizing a market-based approach to expand and improve private sector-led recycling markets, increase demand for recycling services by the commercial sector, improve profitability and performance of private sector service providers, and increase government support for improving business enabling environment for recycling services and material markets.

Solid Waste Management (SWM) is one of the most complex sectors due to the diversity of types and forms of waste as well as different sources of generation and methods of dealing with it, and this imposed the existence of different responsibilities distributed among multiple stakeholders from the public and private sectors in accordance with legislative and legal frameworks governing waste management in Jordan. Besides, the Municipal Solid Waste (MSW) management system of the cities and municipalities (the public system), there is a local recycling market led by private sector (companies and individuals) and comprised of several products and value chains that are reliant on primary and secondary waste streams.

Jordan has yet structural impediments to the sustainable waste management system like the absence of waste separation from the source and subsidized waste collection services that impede waste valorization and reduce material transition from the linear path to the recycling value chains. Notwithstanding, there are other layers of constraints and barriers in the recycling market itself that adversely affect supply and demand and thus growth and expansion trends. Here comes the role of the Market Systems Analysis (MSA) study in figuring out who are the most important market constraints and barriers, and which the Activity may develop interventions that could support supply and demand to overcome them or limit their effects on growth and expansion.

During Year 1, the USAID Recycling in Jordan Activity conducted a Market Systems Analysis (MSA) study for the private sector-led recycling markets in Amman that identified key constraints and barriers influenced the growth of recycling market and its waste value chains in terms of structure, functions, value, volumes, and inclusion. The study was conducted for a set of prioritized waste value chains and its relevant stakeholders through qualitative and quantitative tools. The MSA study indicated insufficient recycling service providers, limited capacities, weak value proposition, and lack of quality waste management solutions to commercial waste generators, who also have low levels of awareness and motivation about the recycling sector and available services and are not aware of the relevant laws and regulations relating to waste management. The study found that the recycling market has a low profile and is relatively small, undeveloped and lacks adequate local and national support. Indeed, the uncertainty of the governmental decisions related to recycled waste exports/imports posed difficulties and impacted the competitiveness and investment appeal of the recycling sector in Jordan.

Various legislations have been recently enacted by the government bodies to improve the waste management in Jordan, the most important of which is the Framework Law for Waste Management (No. 16/2020) and its regulations, which defines in Article 10 roles and responsibilities of the competent authorities and relevant stakeholders related to waste management in Jordan.

After two years and half of implementation, USAID Recycling in Jordan Activity sets a target to update the original MSA study conducted in Year 1 for the purpose of validating market problems

and barriers that are still undermining growth of supply and demand on private-led recycling services in Amman.

1.2 Objective

This report presents the findings of the stakeholders' identification and mapping exercise that the Activity conducted for the SWM and Recycling Sector in Jordan as a part of the process for updating the original MSA study has been conducted in 2020. The purpose of this report is to have a clear understanding of each stakeholder in terms of category, role, interest, influence, or power, and to assess their interactions and relationships. The stakeholder analysis considered the current legislative and regulatory frameworks in the country. This report has been prepared as a part of the process to the original MSA study that the Activity conducted and capture any relevant changes happened in the recycling ecosystem during the last two years.

1.3 Scope and Methodology

The geographical scope of this report is Jordan and particularly the current waste catchment area of Al-Ghabawi landfill that serves GAM and other municipalities within boundaries of the Capital Amman Governorate and Zarqa Governorate as shown in **Figure 1**[1].

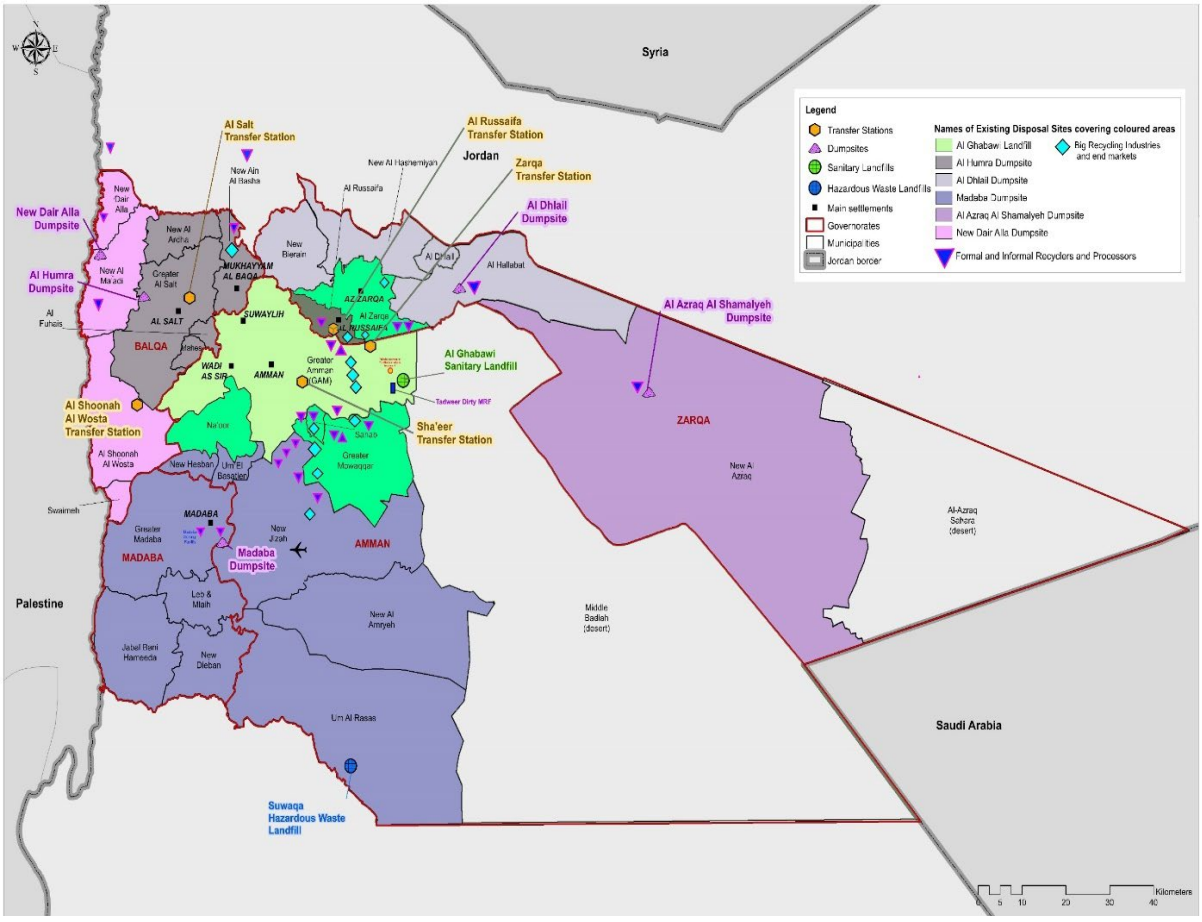

Figure 1: Waste Map of Central Jordan and Catchment Area of Al-Ghabawi Landfill in Amman

Identification of stakeholders began with a desk study and mapping the categories of key and secondary stakeholders relevant for the SWM and Recycling Sector in Jordan and particularly in

[1]The map is originated from the Regional Solid Waste Management Plan (RSWMP) For Central Region of Jordan, 2017, The Ministry of Municipal Affairs and The European Union.

Amman. After listing the relevant groups of stakeholders, an analysis was conducted to understand their roles, mandates, and influences. Another desk research was conducted to map the current projects funded by international donors related to the SWM and recycling sector in Amman.

2 STAKEHOLDERS' IDENTIFICATION AND CATEGORIZATION

Due to the wide variety of solid waste types, characteristics, and sources, the SWM and Recycling Sector in Jordan involves a wide range of stakeholders with different roles, powers, influences, and interests. Stakeholders and market actors could be primary, secondary, internal, or external in any market system, and they can also be listed and categorized in various ways to figure out their importance and interests. The stakeholders with the highest combination of power and interest are likely to be those with the most actual influence over objectives and outcomes.

2.1 Categorization

According the current legislative and regulatory frameworks in Jordan, there are multiple stakeholders and market actors in the SWM and Recycling Sector, and they categorized to two main categories as follows:

Category 1: Public Stakeholders	**Category 2:** Private Stakeholders/Market Actors
This public category includes the three groups of key stakeholders as follows:	Three groups of key stakeholders identified under this private category as follows:
• **Group 1:** Governmental Authorities: includes central ministries, public authorities, institutions, and corporations that have legislative roles and official mandates.	• **Group 1:** Demand of Recycling Services or customers from commercial Businesses and Establishments (large waste generators)
• **Group 2:** Chambers, Professional Business Associations, Affiliations, Unions, Universities, etc....	• **Group 2:** Supply of Recycling Services through the formal and informal market actors including the end-market industries/manufacturers. This group also includes other service providers in the market who offer supporting services such as equipment, maintenance finance, transport, etc....
• **Group 3:** Municipalities as civic institutions	• **Group 3:** Non-Governmental Organizations, Cooperatives, other Civil Society Organizations and social partners, initiatives, etc....

Figure 2 outlines the key stakeholders' groups in the SWM and Recycling Sector in Amman.

Figure 2: The visualization mapping of the Key stakeholders' groups in the SWM and Recycling Sector in Amman

Table 1 presents alliances, scope of influence roles and responsibilities of the key stakeholders' groups in the SWM and Recycling Sector in Amman.

Table 1: Alliances, scope of influence roles and responsibilities of the key stakeholders' groups in the SWM and Recycling Sector in Amman.

Stakeholder's group	Alliances (relationships to other actors	Scope of influence	Role/Interest
Governmental Authorities (Ministries)	Authority power and law enforcement.	Government, high influence on all actors and sector.	• Setting environmental regulations and standards (Regulator role) • Monitoring and enforcement • Planning and land use • Setting tariff structure and fees collection mechanisms • Subsidizing municipal budgets and funding. infrastructure projects • Registering companies and businesses • Controlling the commercial activities • Permitting and licensing environmental projects • Social security

Stakeholder's group	Alliances (relationships to other actors	Scope of influence	Role/Interest
Local Municipalities	Receive their powers and obligations from a central government authority (Municipal Law/Local Administration Law), with allocation of powers and responsibilities to protect the rights of the citizens and to supply municipal services.	Public institutions that are financially and administratively independent and provide municipal services as per the laws and regulations. Municipalities are very close to central government. High influence	• Service delivery and operation of SWM systems (collection, transportation, treatment, processing, and transfer) • Collection of waste fees and cost recovery • Vocational Licensing of companies and business • Buildings and Zoning Regulations for Cities and Villages • Prevention of Health Nuisances within municipal boundaries
Professional Chambers and Business Associations	Receive their powers and obligations from the public chamber laws, and are known as business membership organizations, act as key intermediaries between the government and the business community.	Non-profit organizations that have high influence on the sector through holding regular dialogues with government to advocate, providing. feedback on, and help fine-tune policies and legislations affecting business practices.	• Representation • Networking • Information services • Business and trade development • Training and consultancy services • Membership development • Special export promotion services, etc.
Recycling industries or manufacturers as well as the export-oriented brokers or processors	Lobbying and pushing powers on decision making process.	High influence on the growth and development of the recycling value chains in the local market.	• They are the final processing destination of the recyclable materials (raw material and/or semi-finished products).
Commercial Enterprises and Businesses (waste generators)	Direct impact-relation to government and municipal organizations, and they are members of chambers.	Med-influence.	• They are the source of commercial waste
Community's initiatives	Usually have involved multiple actors and/or get support from other actors, often in ad hoc basis.	Project-based. Low-med influence.	• Responding to market or local community needs. Sometimes it contains innovative and creative product or activity under a pilot scale with a strong local focus.
Recycling Services Providers (Formal and informal actors)	Poor relation with other actors.	Low influence.	• Important companies to which collectors and buy-back centers sell their waste materials.
Civil Society organizations	Good relationship with their community and informal sector.	Low influence.	• Take initiatives to organize themselves into CBOs and CSOs with the direct goal of improving recycling and separation at source practices.

3 STAKEHOLDERS' MAPPING AND ANALYSIS

The identified stakeholders in the recycling sector in Jordan are presented according to the category as following:

3.1 Public Sector

Figure 3 presents the public stakeholders of SWM and the Recycling Sector in Amman.

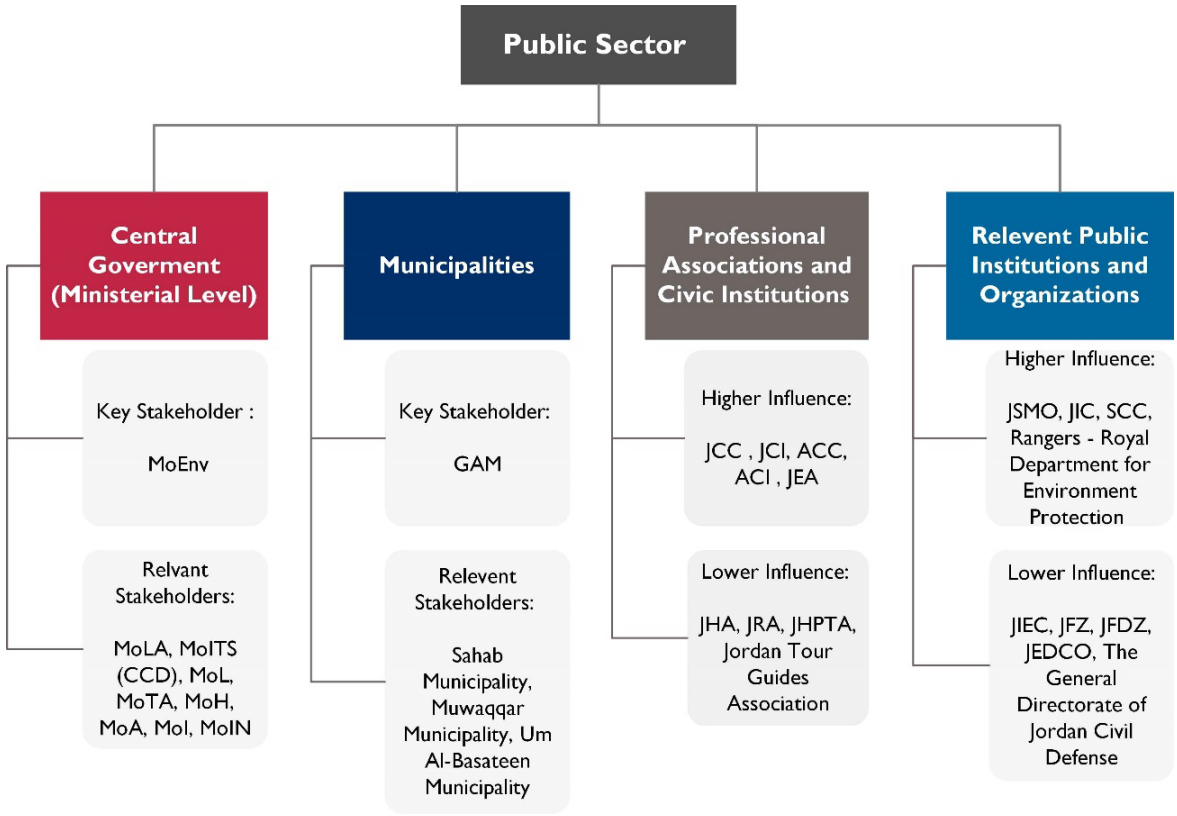

Figure 3: Public stakeholders of the SWM and Recycling Sector in Amman

3.1.1 Central Government

The legal system of Jordan is founded on the Civil Law System, where laws, along with their related written regulations and instructions, hold significant importance in the legal hierarchy. The Constitution is the primary source and fundamental written law of the country.

All official communication related to legislation such as laws and regulations, as well as legal advice, is composed by the relevant Ministry or an independent authority. They are then presented in a legally acceptable form to the Prime Minister, along with the reasoning and pertinent data. These documents are subsequently submitted to the Legislation and Opinion Bureau to be analyzed and prepared in their final form. Finally, they are forwarded to Parliament via the Council of Ministers or the Cabinet. The Parliament scrutinizes, endorses, and produces "Laws". During this process, each law is reviewed by the representatives of the Lower House, and then forwarded to the Upper House, where it is deliberated upon, either accepted as sent, or modified and sent back to the Lower House. Once a royal decree is issued, the law will be published in the National Gazette.

On the other hand, the Council of Ministers has the authority to review and produce "Regulations" arising from any particular law. Additionally, each Ministry may generate "Instructions" to specify the procedures and mechanisms for the implementation of laws or regulations.

Governmental authorities have an important role in the set-up and operation of SWM systems in Jordan. Most urban authorities receive their powers and obligations from a central government authority with allocation of power and responsibilities to protect the rights of the citizens, to provide services and to serve the common good.

At national context, the MoENV is the official authority in charge of the environment and its components and responsible for policy, legislation, planning and monitoring. The MoENV sets waste management policy, regulates the waste sector, monitors, and enforces compliance. Moreover, the MoENV is responsible for monitoring the environmental performance of each of the practices and methods used in the final disposal phase. The MoENV has specific roles and responsibilities, in coordination with the relevant authorities, and undertakes the following tasks:

- Managing data on waste and keeping records related.
- Issuing the necessary environmental approval/consent for waste management establishments.
- overseeing environmental emissions, issuing permits for the construction and operation of diverse MSW management facilities
- Providing the necessary data and information for waste management.
- Training the necessary personnel for waste management.
- Control the hazardous waste management and operations including transportation, storage, and treatment facilities.
- Approving SWM plans for MSW category at the local and regional levels.
- Coordinating cleaning campaigns and implementing educational programs to raise awareness about environmental issues.
- Leading the selection of potential sites for MSW landfills and waste treatment facilities

Article 10 of the new Waste Management Framework Law (No.16/2020) specifies jurisdictions of relevant ministries and autonomous entities such as (GAM, ASEZA, PDTRA).

Figure 4 illustrates the roles and responsibilities as per article 10 of the waste framework law.

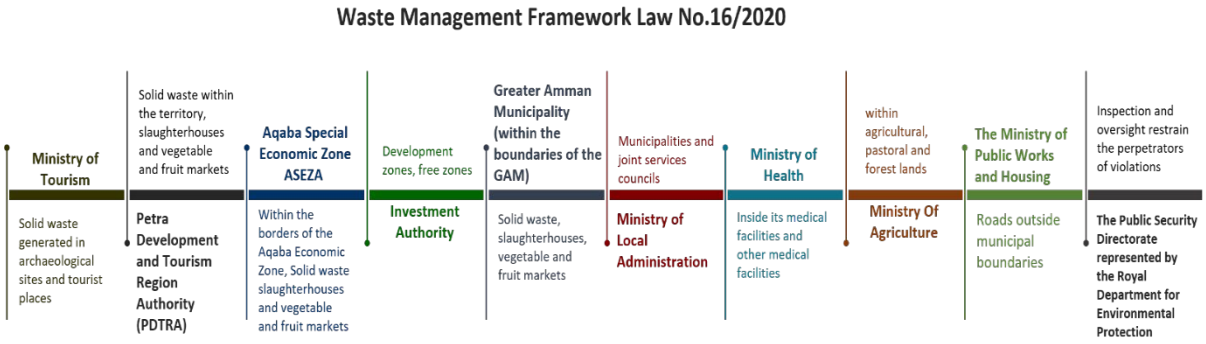

Figure 4: Roles and Responsibilities of each governmental body as illustrated in Waste Management Framework Law (No.16/2020)

The Ministry of Local Administration (MoLA) mandated to regulate all MSW management services through supervising and controlling the performance of local municipalities and Joint Service Councils (JSCs). MoLA exerts direct technical, administrative, and financial authority over their operations. MoLA contributes to financing the investments and operations of municipalities and JSCs and helps in preparation and ratification of their budgets. Local municipalities are responsible for the

direct MSW service delivery within their boundaries, while the JSCs oversee construction and operations of the non-hazardous MSW disposal sites and managing the final treatment and disposal.

The responsibility for MSW in the capital, Amman, is part of the tasks assigned to GAM. It handles waste collection, transport, sorting, recycling, storage, treatment, and final disposal. Aqaba Special Economic Zone Authority (ASEZA) is responsible for these matters within the boundaries of Aqaba Governorate while The Petra Development and Tourism Region Authority (PDTRA) controls MSW management within its jurisdiction. The Ministry of Health (MoH) is responsible for the inspection of landfill and medical waste management within its medical facilities and supervising and controlling waste inside other medical facilities with regards to the waste collection, transport, sorting, storage, treatment, and final disposal. The Ministry of Agriculture (MoA) is mandated to regulate all types of the agricultural waste while the Ministry of Tourism and Antiquities (MoTA) shall manage, supervise, and control waste over the archaeological sites and touristic places. MoTA is also responsible of licensing and categorizing touristic businesses in Jordan such as hotels, touristic restaurants and other touristic activities and initiatives.

The Ministry of Energy and Mineral Resources (MEMR) is responsible for the development of waste-to-energy projects and regulation of natural resources and energy tariffs. The Ministry of Public Works and Housing (MPWH) shall manage, supervise, and control solid waste in roads outside the Municipalities' boundaries with regards to waste collection and transport. The Investment Ministry (MoIN) shall manage, supervise, and control solid waste within the areas affiliated to MoIN.

The Jordan Customs Department, in coordination with the MoENV, shall monitor the waste shipped across borders in accordance with the agreements related to waste, in which Jordan is a party of, and the necessary conditions and controls issued by the competent authorities. The Public Security Directorate, represented by the Royal Administration for Environmental Protection (Rangers), shall undertake inspections and control over waste management field, in cooperation with the competent authorities, and shall detect the perpetrators and leaving them to the judiciary to fulfill the legal requirements against them. JSCs or local municipalities shall:

- Determine the extent of the need for a new site for the Municipal Waste Landfill and inform the Ministry and the relevant authorities thereof.
- Identify potential alternatives for the new Landfill site.
- Establish new sites for Municipal Waste Landfill.
- Operate Municipal landfills and supervise the operations at final disposal sites.
- Conclude contracts with private companies to collect nonhazardous Waste and Dispose it in accordance with the national and Municipal plan.

The Ministry of Industry, Trade and Supply (MoITS) contributes to promoting a stimulating environment for economic and investment activity in Jordan and maximizing the commercial and industrial performance. MoITS is responsible for regulating the industry and Trade by type, classifying, and registering it according to an internal regulation, and preparing the programs and studies that work on developing the industry and Trade and increasing its competitiveness. MoITS governs the registration of companies and business profiles through either the Commercial Register (CR) or the Companies Control Department (CCD). MoITS organizes and regulates the internal and external trade, monitoring and control.

The Ministry of Labor (MoL) contributes to the organization of the Jordanian labor market and employment of Jordanians locally and abroad. The MoL is pursuing efforts to provide modalities to integrate informal sector through a national framework "The framework, entitled "Towards a National Framework for a Transition to Formal Economy in Jordan," was endorsed by the MoL, the General Federation of Jordanian Trade Unions (GFJTU), the Jordan Chamber of Industry (JCI) and

the Social Security Corporation (SSC)1." More than half of Jordan's employment is estimated to be in the informal sector, which is also the case for the recycling sector in Jordan which can be describes as being highly informal.

The above research indicates that there is no conflict of responsibilities between competent authorities dealing with MSW management in Jordan in terms of legal and institutional setups. However, the reality of the service provision in terms of the definition of the service area and management of mixed waste streams that contain overlapping authorities and unclear governance systems. Additionally, the roles and responsibilities do not cover the whole range of MSW management activities, with what relates to treatment and recovery (i.e., recycling, waste to energy).

Table 2 shows the relevant governmental ministries and their mandates related to the SWM and Recycling Sector in Jordan.

Table 2: The central government ministries and their mandates related to the SWM and Recycling Sector in Jordan

Stakeholder's Category	Relevant Legislation Pieces	Mandates/Roles
Key Stakeholders – Ministries at the National level		
Ministry of Environment (MoENV)	• The Environmental Protection Law (No. 6 of 2017) • Waste Management Framework Law (No.16/2020) • The Environmental Classification & Licensing Regulation By-Law No. 69 of 2020 • The non-hazardous solid waste management system By-Law No. 44 of 2022, • The Environmental Information and Control System for Waste Management By-Law No. 85 of 2020 • The Biodegradable Plastic Shopping Bags By-law and its amendments No. 45 of 2017	*Responsible for: Environment* • Setting environmental regulations and standards • Developing waste and recycling policies, laws, and regulations. • Environmental licensing and permitting • Environmental inspection and monitoring • Enforcement and compliance • Organizing hygiene campaigns • Implementing awareness programs • Hazardous waste management
Ministry of Industry, Trade, and Supply	• The Industry and Trade Law No. 18 of 1998 and its amendments • The Companies Law No. 22 of 1997 and its amendments. • The Import and Export Law No. 21 of 2001 and its amendments • The National Production Protection Law No. 21 of 2004	*Responsible for: Trade and Industry (Business Activity)* • Trade policy mandate • Licensing the businesses and ensure the official registration and licensing process in accordance with the laws and regulations. • Controlling the companies and establishments' registration directory
Ministry of Local Administration (MoLA)	• The Local Administration Law (No. 22/2021) • The Municipal Law • (No. 41/2015)	*Responsible for: Municipal waste* • Regulate all MSW management services within municipal boundaries outside Amman including collection, processing, and transfer. • Regulate all MSW management services within landfill boundaries outside Amman including disposal and landfilling. • Supervise and control the performance of

[1] https://www.ilo.org/beirut/media-centre/news/WCMS_363990/lang--en/index.htm

		local municipalities and JSCs. • Contributes to financing the investments and subsidizing the operations of local municipalities and JSCs. • Contributes to financing the construction of waste landfills and closure of dumpsites. • Regulate prevention of Health Nuisances within • municipal boundaries and waste fees collection within Municipal boundaries.
Relevant Stakeholders – Ministries at the National level		
Ministry of Health (MoH)	• The Public Health Law No (47) for year 2008 and its amendments	*Responsible for: Public health and medical waste* • Regulating health related companies and labs. • Inspection of landfill, medical waste management
Ministry of Labour (MoL)		*Responsible for:* • Organizing labor sector in Jordan. • Overseeing the affairs of employers and workers, occupational health, and safety, • Contribute to the organization of the Jordanian labor market, employ Jordanians locally and abroad, etc.
Ministry of Tourism and Antiquities (MoTA)		*Responsible for: Waste management and public cleanliness in historical sites* • Developing the tourism sector in Jordan, including regulating hospitality services
Ministry of Agriculture (MoA)	• The Agriculture Law No. 2 of 2020 and its amendments	*Responsible for: Agricultural waste and public cleanliness of natural forests* • Regulating agricultural policies • Promote local production. • Regulating the organic fertilizers and food waste- based compost productions • Regulates animal feeding products and testing.
Ministry of Interior (MoI)		• Responsible for security permits of the (exports/imports) and control the movement of goods and commodities at the country's cross borders trade
Ministry of Investment (MoIN)	• The Investment Environment Law No. 21 of 2022	• Responsible for promoting investments for the purpose of achieving comprehensive and sustainable economic development, access to global markets, increased competition, and availability of high value-added job opportunities, and finally, funding of development projects.

3.1.2 Relevant Governmental Institutions and Organizations

In addition to central ministries, the existing legal and institutional frameworks in Jordan show that there are governmental institutions and incorporations that in one way or another have participatory roles in the SWM and Recycling Sector and commercial business. Other governmental organizations and entities which have a supporting role or mandate in the SWM and Recycling Sector are presented in **Table 3**.

Table 3: Relevant governmental institutions and organizations in the SWM and Recycling Sector in Jordan

Stakeholder's Category	Mandates/Roles
Governmental Institutions and Organizations	
Jordan Companies Controlling Department (CCD)	*Responsible for: companies' registration services* • Regulate and control the corporate governance according to the Companies Law No. • Responsible for National Corporate Governance Code. • Boost the business and investment environment in Jordan
Jordan Customs Department	*Responsible for:* • Controlling the movement of goods and services • Examination and inspection of goods, • Performing customs procedures on goods. • Applying and collecting customs tariffs and other due fees and taxes on the goods imported and/or exported to/out Jordan.
Jordan Industrial Estates Corporation (JIEC)	*Responsible for:* • Building and running industrial estates in Jordan Attract investments
Jordan Enterprise Development Corporation (JEDCO)	*Responsible for:* • Promoting and supporting entrepreneurship and SMEs' development and growth. • Offering technical and financial support.
Rangers - Royal Department for Tourism & Environment Protection	*Responsible for:* • Enforcing law in partnership with MoENV and MoTA.
Jordan Environment Fund (JEF)	*Responsible for:* • Support activities that contribute to environmental protection and conservation, and development of environmentally friendly practices. • Initiatives that promote resource efficiency contribute to sustainable development. • Contribute to raising environmental awareness, including use of cleaner production technology. • Focus on priority national sectors and provide support to enable fulfillment of environmental requirements. • Promote cooperation and knowledge transfer with national, regional, and international entities with similar mandates to coordinate activities in support of environmental protection.
Social Security Corporation (SSC)	*Responsible for:* • Creating a legislative framework embodying a social security ensuring comfort and reassurance for the worker and good citizen in case of illness disability, and old-age, secure decent live for her/his family member
The General Directorate of Jordan Civil Defense	*Responsible for:* Safety requirements for licensing certificates.
Jordan Free & Development Zones Group (JFDZ)	*Responsible for:* • Providing an adequate environment to attract and develop local and foreign investments. • Attracting local and foreign capitals and employing them in the country in the various investment activities • Encouraging export industries and activating the transit trade • Promoting the unique role of the private sector in setting up private and joint free zones which use local raw materials in production inputs

Stakeholder's Category	Mandates/Roles
Governmental Institutions and Organizations	
Jordan Standards and Metrology Organization (JSMO)	*Responsible for:* • Adoption of a national system for standardization and metrology based on accepted international practices. • Keeping pace with scientific and technical developments in the fields of standards, metrology, conformity assessment and laboratory accreditation. • Ensuring the health and safety of the Kingdom's citizenry and protection of the environment by making sure that goods, products, and services follow the technical regulations adopted by the Organization for the purpose. • Ensuring the quality of local goods, products, and services through the adoption of proper Jordanian Standards to enhance their competitiveness in the local and international markets and thus support the national economy
The Higher Council for the Rights of Persons with Disabilities	*Responsible for:* • Policies and institutional development related to Persons with disabilities. • Inclusive education • Monitoring and coordination Accreditation and Quality Control
The Jordanian National Forum for Women (JNFW)	*Responsible for:* • Advocating for women's rights and • Increasing women's participation in decision-making processes • Political empowerment of women. Monitoring discrimination against women.
Jordan Renewable Energy and Energy Efficiency Fund (JREEEF)	*Responsible for:* • Providing the necessary funding for the deployment of renewable energy sources and the rationalization of energy consumption, including small renewable energy facilities. It supports any program and the financial mechanisms allowing RE and EE users and investors to access financing from banks, local and international financial institutions Supporting government in reducing the financial burden on consumers and the national economy, resulting from energy imports and subsidies to the energy sector. • Promoting the development of a domestic industry as well as to open new markets

3.1.3 Local Municipalities

Local municipalities have a fundamental role in the set-up and operation of MSW management systems at municipal level. They receive their powers and obligations from a central government authority, with allocation of powers and responsibilities to protect the rights of the citizens, to supply services, and to serve the common good. On the one hand, they implement laws and regulations to fulfil their statutory obligations. While GAM is an autonomous legal entity, Like ASEZA and PDTRA, the remaining municipalities within the Capital Amman Governorate are like the legal status of remaining municipalities in Jordan. **Figure 5** shows local municipalities of the Capital Amman Governorate[2].

[2] Ministry of Local Administration (MOLA)

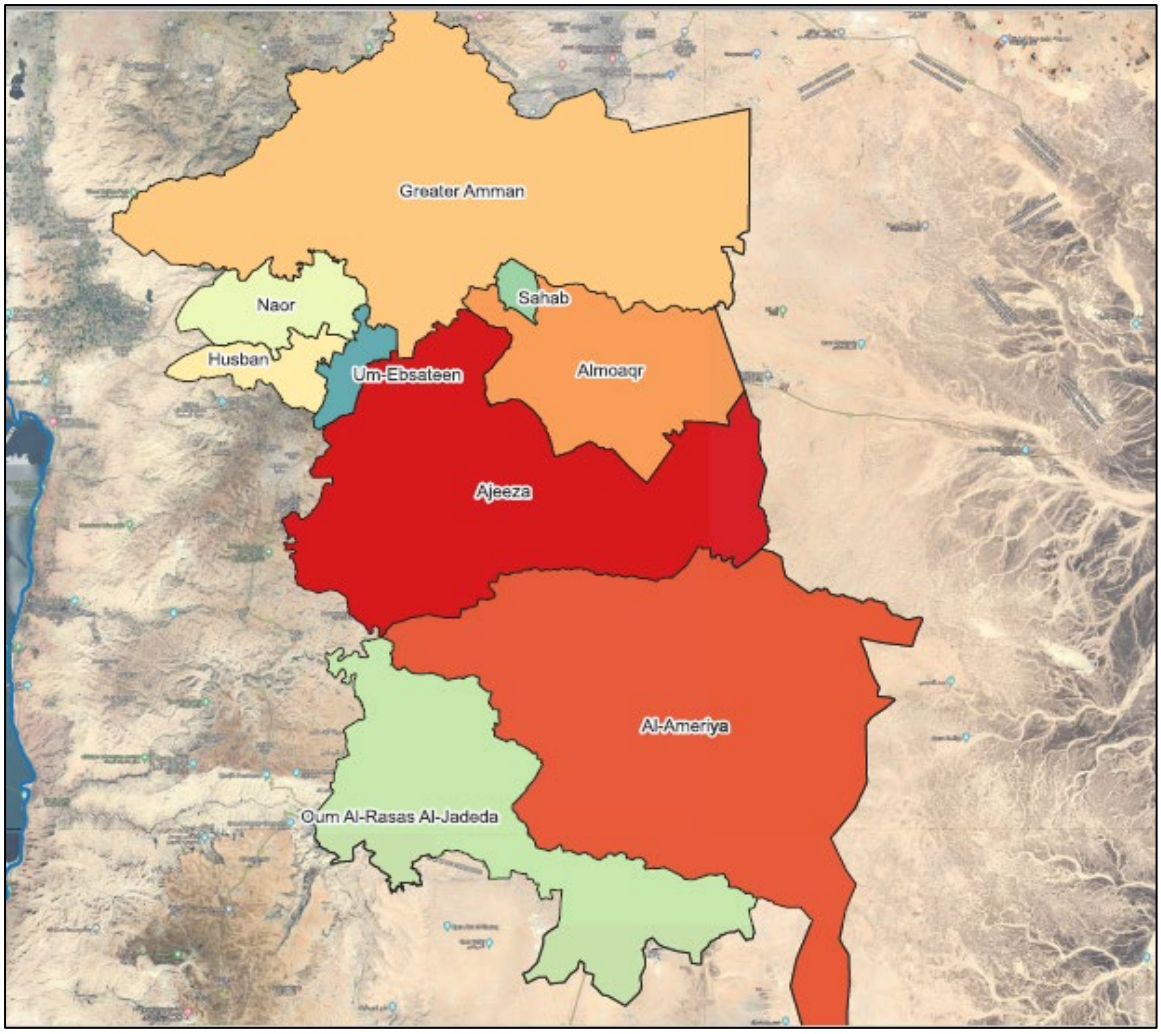

Figure 5: Local Municipalities of the Capital Amman Governorate

GAM is the key stakeholder in the USAID Recycling in Jordan Activity and has a special position among the other municipalities of Jordan. Unlike other municipalities GAM does not report to MoLA but is directly linked to the Prime Minister as it has a special position embedded in Jordan's legal framework. Given the municipalities are governed by the Municipal Law (No. 41/2015) and the Local Administration Law (No. 22/2021), GAM has its own law titled "Amman Municipality Law (No. 18/2021)" which is, for instance, arranged that GAM is a civil institution with administrative and financial independence. The article 13 in the said Law states that GAM is responsible for the MSW management and public cleanliness within its boundaries including (1) waste collection, (2) transfer, (3) treatment, and (4) disposal. The management of solid waste in GAM is also governed by local regulations of which By-law 150 of the year 2016, titled Nuisance Prevention and Waste Collection Fees, is the most important. The By-Law declares the role and responsibility of GAM in obtaining fees for the collection, transportation, disposal, and treatment of SW. GAM is currently working on drafting a new SWM by-law to unify the roles and responsibilities related to solid waste management and public health nuisance issues under one regulation.

Given the fact that several recyclers are placed in Amman but not within the geographical boundaries of GAM, and some of them are placed in neighboring cities and municipalities like Zarqa and Russeifa and practice their businesses in Amman. Sahab, Muwaqqar, Al-Jizah areas are parts of East and South of Amman, but they belong to separate municipalities not to GAM.

Table 4 presents the Municipal stakeholders and their responsibilities relevant to the SWM and Recycling Sector in Amman.

Table 4: Municipal stakeholders and their responsibilities relevant to the SWM and Recycling Sector in Amman

Stakeholder Category: Municipalities	Governing Legislation of Stakeholder for SWM	Role/Responsibilities
Key Stakeholders – Municipalities (civic institutions) in the Capital Amman Governorate		
Greater Amman Municipality (GAM)	• The Greater Amman Municipality Law (18/2021) • Nuisances Prevention and Waste Collection Fees within Boundaries of GAM By-Law No. (150) of 2016 • Instructions for Waste Services Fees, Transportation, Treatment and Disposal of 2014 and its Amendments[3] • The Vocational Licensing Law in GAM No. 11/2022 • The Monitoring and Inspection of Economic Activities Law No. 33/2017, and amendments	Responsible for: *Delivery of MSW management services:* • Delivery of municipal services within its boundaries (22 Districts) including public cleanliness and waste management. • Providing day to day waste management including waste (1) collection, (2) transfer, (3) treatment, (4) and disposal operations. • Applying penalties and fines related to health nuisance preventions in waste management. • Adopting and applying specific regulations (by-laws) or instructions in waste management, in accordance with the Municipal Law (Regulatory Role). • Charging and collecting waste collection fees to the different types of waste generators, including households, commercial entities, and industries. • Charging and collecting waste tipping fees at Ghabawi landfill from private waste transporters. •Vocational Licensing of companies and businesses in Amman
Relevant adjacent Municipalities[4] in the Capital Amman Governorate		
Sahab Municipality Muwaqqar Municipality Um-Al Basateen Municipality Al-Jizah Municipality, Russeifa Municipality Zarqa Municipality, Ain Al-Basha Municipality	• The Local Administration Law No. 22/2021 • The Municipal Law No. 41/2015. The Joint Services Councils By-Law No.113/2016 and its Amendment No.66/2022. • The By-Law for Government procurement No. 8/2022 and its Amendment No.15/2022. • Instructions for organizing government procurement procedures for the year 2022. • Municipal Supplies and	Responsible for: • Supplying day to day waste management including (1) waste collection and transportation to the closest landfill. • Vocational Licensing of companies and businesses within its boundaries • Charging and collecting waste collection fees to the different types of waste generators, including households, commercial entities, and industries. • Applying penalties and fines related to health nuisance preventions in waste management. • Applying specific instructions in waste management, following the Municipal Law and The By-Law for Nuisance Prevention & Waste Collection Fees within Municipal Borders No.68 (2016).

[3] GAM is currently working on drafting a new By-Law for the SWM in Amman to regulate and unify all roles and responsibilities related to solid waste management based on recent updates done on other relevant legislation pieces.
[4] Responsible for: waste collection within the waste catchment area of Al-Ghabawi Landfill or hosting waste recycling service providers that divert the recyclables from Al-Ghabawi.

	Works Instructions 2019 • The By-Law for Nuisance Prevention & Waste Collection Fees within Municipal Borders No.68/2016 and its Amendment No. 59/2019.	• This by-law allows municipalities to offer annual incentives to waste generators from commercial sector (up to 50% of waste collection fees).
The Capital Joint Service Council[5]		Responsible for: • The JSCs By-Law No.113/2016 and its Amendment No.66/2022, which are based on Articles 31 and 75 of the Municipalities Law No.41/2015 grants JSCs certain tasks and responsibilities, including managing waste dumpsites, providing services, managing joint projects, collecting taxes and fees, and carrying out other approved work assigned by the Minister.

In GAM, Licensing Directorate handles revenues collection, estimation of waste disposal and collection fees charged to the private sector (industries, offices, and professionals). The Directorate is also responsible for building licensing and utility clearance. The Department of Professions and Advertising Licenses (DePAL) in every GAM District licenses business premises and profession on an annual basis and collects non-electricity-based tariffs and fees for MSW services to the commercial and private sector.

The Nuisance Prevention and Waste Collection Fees By-Law (article 6) defines the fees schedule for waste (1) collection, (2) transfer, (3) treatment, (4) and disposal. The fees for households, which are collected by the company providing and charging for electricity, are set as a base fee of 20 JOD/year per household while, households that use more than 200 kW of electricity per month, as determined by the electricity company, must pay an extra 0.005 JOD per excess kW.

The Law of Vocational Licenses and the By-Law of Vocational Offices Services Fees state that GAM collects for SWM 20% of the fees paid for vocational licenses. The amount collected by GAM (20% of the total fee) will not be less than 20 JOD. Article 6/B of the Nuisance Prevention and Waste Collection Fees By-Law states that vocational fees calculated and collected annually. The articles 4 and 5 of the By-law set the standards for calculation for vocational license fees and state that fees for businesses (establishments) will be influenced by a set of standard criteria including waste volume, density, and nature. Article 5 of the Nuisance Prevention and Waste Collection Fees By-Law states that fees for vocational licenses are separated into fifteen categories, according to the criteria of article 4. The By-law also formulates exceptions to the general fee setting method including for shops that serve liquid coffee and tea without seating. For these shops, an annual fee of 500 JOD is set. Further, the By-law states that for the following vocational licenses no waste transfer and collection fees are collected:

- Billboards (advertising),
- School buses,
- Water tanks,
- Sewage tanks,
- Petroleum tanks,
- Construction machinery (diggers, winches, loaders, etc.), and
- All other vocations that are performed by a truck or transportation vehicle.

The article 7 of the Nuisance Prevention and Waste Collection Fees By-Law concerns the vocational licenses for firms that use GAM skip loaders for waste disposal. GAM issues vocational licenses concerning waste transfer and disposal to such firms through coordination with the Department of

[5] Established 2023 under Article 33: Addresses Joint Services Councils (JSCs), which are treated as second-category municipalities. The Minister can establish JSCs and issue regulations governing their functions, personnel, finances, and dissolution.

Vocational License and Advertisements. Vocational licenses require that skip loaders have at least three tons of waste per trip to the landfill or treatment facilities. The vocational licenses for waste transfer and disposal also determine permission to enter landfills. Skip loader waste fees ("tipping fees") are determined annually. The determination comes from a waste transfer and treatment cost study. Tipping fees go directly to GAM at the point of entry to the landfill and treatment facilities.

3.1.4 Chambers and Professional Business Associations

The recycling and commercial sectors in Amman embrace a wide range of civic actors who represent professions, interest groups or sections of society, with different roles and mandates. Actors of civil society can for instance include Community Based Organizations (CBOs), nonprofit organizations, professional associations, non-governmental organizations (NGOs), social partners, universities, or media representatives.

The industry chambers are governed by The Industry Chamber Law (No. 01/2005) while the commerce chambers are governed by The Commerce Chamber Law (No. 70/2003). This type of public stakeholder has a high influence on the sector through holding regular dialogues with government to advocate, providing feedback on, and help fine-tune policies and legislations affecting business practices. **Table 5** shows a list of chambers and professional associations along with their responsibilities relevant to recycling market in Jordan.

Table 5: List of chambers and professional associations along with their responsibilities relevant to recycling market in Jordan

Stakeholder Category: Professional Associations and Civic Institutions	Role/Interest/ Mandate
Jordan Chamber of Industry (JCI)	• Industrial sector representation towards reflecting the sector's size and importance. • Promoting the industrial sector development • Providing information and statistics • Local and international promotion and marketing • Consolidation and coordination roles
Amman Chamber of Industry (ACI)	• Representing the Jordanian industrial sector in Amman. • Membership of more than 7,000 of Jordanian manufacturing firms of which 90% are SMEs (Industrial Directory). • Provide and improve data and information base about industrial market and economy. • Connectivity between the industrial sector, Jordanian universities, industrial innovation, and technology transfer. • Specialized guidance and counseling service. • Quality, environment and safety, and local and international conformity certificates. • Local and international promotion and marketing. • Awareness creation and training.
Jordan Chamber of Commerce (JCC)	• Facilitating international trade. • Encouraging foreign investment, • Promoting economic development • Providing market information and economic statistics • Consolidation and coordination roles
Amman Chamber of Commerce (ACC)	• Trade/commercial sector representation towards • reflecting the sector's size and importance. • Provide and improve data and information base about market and economy. • Improve the business environment and influence the economic and trade legislative environment, laws, and policies. • Support for SMEs and encourage innovative projects and works.

Stakeholder Category: Professional Associations and Civic Institutions	Role/Interest/ Mandate
	• Improve the trade practices in terms of both quality and efficiency. • Attract local and foreign investments. • Communication and awareness.
Jordan Hotels Association (JHA)	• Representing Jordanian hotel and lodging sector over 590 hotels (Classified and Unclassified) throughout Jordan. • Advocacy and training • Events and networking • Official supporters of the Jordan Tourism Board and its programs and activities. • Provide and improve data and information base about hotel industry and hospitality market in Jordan.
The Jordan Restaurant Association (JRA)	• Representing over 950 classified members including (restaurants, entertainment cities, coffee shops, fast food, discos, bars, and cabaret of 1-5 stars). • Advocacy and training • Events and networking • Official supporters of the Jordan Tourism Board and its programs and activities. • Provide and improve data and information base about restaurants industry in Jordan.
Jordan Export Association (JEA)	• Develop international trade and promotion of Jordanian exports. • Representing the export sector in Jordan and influencing the economic and trade enabling environment, laws, and policies. • Export promotion and Market information, • Capacity building and advocacy
Jordanian Handicrafts Producers & Traders Association (JHPTA):	• Conservation of the Jordanian handicrafts • Support the producers of these handicrafts. • Awareness and networking • Capacity building and training
Jordan Tourism Board (JTB)	• Independent, PPP organization established in 1998. • Marketing and promoting the Jordan tourism products in the international markets.
Zarqa Chamber of Industry (ZCI)	• Representing the industrial sector in Zarqa and Mafraq. • Provide and improve data and information base about industrial market in Zarqa including the recycling sector. • Industrial innovation and technology transfer. • Specialized guidance and counseling service • Local and international promotion and marketing. • Awareness and training.
The Jordanian Women's Union	• Improving the political, economic, and social status of women and all marginalized groups in the community. • Support the mainstreaming of a gender-equality perspective in all policies and laws. • Women advocacy • Social protection and economic empowerment • Information and communication
East Amman Industrial Investors Association	• Networking and outreach to industrial sector in Amman • Advocacy
EJABI – Euro-Jordanian Advanced Business Institute	• Training and capacity building for industrial sector • EJABI is a non-profit organization belongs to Amman Chamber of Industry.
BPWA - Business and Professional Women Association	• Encourages women in economic development and provides them with different kinds of assistance.

3.2 Private Sector

The private sector is the primary actor in the recycling market in Amman and has many roles to play throughout the waste value chains either through formal or informal business activities, in absence of a dedicated system for public recycling in Amman so far. Three primary stakeholder groups are identified in the SWM and Recycling Sector which are as follows: service providers, waste generators and civil society organizations, as indicated in **Figure 6**.

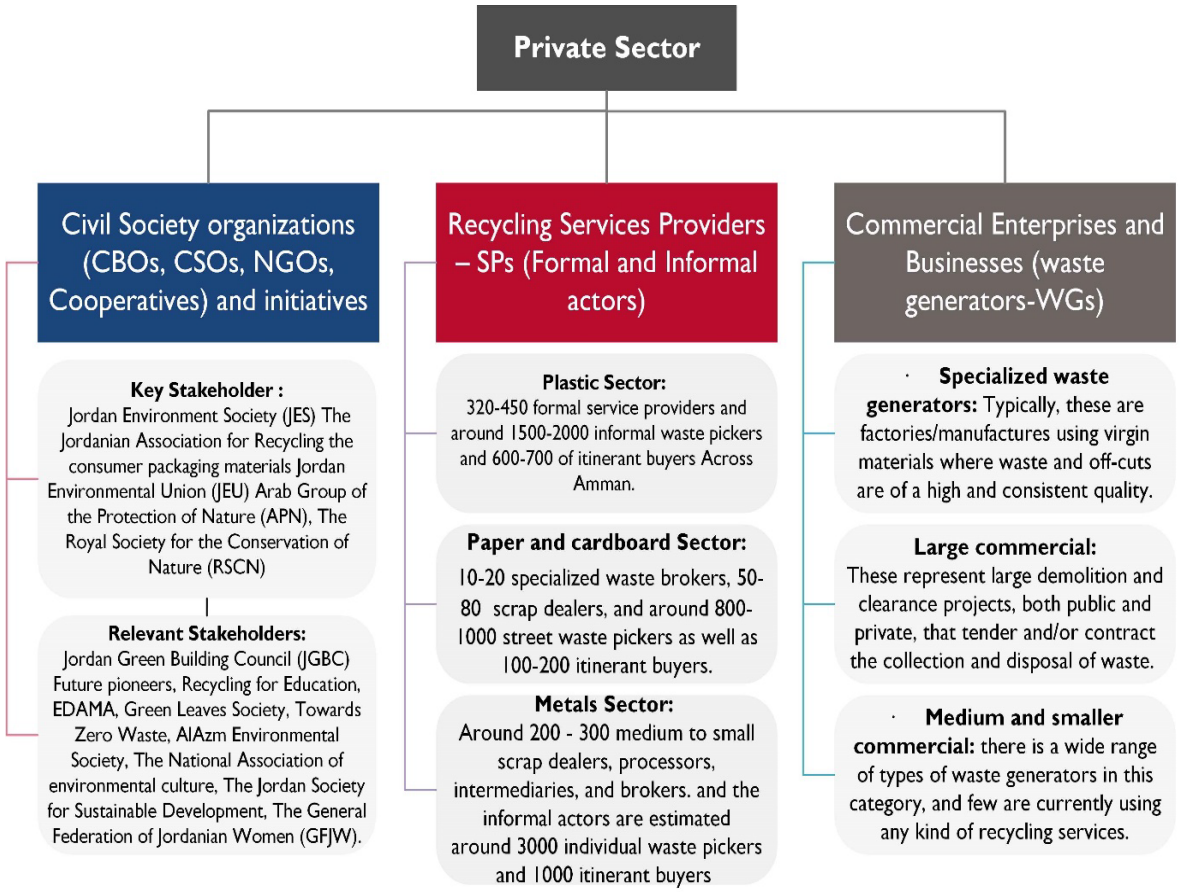

Figure 6: The private stakeholders of the SWM and Recycling Sector in Amman

The formal private stakeholders consist of private sector corporations, institutions, firms, and individuals operating registered and/or incorporated businesses with official business licenses, an organized labor force governed by labor laws, some degree of capital investment, and generally modern technology. In general, the defining characteristic of the formal private sector is that its main aim is to generate a profit on investments. Formal private companies are involved in wide-ranging activities in SWM and recycling systems, varying from waste collection, hauling, sorting, aggregating, processing, manufacturing, and production of recycled products.

Whereas the informal private sector refers to unregistered, unregulated, or casual activities carried out by individuals and/or family or community enterprises, which engage in value-adding activities on a small-scale with minimal capital input using local materials and labor-intensive techniques. Informal activities, in contrast with the formal sector in waste collecting and recycling, are often driven by poverty, and are initiated personally and spontaneously (and sometimes haphazardly) in the struggle for survival (although some enterprises, especially the ones engaged in recycling activities, manage to make considerable profits).

Consequently, the choice of materials to collect is in the first place determined by the value of the waste materials, and in the second place, by their ease of extraction, handling, and transport. Paper and cardboards, metals, and plastics, usually collected from wealthier residential or commercial areas, tend to attract more attention than organic or biodegradable materials, even though these materials are present in much smaller percentages than organic food waste or manures.

In general, the informal sector consists of two types of activities, individuals, and families, performing activities which provide them with subsistence, and small businesses, operating in much the same way as their larger, registered counterparts, but without the benefit of official registration. This is true not only for street waste pickers and itinerant waste buyers, but also for other groups such as small enterprises recycling metals or plastics (recyclers), and marginalized groups who are looking for a way to generate subsistence income in an urban context.

While informal-sector activities vary according to sociocultural, religious, and economic circumstances, some generalizations about gender roles are possible. The least sophisticated forms of labor, including collection of waste from the streets and dumpsites and primary sorting of the material fall to women, most of whom work from home and do any handling or sorting in their homes or yards. Men are more likely to be involved in the processing or manufacturing of items, together with the selling of recovered items and materials.

Communities sometimes take the initiative to organize themselves into CBOs with the direct goal of self-help and improving their living conditions. CBOs may receive external aid in the form of technical and/or financial aid from different agencies/donors. Sometimes, these activities may also take the form of direct participation in SWM, such as feeding organic material directly to their livestock. Usable materials, like bottles, are often reused by the members of the low-income community themselves. Community-based awareness campaigns are provided by CBOs combined with recycling activities they pilot.

3.2.1 Commercial Enterprises and Businesses (waste generators-WGs)

The commercial waste generators refer to all non-residential entities, including private businesses, industrial/manufacturing plants, construction and demolition institutions and projects, public institutions (government building, public schools/universities, foreign embassies, public hospitals), hospitality institutions (hotels, restaurants, café, catering, and events venue), commercial and retail (Malls, and shops), food processing institutions (Food markets, grocery stores, butchers, bakeries, food preparation and packaging), civil society and religious institutions (community centers, mosques, churches), urban/peri-urban farms, and home-based businesses.

According to GAM estimates, Al-Ghabawi landfill receives 3,250 tons of waste every day from GAM districts, of which 30-40% are generated from commercial sources. Those commercial generators are the main supply of the waste recyclable materials in the project.

According to GAM data records (2022), nearly 102,181 commercial businesses are registered in Amman compared to 98,995 businesses in 2020. Of which, around 5000 entities generate 100 kg waste per day and more and so classified as small to large commercial waste generators. There are around 1000 large commercial entities that produce 100 tons per year (274 kg/day) while less than 20 entities produce 1000 tons per year or more and are considered the largest generators.

Table 6 shows the classification and number of commercial entities in Amman per volume of waste generated and using the private waste collection and hauling services.

Table 6: The classification and number of commercial entities in Amman per volume of waste generated and using the private waste collection and hauling services.

Volume of Waste generated	Number of commercial entities in Amman (2021/2022)	The number of commercial generators currently using private waste haulers (2021/2022) (Agreements)	Number of commercial entities in Amman (2019/2020)	The number of commercial generators currently using private waste haulers (2019/2020) (Agreements)
Large: ≥2740 kg/day (1000 ton/year)	18	10	19	10
Medium-Large: ≥600-2739 kg/day	235	77	237	74
Medium: 300-599 kg/day (100 ton/year = 274 kg/day)	804	65	475	57
Medium-small: 100-299 kg/day	4,943	51	3,992	228
Small: 30-99 kg/day	22,918	19	22,359	536
Micro: ≤30 kg/day	73,263	9	71,913	617
Total	**102,181**	**231**	**98,995**	**1522**

Table 7 disaggregates the main waste generators per commercial sector according to data received by GAM.

Table 7: Distribution of Key waste generators per commercial sector in Amman (2021/2022)

No. of business/ commercial sector	Large	Medium - Large	Medium	Medium-Small	Sub-total
Educational institutions (private and public)	0	17	81	301	399
Event venues			6	33	39
Hypermarkets, Food markets/grocery stores/butchers/bakeries/food preparation and packaging	2	53	74	196	323
Hospitals and pharmacies (private and public)	5	27	12	21	60
Hotels and hospitality	10	35	69	187	291
Industrial and manufacturing	1	16	68	194	278
Malls and retail		5	39	391	435
Professional services		13	106	1273	1392
Restaurants, cafes, catering, and food preparation		75	350	2440	2865
Workshops and garages		2	7	49	58
Grand Total	**18**	**243**	**812**	**5,085**	**6,140**

Table 8 shows the amounts of MSW delivered to the Al Ghabawi Landfill (tons/year) by the private waste haulers/ transporters during the period (2014 - 2021).

Table 8: The amounts of MSW delivered to the Al Ghabawi Landfill (tons/year) by the private waste haulers/ transporters during the period (2014 - 2021)

Year	Total MSW tonnage per year landfilled in Ghabawi which diverted by the private haulers/transporters	40% of the GAM direct haul (commercial sources) tons per year
2014	15,319	344,049
2015	26,709	377,720
2016	37,493	408,237
2017	30,687	417,507
2018	30,378	443,558
2019	25,529	430,687
2020	23,132	402,150
2021	18,745	411,172

Moreover, USAID Recycling in Jordan Activity named three distinct types of commercial waste generators based on the source of waste:

- **Specialized waste generators:** Typically, these are factories/manufactures using virgin materials where waste and off-cuts are of a high and consistent quality.
- **Large commercial:** These represent large demolition and clearance projects, both public and private, that tender and/or contract the collection and disposal of waste. While some of this waste enters the recycling market value chains, the majority is diverted to the landfill.
- **Medium and smaller commercial:** there is a wide range of types of waste generators in this category, and few are currently using any kind of recycling services.

USAID Recycling in Jordan Activity targets all businesses that generate 100 ton per year that equals 274 kg/day or above in the interventions.

3.2.2 Recycling Services Providers – SPs (Formal and Informal actors)

Recycling Service Providers (SPs) are defined as individuals, businesses, and/or civil society organizations in the formal or informal sector who perform value-adding services with the objective of introducing solid waste management practices including separate collection, reusing, repurposing. or selling such products of a marketing value and/or supplying relevant supporting services across the recycling value chains.

Recycling services refer to any recovery or handling operation by which waste materials are reprocessed into products, materials, or substances whether for the original or other purposes of reusing, repurposing, or selling such products, typically after some degree of sorting and/or processing. These services include – but not limited to - separation at source, collection, sorting, hauling, aggregating, processing, etc. of recyclable waste materials.

Solid waste products are a byproduct of the waste generator's normal operations and no longer have utility or value to the waste generator's normal business operations. Recyclable waste may be either pre-consumer waste (scrapped from manufacturing of products) or post-consumer waste (waste arising after the use of products at the consumer market). Moreover, Recyclable material

may be left over from product manufacturing and consumption, renovation, maintenance, and new construction projects.

Due to the high quality of the pre-consumer waste, it is often economically feasible to recycle these waste streams, and this is often already done either internally in the production facility or through external channels.

In Amman, the recycling sector is still fairly embryonic whereas less than 5-10% of the recyclables are currently recovered, while the vast majority of the post-consumer waste usually ends up in the landfill. Market value chains are established in the local market for different types of plastic, ferrous metals, segregated paper, mixed paper/cardboard, e-waste, cooking oil, tires, etc.... which are recovered either in the country or through export.

The sector includes formal and informal activities in all waste value chains and comprises numerous self-employed waste pickers, vulnerable refugees, foreign workforce, and informal micro-enterprises at the bottom of the value chain, building up through a series of intermediaries on both sides of the formal–informal economy boundary. Registered companies dominate the end of the value chain; these are large dimension specialized waste brokers, sometimes directly owned by the local or foreign recycling companies, who provide raw materials for the domestic manufacturers or on the global end markets.

The value chain starts at the source: households, commercial and industrial entities where several valorization activities take place, depending on the type of generator and waste produced. Formal and informal collectors are involved in collecting waste including private waste hauler companies, informal street waste pickers, as well as itinerant buyers.

The Second Version of the Recycling Service Providers Directory lists the companies that are engaged with various waste generators in Amman as recycling service providers dealing with collection and sorting, aggregation, processing, and manufacturing of end products from recycled materials.

Informal collectors in Amman range from individual waste pickers in the streets to itinerant buyers with trolleys or trucks where formal waste picking activities have been banned in Ghabawi landfill site since few years ago. The informal actors at the upstream side of the value chain typically carry out primary sorting, segregation and collecting before selling the materials into the recycling value chains.

Official estimates for informal waste picking activities in Amman are currently unavailable. However, the national strategy for Municipal Solid Waste Management indicates that there could be approximately 3,000 to 5,000 individuals engaged in informal waste picking in Amman and Zarqa governorates. The majority of these individuals reside in middle-to-low-income areas outside of Amman, such as Zarqa, Russeifa, Marka, Ain-Al-Basha, Qwismeh, Sahab, Muwaqqar, and others. Additionally, it is estimated that there are around 600 to 700 itinerant buyers operating in Amman. These buyers use various types of collection trucks or pick-ups to gather recyclable materials that hold value within the recycling value chains.

The existing waste value chains in the downstream sides include scrap yards dealers, aggregators, middlemen, sorters, processor, specialized waste brokers, exporters, and recyclers. The actors usually perform such value-adding activities where several of them are also operating in the informal sector. Indeed, there are large and long-established recycling plants and industries exist at higher functional levels in the value chains.

Recycling industries/manufacturers are defined by their outputs, which are finished commercial products that are used by other sectors. Their products are no longer considered recyclable

materials or waste. Manufacturers may use exclusively recycled materials, a combination of recycled and virgin materials, or exclusively virgin materials in their manufacturing process.

Table 9 presents the types of recycling services offered by the current market actors to the large commercial waste generators in Amman.

Table 9: Types of recycling services offered by the current market actors to the large commercial waste generators in Amman.

Type of recycling services offered to the large commercial generators	Description
Mixed collection and hauling to landfill	This service includes provision of containers, uploading of mixed MSW according to specific frequency, hauling of waste to official landfill, provide disposal receipts records.
Separate collection of segregated recyclable materials (post- consumer waste) and hauling to recycling market	This service includes provision of containers/equipment dedicated for waste segregation/processing at the source or provide worker/ waste picker to sort and pick out the recyclable material from the waste stream.
Full recycling service (collection and hauling of mixed waste plus collection and hauling of all types of segregated recyclable materials)	The service provider has the capacity to provide the waste generator with the collection and handling of the mixed waste stream as well as the separate collection of all types of segregated recyclable materials.
Specialized recycling service (collection and hauling of specific type(s) of recyclable materials)	This service includes the provision of separate collection of specific types of segregated recycling materials. This service may include provision of containers/equipment and/or collection workers.
Training, audit studies, reporting, and document expediting	This service includes provision of waste audit exercises, on- job training, reporting and documentation, awareness campaigns/sessions, and expediting services with municipalities.
Cleaning and hygiene Services	Pest control services that include disinfection, sterilization services and public and urban cleanliness
Destruction of expired materials and products (ITLAF)	Provide the waste generator with equipment/tools required for destructing the expired food waste or other products (according to official procedures) in addition to hauling to the destination (landfill, sorting facility, etc.….)
Suppling of waste appliance, cleaning materials, equipment, and leasing services	Providing the waste generator with different appliances, equipment, and materials relevant to waste management and recycling (procurement and tenders). The service provider offers leasing of waste management equipment and tools to the waste generators
Purchasing the pre-consumer recyclable and stock waste of a marketing value from large factories and manufacturers	The service providers offer the large factories and manufacturers which have a large volume and consistent supply of pre-consumer recyclable material higher prices against long-term agreements. Or offer them a full service with very competitive prices to collect and haul the mixed waste stream with a condition to collect the pre-consumer recyclables as well.
Purchase ferrous and non-ferrous scrap materials from large formal commercial	In this service, specialized scrap dealers or brokers purchase and collect scrap materials from large formal

Type of recycling services offered to the large commercial generators	Description
through tenders and contracts	commercial and construction and demolition projects through tenders and contracts.
Aggregation of recyclable materials	The service providers have access to storage space and transport facilities for the recyclable material to control price fluctuations and offers cash payments for the suppliers.
Processing of recyclable materials	The service includes physical and chemical processing such as but not limited to secondary sorting, shredding, crushing, washing/drying, pelletizing, compaction, dismantling, smelting, etc.…
Manufacturing and production of recycled products	The service includes use of recyclable materials as a raw material to produce a new product.
Exporting of recyclable materials to global markets	The service provider has access to global end markets and export domestic materials after processing to these markets.

3.2.3 Civil Society Organizations (CBOs, CSOs, NGOs, Cooperatives) and Initiatives

The community and its representatives have a direct interest in waste management. Communities in low-income areas receive marginal or no services in terms of public transport, electricity, drinking water, sanitation, drainage, and waste removal. These communities will sometimes take the initiative to organize themselves into CBOs with the direct goal of self-help and improving their living conditions. Such CBOs may receive external aid in the form of technical and/or financial aid from different agencies. Sometimes these activities may also take the form of direct participation in waste management, such as feeding organic material directly to their livestock. Usable materials, like bottles, are often reused by the members of the low-income community themselves.

CBOs may also take a role in the actual provision of services, including operations and maintenance, and even in the construction of facilities. Thus CBOs, speaking for the individuals or members involved, play an important role in waste management system development processes. Organized communities have a stronger voice than individuals and bring about improvements more easily.

According to the legal context in Jordan, the environmental CSOs and cooperatives are registered by the Ministry of Social Development and their professions licensed by the MoENV.

In Amman, there are more than (20) CBOs, CSOs, NGOs and Cooperative organizations being engaged with different pilot projects, initiatives, and campaigns targeting solid waste recycling and sorting. Most of them are engaged with GAM to ease their pilot initiatives and/or projects, particularly in the fields of paper and cardboard recycling and reuse. GAM considered these engagements as a kind of contribution to improving the overall public awareness among the citizens in Amman. For instance, in 2009, GAM has an agreement with Jordan Environment Society (JES); one of the first and pioneer local community organizations working on introducing recycling practices and sorting activities to the local community, for implementing a waste recycling project targeting various waste generators at the city level (Ministries, Schools, offices, households, companies, etc.)

Most of the NGOs and CBOs in Jordan are working on environment and SWM by undertaking a variety of initiatives including clean-ups and awareness campaigns, small recycling activities, environmental training, and small-scale composting activities.

Table 10 shows the relevant NGOs and CBOs and their roles/interest related to the SWM and Recycling Sector in Amman.

Table 10: The relevant NGOs and CBOs and their roles/interest related to the SWM and Recycling Sector in Amman.

Stakeholder's Category: NGOs	Role/Interest
Jordan Environment Society (JES)	• Provide recycling services mainly paper and cardboard targeting the commercial businesses and public sectors. • Introducing recycling practices and sorting activities to the local community • Awareness campaigns towards environment and waste recycling activities targeted mainly the schools and youth sector in the local community. • Provide public cleanliness campaigns targeting the Forests and touristic areas. • Awareness and training related to the environment and recycling. • Certified from MoENV to provide environmental courses (EIA, environmental monitoring, etc....) • Long-term partnership with GAM and have a sorting facility to recycle paper and cardboard.
Jordan Environmental Union (JEU)	• Advocating for environmental issues with Jordanian Parliament and MoENV. • Promoting environmental stewardship and conservation, as well as economic and social development.
Arab Group of the Protection of Nature (APN)	• Contribute to the rehabilitation and resilience of environmental, agricultural and food systems in Arab regions affected by war and conflict, particularly in Jordan and Palestine. • Influence the formulation and implementation of global environmental, agricultural and food policies within effective institutional partnerships. • Mobilize individual and collective civil society efforts to advance environmental protection and food sovereignty. • Build the capacity of the Arab Group for the Protection of Nature in order. • to achieve its mission with professionalism, efficacy, and institutional sustainability.
The Royal Society for the Conservation of Nature (RSCN)	• Raise awareness on environmental issues, with a focus on school students through setting up nature conservation clubs, supplying educational programs in the reserves, and integrating biodiversity concepts in school curricula. • Develop large-scale conservation projects that aim to integrate environmental protection with the socio-economic development of local people living in and around the nature reserves. RSCNs socio-economic projects include a wide variety of eco-tourism programs, as well as the production of unique handicrafts and organic food items. These nature- based businesses provide jobs tied to the protection of natural areas and create improved livelihoods for poor rural communities. All of RSCN products and eco-tourism ventures are marketed under the trade name "Wild Jordan" and the full range of handicrafts are available at the Wild Jordan Center in Amman. • Provide training and capacity building to environmental practitioners and institutions throughout Jordan and the Middle East in an attempt to share our expertise and empower others to join in the protection of nature. • Promote public action for environmental protection through campaigns and activities run by an advocacy committee made up of volunteers from different sectors.

Stakeholder's Category: NGOs	Role/Interest
Jordan Green Building Council (JGBC)	• Civil society engagement through communal waste management schemes • Development of 'Your Guide to Solid Waste Management in Jordan' • Awareness raising campaigns and campaigns for the promotion of community mobilization and active citizenship. • In association with the International Solid Waste Association (ISWA), they • provide training opportunities and certification of 'waste experts' in 2015
Qutoof Development Organization	• Qutoof is a non-profit professional development organization aiming to establish a high caliber center of excellence in Jordan for achieving sustainability and green growth indicators with extra emphasis on developing the sector of waste management and the recycling industry in the region. • Develop and manage Green Apprenticeship program. • Community dialogue • Solid waste management • On-Job- Qualification Program for workers, Technicians, Professionals Occupants of Vocational Jobs in the environment sector • Training Services
The Euro Jordanian Advanced Business Institute (EJABI)	• Tailor-Made training services to develop and support SMEs in Jordan. • In-house consultancy services • Senior Experts Service • Networking • EJABI Room Rental
Future Pioneers	• Executing projects in the following domains • Solid waste management • Socio-economic empowerment • Environmental and climate change • WASH • Community dialogue • Civic engagement • Human rights or marginalized groups
EDAMA - Energy, Water and Environment	• Raising awareness and advocating for legislative change towards a green economy in Jordan • Works with private sector through providing services in return for membership such as conferences and support towards more 'green' practices and businesses. • Training academy that provides local and international certified courses that meet market needs. • Advocacy
Green Leaves Society	• Conducting awareness activities • Promoting environmentally safe behaviors • Educating individuals and institutions with the best environmental behaviors.
Towards Zero Waste	• Executing awareness activities • Executing environmentally friendly initiatives and activities.
Al-Azm Environmental Society	• Conducting awareness activities • Capacity Building • Executing SWM projects
The National Association of environmental culture and the media	• Environmental Awareness

Stakeholder's Category: NGOs	Role/Interest
The Jordan Society for Sustainable Development	• Cooperating with all national, regional, and international entities to protect and manage natural resources as well as economic and social resources and using them in a sustainable manner, • Implementing and promoting mechanisms to realize sustainable development that is based on integration and comprehensiveness to fulfill the needs of the present and future in a balanced manner, • Raising awareness among the segments of the society on the importance of natural, heritage, economic and social resources, and the need to preserve them through sustainable development Programs, • Creating a database that helps all sectors determine best methods for realizing sustainable development and defending the principles of sustainable development in an objective manner.
The General Federation of Jordanian Women (GFJW).	• Improving the status of women in national development • Strengthening women's legal status • Women advocacy

In the absence of national and formal recycling structures over the county, several past and current pilot projects, initiatives, and campaigns targeting solid waste recycling and/or sorting are reported in Amman in cooperation with GAM. Most of these initiatives aimed to increase public awareness and the introduction of modern waste recycling and separation at source practices. Main initiatives are listed as follows:

- Paper recycling program implemented by the Jordan Environment Society since 1995 in coordination with GAM and Ministry of Environment.
- Recycling project with COZMO marketing stores in Amman implemented by BE Environmental Services. Separation at source project that GAM implements in Household and Commercial areas (Al- Radwan and Al-Medina neighborhoods, the initiative is funded by GIZ.
- Several social upcycling initiatives.

4 DONORS MAPPING RELATED TO SWM AND RECYCLING PROJECTS

Over the past two years, aided by the assistance of international partners, Jordan's Solid Waste Management (SWM) strategies have undergone significant improvements, embracing more sustainable methods for delivering services. This section highlights the contributions of international donors in enhancing solid waste management practices in Jordan since 2020. To facilitate this donor assessment, a comprehensive review of documents and an extensive web search were conducted. The objective was to identify all ongoing projects and donors involved in the field of SWM and recycling within the country.

Table 11 presents international donors' efforts in the SWM and Recycling Sector in Jordan (2020-2023) and provides an overview of projects implemented in the SWM and Recycling Sector in Jordan.

Table 11: Overview of the other international donors in Jordan related to the SWM and Recycling Sector in Jordan

Duration	Donor C/P	Project Name	Governmental counterpart	Description
7. 2017 - 6. 2021	BMZ through GIZ	CIRCLE -Climate and Resource Conservation through Recycling	GAM	• Establishment of conditions for a climate friendly circular economy in Greater Amman Municipality. In pilot projects, various models for the separate collection and recycling of waste are being developed and tested in cooperation with the population in three selected neighborhoods. The models follow the nation Solid Waste Management Strategy and Amman Strategic Waste Plan and are adapted to different local and cultural conditions. The collected recyclables are treated and recycled in appropriate facilities.
12.2019-06.2025	BMZ through GIZ	EUTF Support for an Integrated Solid Waste Management System in Syrian Refugee Camps and Neighboring Communities Affected by Syrian Crisis	-	• The project aims at improving health, environmental conditions, job opportunities and quality of life of targeted populations by developing environmentally and more financial sustainable systems for integrated solid waste management (SWM) and wastewater treatment in Za'atari and Azraq refugee camps and neighboring communities.
2022-2025	BMZ through GIZ	Solid Waste Management in Jordan (SOWAS)	MoLA, GAM	• The project "Solid Waste Management Jordan" aims to improve the institutional and technical conditions for a sustainable circular economy in Jordan by collaborating with key stakeholders and implementing targeted interventions. The project focuses on enhancing cooperation, improving capacities of municipal authorities, and integrating separate collection of recyclables into the waste management plan for Amman.
10.2021-10.2023	EU	Med4Waste - Mediterranean Dialogue for Waste Management Governance	MoLA-	• The Med4Waste project addresses the environmental impact of current production and consumption patterns in the Mediterranean Sea Basin. It aims to establish new governance models for efficient urban waste management across the region. The project involves a partnership of seven organizations from six Mediterranean countries, supported by associated partners. Through various activities, it builds skills and promotes sustainable practices for waste management. The Union for the Mediterranean (UfM) supports and integrates the project within the 2030 GreenerMed Agenda, facilitating coordination and dissemination of results among UfM countries and stakeholders.
06.2020-03.2023	BMZ through GIZ	Support of the Export Initiative for Environmental Technology	MoENV, GAM, JCI	• The project in Jordan has a clear goal of reducing packaging waste and minimizing its negative impact on the environment. It also seeks to strengthen circular economy practices by promoting the recycling of packaging materials. The project aims to create favorable framework conditions in selected partner countries of the Export Initiative, ensuring the adoption of modern environmental and climate protection technologies. By implementing effective strategies and regulations, the project aims to contribute to a more sustainable and eco-friendly approach to packaging waste management in Jordan and beyond.
09.2019-0.2023	EU through AFD	Technical Assistance	MoLA	• Through a consortium comprising of LDK Consultants (Greece), Egis Group (France), and Engicon (Jordan) provide essential technical assistance for the implementation of Solid

Duration	Donor C/P	Project Name	Governmental counterpart	Description
				Waste Management Project funded by a grant of 53 million euros from the EU. To oversee the construction and rehabilitation of solid waste transfer and treatment facilities in priority areas, with a particular focus on the Ekaider and Husseynyat landfills located in northern governorates of Jordan.
0.9-2019-10.2023	EU through GIZ and Spanish Cooperation	QUDRA 2		• The Qudra 2 program, co-financed by various international organizations, aims to enhance resilience among Syrian refugees, internally displaced people (IDPs), returnees, and host communities in response to the protracted Syrian and Iraqi crises. The program, implemented by multiple agencies, seeks to provide support and solutions to address the challenges faced by those affected by the crises in Iraq, Jordan, Lebanon, and Turkey. The goal is to contribute to a shared European response and provide strength and resilience to individuals and communities impacted by the ongoing refugee crisis in the region.
04.2021-4.2022	AFD	Development of the Municipal Solid Waste Management Master Plan for the Southern Region of Jordan	MoLA	• Development of the municipal solid waste management master plan for the Southern Region of Jordan.
07.2020-07.2022	ACTED	Sustainable Waste Management in Sahab Municipality	Sahab Municipality	• The objective of this two-year project is to mitigate the environmental impact of solid waste and foster economic development in Sahab municipality, Amman. This will be achieved through the establishment of a municipal solid waste (MSW) sorting center on municipal property. The sorting center will be operated as a public-private partnership to ensure its long-term viability. Additionally, ACTED will actively promote and disseminate knowledge on sustainable waste management practices in two specific neighborhoods within Sahab.
07.2014-12.2018	BMZ through GIZ	ADHOC 1 - Supporting Solid Waste Management in Refugee Hosting Communities	MoLA	• Improve solid waste management services in the governorates of Irbid, Ramtha, Karak and Mafraq through the provision of a more efficient environmentally and socially sound waste management system (collection, transfer and disposal).
08.2017-06.2020 (Extended)	BMZ through GIZ	ADHOC 2 - Supporting Solid Waste Management in Refugee Hosting Communities	MoLA	• The ADHOC 2 project, specialist personnel are being trained in operational and financial management. Municipal workshops receive spare parts and equipment; mechanics are being trained. A quality management system with maintenance plans is being set up. Municipal waste management plans are being drawn up to enable forward-looking, sustainable planning for the waste sector. The general objective of the project is to: • Improved implementation of municipal tasks in solid waste management in selected municipalities • Improved capacities in solid waste management in MoMA.
06-2014-06.2020	BMZ through GIZ	Solid Waste Management for Greater Amman Municipality	GAM	The project aims to towards reducing the number and size of landfills in Jordan while promoting recycling. Through the project GAM implemented a plan to recycle reusable

Duration	Donor C/P	Project Name	Governmental counterpart	Description
		(GAM)		material and to improve their overall waste management system. The overall objectives of the project are: • Establishing an environmentally friendly concept of recycling solid waste addressing the entire waste chain. • Job creation in the solid waste sector through labor-intensive activities.
09.2015-01.2019	BMZ through GIZ	Support for UNRWA Solid Waste Management Strategy	Department of Palestinian Affairs (DPA)	• An agency wide SWM Framework is developed and agreed upon within & by UNRWA. • Based on the SWM framework, the methodology to prepare field related operational SWM strategies is available and applied to the Jordan field as pilot case • A methodology for selecting appropriate (effective, cost saving, accepted) SWM Solutions for individual camps is available and forms the basis of camp SWM Plans • The above set of instruments are tested in the Jordan field and UNRWA staff from all fields is trained using the Jordan fields and camps as showcase. • The new proposed system is implemented in Irbid & Talbieh camps.
09.2015-10.2023	BMZ through GIZ	Waste to Positive Energy (WtpE)	MoLA	The objective of the project is to create employment for disadvantaged members of the population (refugee and hosting communities) through waste collection and recycling of materials. The project targeted different areas such as Irbid, Ramtha, Mafraq and Wassatiyah. The project has different components: • Create employment opportunities for most affected population through CfW activities within the solid waste management field, • Enhance social cohesion between Syrian refuges and local hosting communities by creating dialogue forums, • Support different municipalities in enhancing solid waste management planning by developing local solid waste management plan, • Enhance sludge management in refugee camps by implementing a co- digesting pilot plant,
01.2015-12.2018	EU through GIZ	Support to Solid Waste Management in Jordanian Communities Hosting Syrian Refugees	MoLA	• To improve solid waste management services in the governorates of Irbid, and Mafraq through the provision of more efficient, environmentally, and socially sound waste management systems (collection and disposal).
02.2016-01.2019	EU through World Vision	Sustainable Food Security for Refugees through Environmentally Responsible SWM	-	• Refugees attain enhanced food security/resilience through sustainable cash for work (CfW) income from recycling and SWM.
01.2018-12.2024	EU	EU Support to the Implementation of the National	MoPIC, MoLA & MoENV	The purpose of this action is to ensure in the coming five to seven years, the safe and sanitary disposal of municipal solid waste. The specific objectives are to: • Consolidate the existing regulatory framework to bring it in line with the objectives set in

Duration	Donor C/P	Project Name	Governmental counterpart	Description
		Solid Waste Management Strategy		the national strategy. • Improve the transfer and disposal management system in the Central and Northern Region. • Improve the socio-economic well-being and health status of informal waste pickers working in dumpsites; Raise general awareness, understanding and knowledge about key MSW management issues amongst concerned segments of the society.
11.2017-12.2019	EU	National Monitoring Information System for Municipal Solid Waste (NMIS-MSW)	MoPIC, & MoENV	The overall objective of the action is to design, develop and implement a comprehensive computerized and web- enabled "National Monitoring Information System for municipal solid waste (NMIS- MSW). • Result 1: strengthen the capacities of the MoENV/DoS to establish a NMIS-MSW that will support MoENV to fulfill its monitoring role, also in relation to EU budget support. • Result 2: strengthen the capacities of the MoENV to perform environmental controls on existing and new landfills. • Result 3: strengthen the capacities of MoENV/DoS to enhance regulatory framework in line with NSWM strategy.
07.2018-07.2023	EU	Support MOLA in Upgrading Solid Waste Management Facilities in the JSCs most affected by Refugee Crisis	MoPIC	The project aims to: • Improve municipal solid waste services and hygiene conditions in the Northern and Central regions, directly affected by the influx of Syrian refugees. • Rehabilitate and develop Al-Akaider and Husseynyat sanitary landfills. • Create job opportunities during the construction and operation phases. • Increase the institutional and technical capacities of Ministry of Municipal Affairs, Ministry of Environment and Joint Services Councils.
08.2016-12.2018	French Development Agency (AFD)	Technical Assistance to Ministry of Municipal Affairs (MoMA) -Implementation of the Solid Waste Strategy	MoPIC	• Support the MoMA and the inter-ministerial technical committee in implementing the solid waste management strategy.
02.2016-01.2019	EU	Enhancing Employment Opportunities in Jordan Energy and Environment Sectors E4	Greater Irbid Municipality	• Improved job and market opportunities in Irbid, Mafraq and Amman governorates in recycling, green technology, renewable energy (RE), water and energy efficiency (WE/EE) sectors.
05.2015-12.2020	EBRD	EBRD Greater Amman Municipality Solid Waste (LFG) Project	GAM, MoPIC	• The project is designed to finance the landfill gas system (the LFG) for cells 1 & 3 at Al Ghabawi landfill, associated leachate management, generators and connection to the grid

Duration	Donor C/P	Project Name	Governmental counterpart	Description
11.2016-12.2022	EBRD	EBRD Greater Amman Municipalities Crisis Response Solid Waste Programme	GAM, MOPIC	• Improve solid waste infrastructure & associated services, components include the refinancing of GAM's debt; construction of Cells 5 & 6 at Al Ghabawi; capping of Cell 4 at Al Ghabawi; upgrade of the Al-Shaer Transfer station; construction of a new transfer station (potentially at Ain Ghazal); purchase of compactors, other equipment & other investments. • Additional TA compliments the above investments, including ESIA's, technical studies, financial management training, stakeholder participation programs, corporate governance improvement and contract management.
12.2016-03.2019	UK Department for International Development (DIFD)	Greater Amman Municipality Solid Waste Crisis Response	GAM	• To provide emergency support to Greater Amman Municipality to cope with the pressures placed on waste infrastructure following the influx of refugees by funding specialist equipment, compactors, and the construction of an additional cell.
05.2018-05.2022	Global Environment Facility	Reduction & Elimination of POPs and Other Chemical Releases Through Implementation of Environmentally Sound Management of E-Waste, Healthcare Waste & Priority U-POPs Release Sources Associated with General Waste Management Activities	MoENV	• Protection of human health & the environment through reduction & elimination of POPs, & other chemicals through implementation of environmentally sound management (ESM) for e-waste, healthcare waste & priority U-POPs release sources associated with general waste management activities. • The project, through the implementation of a highly sustainable & replicable approach for the integrated & sound management of electronic, hazardous, healthcare & municipal solid waste categories, will achieve the avoidance of releases of U- POPs, PBDEs & CO2, contributing at the same time to the development of the waste circular economy elements based on the 3R (Reduce, Re-use, Recycle) approach principles.
03.2015-04.2019	Global Affairs Canada (GAC)	Improving Solid Waste Management and Income Creation in Host Communities	MoLA	• To improve the solid waste management cycle by complimenting the efforts undertaken by the government, to ensure efficient & effective delivery of basic services. • To address the increasing problem of solid waste disposal & treatment at the Al Akaider landfill while integrating labor-intensive schemes using innovative solutions that will engage more people in recycling, composting & other waste treatment-related activities. • Strengthen the capabilities of MoMA, the Joint Services Council in Irbid, Mafraq & in Northern Shouneh in the solid waste management sector for enhanced capacity of service delivery, emergency response, women empowerment & local economic development
06.2017-05.2022	Global Affairs Canada (GAC)	Jordan Municipal Support Project (JMSP)	MoLA	• Jordan Municipal Support Project (JMSP) implemented by FCM aims to strengthen the resilience of Jordanian municipalities in Central and Southern Jordan. The project has three main components: Governance, SWM, Knowledge Sharing and Public Engagement. • The main objective of the SWM component is improving SWM focusing on the 3Rs. And

Duration	Donor C/P	Project Name	Governmental counterpart	Description
				through the engagement of women & youth and other key stakeholder.
03.2020 - 03.2023	Global Affairs Canada (GAC)	Women's Economic Empowerment in the North of Jordan particularly in SWM	MoLA	• The project aims to improve women's lives in northern Jordan by enhancing their livelihoods and involvement in public life. It focuses on women's economic empowerment and equality to address barriers to their active participation. The project involves strengthening CSOs, providing financial support for women's participation in the local economy, and collaborating with government for gender responsive SWM policies. It aims to create entrepreneurial opportunities for 600 women through business group projects and enhance capacities of 60 women in a community-based sorting/recycling facility in Northern Shouneh
01.2014- 12.2018	UNICEF	Solid Waste Management in Zaatari and Azraq Refugee Camps	-	• Provide solid waste management services for the communities of Zaatari and Azraq Refugee Camps.
05.2018- 12.2022	Japan International Cooperation Agency (JICA)	The Project for Improvement of Waste Management Equipment in Northern Region Hosting Syrian refugees.	-	• The objective of the project is to enhance waste management in Northern region hosting Syrian refugees by/through preparation for necessary equipment for the operation of transfer stations and final disposal sites and transportation, thereby. • contributing to improve sanitation and hygiene of both Jordanian citizen and Syrian refugees.
09.2016- 09.2021	USAID	Jordan Cities Implementing Transparent, Innovative, and Effective Solutions (USAID - CITIES)	MoLA & MOI	• The USAID Jordan Cities Implementing Transparent, Innovative, and Effective Solutions (CITIES) project is supporting the development of more inclusive government operations. Citizens are recognizing their right to articulate their needs, and municipalities are gaining the organizational and management capacity to address those needs effectively. Consequently, communities are becoming more cohesive and receiving the services they need. The goals are to: • Improve how the government delivers core services, such as solid waste management, street naming, and building numbering. • Increase the sustainability of municipal governance operations. • Strengthen the government's capacity to respond to the identified needs of citizens. • Support municipalities and the people who live in them to create communities that are more cohesive and resilient
06.2017- 06.2019	Italian Government through World Bank Trust Fund	Global Facility for Disaster Risk Reduction Facility Technical Assistance Activity	Municipalities	• Under the overall objective of this technical assistance activity of "Improving Urban Resilience in Cities Impacted by the Syrian Refugee Crisis in Jordan", one of the implementation pillars/activities aims at developing solid waste management plans for the improvement of collection, cleaning, recycling and other solid waste services for Jordanian municipalities.
12.2017-	Multi-donor Trust Fund	Municipal Service and Social Resilience Project (MSSRP)	Municipalities	• The project aims to promote broader crisis resilience through support to participating municipalities to provide additional services based on local needs, the strengthening of

Duration	Donor C/P	Project Name	Governmental counterpart	Description
12.2020	administered by the World Bank			community resilience through local economic development and community engagement, and the strengthening of institutional resilience to crises through development of emergency preparedness systems. More specifically, the project aimed to support Jordanian municipalities affected by the influx of the refugees in delivering services and employment opportunities for Jordanians and Syrians.
01.2020-09.2022	GIZ	Waste to (positive) energy in Jordan 2019-2022	MoLA	• The project aims to provide better living conditions by developing improved solid waste management and wastewater treatment in both refugee camps and local communities in Jordan, while providing job opportunities in Mafraq and Zarqa governorates through recycling activities, cash for work activities, conflict management and sludge treatment.

5 ANNEXES: LIST OF MAIN PRIVATE RECYCLING SERVICE PROVIDERS MAPPED IN AMMAN

#	مزودي خدمات جمع ونقل النفايات المختلطة غير الخطرة (Waste Haulers)	
1	شركة زواتي إخوان	نفايات بلدية مختلطة
2	شركة النموذجية للصيانة وخدمات النظافة	نفايات بلدية مختلطة
3	مؤسسة الزوادة لخدمات نقل النفايات	نفايات بلدية مختلطة
4	مؤسسه الشواهنه لجمع ونقل النفايات	نفايات بلدية مختلطة
5	مؤسسة الشخص الأمثل لنقل النفايات	نفايات بلدية مختلطة
6	شركة مسافات للنقل المتخصص	نفايات بلدية مختلطة
7	النجم الأخضر لإعادة التدوير	نفايات بلدية مختلطة
8	شركة آمن ونظيف للخدمات البيئية	نفايات بلدية مختلطة
9	شركة بيئي لخدمة البيئة	نفايات بلدية مختلطة
10	مؤسسة الساحه لخدمات جمع ونقل النفايات	نفايات بلدية مختلطة
11	المدينة الخضراء لاعادة التدوير	نفايات بلدية مختلطة
12	مؤسسة تجدد لنقل النفايات	نفايات بلدية مختلطة
13	مؤسسه استثمار الموراد الوطنيه وتنميتها-مدينة الملك عبد العزيز - الزرقاء	نفايات بلدية مختلطة
14	شركه العاصمه لخدمات التنظيف	نفايات بلدية مختلطة
15	مؤسسه سلطان علي مسلم	نفايات بلدية مختلطة
16	مؤسسه هبه واليمامة لخدمات التنظيف	نفايات بلدية مختلطة
17	مؤسسة القامات لخدمات النظافه	نفايات بلدية مختلطة
18	شركة المشاغل الهندسيه المتخصصه	نفايات بلدية مختلطة
19	شركه اتون لادارة المرافق	نفايات بلدية مختلطة
20	مؤسسه ارجوان للخدمات اللوجستيه	نفايات بلدية مختلطة
21	مؤسسه وضاح للخدمات المسانده	نفايات بلدية مختلطة
22	شركة المستقبل الأخضر للحلول المستدامة	نفايات بلدية مختلطة
23	مؤسسة محمد العمارين	نفايات بلدية مختلطة
24	مؤسسة بوابة الزرقاء لخدمات النظافة ونقل النفايات	نفايات بلدية مختلطة
25	الرميل للخدمات اللوجستيه	نفايات بلدية مختلطة
26	مؤسسة سما عمّان للخدمات البيئية	نفايات بلدية مختلطة
27	البيئة الخضراء لتجارة مستلزمات البيئة (كلين ستي)	نفايات بلدية مختلطة
28	الشركة الريادية لاعادة تدوير المواد العضوية	نفايات بلدية مختلطة
29	شركه اورباسر و الشركه العالميه لاداره النفايات	نفايات بلدية مختلطة
30	شركة عبدون للمجمعات التجارية /مكة مول	نفايات بلدية مختلطة
31	شركة أحمد جلاجل وشريكته للخدمات	نفايات بلدية مختلطة
32	ابو طارق الجبور لاعمال النظافه ونقل النفايات والاعمال الزراعيه	نفايات بلدية مختلطة
33	مؤسسة حسين الكوز لنقل النفايات	نفايات بلدية مختلطة
34	مكتب الجيزه لاعادة تدوير النفايات ونقلها	نفايات بلدية مختلطة
35	السرعة والدقة لنقل النفايات غير الخطرة	نفايات بلدية مختلطة
36	مؤسسة العدوي لخدمات نقل و معالجة النفايات	نفايات بلدية مختلطة
37	مؤسسة بشرى الغيث لنقل النفايات	نفايات بلدية مختلطة
38	التحدي الاردنية الحديثة لخدمة نقل النفايات	نفايات بلدية مختلطة
39	الاداء الافضل لجمع ونقل النفايات	نفايات بلدية مختلطة
40	مؤسسة الابراهيميه لنقل النفايات وخدمات النظافة	نفايات بلدية مختلطة
41	المرافق الخضراء لجمع النفايات و اعادة تدويرها	نفايات بلدية مختلطة
42	الامتياز لخدمات النظافة	نفايات بلدية مختلطة

43	عبق الاردن لجمع ونقل النفايات غير الخطرة لاعادة التدوير	نفايات بلدية مختلطة
44	تبادل لخدمات وادارة النفايات	نفايات بلدية مختلطة
45	غيمه لجمع ونقل النفايات	نفايات بلدية مختلطة
46	شركة الاخلاص للخدمات ونقل النفايات	نفايات بلدية مختلطة
47	مؤسسة الحاج لخدمات نقل ومعالجة النفايات	نفايات بلدية مختلطة

#	مزودي خدمات جمع المواد القابلة لإعادة التدوير بأنواعها المختلفة (Recycling Service Providers)	
1	مؤسسة اسرع خطوة لإعادة التدوير	كرتون-ورق-بلاستيك-حديد-خشب
2	شركة بيئي لخدمة البيئة	كرتون-ورق-بلاستيك-حديد-خشب
3	شركة أمن ونظيف للخدمات البيئية	كرتون-ورق-بلاستيك-حديد-خشب
4	المستقبل الأخضر للحلول المستدامة	كرتون-ورق-بلاستيك-حديد-خشب
5	شركة الحدائق الخضراء لإعادة التدوير	كرتون-ورق-بلاستيك-حديد-إطارات
6	مؤسسة خارج الصندوق لاعادة التدوير	كرتون-ورق-بلاستيك-حديد-خشب
7	مركز المدّور الالكتروني لإعادة التدوير E Recycle hub	كرتون-ورق-بلاستيك-حديد-خشب
8	مؤسسة النقطة الخضراء الأردنية لإدارة المشاريع	كرتون-ورق-بلاستيك-حديد-خشب
9	شمس الربيع الاخضر لاعاده التدوير	كرتون-ورق-بلاستيك-حديد-خشب
10	الروابي الخضراء لاعادة التدوير	كرتون-ورق-بلاستيك-حديد-خشب
11	مؤسسة سواعد اردنية للخدمات اللوجستية واعادة التدوير	كرتون-ورق-بلاستيك-حديد-خشب
12	شركة النجم الأخضر لإعادة تدوير البلاستيك	كرتون-ورق-بلاستيك-حديد-خشب
13	الاجيال لاعادة تدوير المواد الصلبة	كرتون-ورق-بلاستيك-حديد-خشب
14	جرين جو لتجميع المواد القابلة لإعادة التدوير	كرتون-ورق-بلاستيك-حديد-خشب
15	الأفضل للتدريب على تدوير الورق والحفاظ على البيئه	كرتون-ورق-بلاستيك-حديد-خشب
16	شركة الدخيل لإعادة التدوير	كرتون-ورق-بلاستيك-حديد-خشب
17	جمعية البيئة الاردنيه	ورق-بلاستيك
18	مؤسسة محمود الخليلي لإعادة تدوير الورق والكرتون	ورق هالك
19	مؤسسة بس ورق لإعادة تدوير الورق	ورق هالك
20	شركة الامين لتجارة الورق	ورق هالك
21	مؤسسة إقبال لإعادة تدوير الورق والكرتون	ورق هالك
22	مؤسسة راقي بأوراقي لتدوير الورق	ورق هالك
23	مؤسسة معاذ عبد الهادي لتدوير الورق والكرتون	ورق هالك
24	مؤسسة المليار لتدوير الورق والكرتون	ورق هالك
25	مؤسسة النمريني لإعادة تدوير الورق و الكرتون	ورق هالك
26	شركة اليرقات الصغيرة لصناعة الاعلاف الحيوانيه	نفايات طعام ومواد عضوية
27	كمبوست بلدي الأردن	نفايات طعام ومواد عضوية
28	جمعية المخصبات العضوية للنظم البيئية	نفايات طعام ومواد عضوية
29	الشركة الريادية لاعادة تدوير المواد العضوية	نفايات طعام ومواد عضوية
30	شركة تيارات التقنية	نفايات طعام ومواد عضوية
31	البصمة الخضراء لاعادة تدوير الورق والكرتون والبلاستيك	كرتون-ورق-بلاستيك
32	شركة النموذجية للصيانة وخدمات النظافة	كرتون-ورق-بلاستيك-حديد-خشب
33	مؤسسة مكرم سليمان لتشكيل المعادن (كانزي)	كرتون-ورق-بلاستيك-حديد-خشب
34	شركة نجمة الكرك لاعادة التدوير	كرتون-ورق-بلاستيك
35	مؤسسة الساحه لخدمات جمع ونقل النفايات	كرتون-ورق-بلاستيك-حديد-خشب
36	مؤسسة الزوادة لخدمات نقل النفايات	كرتون-ورق-بلاستيك-حديد-خشب

37	مؤسسه الشواهنه لجمع ونقل النفايات	كرتون-ورق-بلاستيك-حديد-خشب
38	مؤسسة الشخص الأمثل لنقل النفايات	كرتون-ورق-بلاستيك-حديد-خشب
39	شركه العاصمه لخدمات التنظيف	كرتون-ورق-بلاستيك-حديد-خشب
40	مؤسسة القامات لخدمات النظافه	كرتون-ورق-بلاستيك-حديد-خشب
41	مؤسسة تجدد لنقل النفايات	كرتون-ورق-بلاستيك-حديد-خشب
42	شركة القواس والعمران لتدوير النفايات الالكترونيه	نفايات الكترونية
43	مؤسسه تفكيك لاعاده تدوير النفايات الالكترونيه	نفايات الكترونية
44	الأردنية لإعادة تدوير أجهزة الحاسوب والأجهزة الألكترونية (جو سايكل)	نفايات الكترونية
45	استنارة لجمع و نقل و تدوير النفايات (tii world)	نفايات الكترونية
46	شركة بترا لإعادة تدوير وإدارة النفايات	نفايات الكترونية
47	شركة ابراهيم جزار	نفايات الكترونية
48	شركة منتصر الكركي وشركاه (سواعد وطن لإعادة التدوير)	نفايات الكترونية
49	بنك الملابس الخيري	ملابس مستعملة
50	شركة الحل الاخضر لتجارة الزيوت العادمة	زيوت طبخ مستهلكة
51	المتجددة لصناعة وتكرير الزيوت	زيوت طبخ مستهلكة
52	المتجددة للزيوت النباتية المستعملة ذ.م.م	زيوت طبخ مستهلكة
53	الحل الأخضر المثالي لتجارة الزيوت العادمة	زيوت طبخ مستهلكة
54	شركة الطرق الحديثة لاعادة تدوير الزيوت	زيوت طبخ مستهلكة
55	أديب العموش لتجارة الورق والكرتون الهالك	كرتون - ورق هالك
56	الاشغال الخضراء لاعادة التدوير	كرتون - ورق هالك
57	العشا لإعادة التدوير	كرتون-ورق-بلاستيك-حديد-خشب
58	شركة ديفيلوبمنت انك انترناشونال ش.م.ح. الأردن	بلاستيك

#	مزودي خدمات تجميع المواد القابلة لإعادة التدوير (Aggregation)	
1	مؤسسة ابو جامع للسكراب	سكراب/خرده
2	مؤسسة الطاقة القصوى	سكراب/خرده
3	اخميس لتجارة الحديد والمعادن	سكراب/خرده
4	الاتكال لشراء جميع أنواع الخردوات	سكراب/خرده
5	الانتماء لتجارة الحديد	سكراب/خرده
6	التوليفة لتجارة السكراب	سكراب/خرده
7	شركة الفرج لتدوير الإطارات	حديد -معادن
8	الاولى المثالية للسكراب	سكراب/خرده
9	الشرق لتجارة الحديد والسكراب	سكراب/خرده
10	الموقر للتعدين والسكراب	سكراب/خرده
11	موندو لاعادة التدوير والسكراب	سكراب/خرده
12	المناصير لاعادة تدوير المعادن	سكراب/خرده
13	شركة خالد محمد أبو هدية واخوانه	سكراب/خرده
14	مؤسسة ايهم الدوايمة لتجارة المعادن والمواد القابلة للتدوير	جميع الأنواع
15	ساحة خردة حسين سمور	حديد -معادن
16	محلات زعتر التجارية للخردة والسكراب	حديد -معادن
17	شركه عبود سعيد وشركاه	سكراب/خرده
18	ساحة حديد محمد أبو هدبه	سكراب/خرده
19	ساحة محمود البرماوي للخرده والسكراب	حديد -معادن

20	مركز ميثاق لتجارة القطع الصناعيه	حديد -معادن
21	ساحة شيخ خابور للخردة	حديد -معادن
22	ساحة القيسي	حديد -معادن
23	ساحة ابوعرقوب للسكراب والخرده	حديد -معادن
24	ساحة جعفر للخردة	حديد -معادن
25	ساحة معادن وخرده	حديد -معادن
26	الفجاري لخردة الحديد	سكراب/خرده
27	محل حسونة لتجارة الحديد	سكراب/خرده
28	ساحة ابو كريم	سكراب/خرده
29	ساحة خردة المعتز	سكراب/خرده
30	ساحة احمد مصطفى للخردة	سكراب/خرده
31	محلات المختار للخرده	حديد -معادن
32	ساحة الحزام	حديد -معادن
33	ساحة صالح سليمان للخردة والصوالح	حديد -معادن
34	ساحة مراد الخليلي للخردة والسكراب	حديد -معادن
35	ساحة جهاد للخردة	حديد -معادن
36	ساحة الدبيس للخرده والسكراب	حديد -معادن
37	ساحة محمد يوسف	حديد -معادن
38	ساحة سكراب امير رجب	حديد -معادن
39	ساحه وائل مصباح	سكراب/خرده
40	ساحة كمال ابو هدبه	سكراب/خرده
41	مستودع سكراب	حديد -معادن
42	شركة ربحي علي	حديد -معادن
43	السند للصناعات الغذائية	حديد -معادن
44	ساحة التلاحمة	حديد -معادن
45	ساحة كعبون للبلاستيك	بلاستيك
46	ساحة الفقية لتوالف الصناديق البلاستيكيه	بلاستيك
47	ساحة بلاستيك و كرتون	كرتون- بلاستيك
48	ساحة سامح أبو صيام كرتون	كرتون
49	ساحة مهيار للكرتون الهالك Gat way	كرتون-ورق
50	مؤسسة الوسيلة للتدوير و السكراب	سكراب/خرده
51	مؤسسة نيشان للخرده	جميع الأنواع
52	الخبراء لتدوير النفايات والسكراب	سكراب/خرده
53	مؤسسة سيسبان محمود لاعادة التدوير	جميع الأنواع
54	ساحة سكراب أبو مصعب الشطرات	سكراب/خرده
55	ساحة اسامه الدبيسيه لشراء الخردة والسكراب	سكراب/خرده
56	ساحة محمود الدبيسيه لشراء الخردة والسكراب	سكراب/خرده
57	ساحة خالد جودة لتجارة سكراب الحديد	سكراب/خرده
58	ساحة خردة_عبدالكريم	حديد -معادن
59	محل ابو سيف للخرده	حديد -معادن
60	محل الشوملي	جميع الأنواع
61	ساحة راكان	جميع الأنواع
62	ساحة تل الرمان	جميع الأنواع
63	ساحة ابوالعبد للخردوات	حديد -معادن
64	محلات الشيخ	جميع الأنواع

65	ساحة الشيخ للخردة	جميع الأنواع
66	اخميس لتجارة الحديد والمعادن	حديد -معادن
67	محلات محمد عليان	جميع الأنواع
68	ساحة ابو العبد	جميع الأنواع
69	ساحة البطل	جميع الأنواع
70	ساحه الهرش و الفقيه للخرده والسكراب	حديد -معادن
71	ساحة راكان الدعجة	جميع الأنواع
72	قبان الاخوه لتجاره المعادن	جميع الأنواع
73	ساحة حسن الهباهبة	سكراب/خرده
74	ساحة مرار للخرده	جميع الأنواع
75	ساحة جمال عميرة	سكراب/خرده
76	ساحة ابو آدم لشراء الخرده والمستعمل	جميع الأنواع
77	محل سكراب وسام المصري	جميع الأنواع
78	ساحة الدعجة	جميع الأنواع
79	ساحة يوسف مثقال	جميع الأنواع
80	ساحة يعقوب للخرده	جميع الأنواع
81	ساحةابو النمر	جميع الأنواع
82	شركة الصعوب و أولاده	جميع الأنواع
83	ساحة العتوم	سكراب/خرده
84	ساحة ابو محمد للخرده	سكراب/خرده
85	محلات طارق وشريكه للخرده	سكراب/خرده
86	محل سكراب فواد	حديد -معادن
87	محل عمر الحزقي لشراء الخرده	جميع الأنواع
88	ساحة عبدالله	جميع الأنواع
89	ساحة ابو سلطان	جميع الأنواع
90	ساحات جمعة للخردة	حديد -معادن
91	ساحة الريماوي للخرده	حديد -معادن
92	ساحة ابو الليل للخرده	جميع الأنواع
93	محل سكراب ومعادن	جميع الأنواع
94	محلات علي شبكة للخرده	جميع الأنواع
95	ساحة ابراهيم للخرده	جميع الأنواع
96	محلات ابو سيف الخولي للخردة والمستعمل	جميع الأنواع
97	ساحة الحوراني	جميع الأنواع
98	ساحة خرده عطا	جميع الأنواع
99	ساحة سلامة للخرده	جميع الأنواع
100	ساحة عبدالله للخرده	جميع الأنواع
101	محلات الأصدقاء للخرده	سكراب/خرده
102	ساحة ابو جمال للخردة والسكراب	جميع الأنواع
103	ساحة احمد ماجد	جميع الأنواع
104	ساحة اسامه للسكراب	جميع الأنواع
105	ساحة سكراب أيوب	سكراب/خرده
106	محل الحديدي للخرده	حديد -معادن
107	ساحة خلف للخردوات	حديد -معادن
108	ساحة عادل جروان لتجميع كرتون والخرده	حديد -معادن
109	ساحة حمودة للخرده	حديد -معادن

110	ساحة الحديدي للخردة	حديد -معادن
111	ساحة سكراب وادي العش	حديد -معادن
112	محلات القدومي للخرده	سكراب/خرده
113	ساحة احمد اليازوري	سكراب/خرده
114	ساحة بلال خطاري	حديد -معادن
115	ساحة ابراهيم السكراب والخرده	حديد -معادن
116	ساحة طارق للخرده	سكراب/خرده
117	ساحة غياض للخرداوات	سكراب/خرده
118	ساحة خالد	سكراب/خرده
119	ساحة مالك للخرده والمستعمل	سكراب/خرده
120	ساحة سكراب صالح	حديد -معادن
121	بلاستيك الوفاء	بلاستيك
122	مستودع سكراب	حديد -معادن
123	ساحة حسن المجدلاوي	حديد -معادن
124	ساحة حمادة للخرده والسكراب	حديد -معادن
125	ساحة صلاح للخرده	حديد -معادن
126	ساحة احمد ماجد	سكراب/خرده
127	محلات النبالي	سكراب/خرده
128	سكراب محمود علقم	سكراب/خرده

#	مزودي خدمات معالجة المواد القابلة لإعادة التدوير (Processors)	
1	شركة الاولى لتدوير الورق والكرتون	كرتون-ورق هالك
2	شركة السعودية الاردنية لتجارة الورق والكرتون الهالك	كرتون-ورق هالك
3	قمة ايفرست لاعادة تدوير الورق والكرتون الهالك	كرتون-ورق هالك
4	حماة البيئة لاعادة التدوير وصناعة الكرتون	كرتون-ورق هالك
5	الالياف العالمية لاعادة التدوير	كرتون-ورق هالك
6	المتحدة لاعادة تدوير الورق والكرتون	كرتون-ورق هالك
7	المجد لاعادة تدوير الورق والكرتون	كرتون-ورق هالك
8	الالياف الخضراء للتدوير	ورق هالك
9	الشركة الاردنية لصناعة الكرتون	ورق هالك
10	المستقبل للخدمات البيئيه	كرتون-ورق هالك
11	صفر نفايات لاعادة التدوير	كرتون-ورق هالك
12	مؤسسة الحزام الدائري لتدوير الورق والكرتون	كرتون-ورق هالك
13	مؤسسة البلوي لتجارة الورق والكرتون	كرتون-ورق هالك
14	مؤسسة هندي التخصصيه لتدوير الورق والكرتون	كرتون-ورق هالك
15	الارض الجديده لتجارة الورق والكرتون المستهلك	كرتون-ورق هالك
16	مؤسسة الصفا لتدوير الورق	كرتون-ورق هالك
17	مصنع حسن للصناعات البلاستيكيه	بلاستيك
18	مؤسسة استبرق للصناعات البلاستيكية	بلاستيك
19	مؤسسة البيئة الجيدة لتدوير البلاستيك	بلاستيك PET
20	شركة الواحة الخضراء لإعادة تدوير البلاستيك (PET)	بلاستيك PET
21	مصنع النجمة الذهبية للبلاستيك	بلاستيك PET
22	سليم كنانه و اولاده للبلاستيك	بلاستيك PET

23	المنتصر لاعادة التدوير	بلاستيك PET
24	مهنة (فايا لارغو للخدمات اللوجستية)	بلاستيك PET
25	مصنع حسين محمود للصناعات البلاستيكية	بلاستيك PVC
26	شركه البنيان للصناعات البلاستيكية	بلاستيك
27	المحور لصناعة البلاستيك الزراعي	بلاستيك
28	شركة الوليد لصناعة البلاستيك	بلاستيك
29	القوي المتين للصناعات البلاستيكية(المصادر للصناعات البلاستيكية سابقا)	بلاستيك
30	بشائر الخير للمنتجات البلاستيكية	بلاستيك
31	شركة الكيس الذهبي لتصنيع الاكياس البلاستيكية	بلاستيك
32	مصنع ابو حمدان للصناعات البلاستيكية	بلاستيك
33	فايز الامير للبلاستيك	بلاستيك
34	الجوبدة لاعادة وتدوير البلاستيك	بلاستيك
35	ساحة الفقية لتوالف الصناديق البلاستيكيه	بلاستيك
36	شركة شفليد للاستيراد والتصدير والتجارة العامة	بلاستيك
37	اخميس لإعادة التدوير البلاستيك	بلاستيك PET
38	جاروشة الدرديري	بلاستيك
39	جاروشة الجبالي	بلاستيك
40	الشركه التقنية العربيه لصناعة البلاستيك	بلاستيك
41	شركة تشاس لاعادة التدوير	بلاستيك
42	جاروشة أبو علندا للبلاستيك	بلاستيك
43	جاروشة ابو علندا	بلاستيك
44	جاروشة الجدع	بلاستيك
45	جاروشة السرهيد	بلاستيك
46	شركة كوكب الهواء للصناعة والتجارة	بلاستيك
47	شركة ابو زيد والحايك	بلاستيك
48	جاروشة ابو الحسن	بلاستيك
49	جاروشة السرهيد	بلاستيك
50	محل محمد سامي لتدوير توالف فوط وحفاظات	بلاستيك
51	محل الشيشاني لتدوير البلاستيك	بلاستيك
52	احمد نمر محمد السعودي	بلاستيك
53	مؤسسة الكيالي للصناعات البلاستيكية والكيماوية	بلاستيك
54	اوستن لصناعه الحبيبات البلاستيكية	بلاستيك
55	البدائل المتعدده للتدوير	بلاستيك
56	مصنع عايده الحواجرة للبلاستيك	بلاستيك
57	جاروشة احمد المصري للبلاستيك	بلاستيك PVC
58	جاروشة بلاستيك مهران المصري	بلاستيك
59	مشغل عمر ابو خرمه	بلاستيك
60	جاروشة اسامة	بلاستيك
61	مؤسسة إبراهيم العجوري	بلاستيك
62	جاروشة محمود للبلاستيك	بلاستيك
63	جاروشة سلمان ابو غيث	بلاستيك
64	شركة التنوع للبلمره واعادة التدوير	بلاستيك
65	ساحة بدر ابو خرمة	بلاستيك
66	جاروشة ابو خليل	بلاستيك
67	جاروشة أمجد خليل لتدوير البلاستيك	بلاستيك

68	جاروشه بلال	بلاستيك
69	جاروشة ابو خرمه للبلاستك	بلاستيك
70	جاروشه عطيه	بلاستيك
71	شركة الرائد الأخضر لاعادة تدوير المواد الصلبة	بلاستيك
72	زين للصناعة البلاستيكية	بلاستيك
73	مؤسسة النشامى لتدوير المخلفات الصناعيه	بلاستيك
74	لذهب الاسود لتدوير النفايات	بلاستيك
75	مركز التنوع الاستراتيجي لاعادة التدوير	بلاستيك
76	سما الزرقاء لتدوير وتصنيع البلاستيك	بلاستيك
77	الدوار الاخضر لاعادة التدوير	بلاستيك
78	مؤسسة جدارا لخدمات تدوير النفايات	بلاستيك
79	النباش الاخضر لإدارة النفايات	بلاستيك
80	النمط الاخضر للتدوير	بلاستيك
81	القواس والعمران لتدوير النفايات الالكترونيه	نفايات الكترونية
82	مؤسسه تفكيك لاعاده تدوير النفايات الالكترونيه	نفايات الكترونية
83	الأردنية لإعادة تدوير أجهزة الحاسوب والأجهزة الألكترونية (جو سايكل)	نفايات الكترونية
84	شركة حميدي شهبان النيف	نفايات الكترونية
85	شركة المحيط لإعادة تدوير البطاريات	نفايات الكترونية
86	شركة ايلاف لإعادة تدوير البطاريات	نفايات الكترونية
87	منجرة محمود لتجارة طبالي الخشب	خشب - طبالي
88	منجرة مفيد لشراء الخشب المستعمل	خشب - طبالي
89	منجرة اللحام لشراء الخشب المستعمل	خشب طبالي
90	منجرة الجبور لشراء الخشب المستعمل	خشب طبالي
91	منجرة وائل القيسي ابو جمعه لشراء الخشب المستعمل	خشب طبالي
92	شركة العربية للاسفنج	توالف أقمشة
93	مؤسسة اللجون لاعادة التدوير	توالف أقمشة
94	LUMEYO	توالف أقمشة
95	مؤسسة الخطوه الاولى لتدوير الصوف والاقمشه والكرتون	توالف أقمشة
96	جاروشة النجار لاعادة تدوير الاقمشة	توالف أقمشة
97	البيئة الماسية لاعادة تدوير الاقمشة	توالف أقمشة
98	مؤسسة بوابة القدس لاعادة التدوير وتجارة البولستر	توالف أقمشة
99	الرياديه لاعادة تدوير النفايات والمخالفات العضويه	نفايات طعام ومواد عضوية
100	شركة اليرقات الصغيرة لصناعة الاعلاف الحيوانيه	نفايات طعام ومواد عضوية
101	كمبوست بلدي الأردن	نفايات طعام ومواد عضوية
102	جمعية المخصبات العضوية للنظم البيئية	نفايات طعام ومواد عضوية
103	الشركة الريادية لاعادة تدوير المواد العضوية	نفايات طعام ومواد عضوية
104	شركة تيارات التقنية	نفايات طعام ومواد عضوية
105	شركة الحل الاخضر لتجارة الزيوت العادمة	زيوت طبخ مستهلكة
106	المتجددة لصناعة وتكرير الزيوت	زيوت طبخ مستهلكة
107	المتجددة للزيوت النباتية المستعملة ذ.م.م	زيوت طبخ مستهلكة
108	الحل الأخضر المثالي لتجارة الزيوت العادمة	زيوت طبخ مستهلكة
109	شركة الطرق الحديثة لاعادة تدوير الزيوت	زيوت طبخ مستهلكة
110	شركة المتجددة لصناعة و تكرير الزيوت	زيوت طبخ مستهلكة
111	الخوري والشريف (بويل الأردن)	زيوت طبخ مستهلكة

112	مؤسسة خارج الصندوق لاعادة التدوير	كرتون-ورق-بلاستيك-حديد-خشب
113	انجاز لاعادة تدوير المنتجات الصناعية	إطارات-مطاط
114	العربية لاعادة التدوير	إطارات-مطاط
115	شركة سابا لعادة تدوير للاطارات	إطارات-مطاط
116	الشيوخ لتلبيس الاطارات	إطارات-مطاط
117	التقنيات المتطورة لإعادة تدوير المواد المستهلكة	إطارات-مطاط
118	محمد صلاح لتجارة الإطارات	إطارات-مطاط
119	الشمال لاعادة تدوير الإطارات التالفة	إطارات-مطاط
120	شركة النسر لتلبيس اللاطارات/ شركة سمير ابو دية ويوسف السنتريسي	إطارات-مطاط
121	مصنع شركة صلاح شقير وشركاؤه	إطارات-مطاط
122	الوطنية لصناعة المواد العازلة	بلاستيك PET

#	مزودي خدمات تصنيع وانتاج منتجات من مواد معاد تدويرها (manufacturers/Industries)	
1	مصنع الاردني لصهر المعادن (العابورة)	معادن
2	شركة الشريف لصهر وتجارة المعادن	معادن -حديد
3	مصنع طيبة للصناعات المعدنية	معادن -حديد
4	البيره لصناعة الحديد والمعادن	معادن -حديد
5	الشركة الوطنية لصناعة الصلب المساهمة المحدودة	حديد
6	شركة الائتلاف الاردني لصناعة الحديد والصلب	حديد
7	الشركة المتحدة لصناعة الحديد والصلب	حديد
8	شركة رام الله لصناعة الحديد (حديد رامكو) - حسونه	حديد
9	مجموعة حديد الأردن (مساهمة عامة)	حديد
10	شركة حديد البحر المتوسط ذ.م.م (الصيني)	حديد
11	العامه لصناعه الحديد التخصصي	حديد
12	البتراء لصناعه الحديد	حديد
13	شركة المدينة الاولى لصناعة الحديد	حديد
14	الشركة الدولية لصناعة الحديد والصلب (العالمية)	حديد
15	شركة معدن لصهر الحديد (بوابة الهاشمية)	حديد
16	شركة طاقة لصهر الحديد و الصلب	حديد
17	بلادي للمواد الاوليه	حديد
18	الحمد لصهر وتنقية المعادن	معادن
19	شركة عبد الرؤوف العجل للصناعات المعدنية	معادن
20	مصنع الزعبي لسكب المعادن	معادن
21	شركه صهر واعادة الالمنيوم	معادن
22	شركة ايون لصناعة الهياكل المعدنية	معادن
23	العملاق لتشكيل المعادن	معادن
24	أبواب مكه لتشكيل المعادن	معادن
25	شركة حسن بصبوص وشريكه السراج المنير لتشكيل المعادن	معادن
26	ساحة الربايعة للمعادن	معادن
27	مصنع العصور الذهبية	حديد-معادن
28	المجال الحديث لسكراب الحديد	حديد-معادن
29	مؤسسة أبو خضرا لتجارة الحديد والصاج	حديد -معادن
30	محددة مازن	حديد -معادن

31	شركة مصانع الورق والكرتون الأردنية (مساهمة عامة)	كرتون-ورق
32	مصنع الكرتون التابع لشركة حياة الطفل (Baby Life)	كرتون-ورق
33	شركة سيدرا لصناعة الكرتون	كرتون-ورق
34	الاردنيه الاوروبيه للتعبيه والتغليف	كرتون-ورق
35	الشركة العربية لصناعة الكرتون	كرتون-ورق
36	شركة النوعية للكرتون	كرتون-ورق
37	الشركة الموحدة للتغليف	كرتون-ورق
38	مصنع طيبة المدينة كرتون	كرتون-ورق
39	شركة الودق لصناعة الكرتون	كرتون-ورق
40	المصنع العربي لأطباق الكرتون (الوليد)	كرتون-ورق
41	شركة البركة للخدمات البيئية (مشروع كيس ورق كرتون)	كرتون-ورق
42	شركة الشريف الصناعية	كرتون-بلاستيك
43	روتوغرافيا	كرتون-بلاستيك
44	شركة التعبئة الفنية لصناعة العبوات البلاستيكية (بتكو الأردن)	بلاستيك PET
45	شركة الغزال للبلاستيك	بلاستيك
46	شركة ستار للبلاستيك	بلاستيك
47	مصنع بلاستك الكردي	بلاستيك
48	شركة الشريف لصناعة البلاستك	بلاستيك
49	شركة موال للصناعات البلاستيكية	بلاستيك
50	البيئه الجديدة للبلاستيك	بلاستيك
51	شركة طرخان الصناعية لاعادة تدوير البلاستيك والزيوت	بلاستيك
52	شركة جميل الساحوري وأخوانه	بلاستيك
53	شركة المثلث الذهبي الاولى للعبوات البلاستيكية	بلاستيك
54	مصنع المعتمدة للصناعات البلاستيكية	بلاستيك
55	مصنع عبدالهادي لتدوير للبلاستيك	بلاستيك
56	شركة الفرسان للبلاستيك	بلاستيك
57	مصنع النجم الفضي للبلاستيك	بلاستيك
58	شركة بيسان للصناعات البلاستيكية	بلاستيك
59	الضرغام للصناعات البلاستيكية	بلاستيك
60	شركة بلاستيك القدس	بلاستيك
61	شركة دجلة للصناعات البلاستيكية	بلاستيك
62	شركة العصرية للصناعات البلاستيكية	بلاستيك
63	مؤسسة سعد قفيشة للصناعات البلاستيكية	بلاستيك
64	الشركة الوطنية للري بالتنقيط	بلاستيك
65	شركة مصنع وايت للبلاستيك	بلاستيك
66	شركة الفخر لصانعه البلاستك	بلاستيك
67	مصنع المشعل لتصنيع برابيش الكهرباء	بلاستيك
68	مصنع الميزان للمنتجات البلاستيكية	بلاستيك
69	العالمية لصناعة انابيب الري	بلاستيك
70	شركة زين للصناعة البلاستيكية	بلاستيك
71	شركة غراند للصناعات البلاستيكية	بلاستيك
72	الأمين لتجارة الحديد و البلاستيك	بلاستيك
73	التقدم الحديث للصناعات البلاستيكية	بلاستيك
74	المؤسسه الدوليه للصناعات البلاستيكية	بلاستيك
75	المزايا للصناعات البلاستيكية	بلاستيك

76	شركة فادي للصناعات البلاستيكية	بلاستيك
77	مصنع ابو راشد للبلاستيك	بلاستيك
78	مصنع البرابيش الزراعية	بلاستيك
79	شركة جفرا للصناعات البلاستيكية	بلاستيك
80	المتحدة للحاويات البلاستيكية	بلاستيك
81	شركة البراري لصناعة البلاستيك	بلاستيك
82	شركه فورموزا للصناعات البلاستيكيه	بلاستيك
83	نور الشام للبلاستبك	بلاستيك
84	الرؤى الحديثة للبلاستيك	بلاستيك
85	مؤسسة هشام حماد الصناعية	بلاستيك
86	بلاستيك القدس	بلاستيك
87	مؤسسة الراقي للصناعات البلاستيكية	بلاستيك

8 ANNEX II: RECYCLING VALUE CHAINS ANALYSIS - VCA REPORT

Please scroll down for the complete Recycling Value Chains Analysis - VCA report or click here to view or download as a separate document.

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Recycling in Jordan Activity

Annex 2: Recycling Value Chains Analysis - VCA Report

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EXECUTIVE SUMMARY

This report presents the findings and results of the value chain mapping and analysis exercise that the Activity conducted in FY2023 for a set of prioritized waste sectors in the recycling market in Amman. The report aims to validate key constraints and barriers that are still hindering growth of the recycling market and to reassess priorities and sectors' selection that the Activity previously implemented to achieve its objective and outcomes. This assessment provided the core foundation for updating the original MSA study in Year 1.

The current recycling market is structured into primary and secondary value chains or sectors in terms of value, volume, and inclusion. The primary recycling value chains are Metals, Plastics, and Cardboards/Papers while the secondary value chains are Used Cooking Oil, E-waste, Old Tires/Rubber, Textile, PET, Wood/Furniture and Organic/Food Waste.

In terms of market channels and value addition, the current recycling sector is characterized by two distinct channels as outlined below:

1. Domestic Channel: This channel encompasses ferrous metals, plastics (excluding PET), old tires, wood/furniture, and certain paper/cardboard materials. The domestic channel places a strong emphasis on value addition within the domestic market, resulting in a heightened focus on product quality compared to the export channel. Key players in this channel are domestic manufacturers and end markets. They primarily acquire their raw materials from industrial manufacturing plants as 'off-cuts.' Additionally, they engage in the procurement of specialized clearances from significant waste generators and demolition sites through established partnerships with scrap yards, intermediaries, and dealers.

2. Export Channel: The export channel includes paper, cardboard, non-ferrous metals (such as aluminum, copper, and precious metals), used cooking oil, E-waste, PET waste, and processed textile waste. Within this channel, products undergo a more limited form of value addition prior to export. This includes activities such as sorting, grading, cleaning, shredding, baling, and packaging. The export channel is characterized by a networked organizational structure that involves broader and looser sets of relationships. The foundation of this channel relies heavily on the contributions of numerous informal waste pickers who serve as the primary suppliers.

These two channels within the recycling sector exhibit distinct operational dynamics. The domestic channel prioritizes quality due to its domestic value addition focus and relies on established relationships with industrial sources and waste generators. In contrast, the export channel emphasizes efficiency in processing and relies on a wider network of informal waste pickers to supply materials with limited value addition prior to export.

As per insights obtained from key informant interviews (KIIs), new competitors have entered the cooking oil and e-waste sectors. Their participation holds the potential to augment value addition within these specific value chains. Furthermore, the sustained upsurge in global plastic prices has motivated domestic processors and manufacturers to amplify their investments in the plastic recycling sector.

In general terms prices in the primary value chains have increased since 2020 and can be attributed to rises in global prices. All these sectors have a strong export orientation, and their pricing is particularly responsive to the competitive pressures posed by virgin raw materials. Similarly, the secondary sectors that predominantly focus on exports experienced a favorable rise in prices since the initial MSA investigation. In numerous instances, the allure of elevated prices prompted an upswing in the quantities of recyclable materials. Nonetheless, despite these elevated prices, certain secondary value chains (such as e-waste, used cooking oil, PET) did not experience a corresponding

surge in quantities. This was primarily attributed to limitations in supply and collection mechanisms. In total, this assessment involved the mapping and analysis of 16 value chains and sub-value chains. The highest representation of more marginalized groups is in waste collecting and sorting functions in the primary sectors of interest while they are found more as employees in upstream processing and manufacturing facilities in the secondary sectors. Nonetheless, women remain generally under-represented across the sector and where they are found tends to be more administration roles in larger enterprises.

Whilst not linear or constant the volume of recycling material has been maintained and, in some cases, increased since the original MSA. This is mainly driven by the price inflation and opportunities created by the restarting of the global economy post-COVID. Whilst this is positive in the short term, continued growth is still being constrained by factors including:

- Value Addition: There is a relatively modest degree of value addition and customization.
- Technology: relatively low introduction of new/ improved technologies.
- Closer End Markets: limited development of closer/ local end markets (which can reduce volatility through exposure to global markets, and support integration and specialization through the value chains).

Some highlights of performance and changes in respect of volume in key value chains of interest include:

Plastics: The research results showed increased volumes in plastics during the last two years indicating growing trends. About 70,000 tons/year of plastics recovered locally compared to 50,000 ton/year in 2020. This increase is attributed to an increase in the material flow because of the prolonged increase of global oil prices and high prices of the virgin plastics. Out of the existing 600 plastic industries in Jordan, around 200 small to medium plastic processors and manufacturers are considered as domestic end-market of the of the plastic recycling. Most plastic recycling is locally recovered where exporting recycled plastics (processed into granules/pellets) to neighboring countries is not competitive due to the relatively high production cost. Only PET waste is shredded into flakes without washing and the majority exported to neighboring countries in the region for further processing.

Paper/cardboard: The findings showed that the paper/cardboard has extremely growing trends during the last two years. The export amounts jumped from 100,000 tons/year to 180,000 tons/year due to considerable increase in the global prices. There are only eight cardboard manufacturers, about twenty small paper mills (classed as 'craft establishments') that have been identified as operating between Amman and Zarqa. There is only one industrial scale paper/cardboard mill in Jordan, based in Zarqa with limited operating capacities. Estimates indicate that Jordan currently has a local manufacturing capacity of around 20,000 – 30,000 tons per year that produce low-quality products such as egg trays, recycled office paper, tissues, cores, and toilet paper. As this value chain is export-oriented, aggregation is a fundamental function, and businesses usually invest in equipment and infrastructure. The market research indicated that inconsistency and instability of government decisions related to export fees are the most critical constraint that hinders the growth and development of this sector.

Metals: During the past two years, this sector has witnessed a rise in its volumes, although the increase has been less pronounced compared to plastics and paper/cardboard. This disparity can be attributed to the well-established nature of the domestic chain, which demands quantities that surpass the local supply capacity.

In the case of ferrous metals (iron and steel), there has been a noticeable upsurge in imports over the last two years, despite the absence of new entrants into the market. Import figures have surged from 70,000 tons in 2019/2020 to a substantial 150,000 tons.

As for non-ferrous metals, exports have also seen a notable increase, primarily propelled by the significant global price hike. Specifically, aluminum exports have soared from 9,000 tons in 2019/2020

to an impressive 25,000 tons annually in 2022. In contrast, copper exports have undergone a decrease, dwindling from 14,000 tons to 4,500 tons per annum. This shift can be attributed to robust global competition, as Jordan faces constraints in value addition and grapples with diminished copper consumption resulting from COVID-19-related shutdowns and restrictions.

Even though the ferrous metals value chain is very developed and domestic oriented, importing additional steel scrap waste is crucial to meet the local demand.

Likewise, the exports of the non-ferrous metals, particularly aluminum and copper waste are often subjected to an export tax (30 JOD per ton). Exempting these scraps or reducing it will improve competition with global markets especially that Jordan has limited value additions in this regard. Price fluctuations and seasonality influence the consistent supply, and therefore aggregation is a fundamental step in the metals recycling sector.

PET waste: The PET recycling market in Jordan is still very limited in terms of value and volumes due to the lack of specialized manufacturing processes in the country such as but not limited to the production of fleece textile or broom brushes or wipes. Hence, the market is export-oriented and driven by global prices of virgin PET. The market estimates showed around 600 tons/year of post-consumer PET waste is being collected from unsegregated waste stream while around 3000 tons of pre-consumer PET is collected from industrial sources. Most of these amounts are exported. The sector showed a progressive increase in terms of volumes, but it is still limited due to lack of value addition and infrastructure. PET waste has three quality segments in local market as follows: pre-consumer, source segregated plastic (preferred segment) (attracting a higher price on the market), and post-consumer sorted after it enters the waste flow. The low-grade post-consumer PET is sorted, baled, and exported to neighboring countries such as Turkey, Egypt, Saudi Arabia, and Palestine. The export prices started from 300 to 320 JOD/ton for the baled PET while the shredded PET has a higher price limit between 340-375 JOD/ton. The global buyers of this low-grade are large manufacturers that produce fleece textiles, broom brushes, wipes, and straps. The pre-consumer PET waste is being generated from industries and manufacturers and there is a handful of domestic manufacturers that buy this high-quality grade and use it in their manufacturing processes to produce broom bristles, cleaning tools, and curtains accessories and supplies, threads, plastic fabric, and home furnishing items for both domestic and export markets. The prevailing price of this grade ranges from 400 – 600 JOD based on global prices, quantities, and seasonality. Although source segregated are not available in large quantities and there are no domestic manufacturing processes dealing with high contaminated waste, the post-consumer PET has been experiencing growth in recent years and the market will remain export-oriented in the upcoming years. This growth can be attributed to several factors, including increased global awareness and focus on environmental sustainability and the growing global demand for recycled products by consumers and businesses. However, the availability of recycled materials at competitive prices has also contributed to market expansion. For instance, the sub-value chain of the pre-consumer PET looks more stable and will grow steadily over the years but with limited quantities. Global trends indicate an increasing reliance on virgin PET for applications in food packaging, beverages, and hygiene products. This escalating demand is poised to incentivize manufacturers of virgin PET to ramp up their production. However, the trajectory of this market is not only influenced by the global prices of virgin PET but also by environmental policies that play a pivotal role in shaping its growth.

Organic and Food waste: Currently, this value chain remains in a static state without any implemented solutions. However, the research has highlighted a limited number of technology suppliers, researchers, community initiatives, and entrepreneurs who are exploring inventive approaches such as animal feeding and on-site composting.

It's worth noting that Jordan lacks dedicated rules and regulations focused on organic and food waste management, particularly tailored for non-residential facilities like commercial and industrial sectors. These regulations could play a crucial role in promoting actions such as food waste reduction, source segregation, and separate collection. To address these challenges, effective enforcement, monitoring, and evaluation mechanisms are essential components.

In addition, economic incentives and policy instruments hold the potential to create a conducive environment for boosting the production of animal feed and compost, fostering innovation, and opening up new market prospects within the organic and food waste value chain. For example, raising landfill disposal fees for waste generators without offering viable alternatives for food waste treatment is unlikely to motivate their active participation.

Used Cooking Oil (UCOs): Although the sector is relatively small, market estimates showed around 4000 tons of used cooking oil per year are collected and exported. The main export channel is Europe and the average selling price for the UCOs ranged between 1200 and 1500 USD per ton. The local market is segmented into foodservice and households, where the main waste generator in is the foodservice sector and specifically the restaurants. Limited quantities collected from households are usually through informal waste pickers and itinerant buyers. Although market seems to have a steady growth over years, Restaurants sector in Jordan drives the UCOs quantities to be recovered in the market. The weakened purchasing power of restaurants will shrink quantities of UCOs available for recycling. The UCOs valorization includes the following functions: collection, transport and storage, pre-treatment (moisture/impurities), refinery, and biodiesel production. Although there is a big demand on renewable energy and the production of biodiesel in Jordan, most of local quantities are export-oriented due to strong industry and technology in Europe that offer better prices for local collection and refining companies. Due to global expansion of the food industry and the rising demand for biofuels, the used cooking oil markets are anticipated to grow and develop in the upcoming years, and this eventually will reflect on quantities and prevailing prices.

Textile waste: There are 2,000 – 3,000 tons of pre-consumer textile waste recovered last year as Grinded fabrics/textiles for export markets. However, this amount varies from season to season and showed a slight growth in recent years, but quantities were bigger prior to outbreak of the COVID in 2020. Jordan has no clear accurate and reliable data about the fabric composition of the textile waste in Jordan. Market estimates indicated that most of the wasted textile fabrics in Jordan include synthetic polymers (i.e., polyester, spandex, nylon) and natural polymers (i.e., rayon (viscose)) and it could not be recycled directly in the RMG industry. Use of recovered synthetic fibrous waste is particularly attractive as the processing characteristics of properly recovered synthetic do not differ much from those of original synthetic staple and cut filaments. Although Jordan enacted a new Waste Framework Law (No. 16/2020) since few years ago, no specific regulations or even a clear and defined environmental policy adopted yet regarding textile and garment waste management in the country. The current end markets for low-valued recycled materials in the textile industry are primarily domestic, with some exports to Saudi Arabia and Palestine. The main products traded are grinded fabrics/textiles through the mechanical processing with a limited value addition (i.e., no fleece or felt production from textile waste yet in Jordan). The key buyers include manufacturing companies in Saudi Arabia who use the recycled materials in their production processes as a filling material for low-cost furniture industry.

E-waste: The market estimates showed that around 1,500 – 2,000 tons of E-waste and about 500 tons of used batteries entered this value chain last year. This value chain indicated a slight increase in volume due to the global increase in the price of the precious metals. Although there is no accurate official data, market estimates indicate that Jordan produces yearly about 120 thousand pieces of electrical and electronic equipment and imports another 100 thousand tons of electrical and electronic equipment. Unofficial estimates indicated that the E-waste generation in Jordan ranges between 5.5 and 6.5 kg/capita/day. It is also estimated that E-waste is available for disposal is about 40-60 thousand tons per year. Despite the economic value, Jordan has small and growing value chain

for the E-waste which is export- oriented as there is no advanced processing or manufacturing capacities for higher value addition as these processes typically require high-end technologies, infrastructure, and large-scaled markets. The current E-waste value chain in Jordan undergoes only limited value addition such as collection, storage, sorting, dismantling, and exporting. In terms of segmentation, this E-waste market is segmented based on the source and type of recycled material. For example, circuit boards/rams of computers, phones and screens devices may be considered as a separate segment due to content and dismantling requirements. Similarly, batteries can be viewed as a distinct market segment. The licensed collection and dismantling companies are also competing with a handful of informal businesses that collect and dismantle E-waste without any legal licensing and usually practice it far away in remote areas. These improper practices caused several environmental and health concerns. Access to finance would be essential for the aggregators and processors/exporters, to upgrade their capacity in terms of equipment, and infrastructure.

Old tires and Rubber waste: In Jordan, that the old scrap tires waste generation in Jordan ranges between 3 and 4 million pieces every year. The energy valorization of old scrap tires helped this value chain to grow. The market estimates showed that energy recovery facilities absorb around 40,000 tons in last year, and the material recovery facilities treat about 4,000 tons per year, while the local used tire dressing (re-tread industry) treat around 10,000 tons per year, most of it is imported. The energy valorization of old scrap tires is growing in Jordan since the last decade due to the strategic direction that Jordan envisioned for developing the renewable and alternative energy sector. Jordan enacted a specific legal instruction in 2016 that regulates the business activities related to the production of industrial fuels from waste. The current market is domestically oriented and segmented based on types of input and finished products (i.e., industrial fuel), but not the source. Currently Jordan has 4-5 private licensed facilities that produce industrial fuel and biodiesel products primarily from old scrap tires and rubber waste through pyrolysis applications. Due to its heat caloric value, the main buyers of these alternative fuels are domestic cement kilns and other industries that have thermal applications. However, the current old scrap tires and rubber waste is stressed in terms of supply and there are no advanced processing or capacities for a higher value addition except energy recovery and used tire dressing or retread industry. In addition to the energy recovery application, the current market includes other segments which are: Material recovery applications, Upcycling and reuse, and retread industry (used tire dressing). There are 3-5 local manufacturers specialized in the material recovery of the old scrap tires and rubber waste and mostly of them work seasonally due to supply limitation and strong competition on the big old scrap tires with the recovery facilities that produce industrial fuel. Collection and sorting are the most limiting factors in this market because all aggregators and processors have no fleet or trucks for collection and rely on formal and informal collectors to feed their daily inputs.

Wood/Furniture waste: Despite this value chain is very small, the results indicated that around 600 tons of wood/furniture scrap is being yearly recovered from the commercial and industrial sectors. Even Jordan do not have any legal or regulatory frameworks related to wood waste management especially that key actors are limited to wood and construction sectors who usually deal with this kind of material such as wood processing industries, furniture traders, and individual carpentries. The generalist scrap yards do not deal with wood due to low demand but there are a few numbers of specialized scrap dealers who trade wood scraps, mainly pallets, boxes, sawdust, old and broken furniture and used wood pieces.

1 INTRODUCTION

1.1 Background

The Recycling in Jordan Activity is a five-year program funded by the United States Agency for International Development (USAID). The Activity is working together with Amman's commercial sector waste generators, private sector recycling service providers, the Ministry of Environment (MOENV), the Greater Amman Municipality (GAM), and relevant business associations to increase the commercial sector's demand for and use of recycling services in Amman through implementing innovative and sustainable solutions and models. Utilizing a market-based approach, the Activity has three strategic objectives as follows:

- Expand the private sector-led recycling markets in Amman and improve performance and profitability of private sector service providers,
- Increase demand for recycling services by the commercial sector in Amman (non-residential waste generators), and
- Improve the business enabling environment for recycling services and markets in Amman.

During Year 1, the USAID Recycling in Jordan Activity conducted a Market Systems Analysis (MSA) study for the private sector-led recycling markets in Amman that identified key constraints and barriers to the growth of recycling market in terms of the supply, demand, and business enabling environment perspectives. Indeed, a set of prioritized recycling value chains in the local market mapped and analyzed using value chain analysis (VCA) approach which included qualitative and quantitative tools.

The MSA study found that the Municipal Solid Waste (MSW) sector in Amman is one of the most complex sectors due to the variety of types of generated solid waste. The recycling and commercial sectors in Amman embrace a wide range of private actors and stakeholders with different roles and mandates in the absence of a public system for MSW segregation, given the subsidized waste collection services that GAM provides. Insufficient recycling service providers, with weak capacities and value proposition, hinder their ability to offer quality waste management solutions to commercial waste generators, who also have low levels of awareness and motivation about the recycling sector and available services and are not aware of the relevant laws and regulations relating to solid waste management and recycling. Although the recycling sector in Jordan is dominated by private sector, it remains under-developed and lacks adequate support at both municipal and national levels. Moreover, the government's frequent alterations of decisions and fees also pose difficulties and risks for private sector recycling companies and new investors.

After two years of the implementation, the Activity sets a target to update the original MSA study conducted in Year 1 for identifying and validating the market constraints and barriers that are still hindering the growth of supply and demand of the private-led recycling services in Amman. The updated MSA also aims to identify any market system changes that happened in the previous two years of implementation in terms of functions, performance, number of actors, and inclusion. The updated MSA also aims to explore potential end-market opportunities for performance, growth, and expansion. The value chain analysis (VCA) report, which is the core foundation of the original MSA study will be updated accordingly.

1.2 Objective of This Report

This report presents the findings and results of the value chain mapping and analysis exercise that the Activity conducted in FY2023 for a set of prioritized waste sectors in the recycling market in Amman. The Value Chain Analysis (VCA) report aims to reflect on the changes that happened in the market over the last two years in terms of functions, performance, number of actors, and inclusion, and to validate key constraints and barriers that are still hindering growth as well as to re-assess

priorities and sectors' selection that the Activity previously adopted to achieve its objective and outcomes. This VCA assessment will provide the core foundation for updating the original MSA study in Year 1.

1.3 Approach and Methodology

This recycling value chain mapping and analysis research was undertaken by Activity's team in May and June 2023, with support from local experts and guidance of the Market Systems Development Expert. The assessment approach followed was consistent with the best practices for market systems development.

1.3.1 Prioritization Step

Given the fact that the recycling sector in Amman is comprised of many different products and value chains with several waste streams/sources and this complexity offers different potential 'dividends' against each of the key objectives of any program. Therefore, it was important for the Activity to adopt a suitable criterion for waste sector' prioritization. Consistent with best practice market development principles, the framework used for prioritization centered on a rapid assessment of each sector against a set of key Activity's objectives and interests. The basic framework is shown in **Figure 1** below; and a detailed set of assessment criteria is shown in **Table 1**.

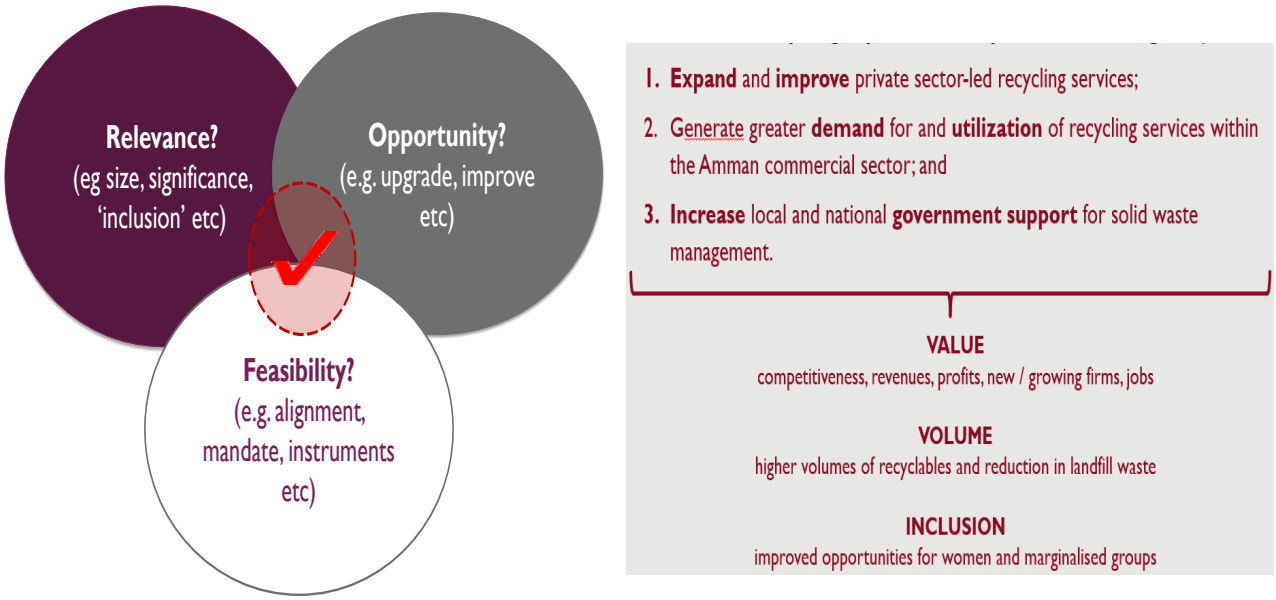

Figure 1: Framework for Sector Prioritization

As shown above, the framework used for prioritization was to consider issues of relevance, opportunity, and feasibility in respect of core Activity objectives interpreted in respect of three key results:

- Increased value of the private sector-led recycling services;
- Increased volume of waste diverted from landfill to the recycling sector;
- Build a strategic framework that reflects on any market system changes that happened in the previous implementation duration (2 years); and
- Inclusive patterns of growth that offer improved opportunities for women, youth, and marginalized groups.

This framework was operationalized through the application of a set of more detailed criteria, which are shown in **Table 1**.

Table 1: List of prioritization specific criteria

Category	Criteria
Relevance	Waste Volume – size and significance?
	Jobs – number and type?
	GESI Representation (inclusion) – where and how many?
Opportunity	Commercial growth prospects – growing output and profits?
	End market stability (access) – markets and market access?
	Job quality (health and safety related) – safe or unsafe?
Feasibility	Alignment with GAM and Government of Jordan's priorities – policies and plans?
	Alignment with USAID priorities – country strategy?
	Activity scope –instruments / skills available – team and modes?
	Activity scope – partners / leverage potential – number and type?

Accordingly, the Activity set out two orders of sector's prioritization that consider issues of relevance, opportunity, and feasibility in respect of core Activity's objectives and results, as follows:

- **First-Order Prioritization (Primary sectors):** where the data gathering and analysis focused **on updating** the VCA assessments completed in Year 1 and included Shallower comparative assessment against the Activity's objectives to explore what's new/different, and why in respect issues related to 'structure, performance, and inclusion of the following primary value chains of interest: Plastics, Cardboards/Papers, and Metals.

- **Second-Order Prioritization (Secondary Sectors):** where data gathering and analysis focused **on expanding** additional value chains of emerging interest to Activity's activities, with deeper assessment to expand as follows: PET waste, Used Cooking Oil, Old tires and Rubber, E-waste, Wood/Furniture, Textile waste and Organic/Food waste. Those prioritized moved to the next step of the diagnostic process, with others taking a second order of priority.

Against a target of 12, an initial list of 16 distinct sub-value chains was considered. These were:

Primary Sectors – first order prioritization		Secondary Sectors – second order prioritization	
Plastics sector	High-Density Polyethylene (HDPE)	Other waste Sectors	PET waste sector
	Polyvinyl Chloride (PVC)		Used Cooking Oil sector
	Low-Density Polyethylene (LDPE)		Old tires and Rubber waste sector
	Polypropylene (PP)		E-waste sector
	Polystyrene (PS)		Wood/Furniture waste
	All plastics except PET		Textile waste
Paper/ Cardboard sector	Paper		Organic and Food Waste
	Cardboard		
Metals sector	Ferrous metals		
	Non-ferrous metals		

The approach considered a step-by-step method for the mapping the recycling value chain, starting from waste generation (upstream side) and move forward across the different added value practices (or steps) exist in the downstream till reaching the activities post-manufacturing (whether domestic or export demand markets). **Figure 2** shows an overarching mapping for the current recycling sector in Amman.

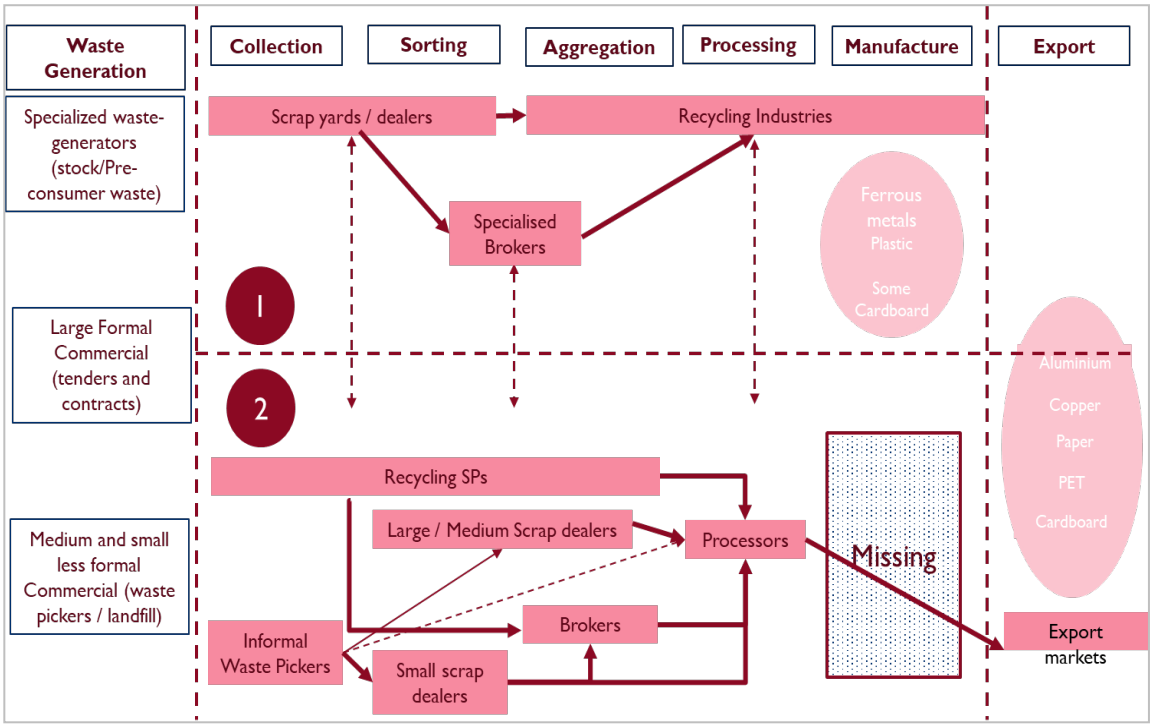

Figure 2: Overarching the recycling value chains mapping for prioritized sectors, channels, and products

As shown above, there are still two primary channels in the recycling sectors of focus. These are:

1. Domestic Channel: This concerns ferrous metals, plastics (except PET), old tires, wood/furniture, and some paper/cardboard. This channel involves more domestic value addition, and hence is more quality conscious than the export channel. In response to such quality drivers, this channel is relatively more vertically integrated, formal and relationship based. Recycling industries is the term used to refer to manufacturers who also engage in processing and aggregation functions (see below). Through their relationships with scrap yards, middlemen, and dealers they source the bulk of their material inputs as 'off-cuts' from industrial manufacturing plants; and through tenders / contracts for specialist clearance from large waste generators / demolition sites. This channel isn't highly inclusive of informal waste pickers and/or itinerant buyers, and their role is minimal as individual suppliers for the collectors and sorters (i.e., small scrap yards and dealers) upstream of this domestic channel.

2. Export Channel: This concerns paper and cardboard, non-ferrous metals (e.g., aluminum, copper, precious metals), used cooking oil, E-waste, PET waste and processed textile waste. Value chains for which there is no domestic advanced processing or manufacturing capacity for higher value addition. These processes typically demand high volumes and intensive use of energy and water – all factors that Jordan is less competitive in compared to other countries in the region (e.g., Saudi Arabia and Egypt) or wider afield. This means that such products undergo only limited value addition – such things as sorting, grading, cleaning, shredding, bailing, and packaging, etc. – prior to being exported. However, the competitiveness of these value chains lies in more efficient sorting, cleaning, grading and aggregation functions further down the value chain and closer (ideally 'at') the level of the waste generator. The cost of sorting large volumes of contaminated mixed waste is both inefficient and erodes 'quality' and hence the price of some

products (e.g., paper). This channel is described as more of a 'networked' organization of looser and much wider sets of relationships. The sector is reliant on thousands of informal waste pickers (including many from more marginalized groups), who sell mixed waste to scrap yards or brokers they know. This network of scrap yards and brokers collaborate as they sort, grade, and sell to / buy from each other, in order to both specialize and aggregate as the product moves up through the value chain towards processing and ultimately export.

1.3.2 Data Collection

Following best practices on value chain analysis, the data tools and investigative process included 2-hour key informant interviews (KIIs) and 2-hour virtual focus group discussions (FGDs) were structured to offer detail, insight, and perspective according to the scope of this MSA study. The Activity conducted 50 KIIs and five FGDs with different market actors across the recycling value chains in Amman including those covered in Year 1. The target group of the data gathering was the private sector-led recycling markets that exist with the Governorates of Amman and Zarqa and particularly in all municipalities located within the waste catchment area of Al-Ghabawi Landfill in Amman. The approach of data collection was reflective of the current 'post-COVID' market context, and responsive to the experience that the Activity earned on the ground through working with partners. Data gathering was a mid-line assessment which meant that we compared 'now' with 'before' across the three key areas of structure, performance, and inclusion measures. The original questionnaire templates used where the old questions updated to reflect previous findings (baselines) and enquired what's new / different now from what was observed before. The questionnaire targeted the previous respondents, but aware of any new/significant players and ensuring representation is proportional to the 90% respondent target. The questionnaire template included present baseline data and reframed questions to solicit current updates, and interpretations of observed changes.

The original guiding questions reviewed and modified to reflect the 'updating' task (compare, contrast, and explain what's new / different now, to before), for the purpose of gathering data as required to capture changes occurred in the market, with focus on the following dynamics.

- Structure, performance, and inclusion: looking to understand value, volumes, and inclusion in each value chain including channels, products, functions, actors, prices, markets, supporting services and interconnected markets, governing policies and regulations, and marginalized groups.
- Vertical relationships: looking to understand the processes – or value-added functions – through which products flow from input markets (i.e., raw materials and generation) to output markets (i.e., final products and consumption). What are they? Who is involved? What does transformation look like? What are the differentials between input and output prices, and value addition? This also offers a focus on end markets / buyers and issues of alternatives / competition as well as competitiveness against these.
- Horizontal relationships: looking within each function in the value chain helps to understand the nature of cooperation between different firms involved in the same type of activity. It also helps to distinguish between different business models used by those performing similar tasks (i.e., technologies, organization, skills, etc.).
- Wider system of supporting functions and rules: firms within the value chain also exist within a wider system of supporting markets – those that add value to the performance of firms in any given value chain and those that create policies, regulations, customs, and norms that influence participation and incentivize performance.
- Assessment of leverage potential: the purpose of value chain analysis isn't just to understand what is happening any why. It's also to inform thinking about realizing latent potentials. In this sense the process was focused also on identifying 'where' intervention might be required, and 'who' might support such interventions.

2 BASELINE AND CONTEXT

Due to several socio-economic contexts, a rudimentary recycling business created in Jordan since many decades ago, which consisted of a largely network of formal and informal businesses as well as individuals who recognized the financial valorization of several waste fractions (mainly metallic scrap items) to be used as secondary raw materials for domestic manufacturers and incorporate it their productive processes. Over time, a few numbers of value chains begun to grow and develop in the market targeted only the waste fractions that have a marketing value, and these included basic value-added activities mainly collection and sorting. Due to the continuous global increase in waste over years that driven by the continuous population, economic and urban growth, the end-market industries recognized the importance of recycling in securing secondary sources of raw materials to their processes as a strategic alternative to compete and sustain in the markets considering limited of virgin resources and their high prices. These conditions created more demand for recyclable materials and enabled the recycling sector to grow and develop.

Nowadays, the recycling industry in Jordan is growing not as a standalone but as a cross-sector with a major economic value in the main pillars of the country's economy such as industry, commerce, and agriculture. This "cross-cutting" advantage accelerates the development and growth of the recycling industry in terms of functions, channels, and products. However, the recycling market is still small, undeveloped, and less competitive in compared to other countries in the region (e.g., Saudi Arabia, Egypt, and Turkey) or wider afield. Jordan recycling market consisted of two domestic and export market channels. The domestic channel concerns ferrous metals, plastics (except PET), old tires, wood/furniture and some paper/cardboard and involves more domestic value addition, and hence is more quality conscious than the export channel. The domestic is relatively more vertically integrated, formal and relationship based, and sensitive to the quality. However, this domestic channel isn't highly inclusive of informal waste pickers and/or itinerant buyers, and their role is minimal as individual suppliers for the collectors and sorters (i.e., small scrap yards and dealers) in the upstream of this domestic channel.

The export channel seems to be wider than the domestic and it concerns paper and cardboard, non-ferrous metals (e.g., aluminum, copper, precious metals), used cooking oil, PET waste, processed textile waste, and Electric and Electronic Equipment Waste (WEEE). This means that such products undergo only limited value addition (i.e., shredding/baling/grading) prior to being exported as Jordan lacks advanced processing or manufacturing capacity for higher value addition as well as the low regional competitiveness. This channel is described as more of a 'networked' organization of looser and much wider sets of relationships and reliant on thousands of informal waste pickers who sell mixed waste to scrap yards or brokers they know. Food waste is also a 'special interest' case in Jordan (represents ~50% of the total municipal waste[1]) because it is having no value chain active yet although the given fact that potential solutions and treatment applications (like animal feed, Refuse Derived Fuel (RDF), biomass energy) are viable and doable in other countries. The current recycling industry is situated in central Jordan and mainly within the boundaries of Amman, Zarqa, East Madaba and East Balqa in the following areas: Marka, Qweismeh, Abu Alanda, Jweideh, Sahab, Muwaqqar, Al-Jizah, Al-Qastel, Na'our, Um-Albasateen, Wadi Alaish, Wadi Al-Qamar, Russeifa, Zarqa, and Ain Al-Basha. The original MSA study in 2020[2] reported that the recycling industry in Jordan locally recovered every year 75,000 tons of plastics, recovers 12,000 tons of aluminum, exports up to 9000 tons of copper, recovers around 30,000 of iron and steel scrap waste and exports up to180,000 tons of paper/cardboards. For the other waste sector, Jordan exports every year around 15,000 tons of used cooking oils, and Approximately 3.5 million pieces of the waste tires are annually recycled through fabrication, energy recovery and retread tires products.

[1] Waste characterization studies conducted in 2010 and 2011 by the Royal Scientific Society (RSS) for commercial and residential districts in Amman

[2] https://jordankmportal.com/resources/recycling-in-jordan-activity-market-systems-analysis-msa

It is worthing to mention that the study stated that Jordan do not have reliable and accurate data bases about waste recycling and most of the available studies were reliant on rough estimates from export and import official raw data. Nonetheless, the market estimates indicated that the above waste sectors represent around 30% of the total volume of the commercial waste stream without considering either municipal/governmental recycling facilities or internal recycling activities that the industries practiced in managing their pre-consumer waste or scrap items. The capacity of the recycling industry is estimated between 500 and 800 tons[3] per day of recyclable materials, which are handled throughout the existing recycling value chains including the stream of the industrial scrap trading and pre-consumer default items. Of which, around 150 -250 tons per day are currently being recovered from post-consumer waste coming from the municipal streams (mainly from commercial waste generators) through private sector-led recycling services and informal sector. The current overall waste recycling rate in Amman ranged between 5% and 10%, and it is projected to reach up to 15% in the next 10 years because of newly adopted municipal plans and stepwise growth of the business recycling.

The recycling sector in Jordan is a significant employer and offers critical livelihood opportunities for many thousands of poorer and more marginalized groups who struggle to access opportunities with 'higher social / economic barriers to entry'. According to market estimates, the recycling industry currently employs about 18,000 jobs and there are about 3000-5000 of individual street waste pickers (including many from more marginalized groups) as well as 1000-1500 itinerant buyers, who are active and sell mixed waste to scrap yards or brokers they know. This network of scrap yards and brokers collaborate as they sort, grade, and sell to / buy from each other to both specialize and aggregate as the product moves up through the value chain towards processing and ultimately export except of the non-ferrous/plastic materials which domestically recovered. In spite of this fact, the recycling sector is limited in both scope and sophistication. Domestic markets are fairly small, and the recycled products are fairly narrow in scope, value addition processes limited, and value chains racked with inefficiencies. Given such prevailing factors, the current supporting services and interconnected markets that can help drive growth of this industry are very limited in scope. **Table 2** provides a baseline summary about the functions and active market actors in the recycling industry and market in Jordan in 2020[4] as a baseline for the updating the value chain mapping exercise.

Table 2: Summary of the functions and active market actors in the recycling industry and market in Jordan in 2020.

Functions across the recycling value chains (Up-to-down order)	No. of active actors in the current local market (2020)
Domestic industries or manufacturers	5 – 8 Steel mills and aluminum smelters 120 Plastic manufacturers/Industries 1 Paper/cardboards Industrial mill 15 – 20 Recycled paper small mills 8 Recycled cardboard manufacturers
Processors	8 Ferrous steel mills 12 aluminum smelters and metal processors 80 Plastic crushers/washers/ pelletizers 6 – 8 Paper/cardboard balers and exporters
Aggregators	200 – 300 scrap yards, middlemen, and brokers 250 – 350 plastic yards, middlemen, and brokers
Sorting and Collection	20 – 30 mixed waste haulers 5 – 15 recycling collection companies (specialized waste collection) 3,000 – 5,000 informal street waste pickers 1,000 – 1,500 itinerant buyers

[3] Estimated by the USAID Recycling in Jordan Activity.
[4] https://jordankmportal.com/resources/recycling-in-jordan-activity-market-systems-analysis-msa

3 MAPPING AND ANALYSIS TO UPDATE BASELINE

Following the sector prioritization step in above sub-section 1.3.1, this section presents the findings of the value chain mapping and analysis for three primary and seven secondary waste sectors in Amman including 16 main and sub recycling value chains as following:

3.1 Plastics Value Chains Except PET

3.1.1 Overview

- Plastics have a variety of products that find use in a wide range of applications in the modern lifestyle, and it currently comprise about 16 - 18% of municipal solid waste generation in Amman[5], which is increasing primarily due to proliferation of single-use plastics in packaging and other consumer products.
- Despite Jordan is non-oil country, the plastic industry is a leading economic sector and growing over the last two decades due to the low cost/easy access to virgin plastic sources from Saudi Arabia and other Gulf countries. With close to 600 companies operating in the plastic industrial sector, employing around 13,000 jobs, with a total registered capital of approximately 200 million USD. The yearly production volume of the plastic industry sector is more than $1.5 billion, which constitutes approximately 5% of the total industrial production in Jordan. The packaging, agricultural, construction, furniture and medical supplies are the main sub-sectors of the Jordanian plastic industry while the plastic textile industry is limited so far[6].
- Despite the impact of the COVID-19 pandemic crisis, the plastic products accounts for 4% of the total Jordanian exports to 70 global markets including the United States[7].
- Global oil prices are the most important factor that impacts the competition of recycled plastics against virgin plastics, and the prolonged decline in the global oil prices makes virgin plastics more competitive.
- Jordan imports around 200 thousand tons[8] of the virgin plastic resins per year to supply its plastic sector, primarily from Saudi Arabia, but with significant quantities of plastic fillers from South Korea and Thailand. In addition, Jordan plastic manufacturers also purchase significant quantities of recycled plastic resin from Jordanian plastic recycling processors or import recycled pellets from neighboring countries. The large users of the recycled plastic resin in plastic sector are pipe, boxes, furniture, and film manufacturers.
- Recycling of plastics contains several different plastic resins, color pigments and impurities/filler additives represents a low-grade of the material, and thus normally also the value which will limit the usage areas. Plastics of high-quality grading and processing are marketed with higher prices over the chain and are easier to distribute.

3.1.2 Performance

3.1.2.1 Mapping, Channels and Products

- Plastic is one of the most stable and growing sectors in the recycling market in Jordan due to the abundance of domestic end-market industries that produce a wide range of plastic products.
- The proliferation of single-use plastics in packaging is widely common in Jordan.

[5] GAM official reports 2022 and 2023.
[6] Jordan Chamber of Industry 2022
[7] Jordan Chamber of Industry 2022
[8] Interviews with market actors in the plastic sector in Amman

- Except PET plastics, the current plastics sector in Amman consisted of (5) domestic sub-value chains as follows: Polypropylene (PP), High-Density Polyethylene (HDPE), Low-Density Polyethylene (LDPE), Polyvinyl Chloride (PVC), and Polystyrene (PS). Yet, Jordan has no recycling for PET post-consumer waste. However, a few numbers of manufacturers collect and re-process PET pre-consumer waste (defects) for export to neighboring countries.
- Internal recycling and downcycling are common practices in plastic manufacturers and producers, where their pre-consumer waste or defective materials are re-processed in producing similar or downgraded products. Some of these industries sold their pre-consumer waste to specialized scrap dealers, brokers, itinerant waste brokers, as well as processors.
- Out of the existing 600 plastic industries in Jordan, around 200 small to medium plastic processors and manufacturers are considered as end-market of the of the plastic recycling[9]. They are in east and south Amman, as well as Zarqa and Russeifa. They use recycled granules/pellets from local sources to manufacture off-grade consumer products in fields of agriculture, packaging, construction, and home furnishings. Recycled plastics are banned in food grade products according to local regulations and standards.
- The interviews with the market actors indicated that the capacity of the plastics value chains increased over the last two years and most amounts were locally recovered. The market estimates show that about 6,000 – 7,000 tons of plastics enter the value chains each month[10].
- The market influenced by seasonal fluctuations, particularly related to agricultural and construction activities in Jordan. Additionally, the pricing of recycled materials is often linked to global virgin prices, which tend to increase in summer and decrease in winter. The market trends over the last two years indicated an increasing amount of collected and recovered material, improved sorting techniques, and a growing number of actors in the collection as an important function.
- Exporting recycled plastics (processed into granules/pellets) to neighboring countries is not competitive due to the relatively high production cost. Only PET waste is shredded into flakes without washing and the majority exported to neighboring countries in the region for further processing.
- Although the import of recycled plastic is not prohibited, most factories have concerns about the origin of the material not being virgin as required due to the lack of accredited laboratory tests to prove this. Consequently, factories vary in their desire to import based on the type of their products and their requirements in terms of quality and accreditation.
- Although impact of the global COVID-19 pandemic, the revenues of manufacturers and processors have increased trends over the last two years, and this attributed to increase in the material flow because of the prolonged increase of global oil prices and high prices of the virgin plastics.
- Regarding the products, the current plastics recycling market in Jordan has advanced value additions and completed life cycles including but not limited to collection, sorting, cleaning, shredding, washing, grinding, grading, pelletizing, and production of finished products from recycled raw materials.
- The quality and color of plastic recyclables are one of the most parameters that affect the price and handling. For example, contaminated and black-colored post-consumer plastics have low prices and handled to produce off-grade pellets, comparing with the transparent/colored post-consumer plastic waste sorted from the source. The pre-consumer transparent/while plastics are most expensive than the ones that have colors. The plastics of low-grade quality, including those with color pigments and impurities/filler additives, have limited usage areas and lower value.

[9] Estimated by the USAID Recycling in Jordan Activity
[10] Interviews with market actors in the plastic sector in Amman

- The key buyers of the recycled pellets are manufacturers that produce rigid and flexible products (film/nylon) as follows: garbage bags, irrigation pipes, vegetable boxes and packaging, chairs, tables, broom fibers. Recycled pellets are prohibited in the packaging of food grades, houseware items, medical items, etc.
- There is a high seasonality in this value chain over the year in terms of supplying the plastic wastes to the plastic recyclers either though the street waste pickers or the industries that sell out their off cuts and defective materials.
- The flow of plastic waste depends on agricultural and construction seasons in Jordan. Thus, the pricing of the recycled materials in the local market is often linked to global virgin prices (usually increased in summer and decreased in winter).
- The agricultural plastic industries are allowed to import recycled granules no more than 20% of the yearly production. However, they are one of the main buyers of the recycled granules locally produced.
- The plastic recycling market in Amman is linked for most of the plastic segments with the existing industrial capacity in the same governorate. These factories have the capacity to recover larger streams of recycled waste. Nevertheless, the market is strictly linked with the global commodity prices for virgin raw materials.
- SABIC Saudi Arabia is a global market leader in supplying all virgin plastic polymers to almost plastic manufacturers and industries in Jordan, as well as the region. The polymers' virgin prices decreased in winter and increased in summer according to the market demand and supply dynamics. Global virgin prices of plastics usually range between 900 – 1,400 USD/ton (an average trend)[11].
- There is no strong competition in the local market in terms of the virgin plastic supply. Even, Jordan market is open the import of the international plastic products mainly from the Gulf Council Countries (GCC) that compete with the local products. Therefore, a strong competition between local and imported plastic products is notable, and this resulted in reduced the price profit margins and expansion of low-quality grades.

3.1.2.2 Functions and Actors

- Table 3 presents the current functions and active actors across the plastics value chains in Amman.

Table 3 : The current functions and active actors across the plastics value chain in Amman

Functions across value chains	No. of active actors in the current local market	Volume Estimate (ton/month)	Price Estimate 2023 (JOD/ton)
Domestic industries or manufacturers	150 – 200 Plastic manufacturers/Industries in Amman and Zarqa Governorates	6,000 – 7,000	350 – 480
Processors	10 – 20 Plastic Processors (pelletizers) 40 – 80 Plastic Processors (crushers/washers)	6,000 – 7,000	250 – 350
Aggregators	50 – 60 specialized waste brokers 80 – 100 Large scrap yards, middlemen, and brokers	6,000 – 7,000	180 – 220

[11] IHS Markit and AFARA analysis 2023

	150 – 200 Medium scrap yards, middlemen, and brokers		
Collection and Sorting	250 – 300 Small plastic yards, middlemen, and brokers	6,000 – 7,000	140 – 180
	Large Formal tenders and contracts (pre-consumer)	150 – 250	150 – 200
	5 – 8 specialized recycling collection companies (post-consumer sorted from source)	350 – 500	100 – 140
	1,000 – 1,500 Itinerant buyers 1,500 – 2,000 Informal Street waste pickers	3,500 – 4,500	80 – 120
	Landfill contractors /waste scavengers (off-grade)	300 – 500	50 – 80

- The main sources of the plastics in the recycling market are as follows:
    - Post-consumer plastics from Municipal Waste Stream
    - Post-consumer from Agricultural and Construction Streams
    - Post consumer plastics that are sorted from the source (commercial sectors).
    - Post consumer plastics scavenged from the landfill/dumpsites.
    - Pre-consumer and defective plastics from the industries and manufacturers (off-cuts)
    - Formal tenders and contracts (Pre-consumer/ scrap items)
    - Importing recycled plastic pellets from virgin defective materials
- The main functions and actors within the plastics value chains are as follows:

Domestic industries or manufacturers: The research results confirm around 200 plastic industries and manufacturers are mainly involved in plastic recycling business and typically using technologies such as injection, blow-molding, and film extrusion to produce consumable products such as water tanks, chairs, buckets, packaging for non-food, textiles, food trays and bags. The sector also plays an important role providing input materials for a range of other domestic industrial sectors. Some more basic products can be made using solely recycled granules/pellets. More, and typically higher value products, can be made using differing ratios of recycled to virgin plastics. While 'quality' thresholds apply to these 'mixes', they are also affected strongly by price – with virgin products substituting for recycled inputs if prices (linked to fluctuations in global oil prices) start to align.

Processors: There are an estimated 40-80 plastic processors (crushers/washers/dismantlers) producing different quality grades of plastic flakes, mainly in Sahab, Muwaqqar, Marka, Abu-Alanda and Zarqa. Some of them have further value addition and produce recycled pellets, granules, and powder (PVC). The market research indicated that there big variations in specialty and process between the larger plastic processors and some of them produce only pellets in large volumes and others produce final products like the manufacturers but only for off-grade items that originated from contaminated sources such as dumpsites/landfill. More advanced processing, such as technologies for recycling PS (polystyrene/Styrofoam-EPS) and Raffia PP/PE bags do not exist. However, one processor who usually deals with off-grade plastics from landfill started with new business model to produce recycled isolation sheets for the building from PS waste and offer the landfill scavenges higher prices than expected to encourage them to sort.

Aggregators: Aggregation is an important added value function in plastics recycling and allows further sorting, cleaning, and grading for sorted and graded products, over time, and on-selling when required volume demands are met. Aggregations also manage the impact of price 'shocks' in the local market due to global trends and price fluctuations. Aggregators usually medium or large scrape dealers, middlemen, or specialized brokers. The small scrap dealers seem to be considered as primary sorters and collectors. In terms of numbers, there are an estimated 150-200 medium scrap

yards, 80-100 Large scrap yards or middlemen and 50-60 specialized waste brokers (mainly concentrated in East Amman, Sahab, South Amman, Muwaqqar and Zarqa).

Collectors and sorters: Most waste is mixed and needs to be sorted by type, then further sorted by grade and very little waste is separated at source. Those relatively few that do practice waste separation at source tend to have contracts from the small number of relatively new specialized recycling service providers. Collection and sorting by type are generally done by the several thousand self-employed waste pickers working widely across Amman. They then sell to scrap yards, which then further sort by grade before aggregating or, alternatively, selling to aggregators. The system is low skilled, informal, and generally suffers from a host of 'inefficiencies' that depress prices and margins throughout the value chain. Some collection and sorting are more organized and professional in nature, and this concerns waste coming from contracted demolitions and clearances, as well as off-cuts from industrial processes.

3.1.2.3 Prices and Markets

Jordan consumes most recycled plastic domestically. The results of the interviews in this research indicated that the current selling prices of plastics to the domestic industries/manufacturers are as follows:

- PP: 130 – 150 JOD/ton which after washing/pelletizing, increases to between 250 – 350 JOD/ton.
- PE (film packaging): transparent sells for 160 – 180 JOD/ton and colored for 100 – 120 JOD/ton.
- HDPE: sells for between 80-150 JOD/ton and after shredding for between 200 – 250 JOD/ton. The dense HDPE materials such as irrigation pipes sell for slightly higher prices at around 220 – 300 JOD/ton.
- LDPE: sells for between 80 – 150 JOD/ton, which, after shredding, significantly increases to between 200 – 250 JOD/ton.
- PVC: sells for 130 – 150 JOD/ton.
- PS: sells for 300 – 400 JOD/ton collected from the landfill.
- Mixed plastic types: sell for 80 – 120 JOD/ton and the off-grade 50 – 80 JOD/ton from the landfill.

In the plastic value chains, 6,000 – 7,000 tons per month of plastics waste are currently processed and recovered by domestic plastic industries to manufacture new products from recycled plastics.

3.1.2.4 Supporting Services and Interconnected Markets

The findings of this research showed that the supporting services and interconnected markets related to the current plastics value chains are very limited in scope. The following observations emerged from the Activity's interviews with actors across all functions, and all value chains.

Financial Services: The formal and registered businesses in plastics recycling have better access to financial institutions (banks and micro finance institutions), as they can provide well-defined investment plans and collaterals. However, small dealers and informal businesses often lack access to finance due to lack of valid registration documents and licensing records. However, most of the market actors that were interviewed are reluctant to access these financing as well as non-financial resources (i.e., leasing services) due to high commercial interest rates and Islamic products do not offer money in cash. Furthermore, there was limited evidence of specialized industry financial products being available. They tend to rely on self-financing or direct access to equipment providers who offer forward payments. For example, transactions between waste pickers and scrap yards are all done in cash, and usually via daily transactions. This is highly inefficient, and risky, where frequent 'cash outages' result either in lower prices for poorer waste pickers or higher costs for them having

to travel further to sell to those scrap yards flush with sufficient cash. Some of the interviewees have deficiencies in their investment and business capabilities to grow and develop.

Business Advisory Services: There were few examples of firms outsourcing any specialist business service functions. Most times these are performed internally by the firm – often by managers, though sometimes through specialist positions (i.e., HR, finance, marketing etc.) existing at larger processing and manufacturing establishments. While grading and certification processes are important (particularly in plastics where quality affects use in different end products) there was no evidence of any specialist services or functions in this regard.

Transport Services: Play a crucial role in the plastic recycling sector, particularly for scrap dealers and small recyclers who require local market transport. The cost of transport has increased in recent years, posing a challenge in terms of both cost and availability. Large scrap dealers and industries may have their own transport trucks, while itinerant buyers offer transport services to smaller actors. All the interviewed actors confirmed that the transport cost is a challenge in waste recycling in terms of cost and availability, especially those plastics are bulky and loose materials.
Occupational Health and Safety: Despite the national laws and regulations related to occupational safety and health, most workers in the recycling sector do not adhere strictly to public safety requirements and use of Personal Protection Equipment (PPEs) during the work despite their awareness of potential risks and their knowledge of cases of injuries that may have already occurred in the past. In addition, most of the existing facilities and buildings in the recycling sector lack the minimum standards of health and safety, as local investors do not consider the need to invest in a healthy, safe, and secure infrastructure in buildings and work sites, because do not recognize the positive impression and long-term returns on his business.

Cooperation and Advocacy: Most of the actors interviewed in these value chains confirmed the weak horizontal relationships and most of the time are competitors. However, there is evidence of firms cooperating in different ways to overcome operational challenges, but no formal cooperation established yet with respect to more strategic challenges, such as policy advocacy towards Government on a host of issues that matter in the present and the future of recycling in Jordan. Many firms are members of the Jordan Chambers of Commerce, and Industry. Though there was no evidence of there being a 'Recycling Chapter' – or similar – being used to help engage and inform the Government. Indeed, most of the actors are members in the chambers because the official licensing and registration system requires this membership as a prerequisite to import or export.

Standards and Certifications: Plastic recycling is sensitive to material quality and standards. However, the Activity research indicated that there is lack of such relevant certificates in the upstream of the value chain while the manufacturers have certifications and commitment to the customers' requirements.

R&D/Technology: Most of actors interviewed in these value chains still used old-fashion technologies and depreciated equipment to recycle the plastic materials and they are not motivated to upgrade the capacity due to low competitiveness and the inconsistent supply of the materials over the year is challenging their investment planning. Moreover, no concrete evidence was found with respect to R&D/technology partnerships between firms in plastic recycling, and, say, academia. In such a fast-evolving technology landscape across recycling markets globally, this is a particular surprise and arguably significant barrier to the future competitiveness of Jordan's recycling sector.

3.1.2.5 Governing Policies, Laws, Regulations and Norms

- The recycling sector isn't an industrial classification per se, and hence most of the policies, rules and regulations that impact the recycling sector relate more specifically to product types, and functions in the value chain. The resulting situation is that there is much complexity and limited cohesion across the sector as a whole. Alongside the complex sets of 'rules' lies a complex set of stakeholders responsible for setting, informing, and enforcing according to their specific mandate and/or area of responsibility. This runs through all levels from local to national level bodies.
- The high energy cost and tariffs for electricity and fuel and the inconsistency and instability of government decisions on export/import duty taxes lead manufacturers to lose their competitive advantage over their regional competitors. There is no government protection for the domestic production in the Jordanian market, and the competition with the foreign plastic products has become increasingly strong, resulting in reduced revenues for local businesses.
- The insufficient governmental inspections and ineffective law enforcement, particularly in remote areas, lead to a pervasive sense of informality and non-compliance with legal obligations within the plastic industry. This has a detrimental impact on the competitiveness of legally operating businesses. Furthermore, it was found that some actors in the plastic sector lack awareness about the significance of understanding the legal framework, including relevant laws and regulations.
- Bureaucratic licensing procedures for solar energy systems in the industrial sector pose a challenge, further hindering progress in adopting renewable energy sources.
- Seasonal changes in consumption patterns and cultural expectations in Jordan exert additional pressure on the economics of the plastic recycling value chain due to price fluctuations between summer and winter. Consequently, many scrap dealers, middlemen and manufacturers have significant stock materials in storage, affecting their financial capacity.
- The common use of forward payment agreements between industries and local distributors and customers also affects the cash flow management in the recycling market.

3.1.2.6 Business Models at Enterprise Level

Participation of Women and Marginalized Groups: Many informal streets waste pickers and itinerant buyers recently recognized the stability of prices in the domestic plastics value chains compared with other types of waste even in and after the COVID-19 pandemic crisis. Then, they started to invest more efforts in collecting plastics in larger volumes along with metals and paper/cardboard. Most people from poorer and more marginalized people are involved in collection and sorting alongside the upstream side, while women and marginalized groups in these roles often have low levels of education and lack formal training or certifications. Besides, the value addition done by aggregators, processors and manufacturers offers critical livelihoods for many hundreds of poorer and more marginalized people, mainly in sorting, grading, cleaning, washing, shredding, and pelletizing. However, Returns are low, and dangers are high, but barriers to entry are low and therefore do at least offer opportunities hard to find in other sectors. Women are usually involved in administrative positions, and skilled workers from women mainly involved in grading, sorting, and packaging the final products.

Business Organization and Performance: As you go deeper into a value chain, you find that the companies have become more structured, and this applies for the domestic plastic value chains in Jordan. The research found that the level of organization and performance was the lowest at the upstream side of the value chains where the collection and sorting happened. It is charactered by high informality and weak horizontal structure except the formal businesses that exist in this step which have higher levels of organization and maintain proper record-keeping practices and comply

with legal requirements. However, these formal businesses face unfair competition with informal businesses that generate larger profit margins by avoiding taxes and fees.

The research indicated that changes happened in the plastic recycling market in the last two years where a few numbers of specialized waste collection firms adopted new recycling business models and improved their capacities to sort and collect recyclable materials from the source. These collection firms offered the aggregators a new stream, a consistent supply, and better quality compared to what informal sector provides. Moreover, some of the aggregators and processors adopted new plans to secure better quality material through building business cases and relationships directly with large waste generators.

3.1.2.7 Growth Opportunities and Constraints

According to the findings of this research, the following constraints have been identified that limit the performance and growth of private sector-led recycling services in the plastics sector in terms of increasing volumes, increasing values and increased/improved jobs:

- Poor quality of materials and standards: The level of contamination is crucial in the plastics recycling and influences the prices offered in the market. For example, manual sorting by color should be a primary focus by the waste collector at the source. Most of the waste collectors have limited theoretical knowledge of the classification of plastic polymers resins and therefore they offered scarp dealers mixed plastics. On the other hand, improving the scrap dealers' management skills and certifications would increase their profitability margins and assist in raising awareness of the importance of ensuring safe and hygienic working conditions.
- The inconsistent supply of materials and the absolute reliance on the informal sector challenged the supply and growth of the plastic value chains in terms of volumes. Therefore, improving access to waste and techniques of plastic valorization will enable informal sector to offer a consistent supply of plastics over the year. Some commercial waste generators require regular reports on recycled amount while informal waste pickers cannot offer this service to access this waste. In recent years, informal waste pickers have gained experience in different types of plastic and sorting techniques, and this helped them in improving quality control and assurance, especially in the sorting and grading. This has been driven by price variances based on material quality and quantities.
- Adoption of source segregation at commercial sector: High purity waste streams have higher value, avoids costs of sorting, and issues with contamination. Maximizing the linkages between the extra-large generators from the commercial, industrial and tourism sectors (1000 ton/ year) could facilitate separation at source schemes to reduce the waste fees collected at the landfill site. The scrap dealers or professional waste pickers could contribute to the collection and transport of plastic recyclables.
- Weak horizontal cooperation between the actors is reported across the entire value chains and especially in the collection and sorting. The collectors and sorters are competitors not collaborators and they always offer dispersed prices to informal waste pickers and do not reflect the real market dynamics. These improper practices destroyed the trust building and relationships between the actors and suppliers. In meanwhile, the weak horizontal cooperation and collaboration resulted in lack of representation and negotiations with national authorities regarding the common sectoral issues.
- Even though plastics have a strong domestic market channel, the global oil prices have a direct impact on the competition between virgin and recycled plastics, and this has direct reflections on the stability of the domestic prices, and these cause a sudden "price volatility" for the actors in the collection and sorting. Therefore, they temporarily interrupted their supply until prices improved. Also, the current export prohibitions by local authorities limit alternatives that plastic collectors and sorters could utilize.

- Lack of access to finance in the plastic value chains is critical for the growth and development of the plastic recycling industry in Jordan in terms of technology and equipment. yet, Jordan has no governmental support (tax/export incentives and polices) for the plastic recycling as it is one of the main contributors in the environmental protection, transition to circular economy and mitigating the climate change.
- Lack of business skills and legal recognition specially for the collection and sorting: enhancing the business skills of informal collectors and sorters can contribute to expanding their performance and profitability. This includes developing a business modality with a feasible flow of supplies and products, as well as seeking legal recognition to ensure their rights and protection in the market.
- To address the above valid constraints, the Activity shall focus to design its interventions in the upcoming years on the following areas:
    - Improve technical and business capacity through firm-level technical assistance to the plastic market actors across the value chains.
    - Scale up the business training and capacity building programs to cover larger numbers of the actors in the plastic collection and sorting, and to improve their technical knowledge about the quality and advanced value addition.
    - Produce and disseminate market-driven guidelines about the quality of plastic materials and standard procedures for the professional added value activities in the recycling sector.
    - Facilitate access to finance for the aggregators, processors, and manufacturers to upgrade their capacity in terms of technology, equipment, and certifications.
    - Improve access to information for market intelligence and linkages: establish mechanisms to provide market information and linkages to actors in the value chains. This can include creating platforms or digital solutions that connect waste generators with waste pickers and recyclers. Additionally, support the development of market linkages with local and international buyers to reduce market volatility and expand market access for recycled materials.

3.2 Paper/Cardboards Value Chains

3.2.1 Overview

- Paper/cardboard corrugated boxes have a wide range of applications in terms of packaging, storage, and product display. This packaging industry contributed to thousands of wastes a year being generated by end user of the products. Paper/cardboard waste currently comprise about 14 - 16% of municipal solid waste generation in Amman20, which is increasing primarily due to the wide use and diversity of packaging material.
- With close to 900 companies operating in the Jordan Packaging Sector, Paper (30% are industrial establishments and 70% are small craft establishments), Cardboard, Printing and Office Supplies Industry, employing around 10,000 jobs, with a total registered capital of approximately 230 million USD[21]. The yearly production volume of the packaging industry sector is more than $1.8 billion, which constitutes approximately 6.4% of the total industrial production in Jordan. The domestic sector's share in the local market is estimated at 73% of the Kingdom's total consumption[22].

[20] GAM official reports 2022 and 2023
[21] Jordan Chamber of Industry 2022
[22] Jordan Chamber of Industry 2022

- Despite the impact of the COVID-19 pandemic crisis, the paper packaging products accounts for 1.7% of the total Jordanian exports to 50 global markets including the United States23.
- The Jordan paper/cardboard packaging sector needs more governmental support by activating methods of protecting domestic products vs foreign products, limiting the entry of imports with a local alternative, activating the principle of reciprocity with countries that impede the entry of Jordanian exports to them, supporting the sector's highly competitive exports and products to access new export markets, and conducting a comprehensive review. transportation and energy costs.
- The demand for packaging of commercial products has been growing over the last few years, and the converting technologies for printing on paper/cardboard boxes is increasing as brands require more vibrant and attractive packaging. Consequently, paper/cardboard recycling sector is also globally growing with seasonal demands, but this attributed to global environmental concerns on sustainability of producing virgin paper pulps from natural resources and high prices of virgin paper in recent years.

3.2.2 Performance

3.2.2.1 Mapping, Channels and Products

- Paper/cardboard sector is one of the main recycling values chains in Jordan and come in the third place after the metal and plastic sectors, respectively, in terms of performance, volume and value. Paper/cardboard recycling is relatively stable and growing due to the abundance of domestic packaging industries that produce a wide range of paper/cardboard packaging products. However, it seems riskier than plastics and metals because of the reliance on global end-market industries.
- The paper/cardboard recycling sector is mainly export oriented, because there is no domestic advanced processing or manufacturing capacity for higher value addition as these processes typically demand high volumes and intensive use of energy and water – all factors show that Jordan is less competitive in compared to global countries such as India and Indonesia. Thus, paper/cardboard waste in Jordan undergoes only limited value addition – such things as sorting, grading, cleaning, shredding, bailing, and packaging, etc. – prior to being exported.
- The paper/cardboard recycling sector is driven by global prices and sector competitiveness replies on the capacity and efficiency of sorting, cleaning, grading and aggregation functions further down the value chain, as well as vertical relationships and networks with thousands of informal waste pickers (including many from more marginalized groups), who sell mixed waste to scrap yards or brokers they know.
- The main types of paper waste include sorted office paper (SOP), duplex, old newspaper print paper, old magazines, print cut-off, tissue, and sorted white ledger (SWL). The main types of cardboard waste are old, corrugated containers (OCC) and double-lined Kraft cuttings.
- The paper/cardboard recycling sector segmented into two sub-value chains as follows: The first segment is OCC, which includes Clean OCC (source-separated carton boxes/rolls/boards from malls and commercial markets), Dirty OCC (carton boxes/rolls/boards collected from the municipal waste stream or landfills), and New OCC (new carton boxes/rolls/boards generated as by-products or defective stocks in packaging factories). Clean OCC is characterized by high quality and low contamination levels, Dirty OCC consists of low-quality materials with high contamination levels, and New OCC comprises very clean materials with zero contamination. The second segment is the Super Mix paper, which consists of various types collected from printing and press companies, including books, Sorted Office Paper (SOP), old newspaper pulp (ONP), magazines (OMG) without laminated plastics, carbonic paper, and others. These types

[23] Jordan Chamber of Industry 2022

are sorted upon delivery to recycling industries into sub-categories to improve quality and achieve better profit margins.

- There is only one industrial scale paper/cardboard mill in Jordan, based in Zarqa – The Jordanian Paper and Cardboard Company. It is currently under development and renovation to increase its capacity and efficiency. Additionally, there are eight cardboard manufacturers about 20 small paper mills (classed as 'craft establishments') that have been identified as operating between Amman and Zarqa24. These mills are rudimentary and old fashion paper/cardboard mills (classed as 'craft establishments') in Amman and Zarqa that produce low-quality products from recycled inputs (such as egg trays, recycled office paper, tissues, cores, and toilet paper) and they use both domestic and imported recycled materials in their production. Estimates indicate that Jordan currently has a local manufacturing capacity of around 20,000 – 30,000 tons per year25. These cardboard manufacturers and mills lack a proper infrastructure to treat and circulate wastewater and to use optimized energy systems. Subsequently, most of these mills were closed due to strong competition or environmental violations. The other informal mills operated from time to time on a seasonal basis only to meet a share of the domestic demand. They use both domestic and imported recycled materials in their production.
- The paper/cardboard recycling market is more driven by (5) paper/cardboard export processors; with the bulk of around 180,000 to 240,000 tons exported while Jordan used to export around 100,000 tons per year before the outbreak of COVID-19 pandemic crisis. This recent increase is attributed to the sharp rise in prices during the last two years. The prices of cardboard tonnage increased from 35-40 JOD in 2019 up to 75 -100 JOD until the first quarter of 2023. This applied to paper waste, increased from 70 JOD up to 120 JOD during the first three years of this decade26.
- The market estimates indicated that the capacity of the paper/cardboard value chains increased over the last two years and the amount was locally recovered. About 15,000 – 20,000 tons of paper/cardboard enter the value chains each month and are mostly exported to global industries. Exporting processed paper/cardboard waste (sorted, graded, baled, or shredded) is the common practice and India is the most preferable and competitive destination in terms of quantities. Jordan also exports small amounts to Saudi Arabia, China, and Turkey27.
- In Amman, there are about 2,500 to 3,000 people from marginalized groups employed at different levels of paper/cardboard value chains, ranging from individual waste pickers to cardboard manufacturers and exporters28. Waste pickers have easy access to the municipal stream and can collect paper/cardboard from the streets or from selected commercial entities.
- The market is influenced by global seasonal fluctuations which tend to decrease in summer and increase in winter. However, the performance will increase if the prices go up. Although impact of the global COVID-19 pandemic, the revenues of manufacturers and processors have increased trends over the last two years, and this attributed to the prolonged incline of the prices in the market.
- Regarding products, the current paper/cardboard recycling market in Jordan produced processed secondary raw material (sorting, grading, baling,) and exported for global industries, and Jordan do not have yet the competitiveness to invest in the advanced value additions considering the industrial scale of manufacturing new grades/products from recycled paper/cardboard.
- The sorting and grading are critical steps in the paper/cardboard recycling market in Jordan for matching the requirements of the global industries.

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[24] Interviews with market actors from the paper/cardboards recycling sector
[25] Estimated by the USAID Recycling in Jordan Activity
[26] Interviews with market actors in the paper/cardboards in Amman
[27] Interviews with market actors in the paper/cardboards in Amman
[28] Estimated by the USAID Recycling in Jordan Activity

- Besides high energy cost and tariffs for electricity and fuel, the inconsistency and instability of government decisions on export/import duty taxes lead export processors to lose their competitive advantage over their global competitors and to threaten their contractual commitment with their global customers. Upon export, certain waste/ scrap items including paper/cardboard are subjected to export fees based on Cabinet decisions. All exported items are subject to general sales tax (GST) and special sales tax (SST), at zero rate tax. For example, the decision taken by the Cabinet in 2021 to set a ceiling for exports was based on an estimate of market needs and the total waste generated per month, as the amount of paper and cardboard collected per month was estimated at about 11,000 tons, while the market need is estimated at about 6,000 tons per month. According to the decision, export fees (35 JOD per ton) are imposed on the total quantity more than 5,000 tons or the quantity more than the quota allocated to the exporter. In August 2022, export fees were cancelled, as well as the ceilings for exported quantities.
- As confirmed earlier, the recycling sector isn't classified as an industrial sector in its own right. As such there is a lack of coherence in the myriad of policies, rules, regulations, and inspection bodies – at all levels of Government relevant to the different products (i.e., product specific considerations) and functions (e.g., handling, manufacturing, and exporting) of the recycling sector.

3.2.2.2 Functions and Actors

- Table 4 presents the current functions and active actors across the paper/cardboard value chains in Amman.

Table 4 : The current functions and active actors across the paper/cardboard value chain in Amman

Functions across value chains	No. of active actors in the current local market	Volume Estimate (ton/month)	Price Estimate 2023 (JOD/ton)
Domestic Industries or manufacturers	1 Paper/cardboards Industrial mill in Zarqa (1,000 ton per month) 20 Recycled paper small mills/craft establishments in Amman and Zarqa 8 Recycled cardboard manufacturers in Amman and Zarqa	1,600 – 2,500 ton per month	50 – 75
Processors/ Exporters	5 Paper/cardboard balers and exporters to global industries in India, Saudi Arabia, Turkey, and others. These exporters have their own collection fleet, aggregation sites and direct contracts with large waste generators	15,000 - 20,000 ton per month	45 – 65
Aggregators	10-20 specialized waste brokers 20-30 Large scrap yards, middlemen, and brokers 50 -60 Medium scrap yards, middlemen, and brokers	6,000 – 8,000 ton per month	40 – 50
Collection and sorting	8 specialized recycling collection companies (post-consumer sorted from source) 1,000 Itinerant buyers 2,500-3,000 Informal Street waste pickers	6,000 – 8,000 ton per month	35 – 40
	Landfill contractors /waste scavengers (off-grade)	100 ton per month	15 – 20

- The main sources of paper/cardboard waste in the recycling market are as follows:
    - Post-consumer paper/cardboard from Municipal Waste Stream

- Post consumer paper/cardboard that are sorted from the source.
- Post consumer paper/cardboard scavenged from the landfill/dumpsites.
- Pre-consumer paper/cardboard from local industries and manufacturers
- Formal tenders and direct contracts
- Post-consumer paper/cardboard from Municipal Sorting Facilities

- The main functions and actors within the plastics value chains are as follows:

Domestic industries or manufacturers: The research confirms that paper/cardboard value chains have export-oriented channel, and most of the quantities are graded and baled then exported to global markets in India, Saudi Arabia, Turkey, and Southeast Asia. However, there is only one industrial scale paper mill in Jordan, based in Zarqa called "The Jordanian Paper and Cardboard Company" and have intake capacity of about 1000 tons per month. Additionally, there are eight cardboard manufacturers and 15-20 small paper mills (classed as 'craft establishments') that have been identified as operating between Amman and Zarqa. They use both domestic and imported recycled materials in their production. Estimates indicate that Jordan currently has a local manufacturing capacity of around 20,000 – 30,000 tons per year; with the bulk of around 180,000 - 240,000 tons exported.

Processors: There are currently five paper/cardboard balers and exporters, who are the most influential in the market in terms of the function. These produce different quality grades of paper and cardboard products which are processed to be raw materials for global industries. These processors are in Amman and Zarqa and have several sites for aggregation and fleet of collection trucks. These processors have high cash power and buy products from large and medium scarp yards, middlemen, and brokers and sometimes buy directly from informal street waste pickers and itinerant buyers and this depend on the grade and quantity. To secure large volumes, those processors/exporters changed their business model and started to handle large waste generators with various services against getting their paper/cardboard waste. This expansion pushed them to invest in their processing and aggregating capacities.

Aggregators: There are dozens of medium and large scrap dealers as well as specialized brokers who act as aggregators in these value chains and benefit from proximity factor and the transport cost, where the individual waste pickers and itinerant buyers who located in other cities and areas sell their waste with no need to travel to the locations where processors exist. The small scrap dealers seem to be not considered as aggregators but as primary sorters and collectors. In terms of numbers, there are an estimated 50 – 60 medium scrap yards, 20 – 30 large scrap yards or middlemen and 10 – 20 specialized waste brokers (mainly concentrated in Russeifa, Ain-Albasha, Madaba, Al-Jizah, Balqa, Jerash and Irbid).

Collectors and sorters: like other value chains, the collection and sorting by type is generally done by the several thousand self-employed waste pickers and itinerant buyers working widely across Amman. They then sell to scrap yards, which then further sort by grade before aggregating or, alternatively, selling to aggregators. Although very little waste is separated at source, some specialized recycling companies do waste segregation more organized and professional in nature though service contracts with large waste generators. The aggregators and processors in this value chain do collection and sorting from annual contracts and tenders with industrial and commercial processes.

3.2.2.3 Prices and Markets

Jordan exports most recycled paper/cardboard globally with limited value additions (sorting, grading, shredding, and baling). This research indicates that the current selling prices of paper/cardboard waste are sensitive to global markets and seasonally changed as follows:

The average collected paper and cardboard per professional waste picker is estimated at 80 – 100 kg per day with a selling price in the range of 35 – 45 JOD per ton (depending on quality and quantity). Processing costs are typically between 15-20 JOD per ton. The final Cost Insurance and Freight selling price of paper is 50 – 65 JOD per ton while the duplex type with minimum ink content reaches 65 – 75 JOD per ton. It is worth mentioning that after the outbreak of novel COVID-19 pandemic crisis the market prices of cardboard had gone up exceptionally and reached 100 – 120 JOD per ton while the paper exceeded 140 JOD per ton. These high prices remained until mid-2022 and then went down to a lower range (90 JOD per ton for cardboard and 110 JOD per ton for paper). With the beginning of the year 2023, market prices began to take a gradual decline curve to become around their previous normal levels (~45 JOD per ton for unprocessed cardboards).

3.2.2.4 Supporting Services and Interconnected Markets

The research showed that the supporting services and interconnected markets related to the current paper/cardboards value chains are very limited in scope like plastics. The following observations emerge from Activity interviews with actors across all functions, and all value chains.

Financial Services: Most of the actors in the current paper/cardboard value chains are family businesses and prefer private finance whether personal savings or family funding. They are often reluctant to access financial institutions (banks and micro finance institutions) except the large processors and exporters as they can provide well-defined investment plans and collaterals. They are usually interested in specialized financial products to fund equipment and infrastructure.

Business Advisory Services: There was no evidence of any specialist services or functions in this regard and most actors lack proper business organization and do not have specialist positions for administrative functions (i.e., HR, finance, marketing etc.) and mangers performed these functions internally. The large processors and exporters have a basic structure for business organization while the internal governance is weaker. The business owner is usually involved in daily managerial and operational tasks and performs external relationships with global customers by himself.

Transport Services: Like plastics, transport of bulky materials as paper/cardboard is a challenge, particularly for scrap dealers and street waste pickers. Most of the processors and large aggregators have their own transport trucks, while itinerant buyers offer transport services to smaller actors.

Occupational Health and Safety: The research showed that the workers in this value chain do not adhere strictly to public safety requirements and use of PPEs during the work. However, the large processors and aggregators applied strict procedures against smoking and fire. The recycling sector lacks the minimum standards of health and safety in the buildings and operation sites.

Cooperation and Advocacy: The research indicated weak horizontal relationships at all functions and steps. However, there is evidence of occasional cooperation only against the export/import tax decisions. This formal cooperation is usually led by the processors and exporters they coordinate with the chamber of industry to advocate towards Government. Though there was no evidence of there being a 'Recycling Chapter' – or similar – being used to help engage and inform the Government.

Standards and Certifications: Not as in the plastic sector, quality is important, but not to that degree, because the paper and cardboard sector does not have the manufacturing capacity for advanced value additions like plastics. The processors and exporters have certifications and commitment to the customers' requirements in terms of processing (especially the grading).

R&D/Technology: Due to limited value addition in the current paper/cardboard value chains, all the actors are reliant on physical processing such as sorting, grading, shredding, and baling. The research concluded that R&D/technology is not a critical issue yet in paper/cardboard.

3.2.2.5 Governing Policies, Laws, Regulations and Norms

- As paper/cardboard recycling is an export-oriented market, the sector is one of the sectors most affected by the inconsistency and instability of government decisions related to export fees. This uncertainty might put a risk on their competitive advantage over global competitors and break their contractual commitment with global customers.
- Unfair competition with informal businesses is reported in the paper/cardboard sector due to insufficient governmental inspections and ineffective law enforcement.
- Bureaucratic licensing procedures for solar energy systems in the industrial sector pose a challenge, further hindering progress in adopting renewable energy sources.
- Due to increasingly strong competition and weak horizontal relationships, negative business practices take place in paper/cardboard recycling sector that might affect the growth and sustainability, such as but not limited to predatory pricing, monopoly, price exploitation, and price volatility.

3.2.2.6 Business Models at Enterprise Level

Participation of Women and Marginalized Groups: Thousands of informal streets waste pickers and itinerant buyers became main suppliers in the paper/cardboard recycling especially during the last two years when the market prices exceptionally increased. Most of them are from poorer and more marginalized people and involved in collection and sorting alongside the upstream side. Most of the processors and exporters involved workers form marginalized groups in the sorting, grading, and baling. Most businesses in paper/cardboard value chains are owned and operated by men, while the involvement of women is relatively limited. However, women's participation as entrepreneurs in this sector has been observed primarily through existing initiatives led by NGOs, CSOs, and waste collection companies owned or managed by women. These efforts have facilitated increased access for women to engage in the value chains. Nonetheless, women are usually involved in administrative positions, and skilled workers from women mainly involved in further sorting and grading processes.

Business Organization and Performance: The research indicated that most actors in this value chain have weak business organizations, especially the small and medium enterprises. In the downstream of the value chain the business organization becomes higher, especially the exporters, where the actors maintain proper record-keeping practices and comply with legal requirements. However, the weak horizontal relationships and cooperations across the value chain threaten the stability and sustainability of formal businesses in the presence of fierce competition with informal businesses.

3.2.2.7 Growth Opportunities and Constraints

According to the findings of this research, the following constraints have been identified that limit the performance and growth of private sector-led recycling services in the paper/cardboard sector in terms of increasing volumes, increasing values and increased/improved jobs:

- The inconsistency and instability of government decisions related to export fees are the most critical constraint that hinders the growth and development of the paper/cardboard sector. A clear and specific tax policy and well-defined procedures would be required from the government to attract more investments to this kind of business. Moreover, the actors, especially the exporters, should improve their formal cooperation and establish a representation entity for the paper/cardboard recycling sector to advocate against the governmental decisions.
- The role of the informal waste pickers and itinerant buyers in the paper/cardboard sector is crucial in the paper/cardboard recycling sector, and then the actors shall improve their relationships and cooperation both horizontally and vertically to grow and develop. However, the unfair competition with the informal businesses undermines the competitiveness of the formal businesses in the sector.

- The price fluctuations and seasonality will undermine the consistent supply, and therefore aggregation is a fundamental step in the paper/cardboard recycling sector.
- Adoption of source segregation by the commercial sector will improve the quality and value of paper/cardboard waste. Therefore, the large formal businesses should upgrade their business models to offer large waste generators suitable schemes for adopting separation at source in their facilities.
- Lack of access to finance in the paper/cardboard recycling sector which is critical for the growth and development of formal businesses in terms of equipment and infrastructure.
- Lack of business skills and business organization needed for expanding the performance and profitability of the market actors. This includes developing a business modality with a feasible flow of supplies and products and export marketing.

To address the above valid constraints, the Activity shall focus to design its intervention I the upcoming years on the following areas:

- Improve technical and business capacity through firm-level technical assistance to the paper/cardboard market actors across the value chains.
- Support the development of specific export tax policy and formulation of sector representation.
- Scale up the business training and capacity building programs to cover larger numbers of the actors in the paper/cardboard collection, sorting and grading, and to improve their business model to establish large scale separation at source scheme with larger waste generators.
- Facilitate access to finance for the aggregators and processors/exporters, to upgrade their capacity in terms of equipment, and infrastructure.
- Specific trainings on occupational health and safety as well as the potential risk concerns with paper/cardboard recycling
- Improve access to information for market intelligence and linkages: establish mechanisms to provide market information and linkages to actors in the value chains. This can include creating platforms or digital solutions that connect waste generators with waste pickers and recyclers. Additionally, support the development of market linkages with local and international buyers to reduce market volatility and expand market access for recycled materials.

3.3 Metals Value Chains

3.3.1 Overview

- The metals industry is divided into two main parts, ferrous and non-ferrous, as ferrous metals specifically "Iron and Steel" are the largest and most prevalent economic industry in Jordan compared to other metal industries. "Iron and Steel" industry falls within the construction industries sector and represents 35% of the production[29]. "Iron and Steel" industry contains valued and large-scale investments, anchor firms, and thousands of employees. In meanwhile, there is a smaller sector for smelting and casting non-ferrous metals that include thousands of individual smelters (classified as craft establishment) and few numbers of big non-ferrous metals smelters and fabricators, that produced a variety of primary and secondary metal products. Most current metal melting factories are family businesses (sized as small and medium enterprises), and specialized in processing, trading, and recycling of ferrous and non-ferrous metals (i.e., aluminum, copper, lead, zinc, etc....). They buy metal scrap from local suppliers, factories and auctions, segregate materials, and then recycle it into light and secondary products, or export it to global markets (processed as molds/alloys).

[29] Jordan Chamber of Industry 2022

- The metals sector is the most developed, long established, and significant in size and value. Ferrous metals – specifically cast irons or carbon steel – are fully recycled and used domestically. Iron and Steel industries produce rebar, steel pallets and other finished products used primarily as key inputs – arguably strategic inputs - to the domestic construction sector. Non-ferrous metals (particularly aluminum, copper, and stainless steel) are generally exported, typically with little value-added processing.
- Exports of non-ferrous metals (mainly processed aluminum and copper) are estimated to be around 20,000 tons in 202230. Estimates show the metal sector employs around 7200 full-time and formal workers31. As a global commodity metal prices are affected by global trends; but the sector remains generally competitive albeit with weak regulations, little cooperation, and low research and development/technology engagement.
- Due to its properties, Metals is crucial to the economy, and they form a strong industrial base, producing a broad range of goods and applications used in everyday life and modern technologies. Due to its precious value, metals do not constitute a large proportion of municipal solid waste generation in Amman (1-2%), as Metals are the main material targeted by informal waste pickers, and for them Aluminum and copper are the top valuable items in terms of value and income.
- Although COVID-19 pandemic crisis impacted the economy of the country during the last two years, large sectors like metals recovered strongly compared to other industrial sectors, and this is attributed to the steady domestic demand on the metals products.

3.3.2 Performance

3.3.2.1 Mapping, Channels and Products

- The current metals recycling market in Amman has distinct channels based on type and grade of material. There are two main sub-value chains for the metals: ferrous that their alloys have iron and non-ferrous do not. The stream of ferrous metal waste includes steel in all its forms, such as, carbon steel, and alloy steels; cast iron, light iron, and sheet iron. Non-ferrous metals tend to be more expensive than ferrous metals but are used for their desirable properties, including light weight (aluminum), high conductivity (copper), nonmagnetic properties or resistance to corrosion (zinc). The non-ferrous metals typically have higher prices than ferrous metals on scrap metal commodities market. In terms of grading, there is a wide range of grades for copper and aluminum based on the end use, and this grading impacts the value and pricing. For example, the yellow brass which contains 60% copper is significantly cheaper than the Red Brass, which contains 85% copper because this change in copper content affected its properties and commercial use.
- Metals (Ferrous/Non-Ferrous) sector are the most valuable recycling value chains in Jordan and comes in the first place in terms of value, scope, and sophistication. It is the most developed and well-structured value chain in Jordan. For instance, ferrous metal is a fully domestic value chain with advanced value additions due to strong "Iron and Steel" industries that Jordan has. This value chain domestically recovers all recycled ferrous metals, and even relies on importing more quantities from neighboring countries to meet the domestic demand and protect price stability against the prolonged increase of the energy costs over the recent years. On other hand, non-ferrous metal is an export-oriented value chain with little value addition because Jordan does not have the market size and competitiveness to such heavy and sophisticated industry like in China, India, and Southeast Asia. Local processors in this value chain are mostly small and medium sized smelters, who mainly engage in aggregation, processing, and exporting. Some of these smelters

[30] Interviews with market actors from the metal recycling sector
[31] Jordan Chamber of Industry 2022

fabricate non-ferrous recycled scraps to generate primary and secondary metal products for local demand.

- The non-ferrous metals recycling business is driven by global metal commodities prices and sector competitiveness relies on capacity and efficiency of sorting, cleaning, grading aggregating, melting, fabricating functions further down the value chain. Non-ferrous metals are often corrosion-resistant and are much lighter weight than ferrous metals. The main types are aluminum, copper, brass, and stainless steel. While aluminum is one of the most recycled materials in the world, other non-ferrous materials are scarcer such as copper, tin, lead, zinc. For example, red brass is not as common as yellow brass.
- In Jordan, the yearly demand is estimated around 500-700 thousand tons of finished steel and iron products (a strategic input for the construction projects). Of which 50-60% of which are produced from recycled steel scrap waste32. It is estimated that about 200-250 thousand tons of metal scrap waste are yearly collected from local sources, while the rest is imported from neighboring countries. To balance the dynamics, the government imposes an import duty tax and sets a ceiling for the finished steel products as well as steel scrap waste. Government currently imposes an export duty tax (50 JOD per ton) on steel scrap waste and (30 JOD per ton) on processed non-ferrous aluminum alloys and copper waste to protect the domestic production in the local market. These import/export decisions are regularly reviewed (every 6 months) according to variations in the market supply and demand.
- The ferrous metals recycling market is more driven by (12) domestic "Iron and Steel" industries, of which (8) factories are currently in operation and (3) ones are only use of local steel scrap as a primary input to produce steel plates and rebar with a seasonal operating mode. This "Iron and Steel" industry should define their strategy either to rely on using imported steel/iron scrap waste inputs to produce rebar or importing ready-made steel plates from competitive global markets. In term of non-ferrous, there is three large non-ferrous metal smelters who export aluminum alloys and processed copper waste to global markets India, China, Japan, and Southeast Asia, as well as hundreds of small and medium non-ferrous smelters (crafts establishments) produce finished iron cast-based products for heavy equipment and machinery.
- There are many people involved in the metal value chain, especially in collection and sorting, mostly by the informal sector (Assuming that men are dominated this metal value chain while a weak participation could appear for women/ disabled and refugees). About 60% of the metals diverted to small and medium scrap yards are directly from informal individual street waste-pickers and itinerant buyers, as well as auction/purchase deals. Several people from the marginalized group are employed in scrap dealers and aggregators, mainly for sorting and grading while the processors replied on supply from large scrap dealers as well as auction/purchase deals. Skilled formal and informal workers are usually employed by the smelters in their processing activities.
- The market estimates show that around 3000 – 4000 informal waste pickers and 1000 – 2000 Itinerant buyers are involved in collecting metal scrap waste. The sector includes hundreds of small, medium, and large scrap dealers where each one employs on average about 10 to 20 workers in their aggregation functions. The average collected metal per professional waste picker is estimated at around 150 – 200 kg per day, while the selling price of waste pickers ranges between 0.80 – 1.40 JOD per Kg depending on quality and quantity. The selling price of aluminum is 0.500 – 0.750 JOD per Kg while copper reaches 2.50 – 3.50 JOD per Kg. However, some specialized metal dealers offer cash with lower prices rather than prevailing prices especially for the unprofessional waste pickers and itinerant buyers.
- Despite the good representation in the metals value chains, the industries and processors became more reliant on aggregators to manage their cash flow and capacity, as most of those aggregators offered lower prices to informal waste pickers and itinerant buyers specially when

[32] Interviews with market actors from the metal recycling sector

the global prices increased. On other hand, the aggregators who have large volumes pushed the industries to increase their margins because they are utilizing their cash capacity. Some of these industries decided to purchase directly from the professional waste pickers or through specialized brokers. This situation makes the horizontal and vertical relationships between the actors at each step weaker and more fragile.

3.3.2.2 Functions and Actors

- Table 5 presents the current functions and active actors across ferrous metals (iron and steel) value chain in Amman and Zarqa.

Table 5 : The current functions and active actors across ferrous metals (iron and steel) value chain in Amman and Zarqa

Functions across value chains	No. of active actors in the current local market	Volume Estimate (ton/year)	Price Estimate 2023 (JOD/ton)
Domestic Industries or manufacturers	8 –12 large ferrous metal recycling industries (Iron and Steel). Some of them have seasonal operational mode based on quantities.	500 -700 thousand tons/ year of which 50-60% is from recycled waste	500 -600 including 16% tax
	Import steel scrap waste from neighboring countries	150 -200 thousand ton/ year	**
Aggregators/ Processors/	15-25 Large scrap yards, middlemen, and brokers 250 -350 Medium scrap yards, middlemen, and brokers 100 – 200 Medium scrap yards	170 -200 thousand tons/ year	160 -320
Collection and sorting	8 specialized recycling collection companies 1,000-2,000 Itinerant buyers 3,000-4,000 Informal Street waste pickers	30 -50 thousand tons/ year	80 -140

- Table 6 presents the current functions and active actors across the non-ferrous metal value chain in Amman and Zarqa.

Table 6: The current functions and active actors across nonferrous metals (Aluminum and copper) value chain in Amman and Zarqa

Functions across value chains	No. of active actors in the current local market	Volume Estimate (ton/month)	Price Estimate 2023 (JOD/ton)
Domestic Industries or manufacturers	80 – 100 small and medium non-ferrous smelters (crafts establishments) that melt and fabricate primary and secondary metal products and structures.	5,000 -6,000 Aluminum tons/year	Aluminum 1,000-1,200 JOD per ton
Processors/ Exporters	2-3 large non-ferrous metal smelters that export aluminum alloys and processed copper waste to global markets India, China, Japan, and Southeast Asia)	25,000 -30,000 Aluminum ton/year 4,500 -5,500 copper waste tons/year	Aluminum alloys 1,500 – 2,000 JOD per ton Copper 5,000 – 6,500 JOD per ton

Aggregators	15-25 Large scrap yards, middlemen, and brokers 250 -350 Medium scrap yards, middlemen, and brokers 100 – 200 Medium scrap yards	25,000 -35,000 tons/year	Aluminum 800-1,000 JOD per ton Copper 3,000 – 4,500 JOD per ton
Collection and sorting	8 specialized recycling collection companies 1,000-2,000 Itinerant buyers 3,000-4,000 Informal Street waste pickers	10,000 -15,000 tons/year	Aluminum 500 -800 JOD per ton Copper 2,500 – 3,500 JOD per ton

Domestic industries or manufacturers: The ferrous metal value chain is domestic oriented and there are (12) iron and steel industries with advanced value additions, and some of them have seasonal operational mode based on quantities. These industries recover about 500 – 700 thousand tons per year. Of which 50%-60% are produced from steel scrap waste. The non-ferrous metal value chain is mostly export-oriented, while 80 – 100 small and medium non-ferrous smelters (crafts establishments) are involved in smelting for domestic manufacturing purposes. Estimates indicate that Jordan currently has a local recovering capacity of around 200 thousand tons per year from domestic steel scarp waste excluding the imported amounts. Except exporting, there are about 5,000 - 6,000 tons/year of aluminum waste are locally recovered.

Processors/Exporters: Typically, this function involves smelting for export manufacturing. There are 2-3 large non-ferrous metal smelters that export aluminum alloys and processed copper waste to global markets India, China, Japan, and Southeast Asia. Estimates indicate that Jordan export yearly around 4500 – 5500 tons and 20,000 – 30,000 tons from the processed copper waste and processed aluminum alloy respectively.

Aggregators: Aggregation is a strategic function in metals value chains as they are more integrated with the processors and domestic industries and have formals relationships to control the flows of materials and cash across the value chains. Through their relationships with scrap yards, middlemen, and dealers the industries source the bulk of their material inputs. Large scrap yards, middlemen, and brokers preferred the scrap tenders and contracts from large waste generators. In terms of numbers, there are an estimated 10 – 15 large scrap yards and brokers, 250 – 350 Medium scrap yards, middlemen, and brokers involved in the metals value chains (mainly concentrated in East Amman, Sahab, South Amman, Qwismeh, abu-Alanda, Marka, Ain-Albasha, Russeifeh and Zarqa).

Collectors and sorters: Although the metals value chains are the most developed and structured in the recycling market, most aggregators, especially the medium and small ones, are reliant on waste pickers and itinerant buyers to source materials. With the emergence of more specialized recycling collection companies in recent years, they have a good share in collection and sorting before selling to aggregators. In terms of numbers, there are an estimated eight specialized recycling collection companies, 1,000-2,000 Itinerant buyers, and 3,000 – 4,000 Informal Street waste pickers involved in the metals value chains. Compared to the period before the outbreak of COVID-19 pandemic in 2020, these numbers increased due to the prolonged market prices over the last two years.

3.3.2.3 Prices and Markets

- The metal recycling market has prolonged global price trends during the last two years and these prices began to decrease since the start of 2023. For the ferrous metal value chain, all quantities are locally recovered with a critical reliance on importing from neighboring countries. The unprocessed high-grade steel scrap waste ranged from 160 – 320 JOD per ton based on quantity, type, and grade. The light steel waste prices typically fetch between 80 – 140 JOD/ton.

- For non-ferrous, aluminum waste is the most dominated in the market and has different types or forms which are highly requested by the recyclers. Soft drink cans of 100% aluminum are mostly collected by waste pickers and then sold up the value chain in prices range between 400 – 950 JOD/ton and some high-grade aluminum exceeded 1200 JOD per ton. The unprocessed copper ranged between 2900 – 3500 JOD per ton for yellow Brass, and between 4600 – 5500 JOD per ton for red Brass. The unprocessed stainless steel ranged between 250 – 1000 JOD per ton based on quantity, grade type, and form/mold. Some rare industrial and medical stainless-steel types reached up to 10,000 JOD per ton.
- With respect to non-ferrous metal exports, around 4,500 – 5,500 tons of processed copper waste are exported annually, at prices ranging between 5,000 – 6,500 JOD/ton. Likewise, around 20,000- 30,000 tons of processed aluminum alloys are exported annually, at prices ranging between 1,500 – 2,500 JOD/ton.

3.3.2.4 Supporting Services and Interconnected Markets

Given the metals value chains are long established, developed, vertically integrated, and formal relationships based especially in downstream side, the research observation indicated that the supporting and interconnected markets in this sector is the most extensive in terms of scope compared to other sectors in the recycling market. The following observations emerged from Activity's interviews with actors across all functions, and all value chains:

Financial Services: There is a good knowledge among the large industries and processors, and they access finance through bank credits to manage operating costs, infrastructure, and importing/exporting. However, they use self-financing to source material from local aggregators through cash payments. Lack of financial services is reported for the entrance and middle of the value chains, particularly the scrap yards, middlemen, and brokers. They tend to rely on self-financing or direct access to equipment providers who offer forward payments. The transactions between waste pickers and scrap yards are all done in cash, and usually via daily transactions. Limited capacity is observed in the preparation of financial and cash-flow statements, project feasibility studies and business plans, especially metal scrap yards and specialized brokers.

Business Advisory Services: There were few examples of firms outsourcing any specialist business service functions. Most times these are performed internally by the firm – often by managers, though sometimes through specialist positions (i.e., HR, finance, marketing etc.) existing at larger processing and manufacturing establishments. While grading and certification processes are important (particularly in non-ferrous metals where quality affects use in different end products) there was no evidence of any specialist services or functions in this regard. Nonetheless, most training activities are internally done where "trial and error" approach is a common practice.

Occupational Health and Safety: Despite national laws and regulations related to occupational safety and health, most workers in the recycling sector do not adhere strictly to public safety requirements and PPEs during the work despite their awareness of potential risks and their knowledge of cases of injuries that may have already occurred in the past. In addition, most of the existing facilities and buildings in the recycling sector lack the minimum standards of health and safety.

Cooperation and Advocacy: The cooperation and advocacy in the metals sector is much better than other recycling sectors, and there is evidence of domestic industries cooperating in different ways to overcome strategic challenges, such as advocacy on governmental export/import decisions. These industries are members in Jordan Chambers of Industry and utilized their industrial classification as construction sector to help engage and inform the Government. This high level of representation on the downstream side will become lower as going up to the front of the value chain.

Standards, Trainings, and Certifications: Trainings on grading and sorting would be useful to improve value and destination, as well as specialized technical lab testing become a crucial in non-ferrous

smelting and processing. The research indicated that only large industries and processers/exporters have relevant certifications and commitment to the customers' requirements.

R&D/Technology: No concrete evidence was found with respect to R&D/technology partnerships between industries and processors in metal recycling, and, say, academia. In such a fast-evolving technology landscape across recycling markets globally, this is arguably significant barrier to the future competitiveness of Jordan's recycling sector.

3.3.2.5 Governing Policies, Laws, Regulations and Norms

- Even though the ferrous metals value chain is very developed and domestic oriented, importing additional steel scrap waste is crucial to meet the local demand. Therefore, considering the government decision thoroughly to impose or exempt duty tax on import/export steel scrap waste is a critical need for the sector instead of the current procedure. This improvement will give the metals sector higher competitiveness and stability in the long run. Likewise, the exports of the non-ferrous metals, particularly aluminum and copper waste are often subjected to an export tax (30 JOD per ton). Exempting these scraps or reducing it will improve competition with global markets especially that Jordan has limited value additions in this regard.
- The insufficient governmental inspections and ineffective law enforcement, particularly in remote areas, lead to a pervasive sense of informality and non-compliance with legal obligations within the metals industry. Strict inspections are required to reduce environmental violations, safety and health damage associated with informal metals smelting. This also has a detrimental impact on the competitiveness of legally operating businesses.
- Bureaucratic licensing procedures for solar energy systems in the industrial sector pose a challenge, further hindering progress in adopting renewable energy sources.
- Due to increasingly strong competition and weak horizontal relationships, negative business practices take place in the metals value chains (particularly the aggregation functions) that might affect the growth and sustainability, such as but not limited to predatory pricing, monopoly, price exploitation, and price volatility.

3.3.2.6 Business Models at Enterprise Level

Participation of Women and Marginalized Groups: Metals industry concentrates on employing males mainly, while the role of women comes in administrative and supportive positions. People from marginalized groups are employed as workers in grading and sorting while skilled workers are employed in smelting and processing. Thousands of individual street waste pickers and itinerant buyers are involved in collecting metal waste alongside the upstream side.

Business Organization and Performance: The research indicated that aggregators (mainly medium and small scrap yards) have weak business organizations where the business organization is stronger in the metal industries and processors. Nonetheless, the performance of the actors is generally high and increases when prices rise. This is attributed to the high value of the metals in comparison with other waste sectors. The weak horizontal relationships between the actors in the upstream site (i.e., collection, sorting and aggregation) have negative impacts on performance and lead to unfair competitions at the bottom of the value chain.

3.3.2.7 Growth Opportunities and Constraints

According to the findings of this research, the following constraints have been identified that limit the performance and growth of private sector-led recycling services in the metals sector in terms of increasing volumes, increasing values and increased/improved jobs:

- Lack of consistency and stability of the government decisions regarding imposing/exempting export/import duty tax on steel scrap waste and aluminum/copper waste. Export tariffs mean products are not price competitive on international markets.
- Market inefficiencies which erode price margins and returns are observed and undermine sector competitiveness.
- Lack of business skills and business organization needed for expanding performance and profitability of the market actors at the upstream side. This includes developing a business modality with a feasible flow of supplies and products, marketing, negotiation, and valorization.
- Lack of published/accessible market data on the recycling sector, and this helps in building evidence-based advocacy from the sector towards the government.
- Despite sector representation and strong formal cooperation in the downstream, the weaknesses in horizontal relationships among the collectors, sorters and aggregators create kinds of informality and unfair competitions that affect their voice and collaborate on sectoral and strategic challenges.
- Limited capacities to enhance the procedures for improving the product quality and certification, which is important to improve competitiveness and export opportunities.
- Price fluctuations and seasonality undermines the consistent supply, and therefore aggregation is a fundamental step in the metals recycling sector.

To address the above valid constraints, the Activity shall focus to design its intervention I the upcoming years on the following areas:

- Support the development of a clear and well-defined mechanism and policy to impose or exempt export/import tax steel scrap waste and aluminum/copper waste.
- Provide firm-level technical assistance on improving business organization and upgrade capacity especially for the collection and aggregation.
- Specific training programs on occupational health and safety as well as the potential risk concerns with metals recycling.
- Improve access to information and horizontal linkages across the metal recycling market and creating platforms or digital solutions.

3.4 PET waste Value Chain

3.4.1 Overview

- Polyethylene Terephthalate, commonly referred to as PET (or PETE) which is a type of polyester, and PET is the most common thermoplastic polymer resin in the polyester family. PET is a non-toxic synthetic resin widely used in clothing fibers and containers for food and liquids33.
- PET is the most consumed plastic in Europe and in the food ingredients and agricultural sectors overall because it works well as a fiber, film, and container. PET plastics are FDA-approved for contact with food and beverages as well as other perishable items because PET is a clear BPA- and phthalate-free plastic34. Though derived from natural gas and oils, PET plastics are a sustainable packaging option compared to aluminum or glass.
- PET is both excellent packaging materials because its lightweight and heat resistant. PET has a strong gas barrier that protects its contents against moisture exposure for longer. PET also

[33] https://www.hyosungtnc.com/en/trade/synthesis_fiber.do
[34] Food Grade Plastic: Which Plastics Are Safe for Food Storage (palmetto-industries.com)

offers better stress crack resistance and easier recyclability than other plastic resins, mainly HDPE.

- PET is extruded or molded into plastic bottles and containers for packaging foods and beverages, personal care and beauty products, and many other consumer products. PET is a thermoplastic polymer resin that begins its life cycle as white resin pellets that become transparent when heated and cured into a desired plastic part.
- PET is a recyclable material and has a recycling rating of "1" on the base of each type of plastic. However, PET needs to be separated from other plastics before recycling because PET requires different processes to break down and reconstitute the compound. PET is intended for single use only, as heating or reusing these items can cause "antimony" to leech from the plastic. PET is accepted in most United States' jurisdictions and are easily recycled by shredding them into flakes. They need to be collected and transported to the manufacturers that process them. And that's where the first challenge in making recycled plastic available presents itself: how to collect all the plastic.
- PET is recycled using mechanical or chemical methods, but it also starts at a material recovery center where the plastic is cleaned and sorted by color and size, thankfully made more efficient by near-infrared light which detects the properties of different plastics. Mechanical, or physical recycling, can be grinding, crushing, re-granulating and compounding PET into PET flakes. In the final step, contaminants in tiny flakes are filtered out with a liquid. Mechanical recycling is the dominant method in Europe but drops in recycled PET (rPET) feedstock can reduce its viability. PET flakes could be recycled in several manufactured forms as follows: polyester fleece, fiber, bottle, sheet, broom wipes, straps, etc...
- Although the use of plastic in products and packaging comes with many economic and societal advantages, the extent of its use creates environmental concerns. With more pressure to act on the impacts of plastics and single waste plastic being banned in more countries, rPET will likely have to continue competing with virgin plastics in the coming years, and this industry will also be impacted by government policies and brand owner decisions in this regard. Moreover, chemists and engineers in the recycling field will need to work with plastics producers to make large recycling operations and technologies everywhere.
- If every material, every product, and its components can be recycled several times without losing material quality, this is called "closed-loop recycling". "Downcycling" or cascade recycling refers to the recycling of waste in cases where the recycled material is of lower quality and functionality than the original material. Downcycling is triggered by market demands but also due to material composition (e.g., laminates) and/or contamination. A prominent example of the first reason for downcycling (demand on another market) is the recycling of plastic bottles which are being processed into fleece fabric for clothing. In such fleece fabrics, rPET is easy to use. Hence, considerable amounts of rPET are being used for this application. However, the material cannot be recycled after the end of life of the fleece fabrics. At the same time, bottle-to-bottle recycling of PET allows closed loop recycling, but the demand for fleece fabrics is also high. Therefore, not all the collected and rPET is used for the bottle-to-bottle approach.
- In general, such contamination limits the types of application for which the recycled material can be used. In the construction sector in general, it is not necessary to pay so much attention to harmful trace substances. Such downcycling takes place where no single-origin waste stream is distinguishable. However, in both cases, the material cannot be recycled again – or at least not to a high degree which is comparable to virgin material – and will most likely have to "leave the loop", ending up as non-recyclable waste. This means that while open-loop recycling can prolong the lifetime of a material, closed-loop recycling can finally support zero-waste strategies and will lead to less resource depletion in the long run.

- Jordan imports around 30-50 thousand tons of the PET virgin plastic resin per year35 to supply its plastic sector, primarily from Saudi Arabia through a few numbers of manufacturers, who specialized in producing PET virgin performs used for bottle packaging mainly water and soft drinks, personal care, hygiene, and cosmetics. There is progressively more demand for these single use products over the years and has meant that tons of this PET post-consumer waste end up daily in municipal stream. Currently, there are no PET virgin performs manufacturers employing rPET in the production because local regulations related to food-grade products, and they bounded to contractual requirements with their customers.

3.4.2 Performance

3.4.2.1 Mapping, Channels and Products

- Even though Jordan has fairly developed plastic recycling value chains and the abundance of domestic plastic industries providing an end use to the recycled material, the only notable exception within the sub-value chain is thermoplastics namely PET, whose only end destination, at present, seems to be export. The lack of alternative manufacturing processes in the country (such as the production of fleece textile or broom brushes or wipes) has made export a strategic market channel for those who handle this kind of plastic waste.
- PET recycling in Jordan is very limited because of the lack of PET available for recycling due to low levels of collection and insufficient waste management infrastructures. The unsegregated collection increase material contamination, and thus limits the types of application for which the recycled material can be used. For instance, Jordan does not have yet such a certified mechanism or EPR framework that is crucial for plastic packaging producers to establish reliable financial bases for large-scale collection, sorting, and recycling of packaging and to create sufficient business cases along the value chains.
- This market research shows that most generalist scrap yards, middlemen, and brokers don't trade PET bottles at large extent, and only few numbers of specialized and export-oriented brokers – who have a greater turnover capacity– with access to cheap storage space (most notably contractors operating inside the dumpsites) are still collecting it. When feedstock reaches the required level in terms of quantity and price, these specialized scrap dealers and brokers start sorting, baling, or shredding, and then exporting to neighboring countries for further value addition.
- PET waste has three quality segments in local market as follows: pre-consumer, source segregated plastic now being preferred (attracting a higher price on the market), and post-consumer sorted after it enters the waste flow. These segments help specialized scrap dealers and brokers to increase profits and minimize the risks associated with price fluctuations.
- The post-consumer PET waste is mostly recovered from the mixed municipal stream either by a few numbers of waste pickers and itinerant buyers especially who have access to storage space or at dumpsites/landfills, where private contractors sort the material by type and grade. The source segregated post-consumer waste is collected through specialized recycling collection companies that have direct contracts with large waste generators like restaurants and hotels. The recovered material is traded up through the value chain to only a handful of specialized scrap dealers and export-oriented brokers who can afford the space to store sorted post-consumer PET waste. All post-consumer PET waste is sorted, collected, baled, and exported, with none remaining in the country because there is no advanced value addition for this low-quality grade.
- The market estimates showed around 10 tons/day of post-consumer PET waste is being collected mainly from the dumpsites/landfills. One of those specialized brokers has a large

[35] Interviews with market actors from the PET plastic sector

stockpile of this waste as he has a plan to invest in equipment and machinery for greater added value prior to export. The prices in this sub-value chain vary according to quality and source. The specialized scrap dealers buy post-consumer PET from unsegregated collection (mainly dumpsites/landfill) at 120-150 JOD/ton, while prices increased for better quality of the same grade to 160-180 JOD/ton that waste picker provides. The highest price of this grade is the source segregated which reach up to 230 JOD/ton. These scrap yards usually attract a higher price on the market to waste pickers to encourage them.

- This low-grade post-consumer PET is sorted, baled, and exported to neighboring countries such as Turkey, Egypt, Saudi Arabia, and Palestine. The export prices started from 300 to 320 JOD/ton for the baled PET while the shredded PET has a higher price limit between 340-375 JOD/ton. The global buyers of this low-grade are large manufacturers that produce fleece textiles, broom brushes, wipes, and straps.
- On the other hand, there is another sub-value chain that deals with pre-consumer PET waste, as it seems more developed and expanded in terms of quantity and quality. The pre-consumer PET waste is being generated from industries and manufacturers. This type is a high-quality grade and includes defective virgin materials and scraps resulting from PET virgin manufacturers for packaging food, beverage, hygiene, etc....
- The pre-consumer PET sub-value chain provides a greater value addition through a handful of domestic manufacturers that buy this high-quality grade and use it in their manufacturing processes to produce broom bristles, cleaning tools, and curtains accessories and supplies, threads, plastic fabric, and home furnishing items for both domestic and export markets. The main manufacturers in this sub-value chain are: Golden Star Factory in Marka and Salim Kittaneh & Sons Co in Muwaqqar. Both manufacturers have direct contracts with manufacturers that use virgin PET. The prevailing price of this grade ranges from 400 – 600 JOD based on global prices, quantities, and seasonality. The specialized scrap yards and export-oriented brokers play a seasonal role in this sub-value chain and start to compete with domestic manufacturers on this commodity when the global price rises to higher levels (above 650 JOD). The volume that this sub-value chain absorbs yearly is about 600 tons while specialized brokers yearly export around 1500 tons of high-quality pre-consumer PET with baling and shredding to reduce the bulk volume.
- Although source segregated are not available in large quantities and there are no domestic manufacturing processes dealing with high contaminated waste, the post-consumer PET has been experiencing growth in recent years and the market will remain export-oriented in the upcoming years. This growth can be attributed to several factors, including increased global awareness and focus on environmental sustainability and the growing global demand for recycled products by consumers and businesses. However, the availability of recycled materials at competitive prices has also contributed to market expansion.
- The sub-value chain of the pre-consumer PET looks more stable and will grow steadily over the years but with limited quantities. The global trends show the growing use of virgin PET in packaging food, beverage, and hygiene and this will push PET virgin manufacturers to generate more products. Nonetheless, the global prices of virgin PET as well as the environmental policies drive the growth of this market.

3.4.2.2 Functions and Actors

- Table 7 presents the current functions and active actors across post-consumer PET waste sub-value chains in Amman and Zarqa.

Table 7: The current functions and active actors across post-consumer PET waste sub-value chains (export-oriented channel)

Functions across value chains	No. of active actors in the current local market	Volume Estimate (ton/month)	Price Estimate 2023 (JOD/ton)
Domestic Industries or manufacturers	Jordan has no yet advanced value additions for post-consumer PET and the collected amounts are processed and exported by the aggregators and processors	**	**
Aggregators/ Processors/	4-6 specialized export-oriented brokers export baled/shredded post-consumer to Turkey, Egypt, Saudi Arabia, and Palestine 30-50 Medium and small scrap yards	260 tons per month	300 to 320 JOD/ton for the baled PET 340-375 JOD/ton for shredded
Collection and sorting	8 specialized recycling collection companies (source segregated)	10 tons per month	200 -230 JOD/ton
	500-700 Itinerant buyers 1,000-1,500 Informal waste pickers	50 tons per month	160 -180 JOD/ton
	3-4 Landfill contractors and waste scavengers (off-grade)	200 tons per month	120-150 JOD/ton

- Table 8 presents the current functions and active actors across pre-consumer PET waste sub-value chains in Amman and Zarqa.

Table 8: The current functions and active actors across pre-consumer PET waste sub-value chain in Amman and Zarqa

Functions across the Plastic recycling value chains	No. of active actors in the current local market	Volume Estimate (ton/month)	Price Estimate 2023 (JOD/ton)
Domestic Industries or manufacturers	2–4 domestic manufacturers for producing broom bristles, cleaning tools, and curtains accessories and supplies, threads, plastic fabric, and home furnishing item	50 tons per month	400 – 600 JOD/ton
Aggregators/ Processors/	4-6 specialized export-oriented brokers export baled/shredded pre-consumer to Turkey, Egypt, Saudi Arabia, and Palestine 30 -50 Medium and small scrap yards	125 tons per month	400 – 700
Collection and sorting	8 specialized recycling collection companies 6-8 PET virgin Manufacturers	175 tons per month	350 – 450

Domestic industries or manufacturers: Both PET sub-value chains are small and constrained to reduced quantities and limited value additions. The post-consumer PET is fully export-oriented while minimal quantities of pre-consumer PET is domestically recovered through the production of broom brushes and curtains accessories. A handful of specialized scrap yards and export-oriented brokers – who have a greater turnover capacity– with access to cheap storage space are reliant on contractors operating inside the dumpsites and contract with PET virgin manufacturers to collect and store this commodity, and when global prices rise, they export for greater value addition. They recently attract a higher price on the market to waste pickers and specialized recycling collection companies to encourage them to collect source segregated materials. This market research showed that there are at least two manufacturers in Jordan (namely Golden Star Factory in Marka and Salim Kittaneh & Sons Co in Muwaqqar) that started using the pre-consumer PET as raw materials in their manufacturing processes to produce broom bristles, cleaning tools, and curtains accessories. Currently they have annual contracts with several industries that use virgin PET. The current value chains have a collection capacity of ~ 4000 tons of PET per year, of which 3000 tons are pre-consumer PET collected from industrial sources. Most of the collected PET is sorted, baled, or shredded and exported with a limited value addition to neighboring countries such as Turkey, Egypt, Saudi Arabia, and Palestine.

Processors/Aggregators: The PET value chains are not structured as other waste sectors where processors and aggregators merged into one function. The most generalist scrap yards, middlemen, and brokers don't trade PET waste at large extent, and only few numbers of specialized scrap yards and export-oriented brokers – who have a greater turnover capacity– with access to cheap storage space are collecting it. Aggregation is a fundamental step for those specialized brokers to minimize the risks associated with price fluctuations. Those processors usually have formal relationships with PET virgin manufactures and the private landfill contractors. The Activity research confirms that this value chain includes a very limited number of actors. There are 4 – 6 specialized export-oriented brokers in Amman and Zarqa and around 30 – 60 Medium and small scrap yards who buy PET waste whether pre-consumer or post-consumer.

Collectors and sorters: At the bottom of this value chain, there are low numbers of individual waste pickers and itinerant buyers who deal with collecting PET bottles from the unsegregated waste stream. Therefore, private landfill contactors play a pivotal role in the whole system, and they recover most of the postconsumer PET in the unsegregated stream. The processors/aggregators also attract a higher price on the market to encourage individual waste pickers. In recent years, some recycling collection companies started to collect source segregated postconsumer PET from large waste generators (i.e., hotels and restaurants), and then sort before selling it to the specialized export-oriented brokers.

3.4.2.3 Prices and Markets

The PET recycling market in Jordan is still very limited in terms of value and volumes due to the lack of specialized manufacturing processes in the country such as but not limited to the production of fleece textile or broom brushes or wipes. Hence, the market is export-oriented and driven by global prices of virgin PET. The market is mostly dominated by a handful of specialized scrap dealers and export-oriented brokers who are reliant on the private landfill contractors as main suppliers for the prost-consumer PET with limited participations of the informal waste pickers. The recovered PET is sorted, baled, or shredded and exported to neighboring countries such as Turkey, Egypt, Saudi Arabia, and Palestine. The current market is segmented into three sub-value chains based on the quality and the source as follows:

- Postconsumer PET from unsegregated stream (mainly from the private landfill contractors): 120-150 JOD/ton which after sorting/baling, increase to be between 300 – 320. The specialized scrap dealers and brokers offer a higher price to get better quality from this grade ranges between 160 -180 JOD/ton.

- Postconsumer PET that is a source segregated: 200 – 230 JOD/ton, which sorted, shredded, and stored until global price increases to be between 340 – 375 JOD/ton.
- Pre-consumer PET: this grade has a higher demand with seasonal price fluctuations between 350 and 450 JOD/ton without any processing. The export-oriented brokers provide sorting and shredding for an export destination, where the price increases to between 450-700 JOD/ton based on virgin PET global prices.

Jordan imports yearly about 30-50 thousand tons of the PET virgin plastic resin to supply its plastic sector while only 5 thousand tons per year are recovered and mostly are post-consumer from the unsegregated stream.

3.4.2.4 Supporting Services and Interconnected Markets

Like other plastic value chains, the supporting services and interconnected markets related to the current PET sub-value chains are very limited in scope.

Financial Services: Most of the current actors are reluctant to access to the financial institutions including the banks and micro finance institutions due to the high commercial interest rates and the lack of valid registration documents and licensing records as well as the required collaterals. They tend to rely on self-financing or direct access to equipment providers who offer forward payments. Most interviewees confirmed that finance is a constraint to upgrade equipment and infrastructure as the actors already have deficiencies in their investments and business capabilities for improving performance, and this is attributed to the variables and shocks of the global markets.

Business Advisory Services: Most of the actors show significant deficiencies in managing their businesses as most of them are one-person show, and there is no evidence that firms outsource any specialist business service functions and most times these are performed internally by the firm, often by managers.

Transport Services: High transport costs in relation to very low profit margins are a major constraint to PET collection. So, the specialized scrap dealers and export-oriented brokers who can afford to spare the required storage space to accumulate PET waste and have their own transport trucks can strongly compete and take the lion's share of the market.

Occupational Health and Safety: this research shows that most existing facilities and buildings in the recycling sector lack the minimum standards of health and safety, as local investors do not consider the need to invest in a healthy, safe, and secure infrastructure in buildings and work sites, because do not recognize the positive impression and long-term returns on his business.

Cooperation and Advocacy: Due to strong internal competition and limited quantities, very weak horizontal relationships and communication channels are reported among the actors at each step of the value chains. There is no evidence that firms cooperate to overcome operational or strategic challenges such as policy advocacy towards the government.

Standards and Certifications: Despite plastic recycling is sensitive to quality and certifications, the PET sub-value chains are small and limited to low value addition. Therefore, the market is segmented into three separate material grades based on the source and contamination and differentiate the value and price based on the market demands and requirements.

R&D/Technology: There is no evidence found with respect to R&D/technology partnerships between firms in PET plastic recycling, and, say, academia. In such a fast-evolving technology landscape across recycling markets globally, this is a particular surprise and arguably significant barrier to the future competitiveness of Jordan's recycling sector.

3.4.2.5 Governing Policies, Laws, Regulations and Norms

- Apart from insufficient capacities, the market limitation in terms of value, volume and actors is due to lack of national standards related to recycling processes, products, and functions including the packaging standards. Economic incentives and policy instruments can create an enabling environment for increasing the demand on employing rPET and support industries to become more circular producing recycled sourced materials that can, again, be recycled. This will create new market opportunities along the plastic value chains including the PET. There is poor coordination and communications among institutional stakeholders (mainly the ministries) regarding the recycling sector, and hence the resulting situation is that there is much complexity, fragmented institutional responsibilities, and limited cohesion across the sector as a whole. Alongside the complex sets of 'rules' lies a complex set of stakeholders responsible for setting, informing, and enforcing according to their specific mandate and/or area of responsibility. This runs through all levels from local to national level bodies.
- Adoption of such scheme for the EPR in Jordan will establish reliable financial bases for large-scale collection of plastic packaging waste including PET. This will significantly increase the volumes and value of recycled material locally recovered instead of being exported and reduce dependence on raw material imports.
- Insufficient promotion of the technology among potential investors in the recycling sector is contributing to the present situation.
- The high energy cost and tariffs for electricity and fuel and uncertainty on tax regulations and levels lead manufacturers to lose their competitive advantage over their regional competitors.
- The unfair competition with informal sector, insufficient governmental inspections, and ineffective law enforcement, particularly in remote areas, lead to a pervasive sense of informality and non-compliance with legal obligations within the plastic industry. This has a detrimental impact on the competitiveness of legally operating businesses.

3.4.2.6 Business Models at Enterprise Level

Participation of Women and Marginalized Groups: The PET sub-value chains show low levels of participation at the municipal level in comparison with other waste sectors, while this participation increases at dumpsite/landfill level. Most people from poorer and more marginalized people are involved in collecting or scavenging the waste while women are more involved in sorting and grading.

Business Organization and Performance: The research indicates that current actors have significant deficiencies in their business organization and do not comply with legal requirements as they should be. Maybe, the unfair competition with the informal sector is contributing to the present situation.

3.4.2.7 Growth Opportunities and Constraints

The findings of this research shows that PET recycling in Jordan is still limited and constrained but have potential opportunities to growth and expand in the upcoming years. The main constraints that limit the sector competitiveness and hinder the performance of the private actors are as follows:

- Lack of governmental support to the recycling sector in providing economic incentives and policy instruments that improve the enabling environment. For instance, approaching such an EPR scheme will improve the collection capacity, the quantity, and the circularity of plastic packaging, and will create new market opportunities throughout the value chains. Also, adopting source segregation at commercial sector will be a turning point in this market.
- Lack of local recycling industries or facilities that employ rPET in their manufacturing processes. This is considered a critical gap to increase the domestic value addition and thus increasing volumes to be locally recovered. Investment in mechanical recycling of clean PET waste is a promising opportunity and it will fill a major gap in the current market.

- Insufficient capacities and low levels of collection and sorting undermine the feasibility and viability of establishing a domestic PET recycling industry in Jordan, or even increasing the consistency of PET waste exports.
- Lack of market-driven quality guidelines that help the collectors and sorters to improve the value of the material before selling to the aggregators/processors. The PET market is very sensitive to quality and standards because the level of contamination impacts the treatment process and cost as well as the end market.
- Lack of financial incentives to be offered by the market actors to encourage informal waste pickers to collect the source segregated material. This would increase the recovery rate and the consistency of the supply in the recycling market.
- Weak horizontal cooperation between the actors is reported across the entire PET sub-value chains and especially between aggregators and export-oriented brokers.
- The competition between virgin and recycled PET is the main driver in this sector and hence, lack of strategic governmental policies and directions to incentivize the recycling sector will keep market instable and fragile in facing the global dynamics and sudden chocks.
- The lack of access to green finance undermines the market actors investing in equipment, machinery and technologies related to PET recycling. yet, Jordan has no governmental support (tax/export incentives and polices) for the plastic recycling as it is one of the main contributors in the environmental protection, transition to circular economy and mitigating the climate change.
- Weaknesses are reported in the supporting services and interconnected markets across the value chains, particularly limited access to information and high transport costs.
- Lack of business skills and organization among the market actors that is needed for growth and sustainability, specially that they face an unfair competition with informal businesses.

To address the above valid constraints, the Activity shall focus to design its interventions in the upcoming years on the following areas:

- Improve technical and business capacity through firm-level technical assistance to the PET recycling market actors across the value chains. This includes deeper and advanced business training and capacity-building programs.
- Support the development of specific export tax policy and improve the formulation of sector representation.
- Scale up the business training and capacity building programs to cover larger numbers of the actors in the paper/cardboard collection, sorting and grading, and to improve their business model to establish large scale separation at source scheme with larger waste generators.
- Facilitate access to finance for the aggregators and processors/exporters, to upgrade their capacity in terms of equipment, and infrastructure.
- Produce and disseminate market-driven guidelines about the quality of plastic materials and standard procedures for the professional added value activities in the recycling sector.
- Improve access to information for market intelligence and linkages: establish mechanisms to provide market information and linkages to actors in the value chains. This can include creating platforms or digital solutions that connect waste generators with waste pickers and recyclers. Additionally, support the development of market linkages with local and international buyers to reduce market volatility and expand market access for recycled materials.

3.5 Food Waste Value Chain

3.5.1 Overview

- Organic waste generally refers to biodegradable, compostable waste from homes, businesses, institutions, and industrial sources. Examples include food scraps, yard and garden trimmings, wood waste and food-soiled packaging products. Food waste refers to food that is intended for human consumption that is discarded without ever being eaten. This definition includes kitchen scraps or leftovers, discarded food, and the expired food items that commercial sources generate.
- Apart from reducing food waste at the source, the management of post-consumer food waste typically includes several methods and techniques by which they are managed. These are in order of preference according to EPA's hierarchy as follows: Food Donation, Animal feeding, Rendering, Composting, Anaerobic digestion, Aerobic digestion, Liquefaction, Hydrolysis, Gasification, Pyrolysis, Briquetting, incineration, and landfilling. The current situation indicates that landfilling is the common method in Jordan for organic and food waste disposal, while composting is the most common alternative to landfilling, and it could appear to have widespread application on a commercial scale with MSW.
- Amman generates everyday about 3,250 tons of non-hazardous municipal solid waste and this amount is being collected and landfilled, where biodegradable organic and food waste is the main constituent, representing more than 50% of waste composition36. According to official reports, 30 - 40% of the waste stream is being generated from commercial and non-residential sources37.
- In Jordan, food waste is not only a moral and ethical issue but also an environmental concern with far-reaching implications for climate change. As stated in the Waste Sector Green Growth Actions (2021-2025) and National Strategy and Action Plan for Municipal Solid Waste (NSAP) 2015-2034, Jordan has set out national targets to increase diversion of waste away from landfills, through the reduce, recycle, and reuse, with a special focus on packaging and organic waste.
- There are potential markets (e.g., animal feeding) and applications (e.g., composting), both domestic and export in orientation. However, these will require significant planning and strategic investment in 'new technologies' capable of transforming organic waste into products with a real commercial value. For these reasons organic waste – for which there is currently no value chain active in Jordan.
- Organic waste is a 'special interest' in this assessment due to its strategic importance in increasing volume of waste diverted from landfill toward recycling, which is to some reasonable extent dependent on successful interventions in the organic waste value chain. Therefore, the municipal intervention is very critical, notably that there is currently no private sector engaged in the recycling of municipal organic and food waste. The current situation indicates that food waste generated at commercial or industrial levels is easier to divert from landfills because of economies of scale that allow those generators to recover waste at a high rate. However, at the wholesale and retail level, food waste diversion is a bigger challenge because of the logistical issues resulting from the number of locations and diverse product offerings. In case municipalities change their approach in dealing with non-residential waste and separating the collection routs in the work programs, it is likely that it will provide an opportunity for greater investments in the treatment infrastructure, which the private sector can establish for that organic waste that has a greater value, and thus contribute to extending the life span of the landfill and reducing financial burdens on the government.

[36] GAM reports and studies 2022
[37] GAM reports and studies 2022

3.5.2 Performance

3.5.2.1 Mapping, Channels and Products

- Although there is no value chain for the organic and food waste in Jordan, certain types of waste recovery are commonly practiced mainly animal feeding and composting. A few numbers of commercial hypermarkets, food processing facilities, fruit/vegetable markets, and retailers contracted with a handful of formal and informal collectors to truck-off their organic/food waste for animal feeding purposes. However, some of these establishments rejected food donation due to liability issues and abuse of branded packaging. No official estimates are provided on this limited diversion. In the same context, there are a few investors currently studying the possibility of treating organic and food waste to produce supportive animal feeding materials, especially since there is a global technological development in this field. However, the logistics of securing a consistent supply of organic and food waste remains the limiting factor for the viability of this kind of project.
- The research shows that composting could be one of the most appropriate methods for handling the organic and food waste to produce valuable compost products that have a high demand in Jordan. Composting also includes several technologies and techniques with different scales and requirements. It is noted that technology service providers and technical advisors play an important role in organic waste management. For instance, this research found that there are two waste technology firms in Amman who can supply large waste generators from the commercial sector with small machines and on-site compost solutions to produce high-quality compost on a small scale instead of landfilling. This equipment is intended for yard trimmings waste and only small amounts of food scraps. However, this market is driven by to what extent the business owners are aware of the environmental sustainability, and most of them see landfilling is the cheapest way to dispose of their organic waste and not required for an investment. It worth mentioning that some of these compost machines are expensive due to its advance technology and capacity while there also low-cost technologies and affordable in the local market such as but not limited to containers earth cube, home composting boxes, and on-farm composting applications. Raising institutional awareness on the importance of food waste management and adopting commercial compost applications would be essential to push this market for growth and expansion.
- There are currently many researchers and entrepreneurs who are testing new solutions for the treatment of organic food waste, whether to produce compost or supportive animal feed, and figure out its viability and feasibility. Among these solutions is the black soldier fly technology, worms or vermicomposting and bacteria applications, while some went further in studying large-scale solutions such as anaerobic digestion for energy production and the possibility of their application in Jordan.
- No products specified in this limited value chain except the compost that is being produced from the municipal organic and food waste on a very limited scale and quantity until now.

3.5.2.2 Functions and Actors

Given lack of value chain in Jordan for the organic and food waste, the functions and actors could be as follows:

- Technology Provision: The business offers technology solutions to waste generators, enabling them to produce compost from organic and food waste. This includes providing on-site composting applications or offering suitable collection systems to other composting facilities that exist in Amman. Technology providers play a crucial role in enabling waste generators to convert waste into compost effectively.
- Waste Generation: This function shall include the large waste generators whose organic and food waste match the minimum requirements to produce compost. For example, malls,

industries, restaurants, hotels, universities, and food processing facilities could be the best options.

- Waste Collection: The primary function is to collect organic and food waste from the points of generation like malls, markets, restaurants, hotels, embassies, universities, and private farms. This function involves providing containers and technology to facilitate the collection process. Moreover, this function could be designed with the municipal system in Amman to collect waste from certain routes and locations, such as but not limited to gardens, parks, and commercial establishments.
- Compost Production: The collected waste is processed using the provided technology to produce compost. The business employs staff responsible for compost production. They oversee the composting process, ensuring proper decomposition, and monitoring the quality of the compost produced.
- Compost Marketing: This includes the potential buyers of compost products such as parks, gardens, landscape companies, nurseries, municipalities, universities, public institutional sector, households, and other facilities that have gardens or landscape.

3.5.2.3 Prices and Markets

- Yet, there is no local compost produced from municipal organic and food waste. However, the local market includes a wide variety of organic compost products that originated from botanical and animal waste sources. Some of these compost products are imported from global producers for gardening, potting soil, and landscaping while manure-based organic fertilizers are domestically produced, and the most common products consumed in agricultural and horticultural practices.
- While Jordan has not a value chain for the organic and food waste that end up in landfills/dumpsites, there is another market to produce natural organic fertilizers and compost products from agricultural waste including both potential and animal sources. This market is mostly reliant on the agricultural and horticultural activities in the country, and includes seasonal prices as follows:
  - Untreated Poultry Manure: 1.0 – 1.4 JOD/25 kg
  - Manure-based organic fertilizers (treated): 1.5 -3.0 JOD/25 kg
  - Peat moss (imported): 1.75 – 4.5 JOD/25 Liter
  - Potting mix soil: 6 – 12 JOD/25 Liter
  - Compost: 2.0 – 6.5 JOD/25 kg
  - High-quality Compost (Imported): 5– 10 JOD/25 kg

3.5.2.4 Supporting Services and Interconnected Markets

- Despite the recent developments in many legislations related to waste management and the national goals set to increase waste diverted from landfills, in addition to the growing global concerns in environmental and climate issues, no pivotal change has been made so far in the municipal organic waste management systems in cities and municipalities. Consequently, the expansion of the organic and food waste market in the production of animal feed and compost as well as its decreasing impact on greenhouse gases will raise the demand on the government and municipalities to adopt new polices and actions regarding the food waste management in Amman. The lack of infrastructure or source segregation schemes for the commercial and industrial sources undermines the private sector to intervene and makes landfilling the cheapest solution. Lack of governmental financial incentives and gate-fee mechanisms is also hindering the development of the food waste market.

3.5.2.5 Governing Policies, Laws, Regulations and Norms

- Apart of the market limitation, Jordan does not have yet specific rules and regulations that specifically govern the organic and food waste management to encourage non-residential facilities (i.e., commercial, and industrial sector) on food waste reduction, source segregation and separate collection. Effective enforcement, monitoring and evaluation are also important tools. Additionally, economic incentives and policy instruments can create an enabling environment for increasing the production of animal feed and compost and stimulating innovation and new market opportunities along the organic and food waste value chain. For instance, increasing landfill disposal fees on waste generators without offering alternatives to food waste treatment will not incentivize them to take part.

3.5.2.6 Business Models at Enterprise Level

Participation of Women and Marginalized Groups: This research indicates very limited numbers of people from marginalized groups mainly informal waste pickers involve in this value chain only on collecting moldy bread and fruit/vegetable waste for animal feeding.

Business Organization and Performance: This research shows that there is no market for this organic and food waste. However, there are few numbers of technology suppliers, researchers, community initiatives, entrepreneurs who are trying to offer or test innovative solutions mainly in on-site composting and animal feeding.

3.5.2.7 Growth Opportunities and Constraints

Despite the national municipal solid waste strategy is in a place since many years ago, most of the organic and food waste that constitute 50% of the waste composition is end up in the landfills/dumpsites, which is not only depleting resources but also contributing to environmental and climate challenges. Therefore, promoting and tracking attention towards "value to waste" would be an effective solution approach to pave the way for creating new feasible and viable business models and value addition. Several key barriers were identified to the growth of the organic waste markets as follows:

- Low level of governmental commitment to adopt a sustainable organic and food waste management policy and the provision of necessary resources. Organic waste is not a priority for the government.
- Lack of clear and reliable framework by which the organic and food waste is managed from the collection, transport, treatment, and the production of new valued products.
- The absence of effective and comprehensive legislative frameworks governing municipal organic and food waste and the inadequate enforcement mechanisms.
- Lack of evidence-based studies about the main enablers and barriers to organic and food waste management technologies adoption.
- Lack of widespread source separation system especially for the large waste generators from the commercial and industrial sectors in Amman.
- Lack of governmental support to initiatives from the private sector and NGOs regarding the technology adoption, especially that is no organic waste technology availability in the Jordanian market.
- Lack of incentives to invest in the fields of organic and food waste management. for example, lack of land availability for the organic waste projects is a barrier for the private investors.
- Lack of reliable and accurate data and information about organic waste generation rate, volume, distribution per area/sector, sufficient and full statistics on organic waste

To address the above valid constraints, the Activity shall focus to design its interventions in the upcoming years on the following areas:

- Provide firm-level technical assistance for the service providers who provide innovative solutions and technologies related to organic and food waste management.
- Support the development of specific policies related to organic and food waste and provide technical support to decision-makers regarding technology adoption.

3.6 Used Cooking Oil Value Chain

3.6.1 Overview

- Used cooking oils (UCOs), also known as waste vegetable oil, made from sunflower, corn, canola, olive, palm, rapeseed, soya, and animal fats that have been used for cooking or frying in the food processing industry, restaurants, fast foods and at consumer level, in households. It is also available in a variety of mixed compositions and includes bacon and hamburger drippings that can cause blockages in home plumbing, the sewage collection system, and even septic systems. They form products that linger in the environment for many years, polluting water courses and soil causing severe negative impacts on ecosystems.
- Used cooking oil can be recycled in several ways. Because of its BTU value it is commonly made into a fuel that can be run on diesel engines. The process of chemically converting vegetable oils and animal fats into biodiesel is the most typical method. In many parts of the world, used cooking oil and fat constitute a significant cause of pollution. By utilizing and controlling used cooking oil as a raw material for biodiesel synthesis, these environmental problems may be eliminated. The four main processes for producing biodiesel are pyrolysis, micro-emulsions, direct usage and blending, and transesterification, the most important process of refining. Biodiesels that are produced using the used cooking oil have a lower carbon footprint and burn cleaner. They also release less amount of carbon monoxide and are cost-effective as compared to petroleum diesel. Biodiesel is widely used for transportation, electricity production and heat generation. The recycling process of the UCOs generates by-products, which are useful in the manufacturing of soap, glycerin, cosmetics, and animal feed which increase their demand. According to the Biomass Board of Research and Development, the global biodiesel supply reached 39.7 million liters in 2015 and is expected to reach 50.3 million liters by 2025.
- The market for used cooking oil is driven by the increasing demand for sustainable and eco-friendly energy sources, as well as the growing need for waste management solutions. The increasing awareness of the harmful effects of traditional fossil fuels on the environment and the need to reduce greenhouse gas emissions are also driving the demand for biofuels. The used cooking oil market is projected to grow from $5.97 billion in 2021 to $10.08 billion in 202838. The recent COVID-19 outbreak has significantly affected the supply to used cooking oil processing companies as the nationwide lockdowns in almost all countries have led to the shutdown of the foodservice industry, as well as the production of renewed edible oil decreased. The latest trends show that the global supply chain recovered, and quantities started to increase again.
- Based on the source, the global market is segmented into foodservice and households. The emerging culture of dining out influences the growth of the foodservice agreements. It is expected that the foodservice share will grow faster than households due to potential development in polices and regulations set out by the government in the coming years for the collection of used cooking oil from hotels and restaurants. The wide applications of the used

[38] https://www.globenewswire.com/news-release/2023/06/05/2681992/0/en/Used-Cooking-Oil-Market-Size-to-Hit-USD-10-08-Bn-by-2028-With-a-CAGR-of-7-76.html

cooking oil to produce fuels propel the growth of the industrial application segment. Advance technologies have also promoted its utilization in various industrial processes.

- Jordan has a small value chain for the UCOs waste generated from foodservice providers such as hotels, hospitals, restaurants, and households. The current value chains include a handful of private collectors offer daily door-to-door collection trips and then transferred to local processing facilities, which in turn either produce biodiesel for a domestic demand or filter and segregate it into grades, and then export it to global markets, especially in Europe, for greater value addition. The local market is also linked to an advanced biodiesel industry in Europe through a cross-border network of collection agents from different countries including the Middle East.

3.6.2 Performance

3.6.2.1 Mapping, Channels and Products

- The current value chain of the used cooking oil is small in terms of volume, value, and inclusion. The UCOs market in Jordan is mainly export-oriented and driven by global prices. Nonetheless, demand from local biodiesel processing companies has been growing in recent years as well.
- The local market is segmented into foodservice and households, where the main waste generator in is the foodservice sector and specifically the restaurants. Limited quantities collected from households are usually through informal waste pickers and itinerant buyers. Although market seems to have a steady growth over years, Restaurants sector in Jordan drives the UCOs quantities to be recovered in the market. The weakened purchasing power of restaurants will shrink quantities of the UCOs available for recycling.
- The majority of the collected the UCOs in Jordan is either locally processed or exported for the biodiesel production, while small amounts are used to produce soap and animal feed.
- Market estimates showed about 350 -450 tons of the UCOs traded per month representing around 50-60% of the total cooking oils consumed in the country. The prices change monthly and range between 500 - 950 JOD per ton, depending on the type, quality, and source. The main buyer of this waste is local collection and refining companies. The main export channel is Europe and the average selling price for the UCOs ranged between 1200 and 1500 USD per ton.

3.6.2.2 Functions and Actors

- The UCOs valorization includes the following functions: collection, transport and storage, pre-treatment (moisture/impurities), refinery, and biodiesel production. Although there is a big demand on renewable energy and the production of biodiesel in Jordan, most of local quantities are export-oriented due to strong industry and technology in Europe that offer better prices for local collection and refining companies.
- The value chain of trading the UCOs encompasses several key functions, each adding value to the overall process:

Collection and sorting: this function involves sourcing the UCOs (Palm, Sunflower, Soybean, and other varieties) from various suppliers, including hotels, hospitals, and restaurants. Additionally, collectors and informal waste pickers also serve as an individual supplier for the industries as well as for the animal feed businesses. Once the UCOs is delivered, pre-sorting and grading function comes into play. This involves separating the oil based on its type and quality, ensuring that it meets the necessary standards for further processing.

Aggregating/Processing: After sorting, the UCOs is aggregated, combining the quantities obtained from different suppliers or collectors. This step helps in consolidating the inventory and streamlining the subsequent processes. The aggregated UCOs is then stored in warehouses.

Warehousing facilitates proper inventory management, ensuring an adequate supply of oil to meet market demands.

Distributing/Exporting: The distribution function involves delivering the UCOs to the buyers or customers both locally and globally. The company uses its vehicles to transport the oil to the desired local customers (biodiesel production industries) or ship from Aqaba terminal to global customers (advanced industries in Europe).

- The main actors involved in the UCOs value chain include:

Collectors and sorters: There are a handful of formal businesses and informal itinerant buyers who offer daily door-to-door collection services to foodservice providers and households for buying the UCOs mainly with verbal agreements. They sell it to centralized UCOs collection and refinery firms. The foodservice sector is the main generator or supplier of the UCOs especially that Amman has thousands of commercial establishments that produce used cooking oil. The collectors are competing to build verbal agreements with them to get consistent and viable volumes. It is estimated that there are nearly hundreds of informal actors involved in this business while there are about 3-4 formal collection companies in the used cooking oil market.

Aggregators/processors: They are the cornerstone of this value chain and usually coordinate and manage the flow of the recycled materials across the market. They are usually responsible for collection, sorting, aggregating/processing, and distributing. The local market includes 4-5 local collection and refining companies (processing facilities) in Amman and Zarqa.

Treatment/biodiesel production: There are 2-3 local biodiesel industries that are considered as the end-market buyers of the UCOs based on type and grade. They usually have yearly contracts with the aggregators/processors to secure the supply of the production inputs.

Buyers/clients: There are several pioneering industries in Europe who are the main buyers or clients of the local aggregators/processors. They utilize the UCOs as raw materials for producing biofuels, animal feed, and other industrial applications.

3.6.2.3 Prices and Markets

- The used cooking oil market refers to the market for the collection, processing, and distribution of used cooking oils that are generated from food service sectors and households. Used cooking oils are recycled and used as raw materials for producing biofuels, animal feed, and other industrial applications.
- According to this research, the average collected used cooking oil is estimated to be around 450 -530 tons per month with a selling price in the range of 550 to 950 JOD per ton, depending on the source and type of oil. Due to the special nature of the oils, on-site filling and transport costs are relatively high and constitute about 20% of the selling price and are added to the price. Processing costs, including sorting, cleaning, and storing, are typically between 20 – 35 JOD per ton. The average selling price for used cooking oil for further industrial processing is stated as 1200-1500 USD per ton based on type and quality. The local biodiesel production costs between 50 – 80 JOD per ton while the global industries have greater value addition that enable them to offer better prices to have a consistent supply. However, they have strict technical standards and certifications to be fulfilled by suppliers.
- Due to global expansion of the food industry and the rising demand for biofuels, the used cooking oil markets are anticipated to grow and develop in the upcoming years, and this eventually will reflect on quantities and prevailing prices.

3.6.2.4 Supporting Services and Interconnected Markets

Like PET and Food waste value chains, the supporting services and interconnected markets related to the current UCOs value chains are very limited in scope.

Financial Services: most of the current actors are reliant on their self-financing and have limited access to formal financial sources due to a lack of valid registration documents and licensing records as well as the required collateral. Most interviewees confirmed that upgrading their capacities is dependent on their investment in the collection system especially that the generalist scrap dealers in the recycling sector do not deal with the used cooking oil due to lack of infrastructure and equipment.

Business Advisory Services: most of the local collection and refining companies show significant deficiencies in managing their businesses and there is no evidence that firms outsource any specialist business service functions and most times these are performed internally by the firm, often by managers.

Transport Services: The high transport costs are limiting market competition and all local collection and refining companies must own transport trucks to ensure a consistent supply because used cooking oil needs for door-to-door collection scheme.

Cooperation and Advocacy: no sector representation is reported with very weak horizontal relationships and communication channels among local collection and refining companies. There is no evidence that firms cooperate to overcome operational or strategic challenges such as policy advocacy towards the government.

Standards and Certifications: Exporting used cooking oil to global markets requires strict standards and certifications in terms of organization and products. Some foodservice brands requested global certificates or evidence for the safe disposal as a prerequisite to sign the deal, and this could be offered through relevant global associations that track the used cooking oil waste. Therefore, some local collectors cannot handle commercial brands or export to global markets.

3.6.2.5 Governing Policies, Laws, Regulations and Norms

- Apart of insufficient collection capacities, Jordan does not have yet specific rules and regulations that specifically govern the used cooking oils or even clear guidelines on how to properly handle this special kind of waste from the source. Also, the enforcement, monitoring and evaluation is not a priority for authorities on proper handling and treatment of this type of waste. The formal sector is suffering from unfair competition with the informal sector who use these oils in animal feed applications with poor knowledge and skill. This may concern health and environmental problems.
- Jordan lacks economic incentives and policy instruments can create an enabling environment to setup modern separate collection system for the used cooking oils. Jordan also lacks the standards and certifications that could increase the value addition in the domestic market and expand biodiesel production throughout the country as an alternative and renewable energy source.

3.6.2.6 Business Models at Enterprise Level

Participation of women and marginalized groups: The research indicates limited numbers of people from marginalized groups mainly informal waste pickers in this value chain in comparison with other waste sectors. They are mainly involved in the collection of this type of waste.

Business organization and performance: The findings of this research indicates that current actors have significant deficiencies in their business organization and do not comply with legal requirements as they should be. Maybe, the unfair competition with the informal sector is contributing to the present situation. There are also entrepreneurs/community initiatives who are trying to offer or test small-scale applications to produce biodiesel from the used cooking oil.

3.6.2.7 Growth Opportunities and Constraints

Although the global growing market of the used cooking oils, the local market is still having relatively insufficient collection capacities compared to the potential quantities that are being generated in the country. Several key barriers were identified to the growth of the used cooking oils markets as follows:

- Lack of a specific legal instruction by which the used cooking oil is managed from the source, collection, transport, treatment, and the production of new valued products. The recent Waste Framework Law (No. 16/2020) recommends promoting the integrated waste management practices among the commercial and industrial sectors in Jordan, but nothing has been done yet on this type of waste.
- Lack of widespread source separation system especially for the restaurants with strong enforcement and monitoring programs.
- Strong unfair competition with the informal sector and weak enforcement of the use of these oils in informal animal feed applications.
- Lack of reliable and accurate data and information about the UCOs generation rate, volume, distribution per area, sufficient and full statistics on used cooking oil.
- Weak business capacities and organizations which lead to limiting performance and competition.
- Lack of training and certification programs in related to the UCOs management.
- Like organic and food waste, lack of incentives to invest in the fields of used cooking oil management. for example, lack of land availability for the UCOs processing facilities is a barrier for the private investors.

To address the above valid constraints, the Activity shall focus to design its interventions in the upcoming years on the following areas:

- Provide firm-level technical assistance for the service providers to improve performance and capacity to handle more used cooking oil volumes.
- Support the development of specific policies/instructions related to used cooking oil management.

3.7 Textile Waste Value Chain

3.7.1 Overview

- The textile and apparel industry in Jordan is relatively small, but it is one of Jordan's main industrial as it is employs approximately 75,000 people39, according to the World Bank, and accounts for approximately 27 percent of export earnings. The textile industry is one of Jordan's largest export sectors with a total of 27 % of the Kingdom's manufacturing exports and is projected to grow 12% per year. In 2019, Jordan's exports of textile yarn, fabrics, made-up articles, related products, and apparel totaled US$2 billion, according to the Central Bank of Jordan's (CBJ's).

[39] Jordan Garments, Accessories and Textiles Exporter's Association, 2023.

- The garments industry in Jordan has expanded rapidly over the past fifteen years. Jordan's textile and apparel industry has benefited from numerous free trade agreements (FTAs) the country has signed as part of efforts to strengthen international cooperation and trade and increase its exports. Jordan has signed FTAs with the United States, European Union, European Free Trade Association, the Greater Arab Free Trade Area, Morocco, Turkey, Singapore, and Canada.
- Despite cost management and competition, Jordan has a good opportunity to attract foreign investment in the textile and apparel sector, as many countries in the region — particularly Iran, Iraq, Syria, Lebanon, and Egypt — are experiencing political instabilities. There is a need to innovate and produce more value-added products as this sector holds great potential for the Jordanian economy, especially if it is given adequate support by the government.
- In Jordan, the production of Ready-Made Garment (RMG) in industrial zones results in considerable amounts of textile waste that are presently disposed of in landfills/dumpsites, especially in the Northern parts of the country where the capacity of landfills/dumpsites is stretched to the limit. It is estimated that Jordan annually produces about 2500-3500 tons of textile waste, most of which is produced from Al-Hassan Industrial City located in the north of the Kingdom40.
- As commonly practiced, garments that do not meet the customers' quality standards as well as excess pre-consumer garment products that were not accepted or sold are thrown away. Moreover, the fast fashion industry is putting pressure on the municipal waste management systems by creating low- quality low- value garments which are not designed for long use and thus are disposed quickly and contributing to the increasing amount of post-consumer textile waste. Nonwoven fabrics are engineered fabrics that may have a limited life, single-use fabric, or a very durable fabrics to provide specific functions such as absorbency, liquid repellency, stretch, softness, flame retardancy, cushioning, filtering, bacterial barrier, and sterility.
- The raw material is considered as one of the most important factors affecting product costs in the textile industry based on its type, processing, and end-use. It is impossible to process any textile raw material without producing waste. Consequently, studying textile waste types that come out of processing is of great importance in all modern systems of controlling production and valorization of the wasted materials.
- This textile waste has been treated as a cost factor harming Jordan's environmental ecosystem. However, textile waste also does involve numerous opportunities and could be recognized as a valuable resource on local, regional, and international level on a long term. Currently, there is no clear accurate and reliable data about the fabric composition of the textile waste in Jordan. Official reports showed that the main textile material imported to this industry includes woven polyester and other synthetic fabrics such as spandex, rayon (viscose) and nylon fabrics, knitted cotton fabrics, and other knitted or crocheted fabrics. Market estimates indicated that most of the wasted textile fabrics in Jordan include synthetic polymers (i.e., polyester, spandex, nylon) and natural polymers (i.e., rayon (viscose)) and it could not be recycled directly in the RMG industry. However, it could have a high potential in the manufacturing of recycled nonwovens fabrics that are quite promising materials in the current market. Use of recovered synthetic fibrous waste is particularly attractive as the processing characteristics of properly recovered synthetic do not differ much from those of original synthetic staple and cut filaments.
- Although Jordan enacted a new Waste Framework Law (No. 16/2020) since few years ago, no specific regulations or even a clear and defined environmental policy adopted yet regarding textile and garment waste management in the country.

[40] Interviews with market actors from the Garment sector in Jordan, 2023.

3.7.2 Performance

3.7.2.1 Mapping, Channels and Products

- The current end markets for low-valued recycled materials in the textile industry are primarily domestic, with some exports to Saudi Arabia and Palestine. The main products traded are grinded fabrics/textiles through the mechanical processing with a limited value addition (i.e., no fleece or felt production from textile waste yet in Jordan). The key buyers include manufacturing companies in Saudi Arabia who use the recycled materials in their production processes as a filling material for low-cost furniture industry.
- The current textile waste value chain is small, limited and not well-structured yet. There is a very limited number of actors in this value chain. In terms of volumes, there are approximately 2,220 to 2,960 tons of recycled textiles annually, with higher volumes in the winter season and lower volumes in the summer. The prices for the recycled materials vary depending on factors such as color, polyester content, and season. Colorless white fabrics and fabrics with a high percentage of cotton or wool are purchased for about 2 to 10 JOD per ton, while colorful textiles with high polyester content are bought free of charge.
- The market for recycled materials in the textile industry has shown a slight growth over the past few years. The shrieked growth was attributed to several factors, including the increased number of licensed mechanical processors, becoming known in the domestic and external markets, and the growing awareness about textile recycling at the local ready-made garments industries. The local demand for recycled materials is driven to the recognition of the value in reusing textile waste and unfortunately it is disconnected from the growing global demand as Jordan does not adopt such environmental policies in this way. This growth can be also attributed to other factors, including increased production capacity and modernization of equipment as some local processors have obtained loans to finance the equipment upgrades which resulted in higher production capacity and improved product quality. The growth in the market can also be attributed to the cost-saving benefits offered by recycling, where RMG producers can reduce the cost of transporting waste textiles to landfills, making recycling an economically viable option.
- In terms of segmentation, this textile waste market is segmented based on the type and quality of the recycled materials not the source. For example, colorless white fabrics and fabrics with high cotton or wool content may be considered as a separate segment due to their specific characteristics and potential uses. Similarly, colorful textiles with high polyester content can be viewed as a distinct market segment. By catering to different market segments, the processors can target specific buyers with varying requirements and preferences.
- Competition in the Jordanian market for textile recycling is relatively limited, with only a few numbers of collection companies involved in this business. The main competitors include 2-3 main mechanical processors, and some small informal workshops specializing in recycling colorless textile waste and cotton. Additionally, Egyptian textile grinding and sintering plants pose a strong competition in the Saudi market.
- In terms of end-products the international competition is dominated by the presence of Egyptian and Turkish competitors who offer lower prices compared to Jordanian processors. The lower prices can be attributed to lower operational costs in these countries, as well as the financial aid provided by their governments to encourage exports.
- To stay competitive, the processors on factors such as maintaining good production capacity and establishing relationships with suppliers and buyers. Price, quality, volume, and relationships are important factors in competing effectively in the market. Sometimes, processors also engage in cooperation with each other to meet large orders or source quality materials.
- Compared to regional and international competitors, Jordan's textile recycling industry faces significant challenges in terms of scale and infrastructure. Therefore, this value chain needs

further development to enable the processors to establish a strong position in the market and potentially expand the business further.

- Overall, the market for textile waste is growing, driven by environmental concerns, and increasing awareness of the benefits of recycling. By adapting to market trends, identifying distinct market segments, and competing effectively, the textile recycling value chain has opportunities to further grow its business and contribute to the sustainable development of the textile industry.

3.7.2.2 Functions and Actors

- Given the textile waste has a special case that it is generated only from the RMG industries spread over the Jordan's Qualified Industrial Zones (QIZs), and it separately managed from municipal stream through private collection contracts which ends up in landfills/dumpsites.
- The main functions and actors of the current textile waste value chain are as follows:

Collection and sorting: The process begins with the collection of textile waste and fabric scraps from various ready-made garment factories (input supply) that are mainly located in the QIZ regions, particularly Al-Hassan Industrial City. These industries hire a private contractor to intensively collect and transport this waste due to the lack of a large storage space, and here ends their responsibility by directing the contractor to safely dispose of it in the landfill. In fact, many of these contractors sell the valuable part of it to local processors to reduce the cost of landfill fees, which play a fundamental role in the value of the service contract. Also, some local processors make an agreement with the waste contractor to supply specific textile batches or types for a financial return. The research indicated that there are 4-5 private contractors specialized in textile collection, where some of them owned a private yard for temporary storage.

Aggregating and Processing: This function is the core of the current market. Once textile waste is received, further sorting/grading is conducted where different types of fabrics are separated based on their color, fabric type, and quality. After sorting, the material is stockpiled into large volumes to improve efficiency and cost-effectiveness. They provided mechanical processing including shredding and grinding into two stages to produce low-quality grinded fabrics/textiles products to be used as a filling material. The research indicated that there are 2-3 textile waste aggregators and processors they conduct pre- processing including further sorting, grading, grinding, baling, and exporting.

3.7.2.3 Prices and Markets

- The textile waste market refers to the market for the collection, aggregation, processing of the textile waste is generated form the RMG industries in Jordan. Grinded fabrics/textiles are produced from a limited value addition (i.e., mechanical processing) to be used as filling material in furniture industries and felt manufacturers. This textile waste value chain is mainly export-oriented for Saudi Arabia and Palestine markets. In addition to exports, the market has a local channel for selling these recycled fabrics/textiles for small local felt and furniture manufactures.
- The market size is small and limited in scope with a weak structure in terms of horizontal and vertical dimensions. There are 2-3 textile processing facilities in Jordan who exports yearly approximately 2,220 to 2,960 tons of grinded fabrics/textiles. The price of the grinded fabrics/textiles varies depending on the season and market conditions. For exports to Saudi Arabia, the market price for this low added value product is around 110 JOD per ton, while local sales are priced at approximately 70 JOD per ton.

3.7.2.4 Supporting Services and Interconnected Markets

The current textile waste market presents a very limited scope for the supporting functions particularly in infrastructure, finance, standards, tariff policy, advocacy, and rules/regulations.

Transport Services: The transport cost is one of the main barriers to expand the value chain and increase the value addition in Jordan as textile waste is lightweight, diverse shape, and bulky. Indeed, most of the textile waste volumes are being generated in the extreme north of Jordan while the existing processors placed in Amman, Madaba and Karak. This long distance undermines the feasibility and viability of the existing projects with low added value processing.

Cooperation and Advocacy: No sector representation is reported with weak vertical and horizontal structures against a well-established and financially stable RMG industry that controls textile waste generation. There is no evidence that firms cooperate to overcome operational or strategic challenges such as policy advocacy towards the government.

Standards and Certifications: Textile recycling is sensitive to quality and standards. However, there is no formal relationship between the RMG industries and the local textile processors to exchange information in advance about the textile types, codes, grades, color. This would help the small processing facilities in the market to increase the efficiency of utilizing the textile waste and upgrade equipment and machinery to handle this variety.

Financial services: Most of the current actors are not financially stable and they are reliant on their self-financing and have limited access to formal financial sources due to a lack of valid registration documents and licensing records as well as the required collateral. Very weak investment in this sector is reported and it requires advanced technologies and equipment.

Business Advisory Services: The current textile collection and processing companies show significant deficiencies in managing their businesses and there is no evidence that firms outsource any specialist business service functions and most times these are performed internally by the firm, often by managers.

Occupational Health and Safety: Despite the national laws and regulations related to occupational safety and health, most workers in the recycling sector do not adhere strictly to public safety requirements and PPEs during the work despite their awareness of potential risks and their knowledge of cases of injuries that may have already occurred in the past. In addition, most of the existing facilities and buildings in the recycling sector lack the minimum standards of health and safety, as local investors do not consider the need to invest in a healthy, safe, and secure infrastructure in buildings and work sites, because do not recognize the positive impression and long-term returns on his business.

R&D/Technology: Most of the actors interviewed in these value chains still used old-fashioned technologies and depreciated equipment to recycle textile waste, and all are mechanical processors. They are not motivated to upgrade their capacity due to low competitiveness and the inconsistent supply of the materials over the year is challenging their investment planning.

3.7.2.5 Governing Policies, Laws, Regulations and Norms

- Apart of insufficient collection capacities, Jordan does not have yet specific rules and regulations that specifically govern textile waste or even clear guidelines on how to properly handle this special kind of waste from the source. Also, the enforcement, monitoring and evaluation is not a priority for authorities on proper handling and treatment of this type of waste. The existing market have a weak advocacy capacity regarding the circularity targets by the international textile and apparel brands, which could be an incentive for Jordan's RMG industries to adopt source segregation programs within their facilities or subsidies the transport of their waste to centralized collection hubs. Economic incentives and policy instruments needed to improve textile waste management in Jordan are still missing even the Waste Framework Law is enacted and enforced since few years ago.

3.7.2.6 Business Models at Enterprise Level

Participation of Women and Marginalized Groups: The research indicates no people from marginalized groups involved in this value chain. However, there is a very limited number of informal businesses that collect and handle textile waste to produce a filling material for the local furniture manufacturers.

Business Organization and Performance: The research indicates that current actors have significant deficiencies in their business organization and do not comply with legal requirements as they should be.

3.7.2.7 Growth Opportunities and Constraints

The findings of this research shows that textile waste recycling in Jordan is still very limited and constrained but have potential opportunities to increase volume diverted from the landfill. The main barriers and constraints that hinder the performance of private actors in this sector are as follows:

- Lack of a specific legal instruction by which the textile waste is managed from the source, collection, transport, treatment, and the production of new valued products. The recent Waste Framework Law (No. 16/2020) and circularity targets set by the international brands support sustainable waste management concepts and practices, but nothing has been done yet on this type of waste.
- Lack of interest for Jordan's RMG industries to adopt recycling programs for their waste within their facilities or subsidies the transport of their waste to centralized collection hubs.
- High operating costs for textile waste processing and recycling including transport and electricity. Therefore, tariff policy is highly needed to sustain this kind of industry against the strong competition and small-sized markets.
- Weak business capacities and organizations which lead to limiting performance and competition.
- Lack of advanced technologies and equipment for mechanical recycling especially that the processors have no financial capacity to invest and increase their capacities.
- Like organic and food waste and used cooking oil, lack of incentives to invest in the fields of textile waste management. for example, lack of land availability for centralized collection hubs or facilities is a barrier for the private investors.
- Lack of reliable and accurate data and information about textile waste generation rate, volume, distribution per area, sufficient and full statistics on used cooking oil.
- To address the above valid constraints, the Activity shall focus to design its interventions in the upcoming years on the following areas:
    - Provide firm-level technical assistance for the service providers to improve performance and capacity to handle more textile waste in viable and sustainable way.
    - Improve horizontal and vertical relationships across the value chain and particularly with the owners of the RMG industries.
    - Follow-up with the RMG industries on the progress to fulfill circularity targets set by their clients (big international brands) for contributing to international demand for recycled fibers.
    - Support the development of specific policies/instructions related to textile waste management.

3.8 E-waste Value Chain

3.8.1 Overview

- The term "E-waste" is an abbreviation of "electronic and electrical waste" and refers to any electronic devices that have reached the end of life. E-waste covers a huge range of products, with the most common categories by weight being such as but not limited to large household appliances, small household appliances, IT and telecommunications equipment, consumer equipment, lighting equipment, electrical and electronic tools, toys, leisure and sports equipment, medical devices, monitoring and control instruments, automatic dispensers, batteries, refrigerators, freezers, air conditioners, etc.…
- Improperly managed e-waste, including that which is sent to landfills/dumpsites can release toxic chemicals into the soil, air, and water resources. These toxic materials, and in particular heavy metals such as mercury and cadmium, can cause damage to ecosystems, build up in food chains, and have direct and immediate effects on human health. The management of e-waste has currently become an emerging issue worldwide especially in recent years due to its hazardous contents.
- On the flip side, recycling E-waste allows for the recovery of materials and precious metals such as gold, copper, glass, aluminum, lithium, plastic, and more. These materials are returned to the supply chain to produce new products, reduce the environmental impact, minimize hazardous materials in the environment, and generally increase the sustainability of the production of new electronics. Further still, even individual electronic products are often made of mixed materials such as plastic, metal, and glass. This poses a problem for recyclers, as separating these materials is difficult, costly, and time-consuming, especially compared to single-material products like cans and glass bottles.
- In 2019, approximately 53.6 million tons of E-waste was generated globally - an average of 7.3 kg per capita. It is estimated that the amount of E-waste generated will exceed 74 million tons in 2030, meaning that the global quantity of E-waste is increasing by almost 2 million tons per year[41].
- Since electronic products often contain harmful components, proper disposal of e-waste is imperative. Besides the environmental reasons, there are also economic incentives for proper disposal of E-waste. Electronics often contain valuable resources, such as gold, silver, platinum, iron, copper, and plastic. The E-waste recycling processes include collection, storage, sorting, dismantling, shredding, recovery, mechanical separation, and trading of recovered precious metals to producers of new electronics.
- In 2021, the government has enacted a legal instruction that sets out the procedures for the management of e-waste to achieve their safe and sound management with reduced or minimal environmental and health implications. The main provisions of the instructions prohibit the import of e-waste, and its export should be under specific licensing conditions and with the authorization of the MoENV. E-waste generators must separate e-waste from other types of waste and shall make an agreement with a licensed recycling facility for dismantling and recycling such end-of-life equipment. Each licensed facility also must provide a list of the electrical and electronic equipment that is dealt with annually to the MoENV.
- The Jordan Standards and Metrology Organization tests and monitors new and used E-waste entering the country to ensure that it complies with health and safety standards and falls within the relevant national specifications. The Jordanian Ministry of Industry, Trade and Supply has instructions for importing electronic and electrical devices, provided that the device is no more than three years old.

[41] https://unu.edu/press-release/global-e-waste-surging-21-5-years

- Although there is no accurate official data, market estimates indicate that Jordan produces yearly about 120 thousand pieces of electrical and electronic equipment and imports another 100 thousand tons of electrical and electronic equipment. Unofficial estimates indicated that the E-waste generation in Jordan ranges between 5.5 and 6.5 kg/capita/day. It is also estimated that E-waste is available for disposal is about 40-60 thousand tons per year[42].

3.8.2 Performance

3.8.2.1 Mapping, Channels and Products

- E-waste is one of the rapidly growing waste sectors in the recycling industry and its market is driven by population growth, industrialization and urbanization, the increasing demand for electronic equipment, its valuable resources, and its hazardous nature.
- In such a fast-evolving technology landscape globally, this is not a particular surprise that E-waste is the fastest-growing waste stream worldwide, with estimates of 4% growth per year43. These global technological developments have also contributed to the amount of e-waste becoming a growing part of the waste stream in Jordan. However, there are no reliable and accurate estimates either about e-waste generation in Jordan or ending up in non-hazardous landfills.
- Despite the economic value, Jordan has small and growing value chain for the E-waste which is export- oriented as there is no advanced processing or manufacturing capacities for higher value addition as these processes typically require high-end technologies, infrastructure, and large-scaled markets. The current E-waste value chain in Jordan undergoes only limited value addition such as collection, storage, sorting, dismantling, and exporting.
- There are 6-8 local firms licensed by the MoENV to collect, store, and dismantle E-waste mainly computers, home appliances, batteries, mobile phones, flat screens, and others. These collection and processing companies operate through agreements with the main E-waste generators such as but not limited to telecom, electricity, computer retailers, cellular stores, etc.… and provide safe disposal of electronic waste in their facilities. Plastic and metal waste are locally recovered while precious resources such as gold, silver nickel, and palladium as well as the used batteries are exported to global markets, such as Germany, Europe, Korea, China, and India.
- In terms of segmentation, this E-waste market is segmented based on the source and type of recycled material. For example, circuit boards/rams of computers, phones and screens devices may be considered as a separate segment due to content and dismantling requirements. Similarly, batteries can be viewed as a distinct market segment. Other household appliances and tools have a separate segment as well. By catering to different market segments, the processors can target specific buyers with varying requirements and preferences. It worth mentioning that the small electrical appliances such as bulbs and bulky equipment like medical, refrigerators, freezers, etc. are the least preferences in the value chain, and most of these low-value hazardous materials destructed in a hazardous landfill managed by the MoENV.
- The licensed collection and processing companies have different business models in the collection and disposal services. Some of them do not buy the material from the generator and just offer free door-to-door collection and a certificate for safe disposal. This category is not buyers or traders and usually own their dismantling workshop and the collection truck. Other types of market actors are buyers or traders. They buy material from the generator but without any certificates or records, mainly for the most valuable items such as circuit boards of computers and screens devices. Those buyers or traders usually do not offer destruction services for the generators who have cheap E-waste items such as electrical equipment or old and abandoned household items. The third category includes the large scrap dealers and export-oriented brokers who are reliant on formal tenders and auctions and more interested in large

[42] Interviews with market actors from the E-waste recycling sector.
[43] Global E-Waste - Statistics & Facts | Statista

volumes. They usually offer their services to the large E-waste generators from the commercial and industrial sectors. For the destruction services, they usually outsource this service through one of the licensed collection and processing companies (the recyclers). On the other hand, there are hundreds of informal waste pickers involved in collecting E-waste from the unsegregated waste stream and selling it to medium and bid scrap dealers. Some of these yards employed informal sorters and diameters for a part-time job for further processing, which usually happened under bad working and poor safety conditions.

- According to the market estimates, 1500-2000 tons of E-waste and about 500 tons of used batteries traded per month excluding the volumes that the MoENV officially destroyed in "Swaqa" hazardous waste treatment facility. The recovered quantities of E-waste in the value chain are relatively low compared with the market capacity, and this is attributed to lack of source segregation, weak door-to-door collection capacities, low prices comparing with its lightweight, low levels of awareness for the generator about E-waste valorization, and strong competition between the licensed collection and dismantling companies and the formal and informal scrap dealers and export-oriented brokers. The licensed collection and dismantling companies are also competing with a handful of informal businesses that collect and dismantle E-waste without any legal licensing and usually practice it far away in remote areas. These improper practices caused several environmental and health concerns.
- Like other secondary waste sectors, the current E-waste market is considered small in terms of volume and value, and it is driven by global prices and demand.

3.8.2.2 Functions and Actors

- The main functions and actors across the E-waste value chain in Jordan are as follows:

  Collection and sorting: this function includes several models for collecting E-waste from the generators whether free collection/destruction service, buy and sell product, and through formal tenders, auctions, and other business deals. According to the legal instruction, the licensed collection and processing companies have the right to handle hazardous waste like E-waste. However, the reality on the ground is totally different where hundreds of informal waste pickers, itinerant buyers, and scarp yards are dealing with this type of waste as a valuable item without considering potential hazards on environment and public health that are associated with improper handling and processing. The research indicated that there are 6-8 collection and dismantling companies licensed for the E-waste collection and 20-30 scrap dealers, 5-10 export-oriented brokers, and 150-250 informal waste pickers.

  Aggregation and dismantling: this function involves further sorting/grading, dismantling and storage of the recycled metals for export purposes while plastic and steel materials are locally recovered. The licensed collection and dismantling companies usually own their processing facility and a warehouse for storage, and most of visited facilities are equipped with the minimum requirements for health and safety. However, informal scrap yards are competing with these licensed companies and do not comply with health and safety requirements. The research showed that there are 6-8 collection and dismantling companies licensed for the E-waste aggregation and dismantling, 5-10 export-oriented brokers, and 30-50 informal scrap dealers.

  Distribution and export: The distribution function involves delivering the dismantled e-waste to global buyers or customers.

3.8.2.3 Prices and Markets

- The E-waste waste market refers to the market for the collection, aggregation and processing of E-waste is generated form commercial waste generators and households in Jordan. The recovered recyclable material and precious metals are produced from a limited value addition

including collection, sorting/grading, dismantling, and aggregation to be exported to global industries for greater value addition such as shredding, recovery, mechanical separation, etc.…. This current E-waste value chain is mainly export-oriented for global buyers in Germany, Europe, Korea, China, and India. In addition to exports, the market has a local channel for recovering plastics and metals resulting from local E-waste processing.

- The current E-waste market size is relatively small and limited in scope with a weak horizontal relationship and low legal enforcement on the informal dismantlers.
- There are 6-8 licensed collection and dismantling companies licensed for the E-waste collection and 20-30 scrap dealers, 5-10 export-oriented brokers, and 150-250 informal waste pickers.
- The price of the grinded fabrics/textiles varies depending on the type and quantity. The selling price range between 22 -27 JOD per Kg for computer circuit boards/rams, 20 – 25 JOD per kg for phone cellular boards, 16 – 20 JOD per kg for the screen boards. The selling prices of the used liquid batteries is 540 JOD per ton. Processing costs, including sorting/grading, dismantling, and storing, are typically between 5 – 10 JOD per kg. Global buyers usually buy the pre-processed precious metals based on global commodity prices while exporting price of the lead extracted from the used liquid batteries is around 2000 USD/ton. Due to market limitation and segmentation, the prevailing prices are relatively low, and processors/exporters followed the strategy to accumulate until global prices rise. As a result, price exploitations, sudden fluctuations, and high price volatility are reported across the value chain.

3.8.2.4 Supporting Services and Interconnected Markets

The current E-waste waste market presents a very limited scope for the supporting functions and interconnected markets as follows:

Business Advisory Services: The existing collection and dismantling companies show significant deficiencies in managing their businesses, testing new business models, improving their value proposition. There is no evidence that firms outsource any specialist business service functions and most times these are performed internally by the firm, often by managers.

Standards and Certifications: There are no need to get certificates and standards to practice this kind of business. Since licensed collection and dismantling companies export to global markets, they must follow strict rules and standards, and detailed product requirements. Furthermore, they should adhere to relevant legal instructions and the Basel Convention and international agreements. The exports should be licensed by the MoENV.

Transport Services: The transport cost is one of the main barriers to expand the value chain and increase the value addition in Jordan as E-waste is relatively lightweight and diverse shape.

Cooperation and Advocacy: No sector representation is reported with weak horizontal structures, the licensed companies are suffering from unfair competition with scrap yard dealers, export-oriented brokers, and informal dismantlers. Weak law enforcement, especially in the informal sector, is reported.

Financial Services: Most of the current actors are not financially stable and they are reliant on their self-financing with limited access to formal financial sources due to the high commercial interest rates. They have weak investment capacity, and they require advanced processing equipment and technologies to increase the value.

Occupational Health and Safety: Despite the national laws and regulations related to occupational safety and health, most workers in the recycling sector do not adhere strictly to public safety requirements and use of PPEs during the work despite their awareness of potential risks and their knowledge of cases of injuries that may have already occurred in the past. In addition, most of the

existing facilities and buildings in the recycling sector lack the minimum standards of health and safety, as local investors do not consider the need to invest in a healthy, safe, and secure infrastructure in buildings and work sites, because do not recognize the positive impression and long-term returns on his business.

3.8.2.5 Governing Policies, Laws, Regulations and Norms

- Considering the hazardous nature of the E-waste, Jordan has enacted a specific legal instruction by which E-waste is managed. Unfortunately, the adopted mechanisms and tools for the legal enforcement, monitoring and evaluation does not achieve full compliance with legal requirements and the unfair competition that face the licensed collection and dismantling companies reduced the viability and feasibility of this business, especially that they comply with their legal and regulatory obligations. Economic incentives and policy instruments needed to improve E-waste waste management in Jordan are still missing even the Waste Framework Law is enacted and enforced since few years ago.

3.8.2.6 Business Models at Enterprise Level

Participation of Women and Marginalized Groups: The research indicates moderate numbers of people from marginalized groups mainly informal waste pickers and itinerant buyers in this value chain in comparison with other waste sectors. They are mainly involved in the collection and sorting of E-waste.

Business Organization and Performance: The research indicates that current actors have significant deficiencies in their business organization and do not comply with legal requirements as they should be. Maybe, the unfair competition with the informal sector is contributing to the present situation.

3.8.2.7 Growth Opportunities and Constraints

The findings of this research shows that E-waste recycling in Jordan is still small but have potential opportunities to increase volumes and values. The main barriers and constraints that hinder the performance of private actors in this sector are as follows:

- Weak enforcement of the E-waste legal instructions (2021) by which the E-waste is managed from the source, collection, transport, treatment, and the production of new valued products. The recent Waste Framework Law (No. 16/2020) encourage large waste generators to handle their E-waste through the licensed collection and dismantling companies from "waste to value" perspective, do not go with official final disposal, for the common types and large volumes.
- Unfair competition with unlicensed businesses and informal sector.
- Lack of reliable and accurate data and information about E-waste generation rate, volume, distribution per area, sufficient and full statistics on E-waste.
- Like organic and food waste, used cooking oil, textile waste, lack of incentives to invest in the fields of E-waste management. for example, lack of land availability for centralized collection hubs or facilities is a barrier for the private investors.
- Lack of training and capacity building for the staff working in E-waste regarding the potential hazards and impacts on environment, health, and safety.
- Weak business capacities and organizations which lead to limiting performance and competition.
- Lack of advanced technologies and equipment for further processing especially that the processors have no financial capacity to invest and increase their capacities.

To address the above valid constraints, the Activity shall focus to design its interventions in the upcoming years on the following areas:

- Provide firm-level technical assistance for the service providers to improve performance and capacity to handle more E-waste waste.
- Facilitate access to finance for the aggregators and processors/exporters, to upgrade their capacity in terms of equipment, and infrastructure.
- Specific trainings on occupational health and safety as well as the potential risk concerns with E-waste
- Improve horizontal relationships across the value chain and support sector representation.

3.9 Old Tires and Rubber Waste Value Chain

3.9.1 Overview

- Around the globe, more than 300 million new tires are produced every year[44], and after being used for automobile industry and transportation sector have become a major global waste and environmental problem. Collectively, around 1.5 billion tires reach the end of their useful lives every year45. They can be retread and reused up to a point, but not endlessly. The process for flexible rubber tire recycling seems to be more sophisticated other than waste types because of their complex mix of materials. Generally, tires are composed of 14% natural rubber; 27% synthetic rubber produced from unsaturated hydrocarbons; 16% of fabrics and fillers; 14% of carbon steel wires for reinforcement; and 28% of carbon steel black46.
- The disposal of waste tires has become a global major environmental concern. The average lifespan of a tire is between 3 to 6 years47. After this period, the end-of-life tires are either disposed of in a landfill, recycled, or retreaded. However, the improper disposal of tires poses a significant environmental issue because they are not biodegradable and can last for several decades if no proper handling is carried out.
- Globally, it is estimated that 15 million tons of tires are scrapped annually48, 40% of which come from emerging markets such as China, India, South America, Southeast Asia, South Africa, and Eastern Europe. There are several methods in which tires can be reused or recycled but there are important differences in laws/regulations worldwide aimed at encouraging or discouraging different methods.
- The two main recycling routes are material recovery and energy recovery, and their applications vary from country to country. The processes of material recovery technologies include sorting/screening, retreading, shredding, metal separation, granulation, and pulverization. Material recovery applications are widely used in Europe compared to energy recovery. The outputs of material recovery could be retreading tires, shredded rubber, carbon steel wires, rubber granules and rubber powder. All these recycled materials are traded as raw materials for secondary industries and applications. The energy recovery applications include thermal treatments such as incineration, co-combustion with coal, co-combustion in cement kilns or in thermal power plants for the old scrap tires that have high energy contents, while Pyrolysis and gasification are pursued as emerging technologies to convert old scrap tires in valuable products and alternative energy sources.
- Although there is no accurate official data, market estimates indicate that Jordan imports yearly more than 20 million JOD of new fixable rubber tires for the domestic consumption, mainly for automobile and transportation sectors. The import of used furnished tires and flexible rubber waste are restricted and limited to existing used tire dressing plants (the local retread industry) registered with the Ministry of Industry and Trade, while the imports of the old scrap tires waste

[44] https://www.linkedin.com/pulse/complete-guide-waste-rubber-tire-recycling-labhgroupindia
[45] https://www.linkedin.com/pulse/complete-guide-waste-rubber-tire-recycling-labhgroupindia
[46] Recycling | Free Full-Text | Rudimentary Assessment of Waste-to-Wealth of Used Tires Crumbs in Thermal Energy Storage (mdpi.com)
[47] https://www.way.com/blog/how-many-years-do-tires-last/#:~:text=Before%20we%20dive%20into%20the,in%20which%20they%20are%20used.
[48] Recycling | Free Full-Text | Rudimentary Assessment of Waste-to-Wealth of Used Tires Crumbs in Thermal Energy Storage (mdpi.com)

are prohibited by The Jordan Standards and Metrology Organization has panned since many years ago.

- In Jordan, that the old scrap tires waste generation in Jordan ranges between 3 and 4 million pieces every year, where significant volumes of these waste especially the small used tires are not suitable for used tire retreading applications and thus end up in landfills/dumpsites or even throwing away in a remote area. Big or duty used tires and rubber scraps that have higher content of resources are the most waste channeled for both materials, retreading and energy recovery applications in Jordan.
- The energy valorization of old scrap tires is growing in Jordan since the last decade due to the strategic direction that Jordan envisioned for developing the renewable and alternative energy sector. Currently Jordan has 4-5 private licensed facilities that produce industrial fuel and biodiesel products primarily from old scrap tires and rubber waste through pyrolysis applications. Due to its heat caloric value, the main buyers of these alternative fuels are domestic cement kilns and other industries that have thermal applications.
- In 2016, Jordan enacted a specific legal instruction that regulates the business activities related to the production of industrial fuels from waste. The provision of this legal instruction indicated that each single activity in the industrial fuel business such as produce, storage, import, distribution, and export is for bidden without procuring the license issued by the Ministry of Energy authorizing him to practice any of these activities and under penalty of liability. No details are stated in this instruction about the requirements and characteristics of old scrap tires and rubber waste, which are a primary feedstock of this industry.

3.9.2 Performance

3.9.2.1 Mapping, Channels and Products

- Old scrap tires and rubber waste is yearly increasing in Jordan and mainly driven by automobile and transportation sectors. However, there are no reliable and accurate estimates either about old scrap tires and rubber waste generation in Jordan or ending up in non-hazardous landfills.
- The energy valorization of old scrap tires is growing in Jordan especially in recent years and much more than rubber recovery applications. The current market is domestically oriented and segmented based on types of input and finished products (i.e., industrial fuel), but not the source. The infrastructure of the current value chain is more developed in the downstream (industries) than the upstream (collectors). However, the current old scrap tires and rubber waste is stressed in terms of supply and there are no advanced processing or capacities for a higher value addition except energy recovery and used tire dressing or retread industry.
- The main segments of the current market are as follows:

The used tire dressing or retread industry: This industry is relatively small and driven by the market prices of the new tires and technological development. It focuses specifically on the big tires of trucks, buses and heavy vehicles or machinery whose tires are very expensive. Currently, there are 10 -12 retread manufacturers in the market and most of them are reliant on importing big used tires which have very good operation conditions.

Material recovery applications: There are 3-5 local manufacturers specialized in the material recovery of the old scrap tires and rubber waste and mostly of them work seasonally due to supply limitation and strong competition on the big old scrap tires with the recovery facilities that produce industrial fuel. Indeed, this segment is shrinking because the low domestic demand on recycled rubber sheets/strips products accompanied with low competitiveness of the Jordanian products in the neighboring countries. The MoENV did not allow them to import recycled rubber granules or powders that could help in increasing their products' competitiveness.

Energy recovery applications: This industry is rapidly growing in Jordan due to increasingly demand on the energy products such as industrial fuel and biodiesel. It is considered as the main consumer of the old scrap tires and rubber items especially that have higher heat contents. There are 4-5 private licensed facilities in the downstream of this value chain (~30-40 tons input/day for each) and they influence the supply chain through offering higher prices than other market segments. The main products are 35% industrial fuel/biodiesel, 35% black carbon, 15% steel wires, and 15% material loss. Most of these products have domestic buyers (mainly cement and thermal industries). Most collectors, whether they are formal or informal, sell their waste to these recovery facilities based on wight and regardless of its quality and status while the other segments have such requirements that affect the selling price.

- *Upcycling and reuse:* there business is very small in terms of market share as there are few numbers of formal and informal actors (small upcycling workshops or handcrafts) collect old scrap tires for upcycling and reuse purposes. Minor shredding equipment is essential in this business. For example, fabricating chairs and tables from the old tires and extracting rubber belts/strips are the common practices in this field.
- According to the market estimates, the energy recovery facilities treated around 40,000 tons per year, and the material recovery facilities treat about 4,000 tons per year, while the local used tire dressing or retread industry treat around 10,000 tons per year, most of it is imported. The upcycling and reuse amounts are very tiny and seasonal. These figures indicated that the supply chain of this sector is weakly structured, and sensitive to price and transport cost.
- Like other secondary waste sectors, the current old scrap tires and rubber waste market is small and limited in terms of volume and value, but it also has a high potential growth in terms of value additions.

3.9.2.2 Functions and Actors

- The main functions and actors across the old scrap tires and rubber waste value chain in Jordan are as follows:

Collection and sorting: This function is the most limiting factor in this market because all aggregators and processors have no fleet or trucks for collection and rely on formal and informal collectors to feed their daily inputs. Due to the characteristics of the old scrap tires as a bulky special waste, the informal itinerant buyers who have trucks or pickups are dominating informal collection from small automobile service and maintenance shops across cities and municipalities, while the medium and large scrap dealers and brokers buy from the commercial and industrial sectors through tenders, auctions, and business deals. They usually use their own collection trucks and instantly transfer them to the processors to avoid potential hazards of accumulating old tires in large volumes. There are 100 -200 itinerant buyers specialized in collecting and trading old tires and rubber waste while a limited number of informal street waste pickers are involved in this value chain. However, some of those informal collectors burn old tires and rubber waste outside the city in open and remote areas and extract the carbon steel wires. This improper practice causes considerable environmental concerns.

Aggregation: This function is not so strong or fundamental like other waste sectors due to the potential hazards of accumulating old tires in large volumes. Therefore, aggregation in this value chain is smaller than expected and most of the quantities directly delivered to the processors. There are also 30 -50 medium and large scrap dealers, and 10-15 scrap brokers provide collection and sorting services in this value chain.

Processors: According to market segmentation, the processors mainly consist of the following categories: 10-12 used tire dressing or retread industry (depends on imports), 3-5 material recovery facilities, and 4-5 energy recovery facilities as well as 3-4 upcycling workshops or handcrafts. Those processors buy the waste daily from the collectors and sorters and seasonally from large

aggregators. Due to the strong competition, they also formulated formal relationships with the main sources of the old tires and rubber waste and participated in the relevant tenders and auctions. The main energy recovery facilities have a permanent stockpile of around 2000-3000 tons of waste to ensure consistency of the production process. The material recovery facilities face a supply challenge as their products have lower demand compared to fuel and cannot offer a higher price to attract informal sector to collect. They reduced their scale and adopted seasonal operation plans until they aggregated reasonable quantities. No imports allowed for old tires waste at the present time.

Distribution and Marketing: The recycled products are distributed to the domestic market due to strong regional competition and the special licenses from the MoENV for export.

3.9.2.3 Prices and Markets

- The old scrap tires and rubber waste market refers to the market for the collection, aggregation and processing of old scrap tires and rubber waste is generated mainly form the local automobile and transportation sectors in Jordan. The recycled products in this market are produced through fully domestic value additions and divided into separate segments as follows: energy recovery applications (mainly pyrolysis), used tire dressing or retread industry, and material recovery applications.
- The old scrap tires and rubber waste market is domestic-oriented with few numbers of market actors and low-competitive products for the global markets. The entire market is stressed to limited quantities as it is fully reliant on informal collection, with weak horizontal relationships due to the very strong competition.
- The biggest market share is for the licensed energy recovery facilities that produce the industrial fuel. The selling prices of the old scrap tires and rubber waste depends on type, quality, and quantity. The material recovery applications (rubber recycling) offer a selling price of 20-30 JOD per ton while the energy recovery facilities offer a selling price of 35-45 JOD per ton as they are placed away from the cities on the international highway to Aqaba. For the big old scrap tires that have higher heat content, this price increases to 55 – 65 JOD per ton. The energy recovery facilities are expensive and have higher operating costs due to high potential hazards and risks. The average prices for the products are: Industrial fuel: 350 JD/ton, Black Carbon: 35-40 JD/ton, Steel: 70 JD/ton. Their products are subject to examination and the buyers examine the quality in accredited laboratories. For the material recovery, the finished products i.e., rubber sheets/strips are distributed to local retailers and reflected less than 5% net profits due to strong competition with same foreign recycled items.

3.9.2.4 Supporting Services and Interconnected Markets

The current old scrap tires and rubber waste market presents a very limited scope for the supporting functions and interconnected markets as follows:

Business Advisory Services: The material and energy recovery facilities show significant deficiencies in improving their supply chain management, testing new business models for more advanced value addition, upgrading their equipment and technologies their value proposition. There is no evidence that firms outsource any specialist business service functions and most times these are performed internally by the firm, often by managers.

Standards and certifications: The research indicated that material and energy recovery facilities are committed to standards and certification relevant to their products but not operations. There is no reports on their environmental compliance even though relevant authorities conduct frequent inspection visits and tests. Those processors are more concerned about the legal instructions that govern all the processes.

Transport Services: The transport cost is one of the main barriers to expanding this domestic value chain, especially that all material and energy recovery facilities are reliant on the informal sector as main suppliers.

Cooperation and Advocacy: No sector representation is reported with weak horizontal structures.

Financial Services: Most of the current actors are reliant on their self-financing with limited access to formal financial sources due to the high commercial interest rates. They have weak investment capacities, and they require advanced processing equipment and technologies to increase quality.

Occupational Health and Safety: Despite the national laws and regulations related to occupational safety and health, most workers in the recycling sector do not adhere strictly to public safety requirements and use of PPEs during the work despite their awareness of potential risks and their knowledge of cases of injuries that may have already occurred in the past. In addition, most of the existing facilities and buildings in the recycling sector lack the minimum standards of health and safety, as local investors do not consider the need to invest in a healthy, safe, and secure infrastructure in buildings and work sites, because do not recognize the positive impression and long-term returns on his business.

3.9.2.5 Governing Policies, Laws, Regulations and Norms

- Although this value chain contributes to the national targets related to diversifying of the renewable and alternative energy sources in the country, and there is a legal instruction enacted to govern this sector, the energy recovery facilities are suffering from the mechanisms and tools used to enforce these instructions and the market limitation. Government decisions related to export/import waste have a critical impact on their performance and growth.
- Economic incentives and policy instruments needed to improve old scrap tires and rubber waste management in Jordan are still missing even the Waste Framework Law is enacted and enforced since few years ago.

3.9.2.6 Business Models at Enterprise Level

Participation of Women and Marginalized Groups: The research indicates moderate numbers of people from marginalized groups mainly itinerant buyers in this value chain as they have trucks and can offer transport services. They are mainly involved in the collection and sorting of old scrap tires and rubber waste.

Business Organization and Performance: The research indicates that current actors have significant deficiencies in their business organization and do not comply with legal requirements as they should be. Maybe, the limitation in the market and strong competition with the informal collectors is contributing to the present situation.

3.9.2.7 Growth Opportunities and Constraints

Although old scrap tires and rubber waste are fully domestic due to government policies and strong global competition, the market has been increasingly growing since the last decade and contributes to the increasing energy demands by domestic industries. However, the market is still limited in terms of quantities and scope as well as it constrained to insufficient collection capacities and inconsistent supply of waste. The main barriers and constraints that hinder the performance of private actors in this sector are as follows:

- Limited collection capacities and reliance on the informal sector in terms of supply.
- Lack of advanced technologies and equipment especially that the processors have no financial capacity to invest and increase their capacities.

- Lack of economic incentives and policy instruments needed to improve the collection and recovery of the old scrap tires and rubber waste in Jordan.
- Like organic and food waste, used cooking oil, textile waste, and E-waste, lack of incentives to invest in the fields of old scrap tires and rubber waste. For example, lack of land availability for centralized collection hubs or facilities is a barrier for the private investors.
- Unfair competition with unlicensed businesses and informal sector.
- Lack of reliable and accurate data and information about old scrap tires and rubber waste generation rate, volume, distribution per area, sufficient and full statistics on old scrap tires and rubber waste.
- Lack of training and capacity building for the staff working in old scrap tires and rubber waste regarding the potential hazards and impacts on environment, health, and safety.
- Weak business capacities and organizations which lead to limiting performance and competition.

To address the above valid constraints, the Activity shall focus to design its interventions in the upcoming years on the following areas:

- Provide firm-level technical assistance for the service providers to improve performance and capacity to handle more old scrap tires and rubber waste.
- Facilitate access to finance for the aggregators and processors/exporters, to upgrade their capacity in terms of equipment, and infrastructure.
- Specific training on occupational health and safety as well as the potential risk concerns old scrap tires and rubber waste.
- Improve horizontal relationships across the value chain and support sector representation.

3.10 Wood/Furniture Value Chain

3.10.1 Overview

- Wood waste is a precious resource that is abundantly available and can be used for material recycling or energy production, depending on the quality grade. The term " wood waste" includes all woods and wood-based products that have come to the end of their product lifespan and therefore fall under the definition of waste. The largest wood producing countries are the United States, Canada, Russia, China, Brazil, Finland, etc.…
- Given Jordan is a semi desert country with very limited resources in terms of wood production, the municipal waste generation includes a minor percentage of wood waste, while larger amounts of wood scraps are being generated from other streams such as construction, demolition, agriculture, furniture, storage, and the wood processing manufacturers and handcrafts. The wood scraps include old and broken furniture, used wood pieces, pallets, cable rolls, used sawn wood sheets, MDF boards, veneer sheets: etc....
- There is a rudimentary and simple value chain for the wood scraps in Jordan. It is the smallest sector among the other wastes and its market is very limited in terms of value, volume, and scope. Even Jordan do not have any legal or regulatory frameworks related to wood waste management especially that key actors are limited to wood and construction sectors who usually deal with this kind of material such as wood processing industries, furniture traders, and individual carpentries. The generalist scrap yards do not deal with wood due to low demand but there are a few numbers of specialized scrap dealers who trade wood scraps, mainly pallets, boxes, sawdust, old and broken furniture and used wood pieces.

3.10.2 Performance

3.10.2.1 Mapping, Channels and Products

- Wood/Furniture scrap is the smallest waste value chain in Jordan and domestic oriented. The wood processing industries, furniture traders, and individual carpentry workshops are the stone corner. They realized the economic value of this waste and involved in multiple functions across the value chain due to the small market size. However, it has a high potential growth as the global prices of the global virgin wood are rapidly increasing especially in recent years.
- Wood/Furniture scrap waste is slightly increasing in Jordan per year, and this is mainly driven by raising demand for wood furniture, pallets, boxes, and the growing use of sawdust as a bedding material in the livestock sector. However, there are no reliable and accurate estimates either about Wood/Furniture scrap waste generation in Jordan or qualities that end up in landfills/dumpsites.
- The current end markets for the products sold by the wood processors include packaging factories, vegetable dealers, chicken farms, mechanical workshops, and the used furniture market. The wood recycling processors cater to these domestic buyers in Jordan by providing repaired wood pallets, vegetable boxes, recycled wood (mainly sawdust), and renovated furniture. These end users rely on recycled materials to fulfil their specific needs, such as packaging, poultry farming operations which use sawdust as a bedding material, and furniture trading. The usage and consumption of recycled materials are primarily focused on the domestic market, serving local industries and businesses within Jordan.
- The main recycled products in this value chain are sawdust, pallets, boxes, sawdust, old and broken furniture. Depending on the quantity and quality, the products' volumes, values, and prices may change. The current volumes are averaged at 50 to 80 tons per month of processed wood (sawdust), renovated furniture, and reclaimed fruits and vegetables boxes.
- The market for recycled wooden materials shows signs of both stagnation and gradual growth, influenced by multiple factors. This has resulted in limited demand, which can be attributed, based on a preliminary analysis, to the proximity of processors to key buyers. Processors located near central fruit and vegetable markets, for instance, tend to experience more favorable trading conditions compared to those situated farther away. Therefore, the current market conditions have led to revenue fluctuations monthly. The demand for recycled products is directly tied to buyers' immediate needs, with customers purchasing only what they require monthly, with a noticeable decrease in the winter.
- Within the end markets of packaging factories, vegetable dealers, poultry farms, and the used furniture market, there can be potential market segments based on the type and quality of the recycled materials. For example, wood pallets and vegetable boxes that can be repaired and reused might be considered a higher-quality segment compared to damaged pallets and bunks that are processed into sawdust, also the recycled wooden furniture segment may cater to buyers seeking refurbished products. Each segment may have distinct potential and cater to different customer needs, allowing for targeted marketing and pricing strategies.
- In terms of competition, the processors face competition from various players in the market. These competitors include wood pallet dealers, waste pickers, scrap yards, large-scale carpentry, unlicensed informal carpentry, and other companies involved in the recycling and supply of similar products. The key trends and drivers of competition in this market include price, quality, volume, and relationships with buyers. Competitiveness and productivity can vary based on the resources, experience, relationships with dealers, capital investment, and storage capacity of the competitors.
- As for the competitiveness of Jordan compared to regional and international competitors, it would depend on factors such as the efficiency of recycling operations, transportation costs, quality control measures, and the ability to meet buyer demands. Jordan's geographical location and market proximity may provide advantages in terms of transportation costs, but the overall

competitiveness would require continuous improvement and adaptation to changing market dynamics.

- There is no specific mention of women competitors in the value chain. However, success in this business would primarily depend on factors such as market knowledge, experience, resources, and the ability to meet customer demands. Therefore, women could certainly be competitors and successful in this business if they possess the necessary skills, resources, and characteristics.
- To compete effectively, the actors in the business adopt strategies such as pricing its products at minimum profit margins and cooperating with used furniture dealers, wood quarries, and waste collectors. These collaborations may involve activities such as bulking orders to meet larger demands or sourcing quality materials. It is acknowledged that by leveraging market relationships and strategic collaborations, business competitiveness will be maintained.

3.10.2.2 Functions and Actors

- The main functions within the Wood/Furniture scrap waste value chain in Jordan are as follows:

Input Supply: The first step in the value chain is sourcing the raw materials. For the recycled wooden materials, the input supply includes obtaining wood from various sources, such as waste collectors, bids and auctions, and warehouses of companies and factories. Vegetable boxes are sourced from vegetable and fruit shops, and used furniture is bought from citizens and used furniture stores.

Collection and sorting: Once the input supplies are collected from the source of generation, the materials need to be sorted and graded according to quality and suitability. This includes choosing wood pallets, vegetable boxes, furniture pieces, or other wooden items that can be repaired, repurposed, or recycled.

Aggregating: After sorting and grading, the wood pallets, used furniture, and vegetable boxes are aggregated to stockpile larger quantities for warehousing and distribution. Aggregating ensures efficient handling and logistics in the subsequent stages of the value chain.

Processing: After obtaining their input materials from various aggregators, the processors add value to the wooden materials by performing a variety of operations that depend on the type, quality, and condition of the initial input. These operations range from cleaning and repairing the wood pallets to preparing them for sale as-is or for sawing into sawdust. Also, old furniture and used fruit and vegetable boxes are recovered as part of the operations.

- Finally, the wood pallets and vegetable boxes scraps are sold to potential buyers, such as industries using the pallets for storage and transportation purposes, machinery workshops and livestock farms using the sawdust as a bedding material for their industry, and individuals for renovated furniture or businesses utilizing the vegetable boxes for packaging and transporting fruits and vegetables.
- These main functions add value to the products by ensuring the availability of quality materials, efficient handling and logistics, and timely delivery to meet customer needs.
- The main actors within the Wood/Furniture scrap waste value chain:

Specialized scrap dealers for wood Pallets: These actors are involved in the sourcing, sorting, aggregating, and distribution of wood pallet scraps. They may have relationships with waste collectors, bids and auctions, and warehouses to obtain raw materials. They play a significant role in this value chain by supplying wood pallets scraps to processors, industries, and other customers.

Vegetable Boxes Dealers: These actors are responsible for sourcing, sorting, aggregating, and distributing vegetable boxes. They have relationships with vegetable and fruit shops to obtain the boxes. Their role is crucial in providing packaging solutions to businesses in the agriculture and food industry.

Citizens: These are individuals who sell used furniture or wooden pieces directly to the wood repair and recycling business.

Used Furniture Stores: These stores act as intermediaries between individuals and the wood repair and recycling business by reselling used furniture.

Companies and Industries: These entities provide a source of wood pallets and other wooden materials for repair and recycling purposes.

Waste Collection and Transportation Service Providers: These service providers collect and transport waste materials, including wood, which can be acquired for the wood repair and recycling process.

- In the Wood/Furniture scrap waste value chain, distinct marketing channels may exist based on market segmentation, such as:

Retail Channel: This channel targets individual customers and small to medium businesses who require repaired or recycled wood products for personal use or small to medium-scale projects.

Wholesale Channel: This channel caters to larger businesses, such as furniture manufacturers or construction companies, who require bulk quantities of repaired or recycled wood products for commercial purposes.

The numbers and volumes within the wood repair and recycling value chain can vary depending on factors such as customer demand, availability of raw materials, specific region, and market dynamics. However, some approximate estimates are based on the provided information. The value chain may include a smaller number of actors compared to other value chains, including citizens and waste pickers selling wood materials, workers and processors involved in sorting and repair/recycling, retailers, wholesalers, and end consumers.

3.10.2.3 Prices and Markets

- The Wood/Furniture scrap waste market refers to the market for the collection, aggregation and processing of Wood/Furniture scrap waste is generated mainly form the construction, demolition, agriculture, furniture, storage, commercial and industrial sectors. The recycled products of this value chain are produced through fully domestic value additions and divided into main segments per type as follows: sawdust, pallets, boxes and used furniture and wooden pieces.
- The current market of Wood/Furniture scrap waste is very small and stressed to strong competition from other different sectors, with weak horizontal and vertical structures and relationships.
- The current market volumes are 50 to 80 tons per month of recycled wooden products, mainly sawdust, wood pallets, and wood boxes.
- The average price for sawdust depends on factors such as quantity, quality, and delivery location. As the provided information does not specify exact pricing details or changes, it is understood that the price is negotiated based on these factors. The average price for wooden furniture, after repair, is set at a profit rate of approximately 30%. On the other hand, wood that is chopped and recycled into sawdust is sold at a profit rate of 20%. The prices are determined by the processor, aiming to achieve the minimum profit margin, and sometimes selling at a loss to generate immediate cash flow.
- The selling price of the defected wood pallets ranges from 1 to 7 JOD per piece, influenced by factors such as validity, wood quality, and quantity, while the selling price of the vegetable boxes ranges from 0.005 to 0.30 JOD per piece. After processing, the price of the repaired wood pallets increases to 8 – 12 JOD per piece compared to the virgin wood pallet that price starts from 22 JOD. The celling price of the sawdust is 100 JOD per ton (as bulk) and 2 JOD per 10 kg (in bags). It's important to note that the market size and specific numbers may vary based on the

geographical location, market conditions, and the scale of the wood repair and recycling operations.

- The long experience, relationships with dealers, capital, size of storage are important factors to expand the growth in this small value chain.

3.10.2.4 Supporting Services and Interconnected Markets

The Wood/Furniture scrap waste has an undeveloped market compared to other waste sectors in Jordan and thus very limited supporting functions as follows:

Cooperation and Advocacy: No sector representation is reported with weak horizontal and vertical structures, and unfair competition with the informal sector.

Business Advisory Services: The existing actors show significant deficiencies in managing their businesses and improve value proposition.

Financial Services: Most of the current actors are reliant on their self-financing with no access to formal financial sources due to lack of records and collateral. They have weak investment capacities, and they require advanced processing equipment and technologies to increase quality.

Transport Services: In this value chain the processors rely on themselves to deliver input and outputs. Therefore, transport cost is one of the main barriers to expanding the value chain and increasing the value addition. Owning a collection tuck is essential to do this business.

Access to Information: Lack of information is reported among the functions of this value chain.

3.10.2.5 Governing Policies, Laws, Regulations and Norms

- Although Wood/Furniture scrap waste is a small value chain, the strong competition with players from other sectors as well as the informal sector also stressed the recovered volumes. The vertical and horizontal structure of the market is weak.

3.10.2.6 Business Models at Enterprise Level

Participation of Women and Marginalized Groups: Comparing with other waste sector, the market research indicates limited numbers of people from marginalized groups involved in this value chain. Around hundreds of itinerant buyers who have trucks are involved in collecting Wood/Furniture scrap waste and sell it to aggregators/processors. No women representation in this small value chain.

Business Organization and Performance: The research indicates that current actors have significant deficiencies in their business organization and do not fully comply with legal requirements as they should be. Maybe, the limitation in the market and strong competition with the informal collectors is contributing to the present situation.

3.10.2.7 Growth Opportunities and Constraints

Several barriers and constraints that hinder the performance of private actors in Wood/Furniture scrap waste as follows:

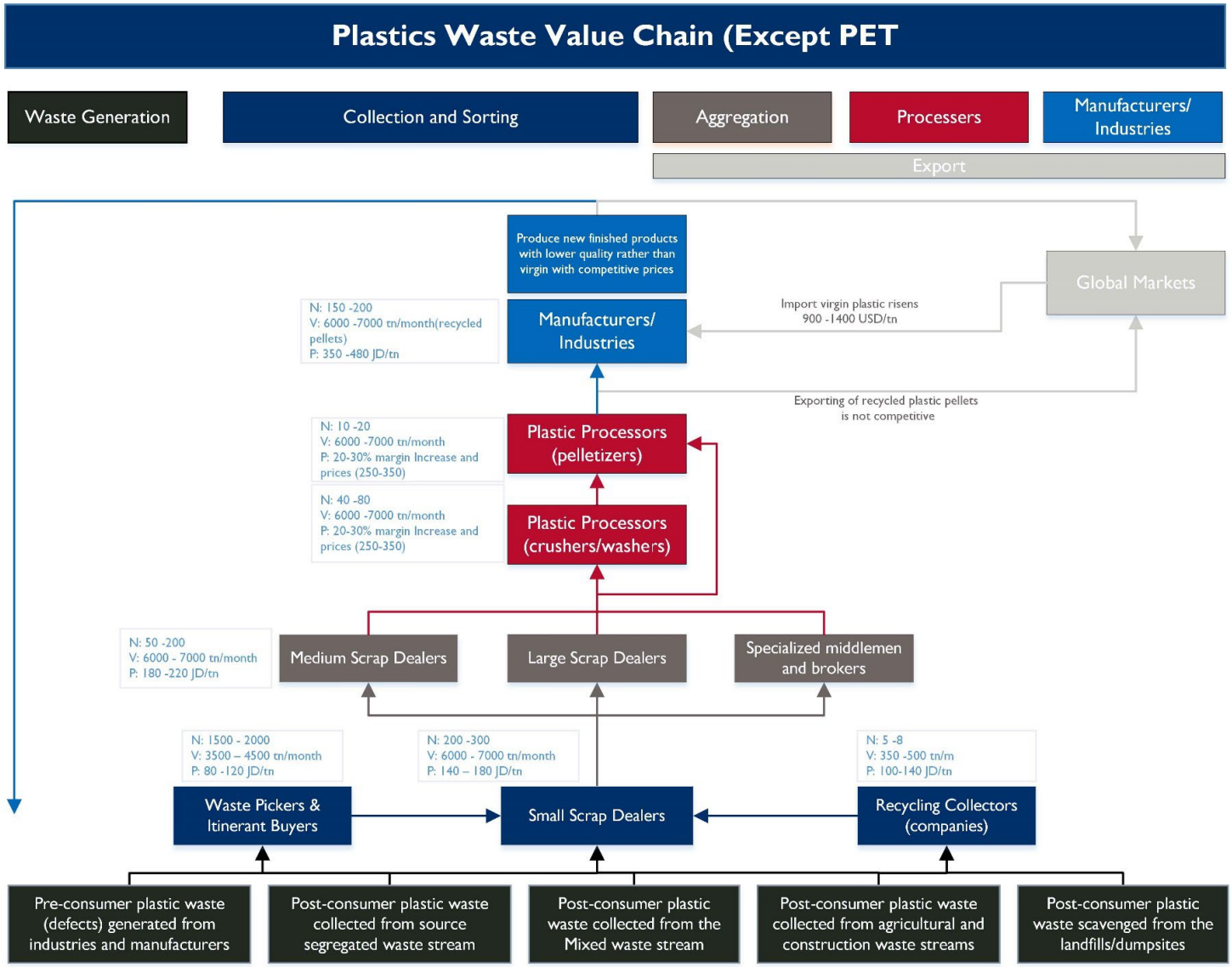
- Weak collection capacities and access to large waste generators are related to this sector.
- Unfair competition with unlicensed businesses and informal sector.
- No sector representation and weak vertical and horizontal relationships.

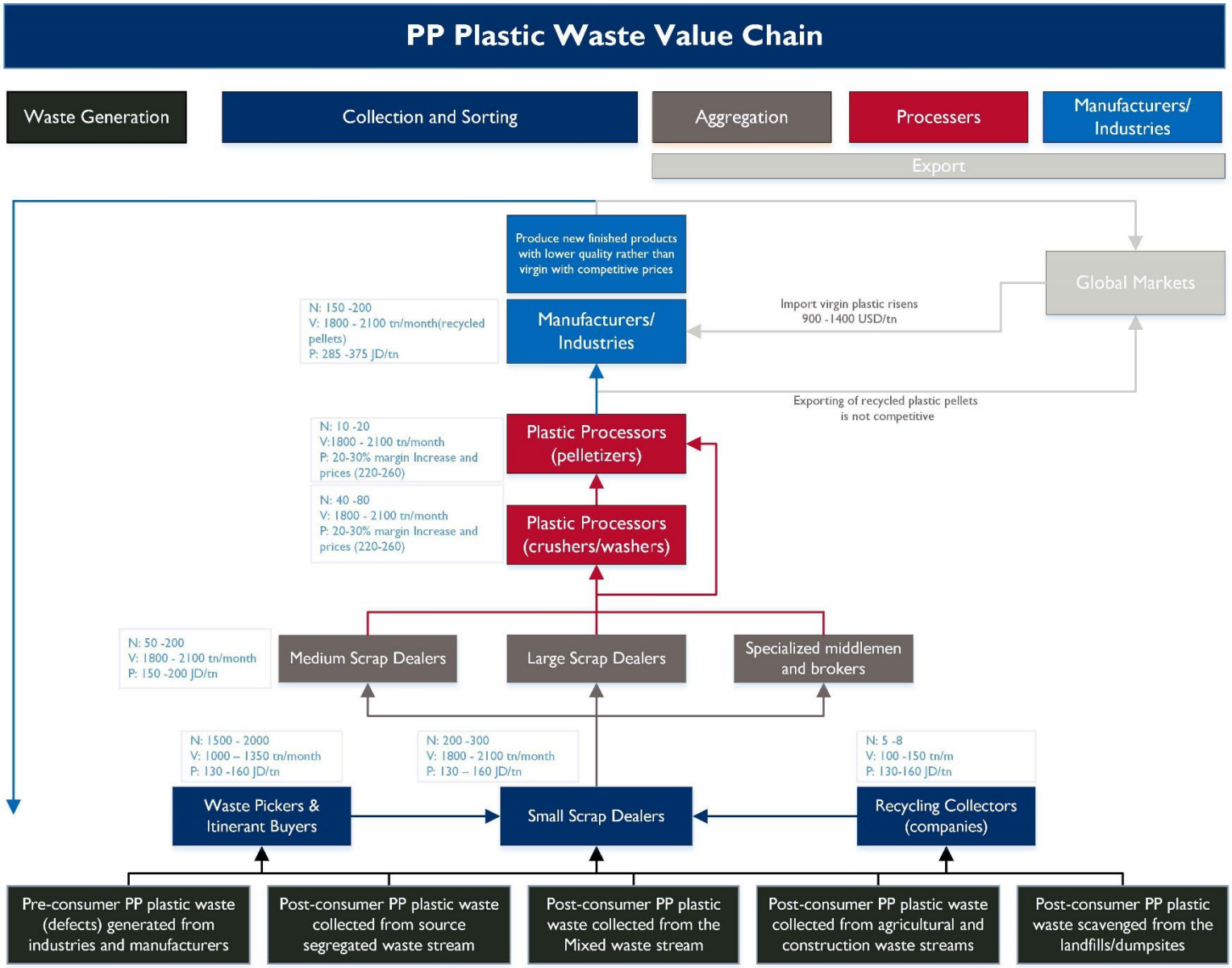
- Lack of reliable and accurate data and information about Wood/Furniture scrap waste generation rate, volume, distribution per area, sufficient and full statistics on Wood/Furniture scrap waste.
- Lack of incentives to invest in the fields of Wood/Furniture scrap waste in Jordan.
- Lack of advanced technologies and equipment for further processing especially that the processors have no financial capacity to invest and increase their capacities.

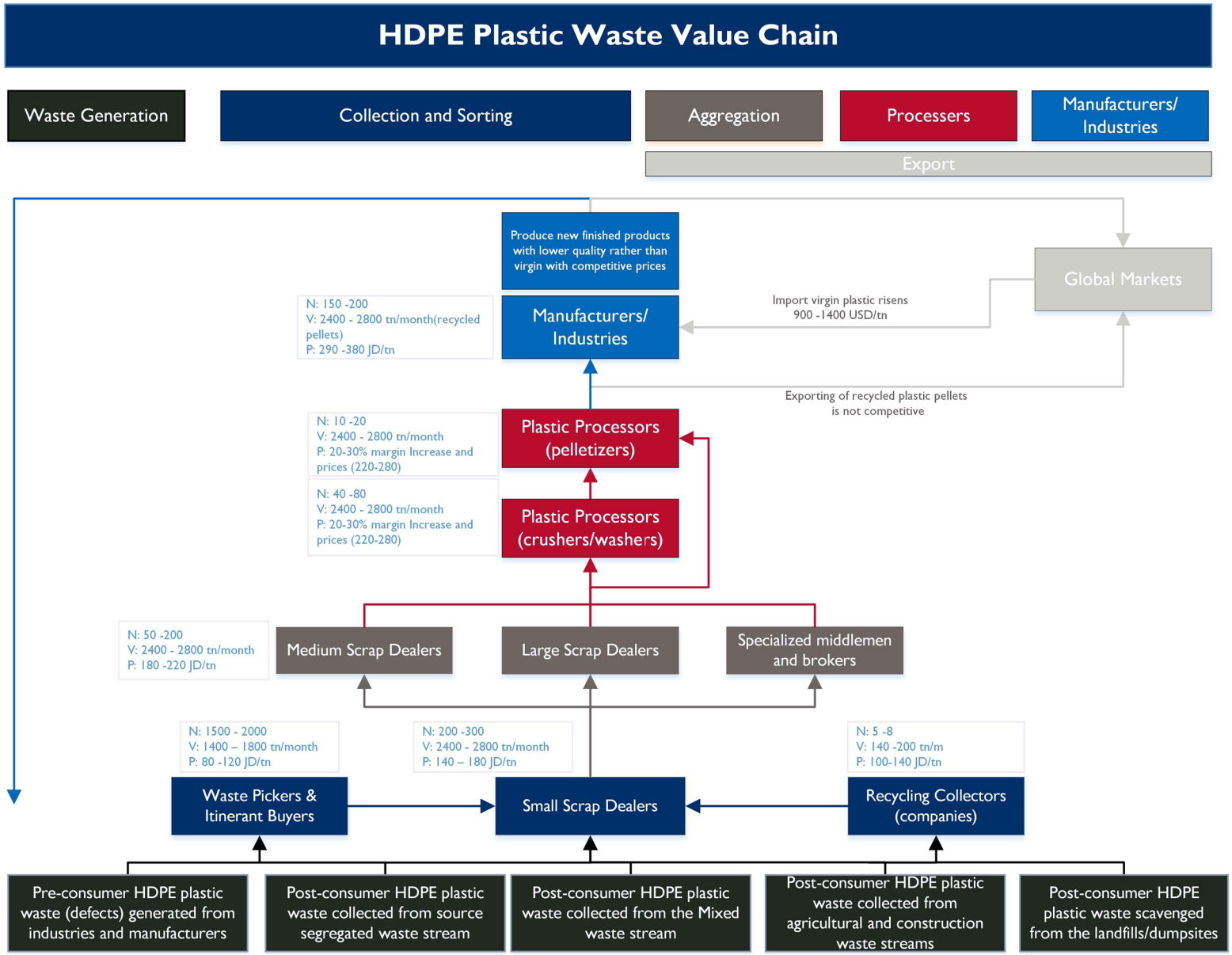
To address the above valid constraints, the Activity shall focus to design its interventions in the upcoming years on the following areas:

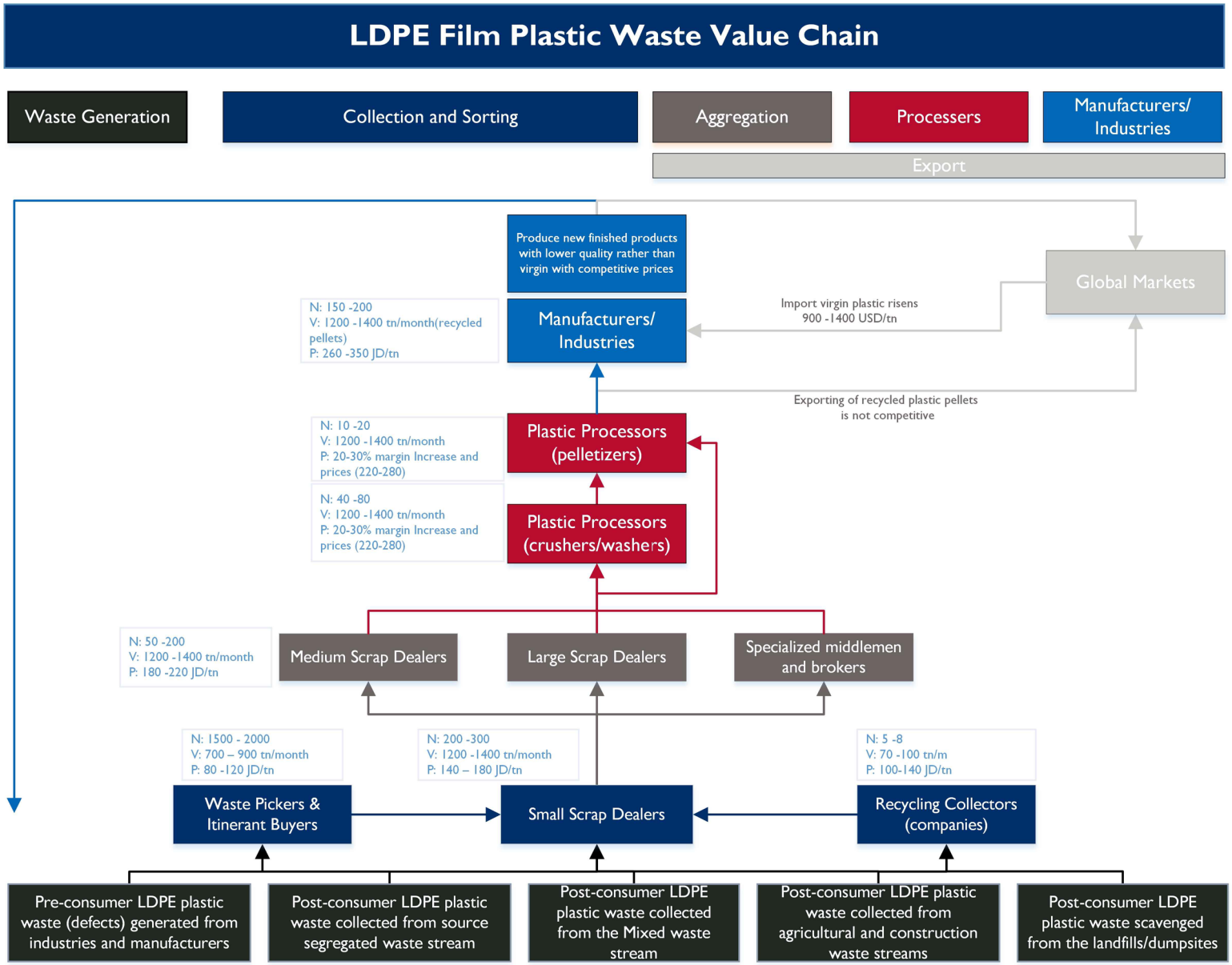
- Support the development of an environmental policy and formulation of sector representation.
- Provide firm-level technical assistance for the service providers to improve performance and capacity to handle more Wood/Furniture scrap waste.
- Facilitate access to finance for the aggregators and processors/exporters, to upgrade their capacity in terms of equipment, and infrastructure.
- Improve horizontal relationships across the value chain and support sector representation.
- Scale up the business training and capacity building programs to cover larger numbers of the actors in the Wood/Furniture scrap waste collection, sorting and grading, and to improve their business model to expand.

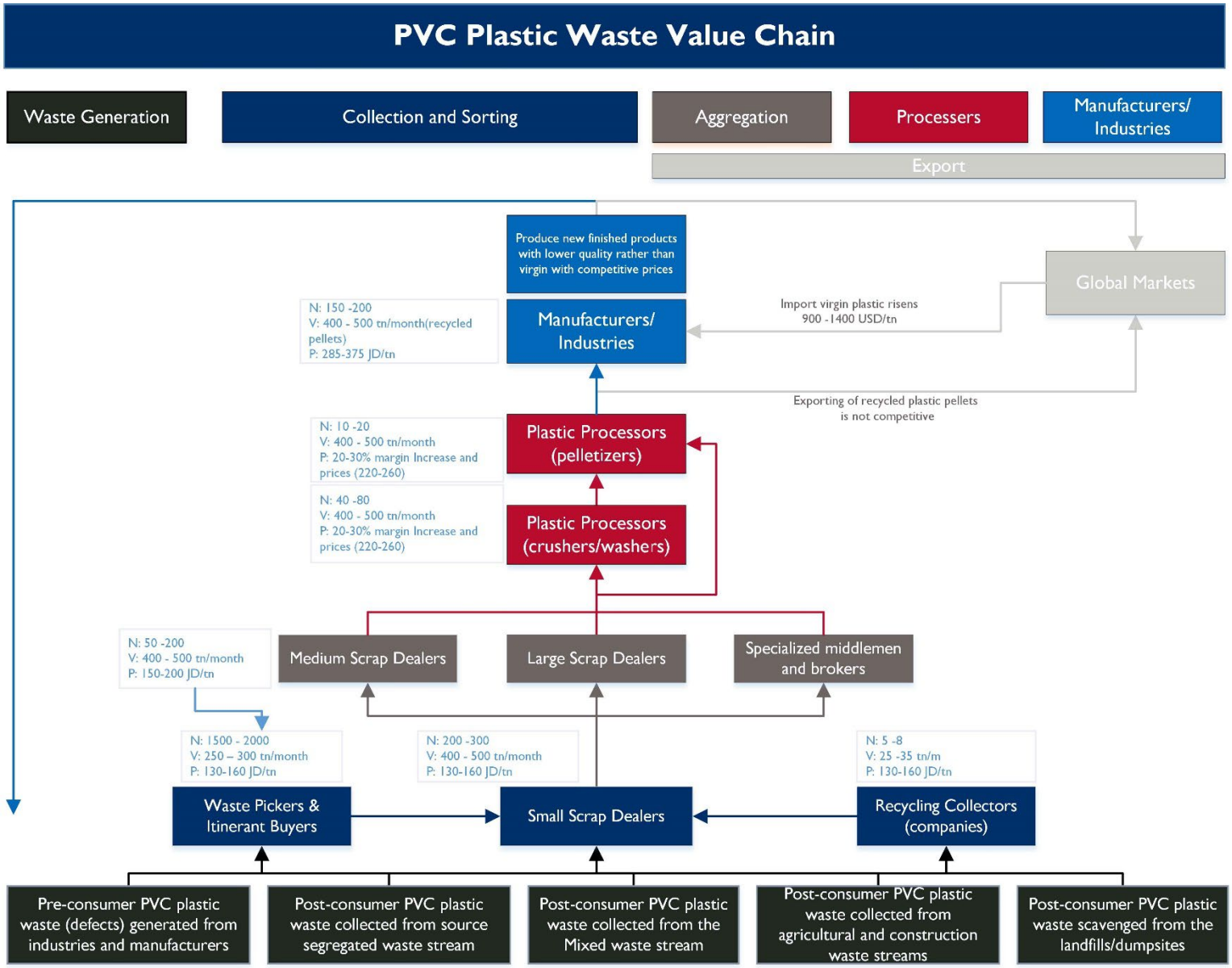
4 UPDATED MAPS OF RECYCLING VALUE CHAINS

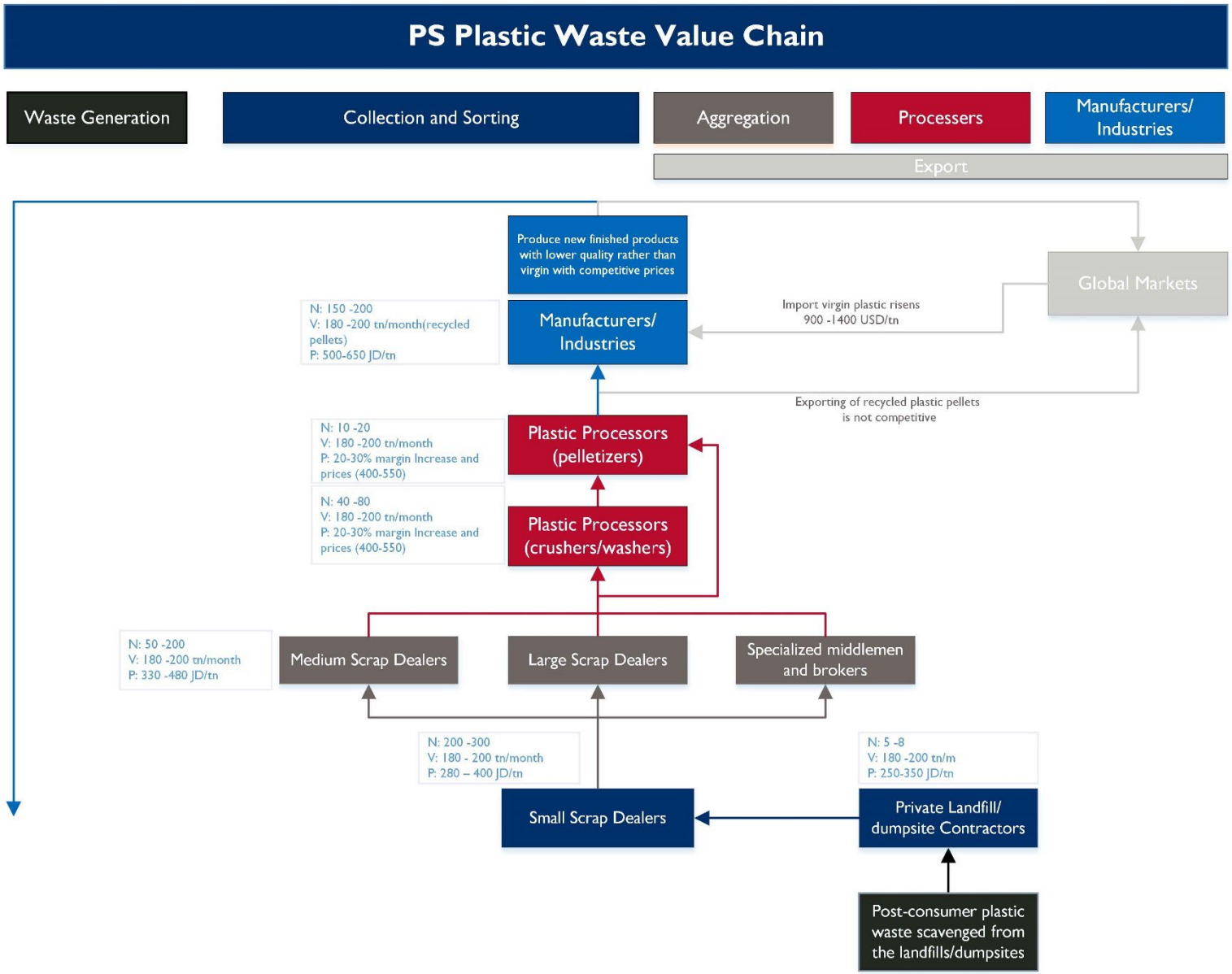


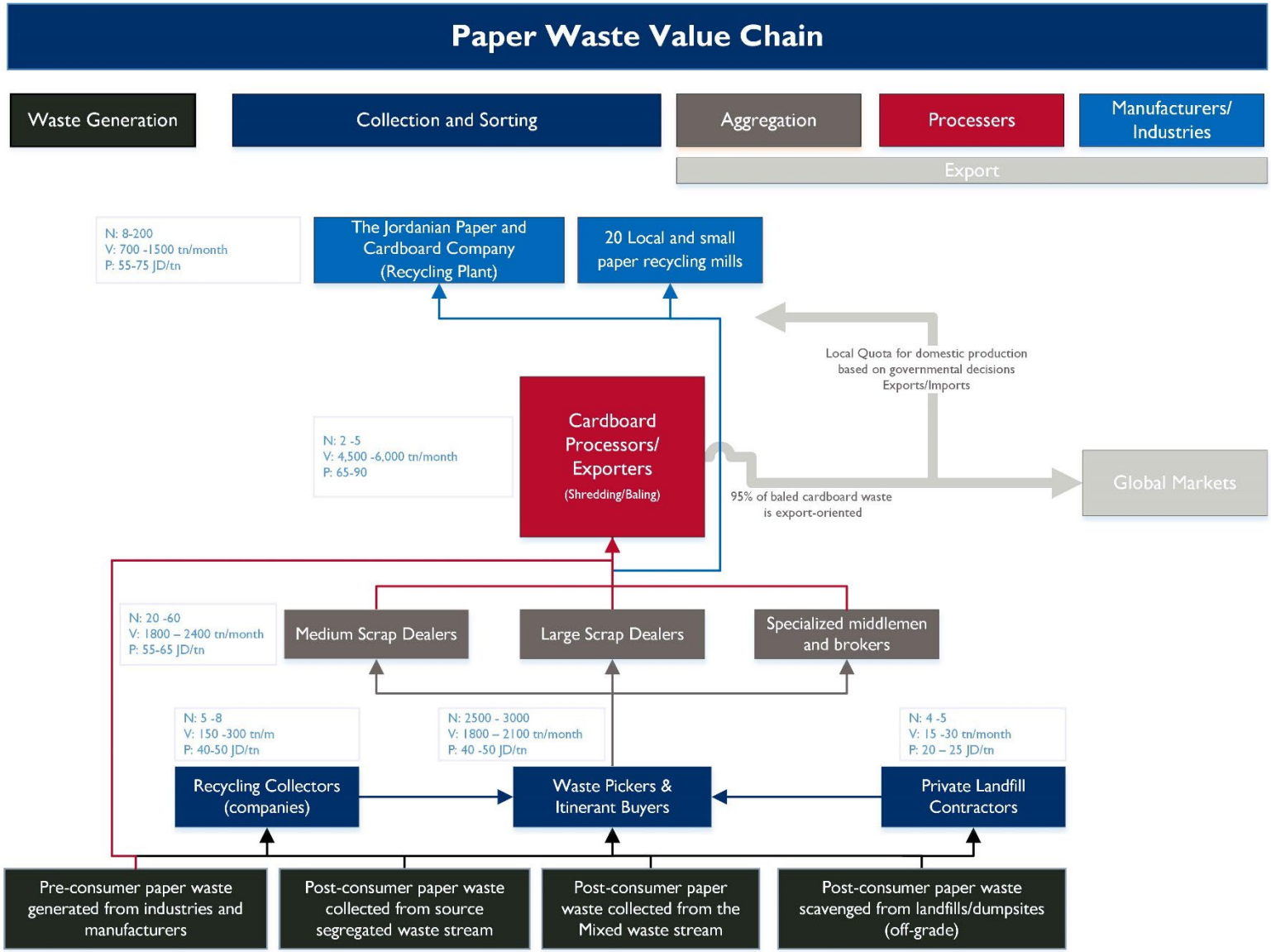

PP Plastic Waste Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processers
Manufacturers/ Industries
Export
Produce new finished products with lower quality rather than virgin with competitive prices
Global Markets
N: 150 -200
V: 1800 - 2100 tn/month(recycled pellets)
P: 285 -375 JD/tn
Manufacturers/ Industries
Import virgin plastic risens 900 -1400 USD/tn
Exporting of recycled plastic pellets is not competitive
N: 10 -20
V:1800 - 2100 tn/month
P: 20-30% margin Increase and prices (220-260)
Plastic Processors (pelletizers)
N: 40 -80
V: 1800 - 2100 tn/month
P: 20-30% margin Increase and prices (220-260)
Plastic Processors (crushers/washers)
N: 50 -200
V: 1800 - 2100 tn/month
P: 150 -200 JD/tn
Medium Scrap Dealers
Large Scrap Dealers
Specialized middlemen and brokers
N: 1500 - 2000
V: 1000 – 1350 tn/month
P: 130 -160 JD/tn
N: 200 -300
V: 1800 - 2100 tn/month
P: 130 – 160 JD/tn
N: 5 -8
V: 100 -150 tn/m
P: 130-160 JD/tn
Waste Pickers & Itinerant Buyers
Small Scrap Dealers
Recycling Collectors (companies)
Pre-consumer PP plastic waste (defects) generated from industries and manufacturers
Post-consumer PP plastic waste collected from source segregated waste stream
Post-consumer PP plastic waste collected from the Mixed waste stream
Post-consumer PP plastic waste collected from agricultural and construction waste streams
Post-consumer PP plastic waste scavenged from the landfills/dumpsites

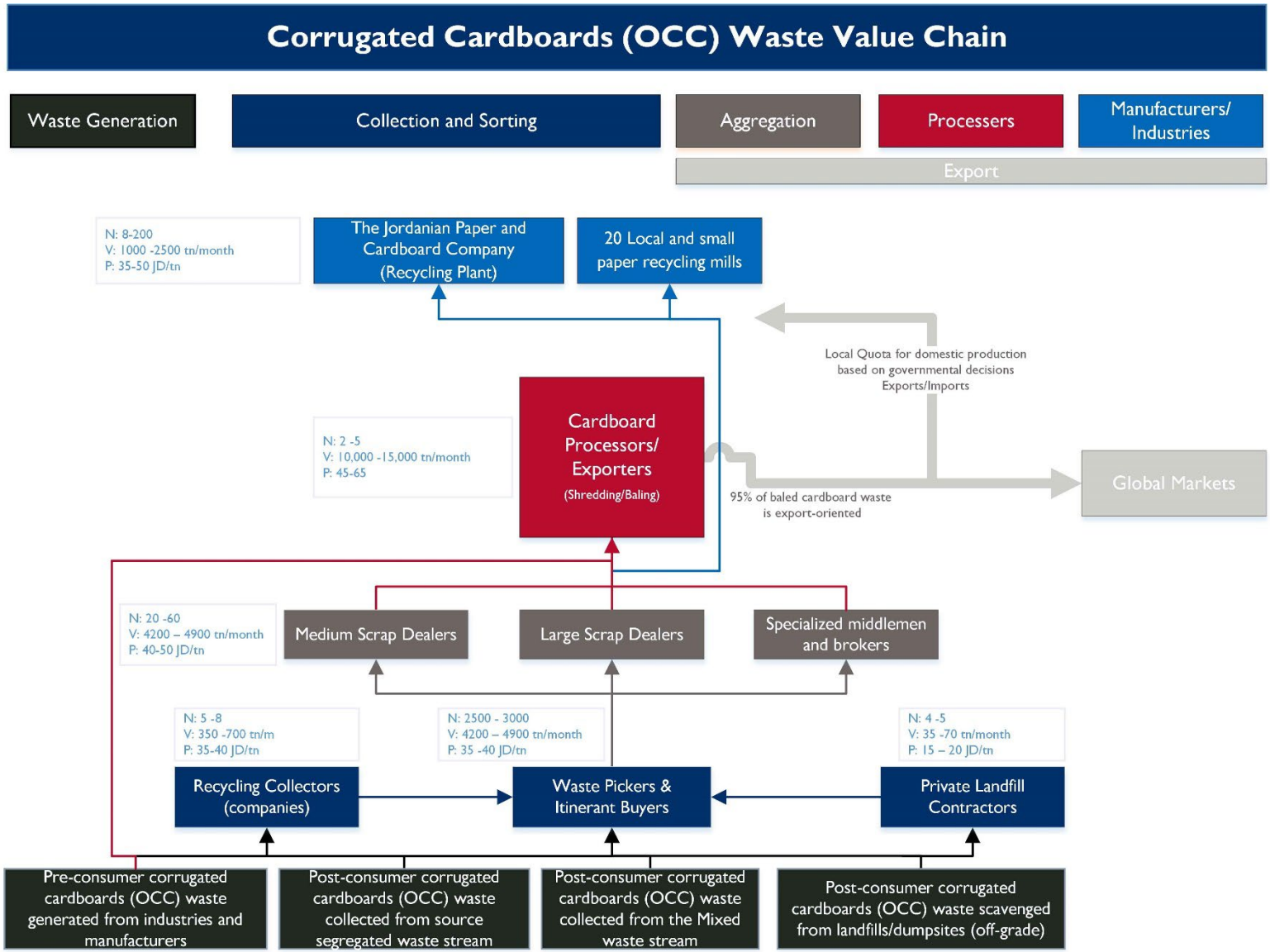

HDPE Plastic Waste Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processers
Manufacturers/ Industries
Export
Produce new finished products with lower quality rather than virgin with competitive prices
Global Markets
N: 150 -200
V: 2400 - 2800 tn/month(recycled pellets)
P: 290 -380 JD/tn
Manufacturers/ Industries
Import virgin plastic risens
900 -1400 USD/tn
Exporting of recycled plastic pellets is not competitive
N: 10 -20
V: 2400 - 2800 tn/month
P: 20-30% margin Increase and prices (220-280)
Plastic Processors (pelletizers)
N: 40 -80
V: 2400 - 2800 tn/month
P: 20-30% margin Increase and prices (220-280)
Plastic Processors (crushers/washers)
N: 50 -200
V: 2400 - 2800 tn/month
P: 180 -220 JD/tn
Medium Scrap Dealers
Large Scrap Dealers
Specialized middlemen and brokers
N: 1500 - 2000
V: 1400 – 1800 tn/month
P: 80 -120 JD/tn
N: 200 -300
V: 2400 - 2800 tn/month
P: 140 – 180 JD/tn
N: 5 -8
V: 140 -200 tn/m
P: 100-140 JD/tn
Waste Pickers & Itinerant Buyers
Small Scrap Dealers
Recycling Collectors (companies)
Pre-consumer HDPE plastic waste (defects) generated from industries and manufacturers
Post-consumer HDPE plastic waste collected from source segregated waste stream
Post-consumer HDPE plastic waste collected from the Mixed waste stream
Post-consumer HDPE plastic waste collected from agricultural and construction waste streams
Post-consumer HDPE plastic waste scavenged from the landfills/dumpsites

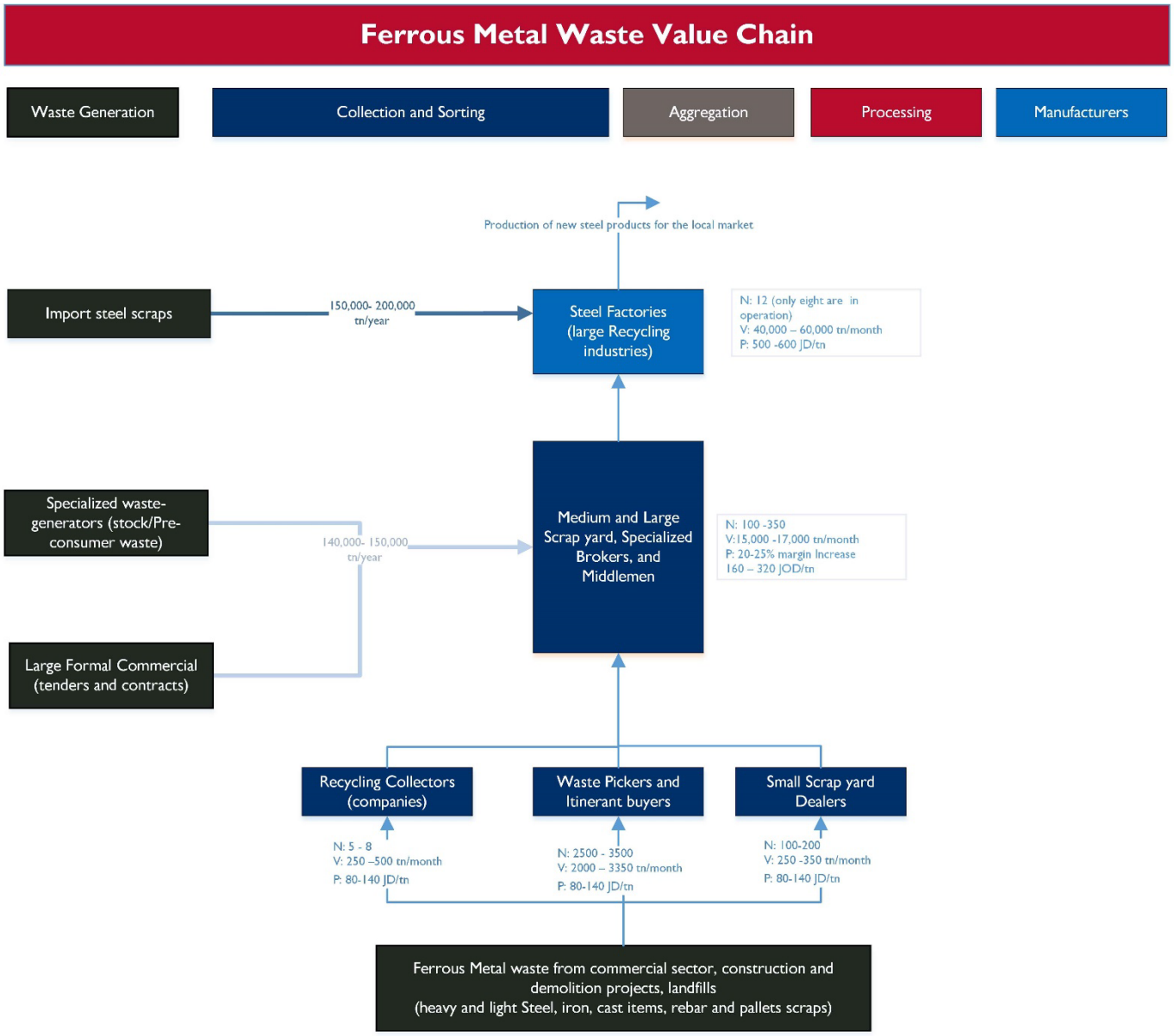

LDPE Film Plastic Waste Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processers
Manufacturers/ Industries
Export
Produce new finished products with lower quality rather than virgin with competitive prices
Global Markets
N: 150 -200
V: 1200 -1400 tn/month(recycled pellets)
P: 260 -350 JD/tn
Manufacturers/ Industries
Import virgin plastic risens 900 -1400 USD/tn
Exporting of recycled plastic pellets is not competitive
N: 10 -20
V: 1200 -1400 tn/month
P: 20-30% margin Increase and prices (220-280)
Plastic Processors (pelletizers)
N: 40 -80
V: 1200 -1400 tn/month
P: 20-30% margin Increase and prices (220-280)
Plastic Processors (crushers/washers)
N: 50 -200
V: 1200 -1400 tn/month
P: 180 -220 JD/tn
Medium Scrap Dealers
Large Scrap Dealers
Specialized middlemen and brokers
N: 1500 - 2000
V: 700 – 900 tn/month
P: 80 -120 JD/tn
N: 200 -300
V: 1200 -1400 tn/month
P: 140 – 180 JD/tn
N: 5 -8
V: 70 -100 tn/m
P: 100-140 JD/tn
Waste Pickers & Itinerant Buyers
Small Scrap Dealers
Recycling Collectors (companies)
Pre-consumer LDPE plastic waste (defects) generated from industries and manufacturers
Post-consumer LDPE plastic waste collected from source segregated waste stream
Post-consumer LDPE plastic waste collected from the Mixed waste stream
Post-consumer LDPE plastic waste collected from agricultural and construction waste streams
Post-consumer LDPE plastic waste scavenged from the landfills/dumpsites

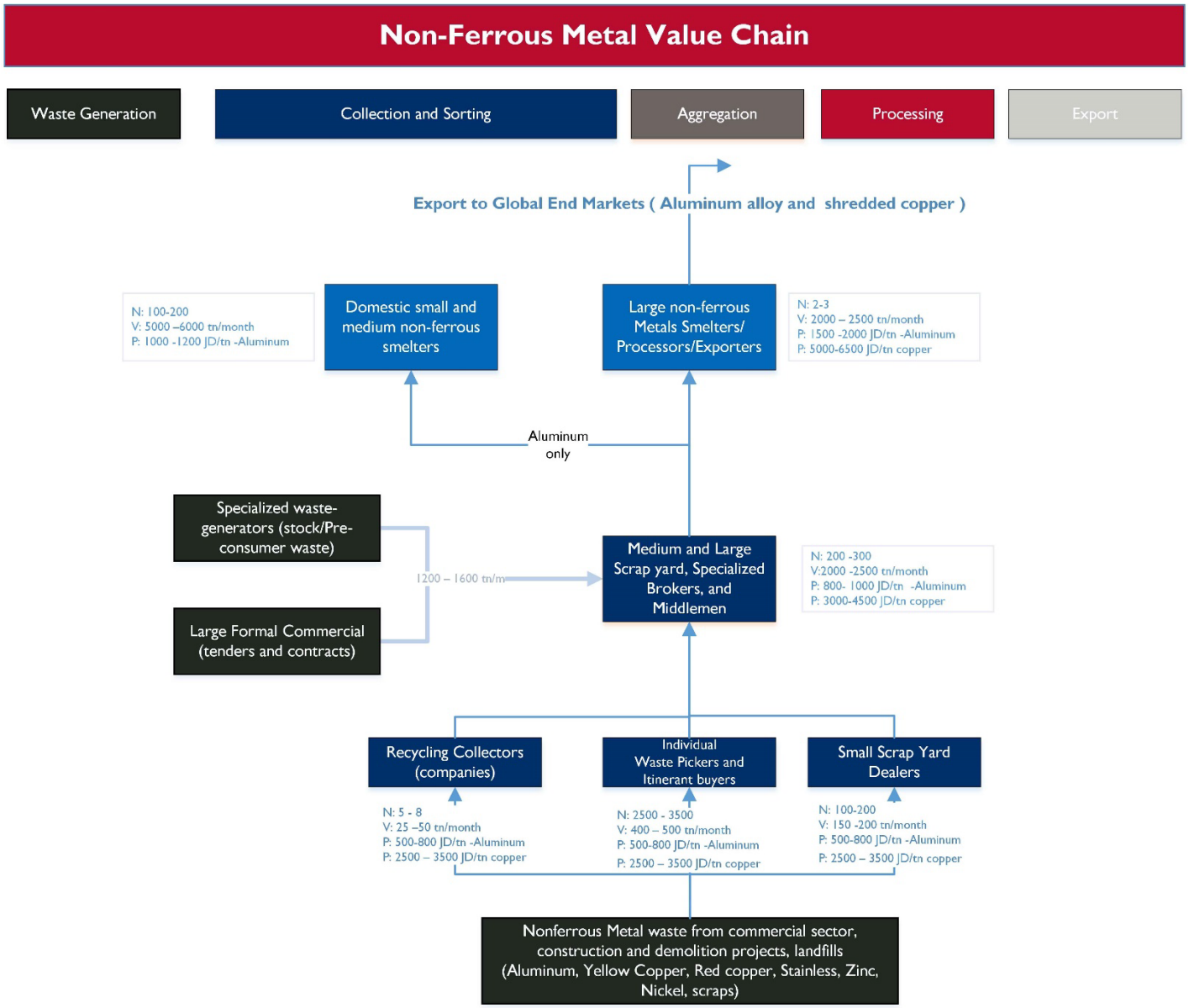

PVC Plastic Waste Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processers
Manufacturers/ Industries
Export
Produce new finished products with lower quality rather than virgin with competitive prices
Global Markets
N: 150 -200
V: 400 - 500 tn/month(recycled pellets)
P: 285-375 JD/tn
Manufacturers/ Industries
Import virgin plastic risens 900 -1400 USD/tn
Exporting of recycled plastic pellets is not competitive
N: 10 -20
V: 400 - 500 tn/month
P: 20-30% margin Increase and prices (220-260)
Plastic Processors (pelletizers)
N: 40 -80
V: 400 - 500 tn/month
P: 20-30% margin Increase and prices (220-260)
Plastic Processors (crushers/washers)
N: 50 -200
V: 400 - 500 tn/month
P: 150-200 JD/tn
Medium Scrap Dealers
Large Scrap Dealers
Specialized middlemen and brokers
N: 1500 - 2000
V: 250 – 300 tn/month
P: 130-160 JD/tn
N: 200 -300
V: 400 - 500 tn/month
P: 130-160 JD/tn
N: 5 -8
V: 25 -35 tn/m
P: 130-160 JD/tn
Waste Pickers & Itinerant Buyers
Small Scrap Dealers
Recycling Collectors (companies)
Pre-consumer PVC plastic waste (defects) generated from industries and manufacturers
Post-consumer PVC plastic waste collected from source segregated waste stream
Post-consumer PVC plastic waste collected from the Mixed waste stream
Post-consumer PVC plastic waste collected from agricultural and construction waste streams
Post-consumer PVC plastic waste scavenged from the landfills/dumpsites

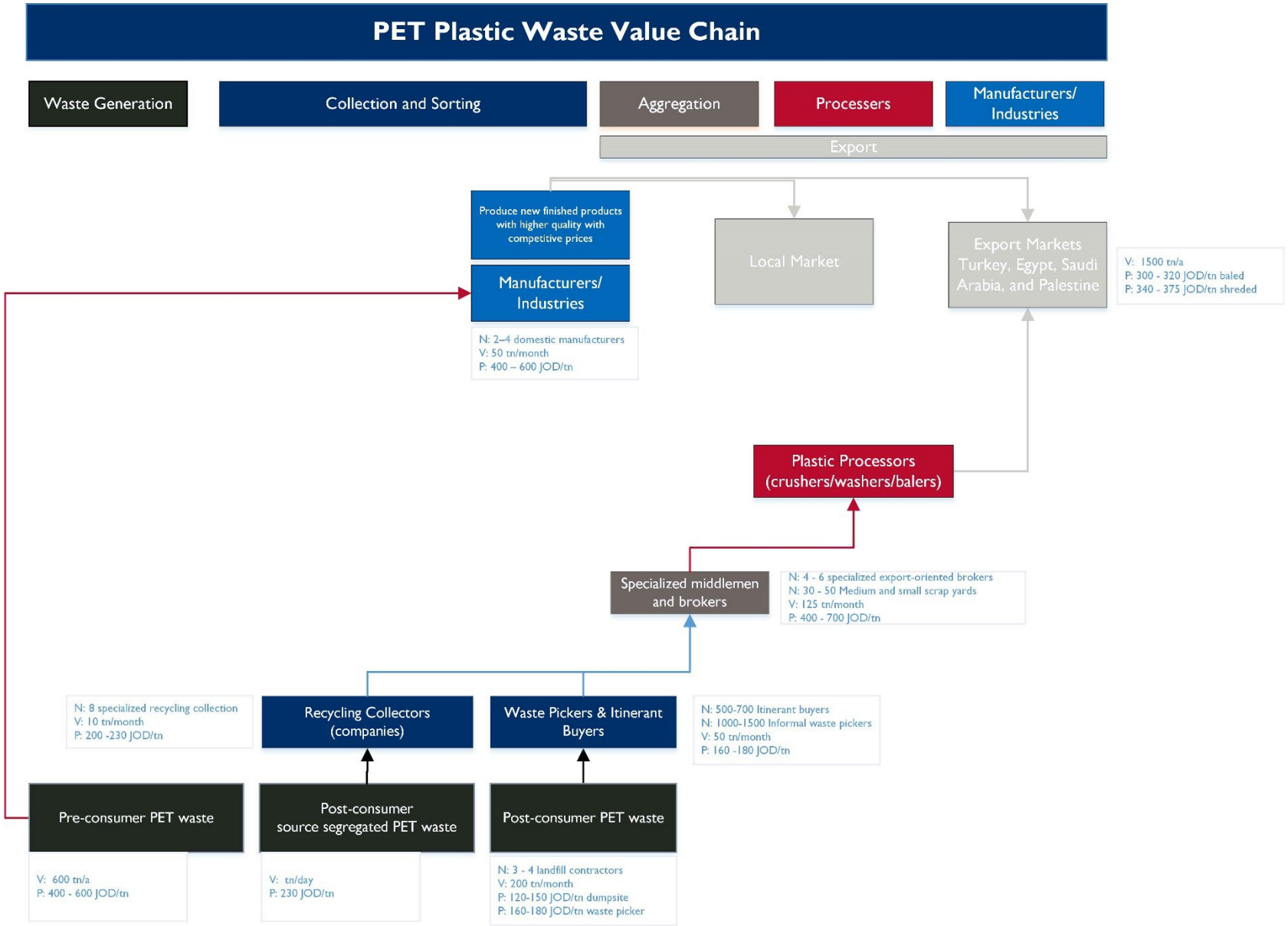

PS Plastic Waste Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processers
Manufacturers/ Industries
Export
Produce new finished products with lower quality rather than virgin with competitive prices
Global Markets
N: 150 -200
V: 180 -200 tn/month(recycled pellets)
P: 500-650 JD/tn
Manufacturers/ Industries
Import virgin plastic risens 900 -1400 USD/tn
Exporting of recycled plastic pellets is not competitive
N: 10 -20
V: 180 -200 tn/month
P: 20-30% margin Increase and prices (400-550)
Plastic Processors (pelletizers)
N: 40 -80
V: 180 -200 tn/month
P: 20-30% margin Increase and prices (400-550)
Plastic Processors (crushers/washers)
N: 50 -200
V: 180 -200 tn/month
P: 330 -480 JD/tn
Medium Scrap Dealers
Large Scrap Dealers
Specialized middlemen and brokers
N: 200 -300
V: 180 - 200 tn/month
P: 280 – 400 JD/tn
N: 5 -8
V: 180 -200 tn/m
P: 250-350 JD/tn
Small Scrap Dealers
Private Landfill/ dumpsite Contractors
Post-consumer plastic waste scavenged from the landfills/dumpsites

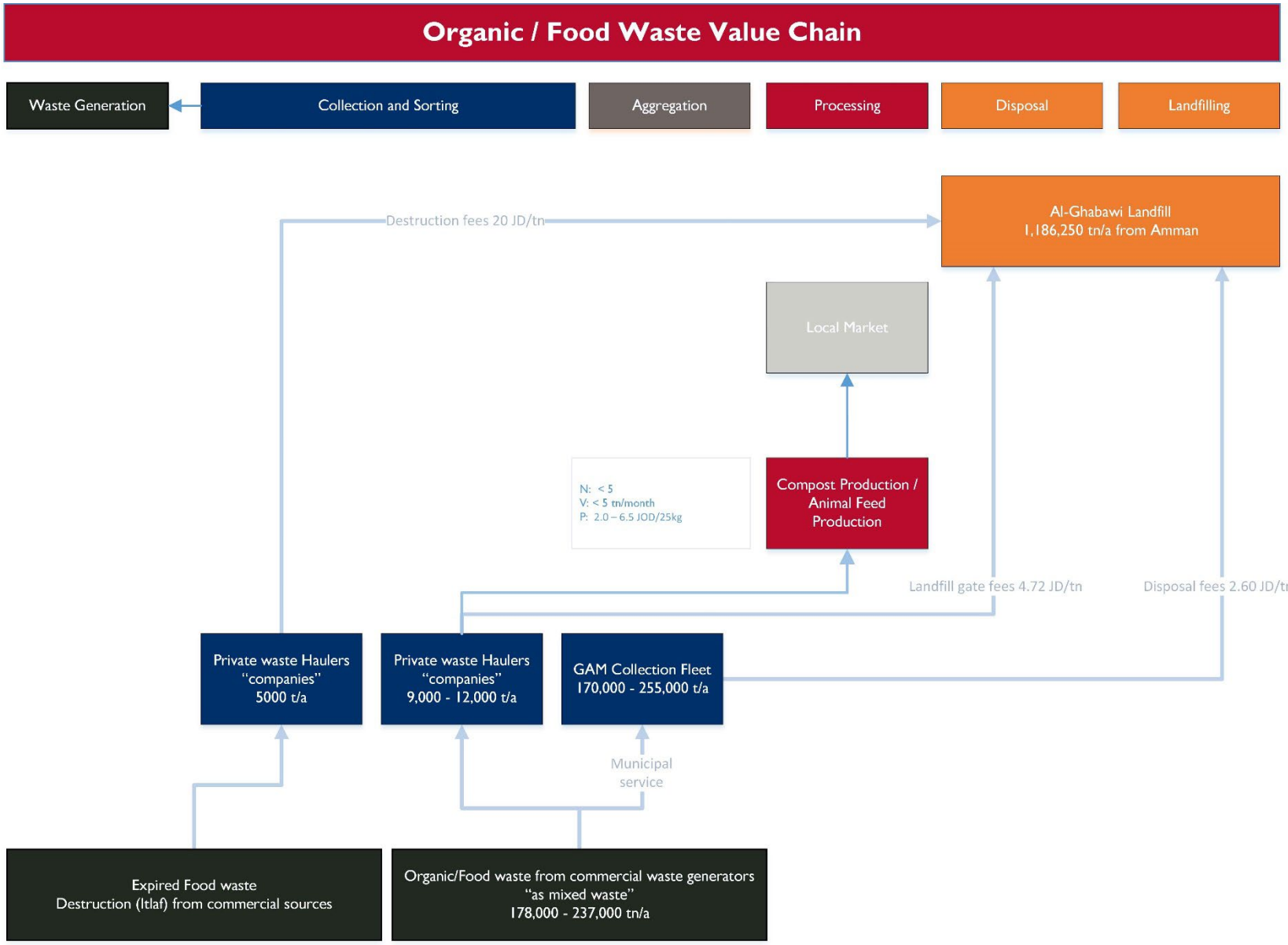

Paper Waste Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processers
Manufacturers/ Industries
Export
N: 8-200
V: 700 -1500 tn/month
P: 55-75 JD/tn
The Jordanian Paper and Cardboard Company (Recycling Plant)
20 Local and small paper recycling mills
Local Quota for domestic production based on governmental decisions Exports/Imports
N: 2 -5
V: 4,500 -6,000 tn/month
P: 65-90
Cardboard Processors/ Exporters
(Shredding/Baling)
95% of baled cardboard waste is export-oriented
Global Markets
N: 20 -60
V: 1800 – 2400 tn/month
P: 55-65 JD/tn
Medium Scrap Dealers
Large Scrap Dealers
Specialized middlemen and brokers
N: 5 -8
V: 150 -300 tn/m
P: 40-50 JD/tn
N: 2500 - 3000
V: 1800 – 2100 tn/month
P: 40 -50 JD/tn
N: 4 -5
V: 15 -30 tn/month
P: 20 – 25 JD/tn
Recycling Collectors (companies)
Waste Pickers & Itinerant Buyers
Private Landfill Contractors
Pre-consumer paper waste generated from industries and manufacturers
Post-consumer paper waste collected from source segregated waste stream
Post-consumer paper waste collected from the Mixed waste stream
Post-consumer paper waste scavenged from landfills/dumpsites (off-grade)

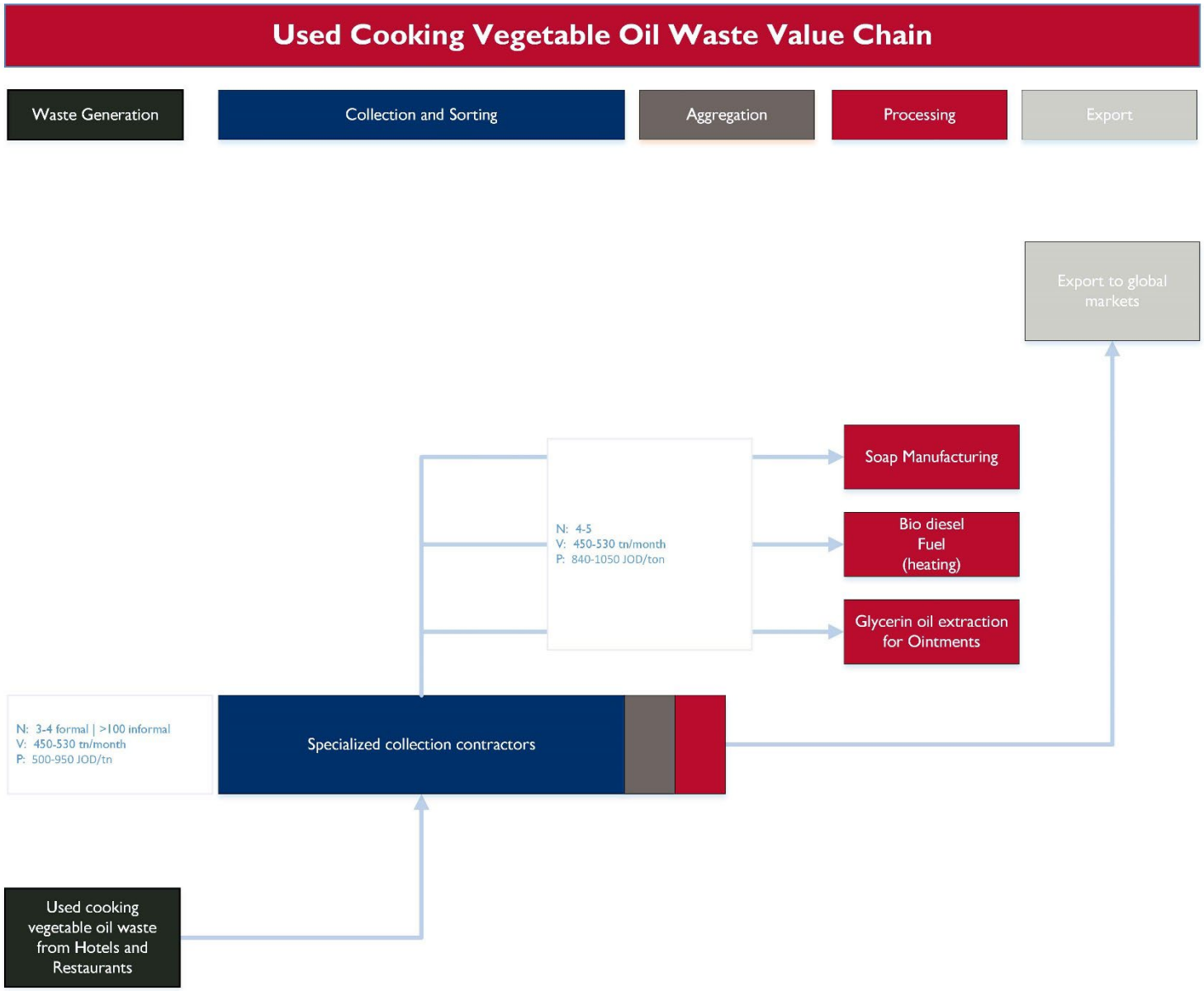

Corrugated Cardboards (OCC) Waste Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processers
Manufacturers/ Industries
Export
N: 8-200
V: 1000 -2500 tn/month
P: 35-50 JD/tn
The Jordanian Paper and Cardboard Company (Recycling Plant)
20 Local and small paper recycling mills
Local Quota for domestic production based on governmental decisions Exports/Imports
N: 2 -5
V: 10,000 -15,000 tn/month
P: 45-65
Cardboard Processors/ Exporters
(Shredding/Baling)
95% of baled cardboard waste is export-oriented
Global Markets
N: 20 -60
V: 4200 – 4900 tn/month
P: 40-50 JD/tn
Medium Scrap Dealers
Large Scrap Dealers
Specialized middlemen and brokers
N: 5 -8
V: 350 -700 tn/m
P: 35-40 JD/tn
N: 2500 - 3000
V: 4200 – 4900 tn/month
P: 35 -40 JD/tn
N: 4 -5
V: 35 -70 tn/month
P: 15 – 20 JD/tn
Recycling Collectors (companies)
Waste Pickers & Itinerant Buyers
Private Landfill Contractors
Pre-consumer corrugated cardboards (OCC) waste generated from industries and manufacturers
Post-consumer corrugated cardboards (OCC) waste collected from source segregated waste stream
Post-consumer corrugated cardboards (OCC) waste collected from the Mixed waste stream
Post-consumer corrugated cardboards (OCC) waste scavenged from landfills/dumpsites (off-grade)

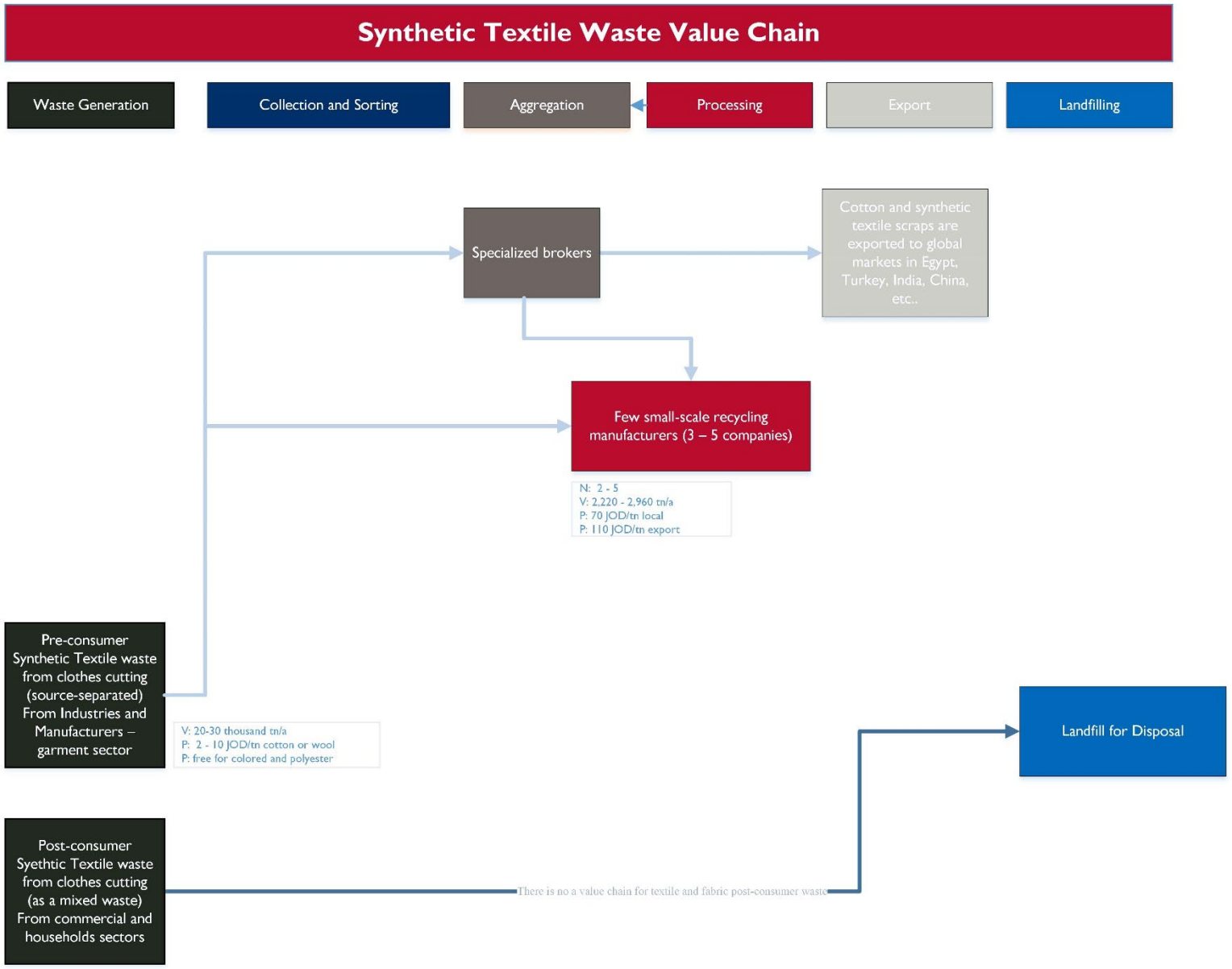

Ferrous Metal Waste Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processing
Manufacturers
Production of new steel products for the local market
Import steel scraps
150,000- 200,000 tn/year
Steel Factories (large Recycling industries)
N: 12 (only eight are in operation)
V: 40,000 – 60,000 tn/month
P: 500 -600 JD/tn
Specialized waste-generators (stock/Pre-consumer waste)
140,000- 150,000 tn/year
Medium and Large Scrap yard, Specialized Brokers, and Middlemen
N: 100 -350
V:15,000 -17,000 tn/month
P: 20-25% margin increase
160 – 320 JOD/tn
Large Formal Commercial (tenders and contracts)
Recycling Collectors (companies)
Waste Pickers and Itinerant buyers
Small Scrap yard Dealers
N: 5 - 8
V: 250 –500 tn/month
P: 80-140 JD/tn
N: 2500 - 3500
V: 2000 – 3350 tn/month
P: 80-140 JD/tn
N: 100-200
V: 250 -350 tn/month
P: 80-140 JD/tn
Ferrous Metal waste from commercial sector, construction and demolition projects, landfills
(heavy and light Steel, iron, cast items, rebar and pallets scraps)

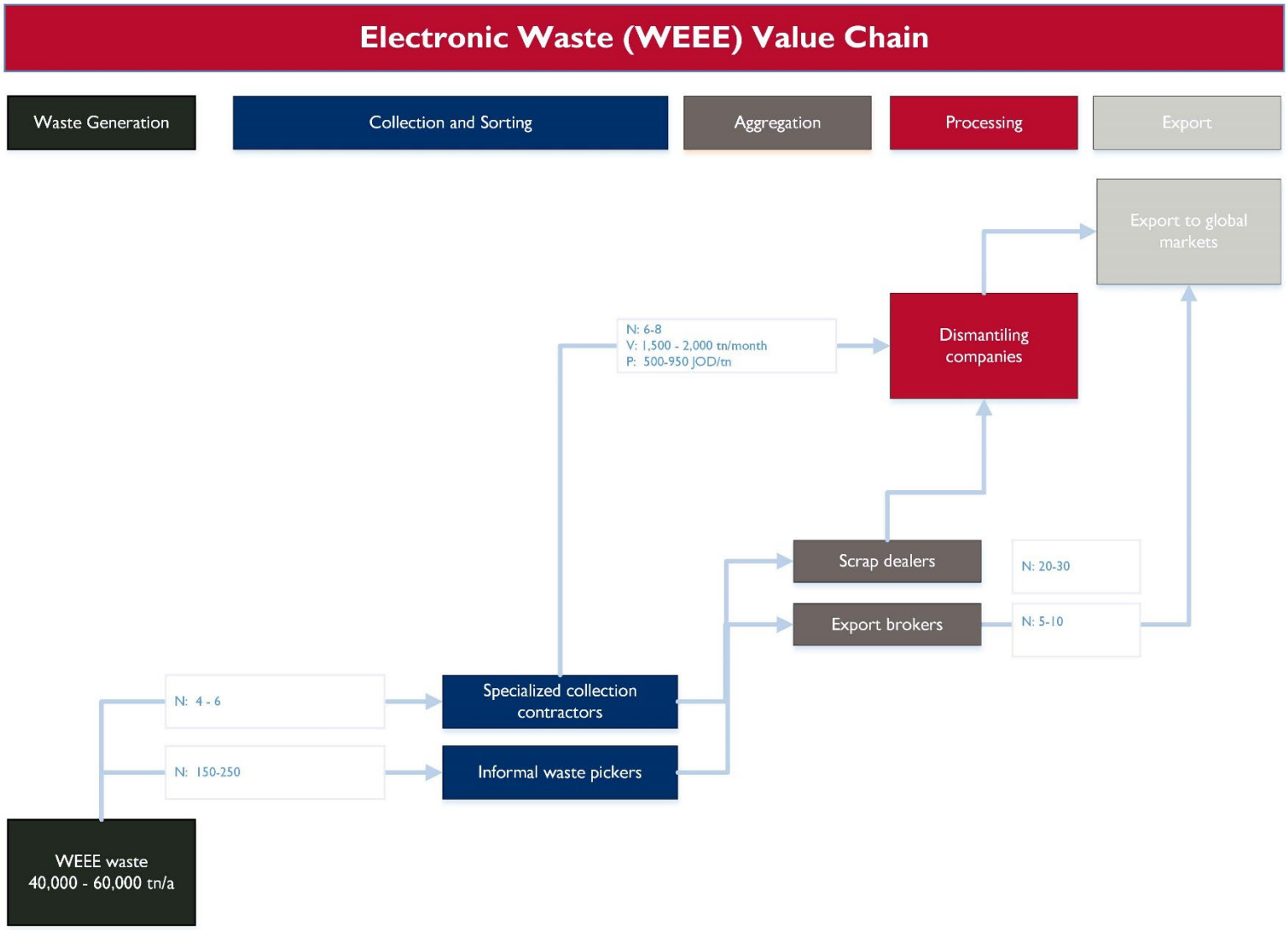

Non-Ferrous Metal Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processing
Export
Export to Global End Markets (Aluminum alloy and shredded copper)
N: 100-200
V: 5000 –6000 tn/month
P: 1000 -1200 JD/tn -Aluminum
Domestic small and medium non-ferrous smelters
Large non-ferrous Metals Smelters/ Processors/Exporters
N: 2-3
V: 2000 – 2500 tn/month
P: 1500 -2000 JD/tn -Aluminum
P: 5000-6500 JD/tn copper
Aluminum only
Specialized waste-generators (stock/Pre-consumer waste)
Large Formal Commercial (tenders and contracts)
1200 – 1600 tn/m
Medium and Large Scrap yard, Specialized Brokers, and Middlemen
N: 200 -300
V:2000 -2500 tn/month
P: 800- 1000 JD/tn -Aluminum
P: 3000-4500 JD/tn copper
Recycling Collectors (companies)
Individual Waste Pickers and Itinerant buyers
Small Scrap Yard Dealers
N: 5 - 8
V: 25 –50 tn/month
P: 500-800 JD/tn -Aluminum
P: 2500 – 3500 JD/tn copper
N: 2500 - 3500
V: 400 – 500 tn/month
P: 500-800 JD/tn -Aluminum
P: 2500 – 3500 JD/tn copper
N: 100-200
V: 150 -200 tn/month
P: 500-800 JD/tn -Aluminum
P: 2500 – 3500 JD/tn copper
Nonferrous Metal waste from commercial sector, construction and demolition projects, landfills (Aluminum, Yellow Copper, Red copper, Stainless, Zinc, Nickel, scraps)

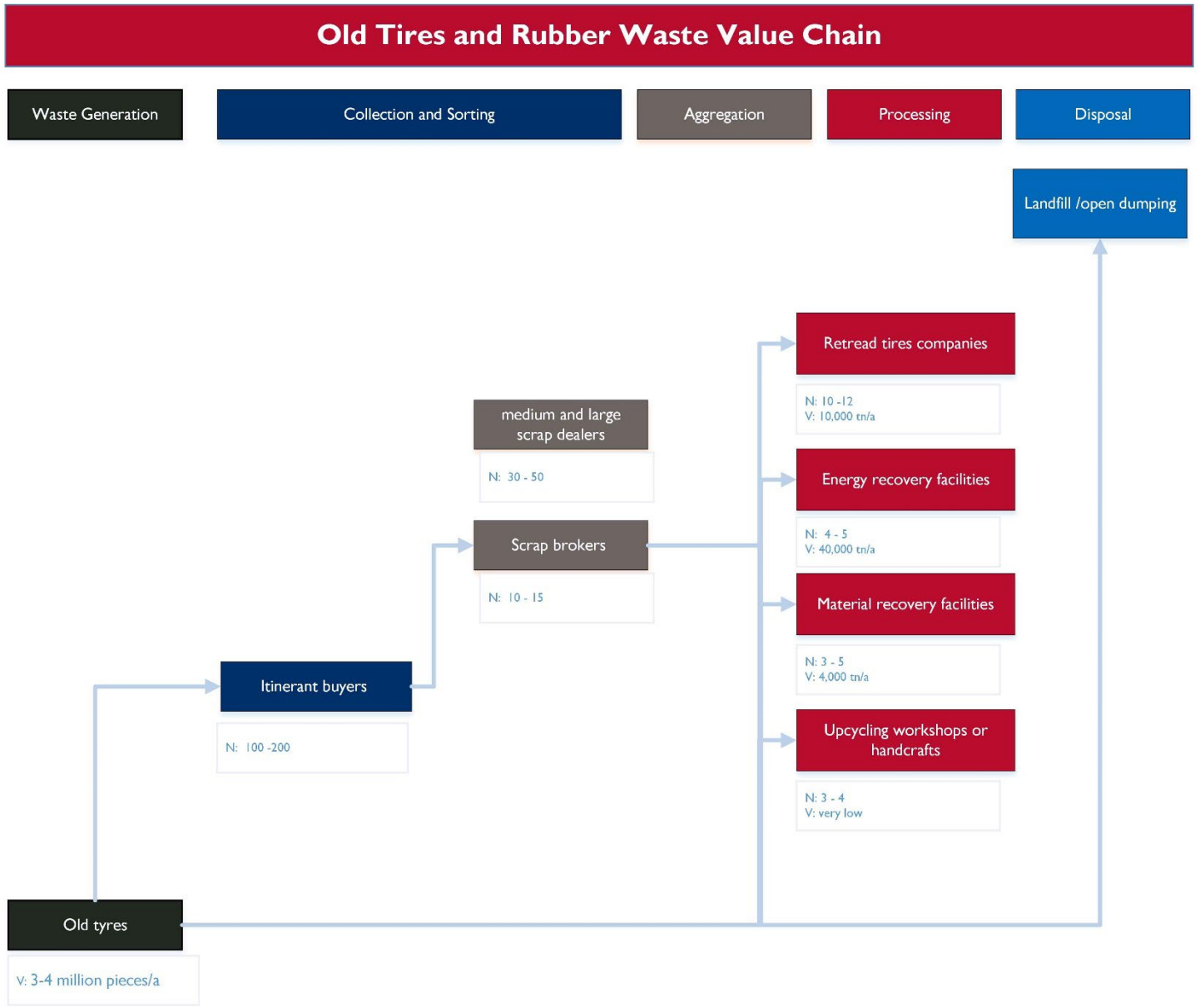

PET Plastic Waste Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processers
Manufacturers/ Industries
Export
Produce new finished products with higher quality with competitive prices
Manufacturers/ Industries
N: 2–4 domestic manufacturers
V: 50 tn/month
P: 400 – 600 JOD/tn
Local Market
Export Markets Turkey, Egypt, Saudi Arabia, and Palestine
V: 1500 tn/a
P: 300 - 320 JOD/tn baled
P: 340 - 375 JOD/tn shredded
Plastic Processors (crushers/washers/balers)
Specialized middlemen and brokers
N: 4 - 6 specialized export-oriented brokers
N: 30 - 50 Medium and small scrap yards
V: 125 tn/month
P: 400 - 700 JOD/tn
N: 8 specialized recycling collection
V: 10 tn/month
P: 200 -230 JOD/tn
Recycling Collectors (companies)
Waste Pickers & Itinerant Buyers
N: 500-700 Itinerant buyers
N: 1000-1500 Informal waste pickers
V: 50 tn/month
P: 160 -180 JOD/tn
Pre-consumer PET waste
Post-consumer source segregated PET waste
Post-consumer PET waste
V: 600 tn/a
P: 400 - 600 JOD/tn
V: tn/day
P: 230 JOD/tn
N: 3 - 4 landfill contractors
V: 200 tn/month
P: 120-150 JOD/tn dumpsite
P: 160-180 JOD/tn waste picker

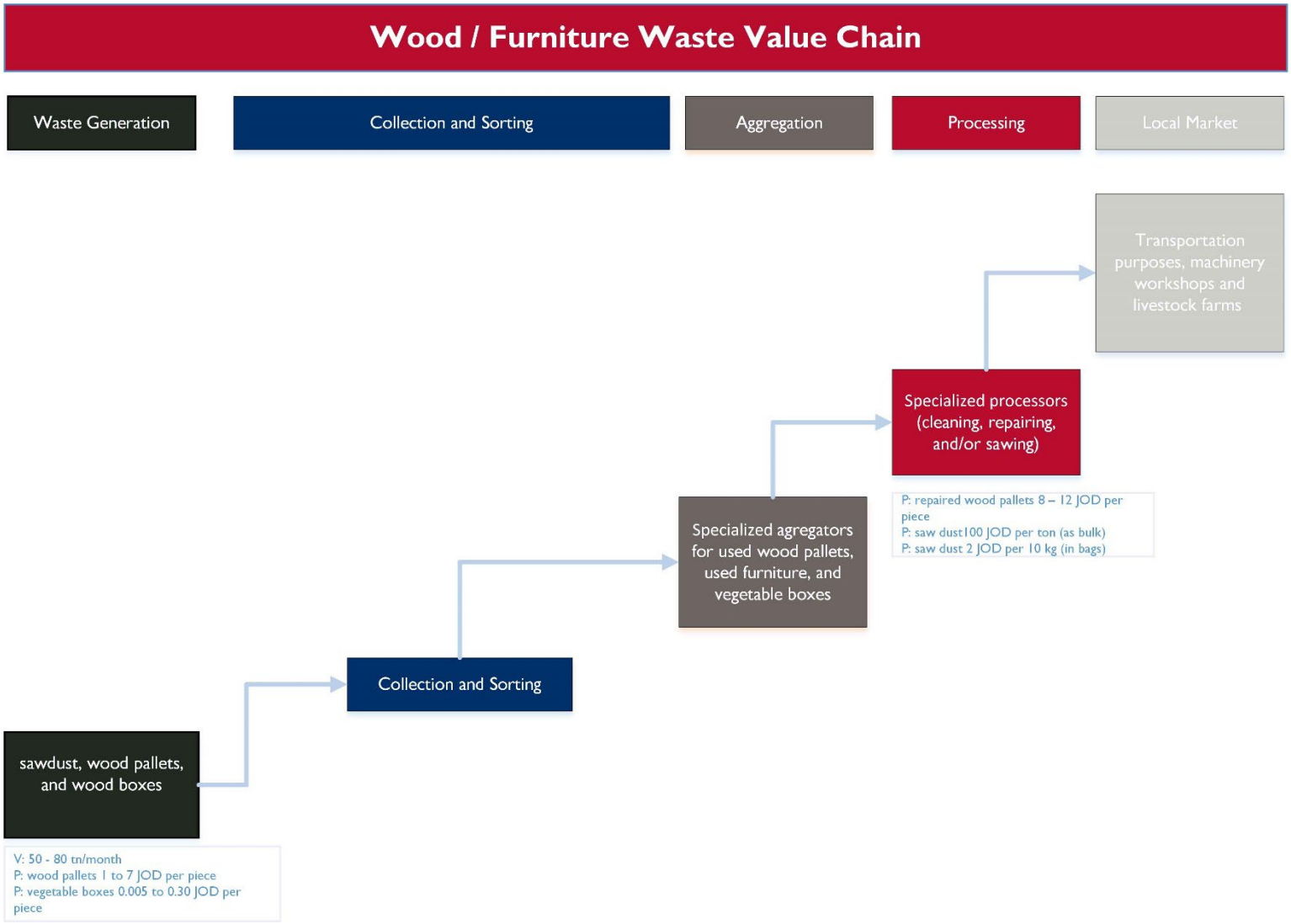

Organic / Food Waste Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processing
Disposal
Landfilling
Destruction fees 20 JD/tn
Al-Ghabawi Landfill
1,186,250 tn/a from Amman
Local Market
N: < 5
V: < 5 tn/month
P: 2.0 – 6.5 JOD/25kg
Compost Production / Animal Feed Production
Landfill gate fees 4.72 JD/tn
Disposal fees 2.60 JD/tn
Private waste Haulers "companies" 5000 t/a
Private waste Haulers "companies" 9,000 - 12,000 t/a
GAM Collection Fleet 170,000 - 255,000 t/a
Municipal service
Expired Food waste Destruction (Itlaf) from commercial sources
Organic/Food waste from commercial waste generators "as mixed waste" 178,000 - 237,000 tn/a


Used Cooking Vegetable Oil Waste Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processing
Export
Export to global markets
Soap Manufacturing
Bio diesel
Fuel
(heating)
Glycerin oil extraction for Ointments
N: 4-5
V: 450-530 tn/month
P: 840-1050 JOD/ton
N: 3-4 formal | >100 informal
V: 450-530 tn/month
P: 500-950 JOD/tn
Specialized collection contractors
Used cooking vegetable oil waste from Hotels and Restaurants


Synthetic Textile Waste Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processing
Export
Landfilling
Specialized brokers
Cotton and synthetic textile scraps are exported to global markets in Egypt, Turkey, India, China, etc..
Few small-scale recycling manufacturers (3 – 5 companies)
N: 2 - 5
V: 2,220 - 2,960 tn/a
P: 70 JOD/tn local
P: 110 JOD/tn export
Pre-consumer Synthetic Textile waste from clothes cutting (source-separated) From Industries and Manufacturers – garment sector
V: 20-30 thousand tn/a
P: 2 - 10 JOD/tn cotton or wool
P: free for colored and polyester
Landfill for Disposal
Post-consumer Syethtic Textile waste from clothes cutting (as a mixed waste) From commercial and households sectors
There is no a value chain for textile and fabric post-consumer waste


Electronic Waste (WEEE) Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processing
Export
Export to global markets
N: 6-8
V: 1,500 - 2,000 tn/month
P: 500-950 JOD/tn
Dismantiling companies
Scrap dealers
N: 20-30
Export brokers
N: 5-10
N: 4 - 6
Specialized collection contractors
N: 150-250
Informal waste pickers
WEEE waste
40,000 - 60,000 tn/a


Old Tires and Rubber Waste Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processing
Disposal
Landfill /open dumping
Retread tires companies
N: 10 -12
V: 10,000 tn/a
medium and large scrap dealers
N: 30 - 50
Energy recovery facilities
N: 4 - 5
V: 40,000 tn/a
Scrap brokers
N: 10 - 15
Material recovery facilities
N: 3 - 5
V: 4,000 tn/a
Itinerant buyers
N: 100 -200
Upcycling workshops or handcrafts
N: 3 - 4
V: very low
Old tyres
V: 3-4 million pieces/a


Wood / Furniture Waste Value Chain
Waste Generation
Collection and Sorting
Aggregation
Processing
Local Market
Transportation purposes, machinery workshops and livestock farms
Specialized processors (cleaning, repairing, and/or sawing)
P: repaired wood pallets 8 – 12 JOD per piece
P: saw dust100 JOD per ton (as bulk)
P: saw dust 2 JOD per 10 kg (in bags)
Specialized agregators for used wood pallets, used furniture, and vegetable boxes
Collection and Sorting
sawdust, wood pallets, and wood boxes
V: 50 - 80 tn/month
P: wood pallets 1 to 7 JOD per piece
P: vegetable boxes 0.005 to 0.30 JOD per piece

9 ANNEX III: POST INTERVENTION QUALITATIVE BARRIER ANALYSIS REPORT

Please scroll down for the complete Post Intervention Qualitative Barrier Analysis report or click here to view or download as a separate document.

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Recycling in Jordan Activity

Annex 3: Post Intervention Qualitative Barrier Analysis Report

June 2023

Submission Date: June 30, 2023

Contract Number: 72027820C00007
Contract Period: August 7, 2020- August 6, 2025
COR Name: Haithem Ali

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CONTENT

EXECUTIVE SUMMARY

Background

In 2020, a behavior barrier analysis was conducted for the commercial sector in Amman. The findings from this analysis were used to inform the strategy and operations of the Recycling in Jordan Activity.

As a post-intervention update, MAGENTA conducted 32 Key Informant Interviews (KIIs) with the same establishments it collected data from in 2020. This study serves as an update to the barrier analysis conducted in 2020, building upon the previous findings and considering the evolving landscape of recycling in Jordan. It recognizes the persisting barriers identified in the earlier analysis while also addressing the increased awareness and motivation among waste generators to recycle. By examining the current state of recycling in Jordan and identifying the specific challenges faced by commercial waste generators, this study aims to provide updated insights and recommendations to further propel the recycling efforts in the country. The findings of this study will contribute to the ongoing efforts to overcome barriers, improve recycling infrastructure, and promote sustainable waste management practices, thus facilitating progress towards a greener and more environmentally conscious Jordan.

Framework

In order to unpack the behaviors around recycling and the different barriers to recycling in Amman, Jordan, MAGENTA used the COM-B model to structure this research. Utilizing the COM-B model, which stands for capability, opportunity, motivation, behavior, allowed MAGENTA to map out different factors that influence behavior at both individual and company levels.

Methodology

This study employed a mixed-methods qualitative methodological approach to assess the behavioral determinants (i.e., drivers and barriers) to the recycling behavior. Qualitative data was obtained through 32 phone-based key informant interviews (KIIs). These interviews were conducted with the managers or staff members responsible for waste disposal at the hotels, restaurants, cafes, malls and hypermarkets in Amman, Jordan.

Key Findings

In general, there were no significant variations observed among different sectors regarding their ability, motivation, and opportunities for recycling. However, the capability and chances for waste generators to participate in recycling activities were significantly influenced by the lack of awareness regarding recycling options and the availability of service providers. The motivation to engage in recycling largely stemmed from multinational corporate policies or financial incentives provided by waste collection and recycling service providers, as well as the Greater Amman Municipality. Therefore, variations were observed among different business sizes, specifically within malls and hotels that are affiliated with global corporations or categorized as large enterprises, rather than between sectors in general.

Capability

In the past few years, due to JRA's interventions, there has been a growing awareness of the importance of recycling among waste generators in Jordan. People are becoming more conscious of the environmental impact of their actions and are actively seeking ways to reduce their carbon

footprint. However, despite this increased awareness, the capabilities to recycle in the country are still lacking.

Opportunity

In recent years, there has been a notable shift in the perception of waste generators in Jordan regarding the importance of recycling. People have become increasingly aware of the environmental consequences of improper waste disposal and are eager to contribute to sustainable practices. However, despite this growing consciousness, a significant obstacle remains: the lack of opportunity for waste generators to actively participate in recycling initiatives. One of the key reasons waste generators in Jordan face challenges in recycling is the inadequate recycling infrastructure.

Motivation

Motivation for commercial waste generators to adopt recycling behaviors has increased significantly since 2020. However, financial factors, such as high costs charged by recycling companies, contribute to the lack of action on such motivations. Furthermore, the absence of specific regulations mandating recycling practices further diminishes motivation among waste generators.

Recommendations

Based on the key barriers and drivers that were identified from the updated analysis, MAGENTA has eight key programmatic recommendations for how to further influence commercial waste generators to adopt more recycling behaviors:

1. Launch comprehensive awareness campaigns targeted specifically at commercial waste generators.
2. Develop customized recycling programs that cater to the specific needs of different industries and businesses.
3. Introduce financial incentives and rewards for commercial waste generators that actively participate in recycling programs.
4. Foster collaborations between businesses, recycling companies, and government entities to create a supportive ecosystem for recycling.
5. Conduct waste audits within commercial establishments to identify the types and volumes of waste generated.
6. Establish or enhance regulations that mandate commercial waste generators to implement recycling practices.
7. Encourage public-private partnerships to address the challenges faced by commercial waste generators.
8. Improve data collection and reporting systems to track and monitor recycling rates among commercial waste generators.

1 BACKGROUND

Currently, most commercial waste generators use municipal waste collection services that take their waste straight to landfills. A small number of these waste generators across sectors allow informal waste pickers access (i.e., sorting and extraction of recyclables) to their waste prior to disposal. An even smaller number of commercial waste generators contract and use formal private sector recycling services. If the Activity is to meet its target of diverting up to 116t per day of landfill waste into recycling markets, it is going to have to change current practices of commercial waste generators with respect to:

- Improved and increased access to waste pickers by commercial waste generators.
- Increased contracting of private sector recycling service providers; and/ or
- Establishment of internal waste management and recycling operations (i.e., separation, sorting, and sale.

Therefore, to help elaborate and inform any/all such options, the Activity conducted this study, which examines current practices and motivations of commercial waste generators in four sectors (restaurants, hypermarkets, hotels, and malls) in Amman.

2 ANALYTICAL FRAMEWORK

2.1 COM-B Model Research

This research has been guided by a social and behavioral change (SBC) approach, which is informed by behavioral models and insights from sociology, psychology, and behavioral science research. Social expectations and norms play a large role in determining an individual's behavior, as many negative behaviors are derived from and reinforced through social expectations.

By using an SBC approach to policymaking and focusing on changing behaviors, attitudes, and beliefs, governments can create long lasting positive change for their citizens. Specifically, the COM-B model was used as the analytical framework for this research, helping to unpack and explore the drivers and barriers to recycling by commercial waste generators. This model recognizes that behaviors are multidimensional, involving three different components. The COM-B model recognizes that capability (both psychological and physical), motivation (conscious and unconscious), and opportunity (physical and social) affect an individual, or in this case a company's, adoption of a behavior.

- **Motivation** is viewed as an expression of an individual's desire to change or adopt a new behavior.
- **Capability** relies on the individual's capacity to change or adopt a behavior, such as having the necessary physical ability, knowledge, and skills.
- **Opportunity** captures external factors that enable or motivate behavior, including changes to the environment and social opportunities.

Therefore, COM-B considers both the individual determinants behind a behavior, as well as the sociological and environmental ones.

Figure 1 presents a full definition for the motivation, capability, and opportunities in the COM-B model.

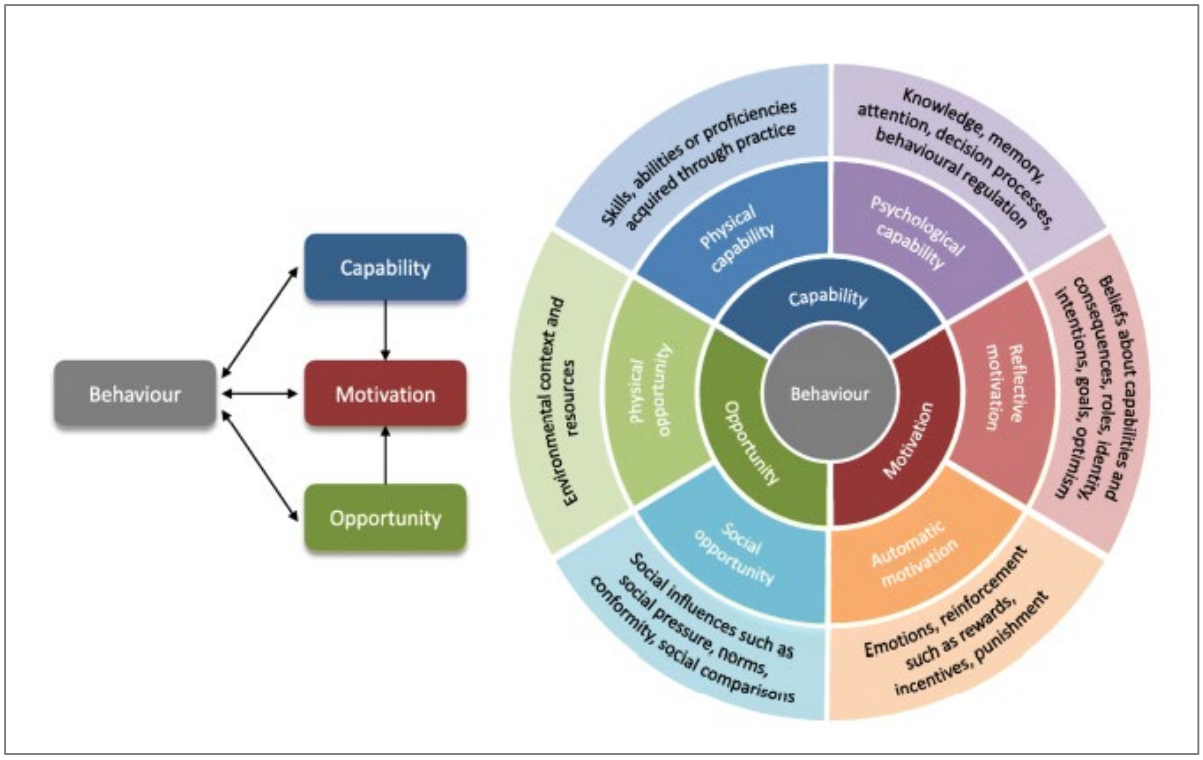

Figure 1:Full definition of motivation, capability, and opportunities - COM-B Model

2.2 Research Questions

The research questions that guided this assessment are split into (1) context questions and (2) behavioral determinant questions. The behavioral determinant questions have been categorized in accordance with the COM-B analytical framework. These are detailed below:

Context research questions:

- What kind of, how much, and how frequently waste is generated by different commercial units?
- What alternatives to private sector recycling services are being used by commercial waste generators.

Table 9: Behavioral Determinate Research Questions

Research Question	Behavioral Driver as per COM-B
What kind of waste disposal mechanisms, or recycling services, do commercial waste generators engage in, if any?	Opportunity
What are the key factors that drive or hinder commercial waste generators from adopting recycling (and waste separation) behaviors (recyclers vs non-recyclers)?	Capability, Opportunity, Motivation
What is the experience of commercial waste generators when seeking to access recycling services, from both formal and informal service providers?	Opportunity

2.3 Research Methodology

MAGENTA conducted rapid post-intervention qualitative research to assess the changes in the behavioral determinants (i.e., drivers and barriers) of recycling by commercial waste generators in the four previously targeted sectors. Qualitative data was obtained through KIIs with the same commercial waste generators contacted in 2020. These interviews were conducted in Amman, Jordan with the managers or staff members responsible for waste disposal in four sectors: Hotels, Restaurants and Cafes, Shopping Malls, and Hypermarkets.

Semi-structured discussion guides were developed to assess changes in behavioral determinants, intentions, barriers, and current knowledge in relation to solid waste management and recycling, as well as to better understand the experiences of the commercial waste generators with regards to provision of recycling services, both formal and informal.

2.4 Types of Interviews Conducted

Figure 2 outlines the types of interviews conducted in each commercial sector in Amman.

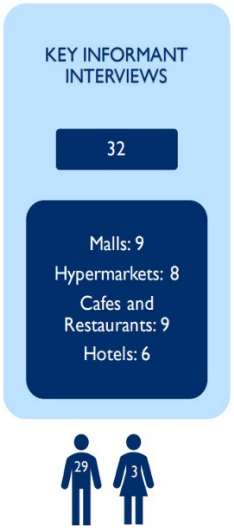

Figure 2: Number and types of interviews conducted in each commercial sector

2.5 Analysis Methodology

To ensure consistency between the research questions, COM-B analytical framework and data collected, MAGENTA employed an iterative approach to coding and analyzing the qualitative transcripts. An initial coding structure was developed that reflected the structure of the COM-B model and questionnaire. But to allow for other themes and trends to emerge, the coding structure was routinely reviewed and updated to ensure that those insights were captured.

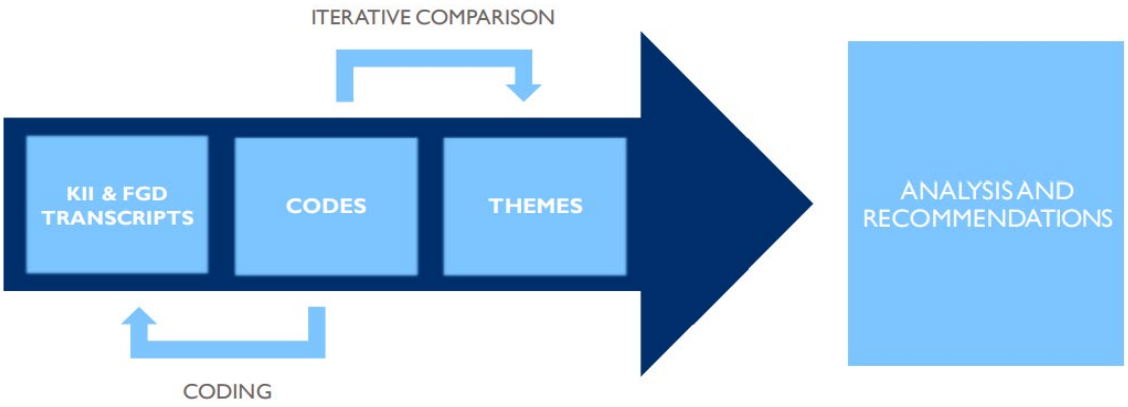

Figure 3: Analysis Methodology of this Research

2.6 Classification of Recycling Behavior

As part of the analysis MAGENTA conducted a post-classification of recycling behaviors as doers, non-doers, and ex-doers. These are defined below and allow for a comparative behavioral analysis to understand key differences between these groups.

- **Doers** were determined if the respondent's company has a system in place to separate recyclable materials from waste) whether internal or external process) and was taken by either private company, municipality, or individual waste picker to be recycled.
- **Non-doers** were determined to be companies who did not separate waste materials, disposing all waste together. The intent of the company was considered, whereby if respondent said there were no systems or programs in place to recycle, they were categorized as non-doers.
- **Ex-doers** were determined respondents whose companies used to partake in active recycling processes but no longer do due to varying circumstances.

3 BARRIERS TO COMMERCIAL WASTE RECYCLING CAPABILITIES

3.1 Barriers to Capabilities

3.1.1 Barriers to Commercial Waste Recycling Capabilities (2020)

In 2020, the capability of commercial waste generators was explored to understand the importance as a factor in determining whether a company recycles or not. Specifically, this looked at physical and psychological capabilities, such as decision-making processes, corporate policies, sorting capabilities, man-power profiles, wages and costs, physical infrastructure, financial means, and knowledge and awareness. The following have been identified as the three primary capability barriers to recycling.

- Waste Generators lack awareness of the recycling concept and the services available. Non-doers reported lower levels of awareness of recycling and the availability of service providers than doers.
- Waste Generators lack finances to afford private sector services and the tools and equipment required. Non-doers were more likely to express perceptions of recycling as being costly and financially taxing than doers.
- Waste Generators lack physical space to place containers and sort different types of waste. Non-doers were more likely to express concerns around the availability of the physical space needed for sorting waste than doers.

The barrier analysis conducted in 2020 shed light on various aspects of recycling behavior among commercial waste generators. When it comes to those who actively recycle, several factors come into play. These individuals typically outsource the sorting of waste to private companies, waste pickers, or daily laborers. In malls, for instance, the cleaning staff collects waste from all stores and shops, separating recyclable and non-recyclable waste in designated skip areas. The recyclable and non-recyclable waste is then transported separately by employees of private companies. The availability of recycling equipment and labor emerges as a crucial component in fostering recycling behavior. In some cases, private companies provide the sorting containers, and their employees spend several hours each day sorting different types of waste on the premises.

A notable observation is the lack of gender diversity in recycling practices. Among the companies surveyed, all of them reported exclusively employing male workers for waste sorting and disposal. While most of the employees are Jordanians, some daily waste pickers, who are predominantly male, are Egyptian or Bangladeshi laborers. Furthermore, the presence of dedicated space for waste collection and sorting is a significant factor for those who actively recycle. Waste generators across sectors reported having rooms or outdoor areas specifically allocated for this purpose. However, some companies mentioned that sorting by private companies on their premises requires special permissions from the municipality due to health and safety regulations. As a result, waste is sometimes transported to designated areas by the private companies for sorting due to limited physical space.

Despite the efforts made by these "doers," the recycling of waste remains limited. Most waste generators in this category primarily separate materials such as cardboard, nylon, and polystyrene, which are then collected by private companies or waste pickers. However, all other types of solid waste are simply placed in bin bags without further sorting and subsequently collected by municipality trucks for disposal in landfills. In the cafes and restaurants sector, recycling efforts primarily focus on the recycling of cooking oil. Establishments either use oil recycling machines or outsource this task to private recycling companies that collect the oil in large drums. Many cafes and restaurants have established contracts with these private companies to manage the recycling process.

On the other hand, the analysis also encompasses commercial waste generators who do not engage in recycling practices. For these "non-doers," sorting waste poses a significant challenge. Many companies in this category lack internal sorting capabilities or dedicated employees for waste sorting. In some cases, the responsibility for adopting recycling behavior falls upon individual shop owners or restaurant operators due to the difficulty and cost of managing and hiring employees to handle waste from all establishments. Additionally, a lack of physical space during the construction phase of buildings for restaurants and cafes is a major barrier. These establishments often do not have separate areas allocated or built specifically for waste collection and sorting, which forces them to dispose of their waste on a daily basis without in-house sorting. Limited financial resources also play a crucial role in preventing these companies from adopting recycling practices. The costs associated with purchasing additional bags, bins, tools, and hiring more employees for sorting and recycling outweigh the perceived benefits. Furthermore, inadequate infrastructure and a lack of required machinery further hinder their recycling efforts. Some modern buildings designed for malls and large hotels lack separate bins or containers for sorting waste, while others lack the physical infrastructure necessary to carry out in-house sorting.

Turning to the decision-making process regarding waste management, it is evident that clear structures are often lacking. Across different sectors and organizations, decision-making responsibilities are distributed among various departments and individuals, leading to a lack of consistent policies and focal points. For example, in malls or hotels, the responsibility for waste disposal lies with departments such as kitchen or housekeeping, with no centralized process for waste management. However, some multinational organizations, like Marriott, make waste management decisions at the headquarters level and implement them globally.

3.1.2 Barriers to Commercial Waste Recycling Capabilities (2023)

Companies across different sectors exhibit a significantly low level of knowledge and awareness with regards to recycling services. Although some respondents may display a lack of awareness regarding the importance of recycling, it is noteworthy that there has been a substantial overall increase in awareness regarding the significance of recycling in Jordan. While most of the interviewed waste generators admitted that recycling is important for the environment and the country, the same interviewees, especially the non-doers, said that they lacked the means or capabilities to engage in recycling. Some respondents, specifically in the hypermarket/supermarket sector, completely dismissed recycling as they did not consider their establishment a major waste generator due to the type and amount of waste they generate. Unfortunately, many respondents were unable to distinguish between waste disposal and recycling services, and their knowledge is limited to private waste disposal companies that remove waste from their premises without knowing if it is being recycled or not.

Most of the respondents demonstrated awareness regarding the significance of waste recycling, an interesting shift from 2020. However, it is important to note that multinational corporations, such as Rotana Hotel and Crowne Plaza, have effective procurement departments that actively gather information about recycling companies operating in the Amman region and actively pursue companies that align best with their recycling goals and objectives. Most other establishments, even

smaller hotels, such as Compass Hotel, rely on recycling companies that approach them with offers. Additionally, most companies are unaware of the waste disposal and recycling services offered by private companies or individual waste collectors. While some commercial waste generators claim to have received free waste disposal and sorting services from recycling companies, the majority claim to either have no knowledge of such services or have never been approached by waste disposal and sorting service providers.

In some malls and hypermarkets, male employees are assigned the responsibility of sorting. However, private companies provide waste containers, which are then separated by the employees before being collected from the premises. Within the malls, the cleaning staff collect waste from all stores and shops, taking it to the designated skip area where they separate recyclable from non-recyclable materials. Mall staff members state that it is the responsibility of shop owners and restaurants to adopt recycling practices, as managing or hiring employees to monitor each shop would incur additional costs. Some of these employees or daily waste collectors are male Egyptian laborers. According to respondents, employees from private companies spend approximately 5 to 6 hours each day on the premises to sort different types of waste. However, a few respondents mentioned that sorting activities by private companies on the premises require special permissions from the municipality due to health and safety regulations. Therefore, the waste is transported to specific areas by the private companies for sorting.

Recyclable and non-recyclable waste are transported in separate vehicles by employees of private companies. In most companies across various sectors, only cardboard, nylon, and polystyrene are separated for collection by private companies or waste collectors. All other types of solid waste are placed in bin bags without sorting and are collected by municipality trucks for disposal in landfills. When it comes to modern constructions, especially those designed abroad for malls and large hotels, there is typically physical space dedicated to recycling activities. However, many of these companies do not have separate bins or containers for sorting and lack the necessary infrastructure to conduct sorting in-house.

According to respondents, waste disposal is often overlooked during the construction of buildings for restaurants and cafes. For instance, no designated area is allocated or constructed specifically for waste disposal or sorting during the building phase. As a result, these companies must dispose of their accumulated waste daily without conducting sorting internally. Many companies that do not engage in sorting or recycling behavior attribute it primarily to a lack of physical space. They simply do not have the required space to carry out these activities.

In certain areas, private companies may lack the specific machinery needed for handling trash containers. Consequently, private companies tend to enter into contracts with waste generators whose infrastructure is more compatible with the machinery they possess.

Lack of Financial Resources: Some companies mention that private recycling companies charge excessively high fees for waste disposal and recycling services. As a result, the cost outweighs the potential benefits for these companies, discouraging them from pursuing such services.

In the past few years, due to JRA's interventions, there has been a growing awareness of the importance of recycling among waste generators in Jordan. People are becoming more conscious of the environmental impact of their actions and are actively seeking ways to reduce their carbon footprint. However, despite this increased awareness, the capabilities to recycle in the country are still lacking.

One of the primary challenges faced by Jordan in implementing effective recycling programs is the inadequate infrastructure. The country lacks well-established recycling facilities and collection systems, making it difficult for waste generators to properly dispose of their recyclable materials. Limited access to recycling centers and the absence of comprehensive waste management systems hinders the recycling process.

Furthermore, the absence of financial incentives and regulatory frameworks to promote recycling poses a significant barrier. Without clear incentives or regulations, businesses and individuals may not prioritize recycling efforts, as there are no immediate benefits or consequences for their actions. The absence of a supportive policy framework and investment in recycling infrastructure limits the expansion and effectiveness of recycling initiatives.

In conclusion, while there is a growing awareness of the importance of recycling among waste generators in Jordan, the country still faces significant challenges in terms of recycling capabilities. The lack of infrastructure, inadequate public education, and the absence of financial incentives and regulatory frameworks hinder the progress of recycling efforts. Addressing these challenges will require a comprehensive approach that involves investment in recycling infrastructure, widespread education campaigns, and the implementation of supportive policies to create an environment conducive to recycling practices.

Implementing infrastructure changes for recycling in a developing country, such as Jordan, is a complex process that requires time and careful planning. Jordan faces numerous challenges, such as limited resources, financial constraints, and competing priorities, which can slow down the progress of establishing a robust recycling infrastructure. Building the necessary facilities, such as recycling centers, sorting facilities, and collection systems, requires significant investments and coordination between various stakeholders, including government bodies, private sector entities, and local communities. Additionally, Jordan may need to address issues related to waste management, transportation logistics, and the integration of informal waste sectors into formal recycling systems. These changes cannot happen overnight and necessitate a long-term commitment, collaboration, and strategic decision-making to develop the infrastructure required for effective recycling practices. While it may take time to achieve the desired results, investing in infrastructure changes is crucial for building a sustainable recycling system that can positively impact the environment and the overall well-being of the community.

3.2 Barriers to Opportunities

3.2.1 Barriers to Commercial Waste Recycling Opportunities (2020)

Opportunities- Key Barriers

In 2020, opportunities for commercial waste generators were explored to understand the availability and quality of services as a factor to determine if the company recycles or not. Specifically, this looked at physical opportunity and social opportunity, such as the availability and quality of services, and social norms and influences, and knowledge and awareness of the services available. The following have been identified as the three key opportunity barriers to recycling.

- Waste generators lack awareness about the availability of recycling services and perceive the services provided by the private companies as expensive and unreliable.
- Waste generators perceive that private sector companies have limited capacity and can only recycle select items, such as cardboard and cooking oil.
- Waste Generators realize that recycling is not aligned with social norms and there is no social pressure, as not recycling is not considered unethical by society.

Perceived Availability of Service

The research explored what commercial waste generators understood to be available in terms of waste management services. It should be noted that this was not a mapping exercise and, as such, all findings are perceptions and do not necessarily reflect what is available. Awareness of following types of services was assessed:

- Private Sector Companies
- Public Waste Disposal Services, i.e., Greater Amman Municipality
- Individual Waste Pickers

In 2020, the waste management landscape in Jordan involved the use of private sector companies, public waste disposal services, and individual waste pickers. Private sector companies are commonly contracted by big hotels and malls in Amman, with some malls having on-site waste sorting done by doers, while different companies are contracted for the disposal of specific types of recyclable waste. In some cases, hotels, cafes, and restaurants have separate contracts with private companies specialized in recycling cooking oil.

Public waste disposal services are provided by the Greater Amman Municipality and are used by companies across various sectors. Non-doers mostly rely on these services, simply throwing all waste into dumpsters for the municipality to dispose of in landfills without any sorting. However, these services are irregular, and their reliability varies by area. Some hotels have reported the municipality initiating recycling services as part of foreign-funded NGO projects. Individual waste pickers are commonly utilized by the cafes, restaurants, and hypermarkets. They collect recyclable waste and sell it to recycling companies, often providing this service for free.

Respondents perceive a lack of sufficient recycling service providers in the formal sector. Although private sector companies approach some doers, the majority of commercial waste generators are unaware of such services as they have never been approached. The limited availability of services affects perceived reliability, as most companies can only recycle specific types of waste due to limited capacity and financial constraints. Some doers contract separate companies for different types of waste.

No public sector entity was described as a recycling service provider. The Greater Amman Municipality solely provides waste disposal services without sorting or recycling.

The perceived quality of services varies depending on priorities. Private sector services are preferred by doers due to perceived reliability and adequate frequency of collection, while non-doers often find them costly. Public sector services are deemed unreliable by doers and are considered acceptable but irregular by non-doers. Individual waste pickers are used by some non-doers, particularly small-scale waste generators, appreciating the free of cost service and full-service recycling they offer.

Overall, recycling is not yet a social norm in Jordanian society, and there is a lack of awareness about its importance and environmental impact. Recycling behavior needs to be integrated into everyday life, and further awareness raising is required to make it more widespread, particularly in sectors like hotels. The concept of "green hotels" is emerging but still requires more customer awareness to achieve tangible results.

3.2.2 Barriers to Commercial waste Recycling Opportunities (2023)

Although knowledge regarding the importance of recycling amongst waste generators in Jordan has significantly increased in the last few years, limited awareness exists among commercial waste generators regarding the availability of recycling services in the Amman region. Private waste disposal and recycling companies are preferred over public sector entities due to perceived better services and affordability. However, the number of companies providing recycling services is insufficient to meet the diverse needs of waste generators. The quality of private services varies, with mixed perceptions about their timelines and commitment. Lack of sufficient infrastructure, logistics, and financial resources hinder the scaling of recycling services. Perceptions regarding the quality of private services vary depending on the service provider. Some companies or individual waste collectors offer daily services and collect waste on a regular basis from the premises of many

commercial waste generators. However, there is a mixed perception among non-doers that recycling services or waste disposal companies are not fully committed and fail to provide timely services as promised in their contracts. In particular, waste generators in the food sector hold a negative opinion about service quality, as the removal of organic and non-solid waste is required on a daily basis from their premises. Comparatively, services provided by the private sector are generally praised in contrast to those offered by the public sector. Private companies are seen as more reliable in providing timely services and fulfilling their commitment to regularly remove waste from company premises.

One of the key challenges reported by waste generators is the lack of sufficient infrastructure and logistics among most private companies. These companies often lack the financial resources and capabilities to meet the recycling needs of waste generators on a large scale. Additionally, the companies themselves do not provide containers or bins for sorting waste, further hindering effective recycling practices. Moreover, most of these companies are only equipped to recycle specific materials such as cardboard, polystyrene, and plastic. None of them have the facilities to recycle organic or non-solid waste.

In recent years, there has been a notable shift in the perception of waste generators in Jordan regarding the importance of recycling. People have become increasingly aware of the environmental consequences of improper waste disposal and are eager to contribute to sustainable practices. However, despite this growing consciousness, a significant obstacle remains: the lack of opportunity for waste generators to actively participate in recycling initiatives. One of the key reasons waste generators in Jordan face challenges in recycling is the inadequate recycling infrastructure. The country struggles to establish well-equipped recycling facilities and efficient collection systems. Access to recycling centers is limited leaving many waste generators with no viable option to dispose of their recyclable materials responsibly. Without convenient and easily accessible recycling options, individuals find themselves unable to convert their intentions into actions. While waste generators in Jordan demonstrate an understanding of the importance of recycling, the lack of public support hampers their ability to participate effectively.

Another significant hindrance to recycling opportunities for waste generators in Jordan is the absence of supportive policies and financial incentives. The government plays a crucial role in driving recycling initiatives, such as implementing regulations, providing financial support, and incentivizing businesses and individuals to participate. However, the lack of a comprehensive policy framework and tangible rewards for recycling efforts diminishes the motivation and urgency among waste generators to actively engage in recycling practices. In the absence of clear incentives and regulations, recycling remains a secondary concern for many, overshadowed by immediate priorities.

While waste generators in Jordan have come to recognize the importance of recycling, their aspirations are hindered by the limited opportunity to do so. The absence of a robust recycling infrastructure, inadequate public support and the lack of policy measures and incentives combine to impede the progress towards a sustainable recycling system. To address this situation effectively, it is imperative for the government, private sector, and civil society to collaborate and invest in developing comprehensive solutions. This includes the establishment of accessible recycling facilities, widespread public education campaigns, and the implementation of supportive policies and incentives. By overcoming these obstacles and providing waste generators with the necessary means and opportunities to recycle, Jordan can unlock its full potential in waste management and contribute significantly to a greener and more sustainable future.

Even if policies to support recycling in Jordan existed, a significant number of waste generators lack awareness of such initiatives. In interviews conducted with waste generators, it became evident that many individuals were unaware of the policies in place or the incentives available for recycling. This lack of awareness can be attributed to a variety of factors, including limited dissemination of information, insufficient public education campaigns, and a lack of clear communication channels. As a result, even when policies are implemented with the intention of promoting recycling, their impact

remains limited if waste generators are not adequately informed and educated about their existence and the benefits they provide. Efforts to bridge this gap should prioritize comprehensive and targeted awareness campaigns to ensure waste generators are well-informed and empowered to participate in recycling initiatives.

3.3 Barriers to Motivation

3.3.1 Barriers to Commercial Waste Recycling: Motivation (2020)

In 2020, the motivations of the commercial waste generators were explored to understand the primary factors that drive the behavior of doers, and what could possibly be the factors that influence the non-doer's behavior. The following were identified as the three key drivers to recycling.

- Provision of waste disposal and recycling services at a lower than-normal cost will encourage the waste generators to adopt recycling behavior.
- Incentives such as discounts, tax exemptions, free publicity and provision of free recycling tools and equipment will motivate waste generators to take up recycling behavior.
- Clear corporate policies regarding waste disposal and recycling activities compel companies to adopt recycling behavior.

For the doers, cleanliness emerged as a central motivator for proper waste disposal. By hiring private sector recycling or waste collection companies, commercial waste generators were able to keep their premises clean and maintain cleanliness through timely and consistent services. Monetary efficiency was another key motivator, as some recycling service providers offered free waste removal, reducing the cost of waste disposal for waste generators. Additionally, using recycling services helped reduce the amount of waste that had to be disposed of through other means, leading to significant cost savings. Furthermore, some companies included environmental protection in their organizational values, aiming to raise awareness and garner support. Discounts for recycling and environmental concerns were also mentioned as motivators. Finally, image-recognition played a role in motivating companies to recycle, as they aimed to be recognized as leaders in protecting the environment.

In contrast, non-doers identified several motivating factors that could encourage them to adopt recycling behavior. The cleanliness of recycling services was a concern, and non-doers expressed interest in adopting recycling if more frequent and reliable services were provided. Lower costs and discounts were important factors, as many non-doers were unaware of the free or discounted waste disposal services offered by recycling companies. Supply of tools and equipment for sorting recyclable waste was also identified as a central motivating factor, as some non-doers lacked the resources to purchase these items. Publicity and image-recognition were seen as incentives that could encourage non-doers to recycle. The influence of the Association of Restaurants in the café and restaurant sector was highlighted as a potential driving force for recycling in that industry. Lastly, increased revenue and financial rewards were mentioned as motivating factors, as non-doers expressed willingness to invest in recycling activities if it could increase their revenue and cover the associated costs.

Overall, understanding these motivations and factors can help shape strategies and initiatives to encourage both doers and non-doers to engage in recycling behaviors, promoting environmental sustainability and waste reduction.

3.3.2 Barriers to Commercial Waste Recycling: Motivation (2023)

Motivation for commercial waste generators to adopt recycling behaviors has increased significantly since 2020. However, financial factors, such as high costs charged by recycling companies, contribute

to the lack of action on such motivations. Furthermore, the absence of specific regulations mandating recycling practices further diminishes motivation among waste generators.

A significant number of companies have a limited understanding of the waste disposal and recycling services offered by private companies or individual waste collectors. While a few commercial waste generators have reported receiving free waste disposal and sorting services from recycling companies, the majority are unaware of such services or have never been approached. Given that commercial waste generators operate with profit-oriented objectives, they often assess cost-benefit analyses. Many of them perceive recycling as costly and potentially reducing their net profit. Consequently, offering incentives such as discounts on electricity or gas costs could help stimulate their interest in adopting recycling behavior.

In recent years, Jordan has witnessed a remarkable increase in the motivation to recycle among waste generators. People are becoming increasingly aware of the environmental challenges posed by improper waste management and are embracing the concept of recycling as a powerful tool to mitigate these issues. One of the primary catalysts behind the rise in motivation to recycle among waste generators in Jordan is the growing environmental consciousness within the population due to the efforts of awareness raising campaign by the Activity. People are increasingly recognizing the detrimental effects of excessive waste, pollution, and resource depletion on their surroundings. This awareness fuels a desire to take proactive measures to protect the environment and preserve natural resources for future generations. As a result, waste generators are seeking ways to reduce their ecological footprint, with recycling emerging as a tangible and effective solution, without increasing the cost of their operations and within their limited capabilities.

The increase in motivation to recycle can be attributed, in part, to the concerted efforts of the Activity in partnership with educational institutions, non-governmental organizations, and government initiatives to promote recycling awareness. Public campaigns and educational programs have been implemented to inform waste generators about the benefits of recycling and proper waste management practices. These initiatives play a crucial role in instilling knowledge and creating a culture of recycling among waste generators, inspiring them to actively participate in recycling efforts.

In Jordan, an additional driving force behind the motivation to recycle among waste generators is the recognition of the positive impact it can have on their business reputation, specifically among malls and hotels. Increasingly, businesses in various sectors are realizing the significance of adopting sustainable practices, including recycling, to enhance their image and gain a competitive edge in the market.

A strong business reputation built on environmentally responsible practices that also account for climate change is becoming an asset in Jordan's evolving business landscape. Consumers are increasingly conscious of supporting businesses that prioritize sustainability, and they actively seek out products and services from companies that demonstrate a commitment to environmental stewardship. By embracing recycling initiatives, waste generators can position themselves as socially responsible entities, garnering trust, and loyalty from environmentally conscious consumers. Moreover, businesses that actively recycle their waste can showcase their commitment to Corporate Social Responsibility (CSR). They demonstrate to their stakeholders, including customers, employees, investors, and regulatory bodies, that they are actively working towards minimizing their environmental impact. This can lead to positive publicity, increased brand value, and a favorable reputation within the industry.

By integrating recycling practices into their operations, waste generators can also seize cost-saving opportunities. Recycling can help reduce waste disposal fees, lower raw material procurement costs, and enhance operational efficiency. These financial benefits further incentivize businesses to prioritize recycling, as it aligns with their profit-driven objectives while simultaneously benefiting the environment. In some cases, waste generators collaborate with recycling companies or engage in

partnerships with environmental organizations to strengthen their recycling efforts. By forming strategic alliances, businesses can leverage the expertise and resources of these entities, further enhancing their reputation as environmentally responsible organizations.

It is worth noting that while some waste generators in Jordan are motivated by their business reputation in recycling, it is crucial to ensure that their commitment extends beyond mere public relations. Sustainable recycling practices should be integrated into their core operations and become an integral part of their long-term business strategies. A genuine commitment to environmental sustainability requires ongoing efforts to optimize recycling processes, invest in innovative technologies, and continually improve waste management practices. The motivation to recycle among waste generators in Jordan is not solely driven by environmental concerns but also by the desire to enhance their business reputation. Recognizing the potential benefits of sustainable practices, businesses are embracing recycling initiatives to gain a competitive edge, build trust with consumers, and demonstrate their commitment to corporate social responsibility. By leveraging their recycling efforts, waste generators can simultaneously contribute to environmental conservation, drive financial savings, and strengthen their position in the marketplace.

4 COMPARATIVE CONCLUSION

In conclusion, it is evident that while the barriers to recycling in Jordan remain largely unchanged since 2020, there has been a notable increase in awareness and motivation among waste generators to participate in recycling initiatives. The growing recognition of the importance of recycling and its positive impact on the environment has led to a shift in attitudes and behaviors towards sustainable waste management practices. However, it is important to acknowledge that certain barriers, such as limited infrastructure, insufficient public support, and the absence of effective policies and incentives, require significant time and investment to overcome. Building the necessary recycling infrastructure, implementing comprehensive education campaigns, and establishing supportive policies and incentives cannot be achieved overnight. These challenges demand long-term commitment, collaboration between stakeholders, and substantial investments to develop a sustainable recycling ecosystem.

Efforts to address these barriers should prioritize strategic planning, resource allocation, and ongoing monitoring and evaluation to ensure progress is being made. It is crucial for the government, private sector, and civil society to work together in a coordinated manner, leveraging their respective strengths and expertise to create an enabling environment for recycling to thrive.

While the journey to overcoming the barriers to recycling in Jordan may be arduous, the increased awareness and motivation among waste generators provide a solid foundation for continued progress. With sustained commitment and dedicated investment over the years, it is possible to surmount these obstacles and build a robust recycling infrastructure that benefits the environment, the economy, and the well-being of the nation. Only through persistent efforts and collaboration can Jordan pave the way for a greener and more sustainable future.

5 RECOMMENDATIONS

This section presents key programmatic recommendations based on the post intervention barrier analysis above. The following are the key eight programmatic recommendations for how to influence commercial waste generators to adopt more recycling behaviors:

- Awareness Campaigns: Launch comprehensive awareness campaigns targeted specifically at commercial waste generators.
- Tailored Recycling Programs: Develop customized recycling programs that cater to the specific needs of different industries and businesses.

- Incentives and Rewards: Introduce financial incentives and rewards for commercial waste generators that actively participate in recycling programs.
- Collaborative Partnerships: Foster collaborations between businesses, recycling companies, and government entities to create a supportive ecosystem for recycling.
- Waste Audits and Monitoring: Conduct waste audits within commercial establishments to identify the types and volumes of waste generated.
- Regulatory Framework: Establish or enhance regulations that mandate commercial waste generators to implement recycling practices. Set clear targets for recycling rates and provide penalties for non-compliance.
- Public-Private Partnerships: Encourage public-private partnerships to address the challenges faced by commercial waste generators.
- Data and Reporting: Improve data collection and reporting systems to track and monitor recycling rates among commercial waste generators.

5.1 Awareness Campaigns

To effectively encourage commercial waste generators in Jordan to adopt recycling behavior, it is crucial to launch comprehensive awareness campaigns targeted specifically at them. These campaigns should aim to educate and inform waste generators about the various governmental incentives and cost-saving opportunities associated with recycling.

The awareness campaigns should emphasize the specific incentives and benefits that waste generators can avail themselves of when they choose to recycle. This could include highlighting tax exemptions or reductions, discounted waste disposal fees, or even grants and subsidies for investing in recycling infrastructure or equipment. By clearly communicating these incentives, waste generators will become more aware of the potential cost savings they can achieve through recycling.

Regular updates and consistent communication should be provided to waste generators to ensure that they stay informed about the available incentives. Many waste generators may not actively seek information about recycling due to the perception that it is burdensome or complicated. By proactively reaching out to them and providing regular updates, they can be made aware of the opportunities they have to participate in recycling without feeling overwhelmed by the process.

The awareness campaigns should also address any misconceptions or myths that waste generators may have about recycling. For example, some waste generators might believe that recycling is not financially viable or that it requires a significant investment of time and resources. By providing accurate and detailed information, backed by success stories and case studies, these misconceptions can be debunked, and waste generators can see the true value and benefits of recycling.

Moreover, the awareness campaigns should tailor their messages to resonate with the motivations and desires of waste generators. Highlighting the environmental impact of recycling and the positive contribution waste generators can make towards sustainability and protecting the environment can be a powerful motivator. Additionally, emphasizing the potential positive image and reputation that waste generators can gain by actively participating in recycling initiatives can also be persuasive.

Overall, the key to successful awareness campaigns targeting commercial waste generators is to provide clear, relevant, and up-to-date information about the incentives and cost-saving opportunities available to them. By addressing misconceptions, providing regular updates, and aligning the messaging with their motivations, waste generators can be motivated to overcome perceived barriers and actively engage in recycling behaviors.

5.2 Tailored Recycling Programs

To promote recycling among commercial waste generators, it is essential to develop tailored recycling programs that cater to the specific needs of different industries and businesses. These customized programs should be designed to address the unique challenges and requirements of each sector, ensuring that recycling becomes a practical and convenient option for waste generators.

One aspect of tailored recycling programs is the provision of specialized collection bins. Different industries may generate distinct types of waste, such as paper, plastic, glass, or organic waste. By providing dedicated bins specifically designed to accommodate these different waste streams, waste generators can easily segregate their recyclable materials, making the recycling process more efficient. For example, restaurants and cafes may require separate bins for food waste and beverage containers, while offices may need designated bins for paper and electronic waste.

In addition to specialized collection bins, offering pickup services can greatly enhance the convenience of recycling for commercial waste generators. Many businesses may lack the resources or infrastructure to transport their recyclable materials to recycling centers on their own. By establishing partnerships with waste management or recycling companies, waste generators can benefit from scheduled pickups of their recyclables. This eliminates the need for waste generators to invest in transportation logistics and ensures a reliable and efficient recycling process.

Another important aspect of tailored recycling programs is establishing partnerships with recycling companies that specialize in handling specific types of waste. Some industries generate waste that requires specialized processing or treatment, such as hazardous materials or electronic waste. By collaborating with recycling companies that possess the necessary expertise and infrastructure, waste generators can ensure that their specialized waste is properly managed and recycled in compliance with relevant regulations. This not only ensures the responsible disposal of potentially harmful materials but also enables waste generators to maximize the recycling potential of their specific waste streams.

By developing customized recycling programs, waste generators are more likely to perceive recycling as a feasible and manageable endeavor. The programs take into account the specific needs and constraints of different industries, providing practical solutions that fit seamlessly into their operations. This approach increases the likelihood of widespread participation and long-term commitment to recycling, as waste generators can easily integrate recycling practices into their day-to-day activities without significant disruptions.

Overall, tailored recycling programs that offer specialized collection bins, pickup services, and partnerships with recycling companies specializing in specific waste streams are instrumental in making recycling more accessible and convenient for commercial waste generators. These programs demonstrate a commitment to meeting the unique requirements of different industries, ultimately fostering greater engagement and participation in recycling initiatives.

5.3 Incentives and Rewards

To further encourage commercial waste generators to actively participate in recycling programs, it is crucial to introduce financial incentives and rewards that recognize and appreciate their efforts. These incentives can take various forms, providing tangible benefits that motivate waste generators to prioritize recycling and offset any initial costs associated with implementing recycling initiatives.

One effective incentive is the introduction of tax credits or deductions. By offering tax benefits to businesses that engage in recycling activities, waste generators are provided with a financial incentive to adopt and maintain sustainable waste management practices. These tax incentives can help offset the costs of implementing recycling infrastructure, purchasing recycling equipment, or training

employees on proper waste segregation and recycling techniques. The potential reduction in tax liabilities serves as a concrete reward for waste generators and encourages ongoing commitment to recycling.

Reduced waste disposal fees are another impactful incentive. Waste generators often incur costs for the collection and disposal of their non-recyclable waste. By offering reduced fees or discounts on waste disposal services for businesses that actively participate in recycling programs, waste generators are financially motivated to divert more of their waste towards recycling. This not only reduces their waste disposal expenses but also promotes the environmental benefits associated with recycling, such as waste reduction and resource conservation.

Recognition and certification programs can also serve as powerful incentives for commercial waste generators. By publicly acknowledging and certifying businesses that achieve high recycling rates or demonstrate exceptional commitment to sustainable waste management, waste generators receive validation and positive reinforcement for their efforts. This recognition can be in the form of awards, certificates, or inclusion in sustainable business directories, showcasing their environmental stewardship. Such recognition not only boosts the image and reputation of waste generators but also provides a marketing advantage by attracting environmentally conscious customers and fostering a sense of pride among employees.

Furthermore, financial incentives and rewards can be combined with educational programs and outreach efforts to enhance their impact. Informational workshops, training sessions, or webinars can be organized to educate waste generators about the benefits of recycling and how to effectively implement recycling initiatives. These educational programs help waste generators understand the value of the incentives offered and equip them with the knowledge and tools to maximize their recycling efforts.

Incentives and rewards play a crucial role in motivating commercial waste generators to actively participate in recycling programs. By providing financial benefits, reducing costs, and recognizing their sustainability achievements, waste generators are more likely to prioritize recycling, overcome any initial barriers, and sustain their engagement in the long term. These incentives not only benefit individual businesses but also contribute to the overall environmental goals of waste reduction and resource conservation.

5.4 Collaborative Partnerships

To establish a robust and sustainable recycling system, it is essential to foster collaborative partnerships between businesses, recycling companies, and government entities. These partnerships create a supportive ecosystem that encourages waste generators to actively participate in recycling programs and ensures a reliable and efficient recycling process.

One crucial aspect of collaborative partnerships is to encourage waste generators to establish direct partnerships with local recycling facilities. By forging these partnerships, waste generators can establish a dedicated channel for recycling their materials. This collaboration ensures that recyclable materials are efficiently collected, sorted, and processed, minimizing the chances of contamination or improper disposal. Waste generators can work closely with recycling facilities to understand their specific requirements, such as waste separation guidelines or preferred packaging formats, to streamline the recycling process and maximize the recovery of recyclable materials.

Moreover, collaborative partnerships facilitate stronger communication channels between stakeholders in the recycling ecosystem. This enables the sharing of best practices, lessons learned, and innovative approaches to waste management. Regular meetings, workshops, or forums can be organized to bring together businesses, recycling companies, and government entities to discuss challenges, exchange knowledge, and collaborate on finding solutions. By fostering these

communication channels, stakeholders can collectively work towards improving recycling practices, addressing common obstacles, and advancing the overall sustainability of waste management systems.

Government entities play a critical role in fostering collaborative partnerships within the recycling ecosystem. They can actively support and facilitate these partnerships by providing resources, expertise, and regulatory frameworks that promote sustainable waste management practices. Government agencies can create platforms or initiatives that encourage businesses and recycling companies to collaborate, such as establishing recycling clusters or offering grants for joint projects. By actively participating in these partnerships, government entities can align policies, regulations, and incentives with the goals of the recycling ecosystem, creating an enabling environment for waste generators to engage in recycling activities.

Collaborative partnerships also offer the opportunity to develop innovative solutions and technologies for waste management. By leveraging the expertise and resources of multiple stakeholders, businesses, recycling companies, and government entities can collectively invest in research and development initiatives. This can lead to the implementation of advanced recycling technologies, waste-to-energy projects, or novel approaches to waste reduction. Collaborative innovation creates a dynamic environment where stakeholders can contribute their unique perspectives and capabilities, driving continuous improvement and pushing the boundaries of sustainable waste management practices.

Collaborative partnerships between businesses, recycling companies, and government entities are instrumental in creating a supportive ecosystem for recycling. By encouraging direct partnerships between waste generators and recycling facilities, strengthening communication channels, and leveraging government support, stakeholders can work together towards a reliable and efficient recycling process. These collaborations foster knowledge sharing, address challenges collectively, and drive innovation, ultimately leading to a more sustainable and effective waste management system.

5.5 Waste Audits and Monitoring

Waste audits and monitoring play a crucial role in driving effective waste management and recycling efforts within commercial establishments. By conducting waste audits, businesses can gain valuable insights into the types and volumes of waste they generate, enabling them to develop tailored recycling programs and identify opportunities for waste reduction.

During a waste audit, trained professionals analyze the composition of the waste generated by a commercial establishment. They sort and categorize the waste into different streams, such as paper, plastic, glass, organic waste, or hazardous materials. This detailed analysis provides businesses with a clear understanding of the composition of their waste stream and the potential for recycling. It helps identify materials that can be easily diverted from landfills and recovered through recycling processes.

The data collected from waste audits serves as a foundation for developing tailored recycling programs. By understanding the specific waste streams and their volumes, businesses can design recycling initiatives that address their unique needs and challenges. For example, if a significant portion of the waste is composed of food scraps, the business can implement a composting program to divert organic waste from landfills. On the other hand, if paper waste is prominent, a paper recycling program can be established to maximize the recovery of recyclable paper materials.

Waste audits also highlight areas where waste reduction efforts can be enhanced. By identifying the sources and quantities of different types of waste, businesses can pinpoint areas where waste prevention or reduction measures can be implemented. For instance, if excessive packaging materials are being discarded, steps can be taken to minimize packaging waste through alternative packaging solutions or working with suppliers to reduce packaging materials.

In addition to waste audits, regular monitoring and reporting of recycling rates are essential for tracking progress and identifying areas for improvement. By consistently measuring recycling rates and comparing them over time, businesses can assess the effectiveness of their recycling programs. This monitoring helps identify trends, patterns, and potential bottlenecks in the recycling process. It allows businesses to set goals, track their achievements, and implement corrective measures to enhance recycling rates.

Moreover, reporting recycling rates can serve as an important tool for benchmarking and external accountability. Businesses can voluntarily disclose their recycling rates to stakeholders, such as customers, employees, and investors, demonstrating their commitment to sustainable waste management. Transparent reporting promotes a culture of responsibility and encourages continuous improvement in recycling practices.

In summary, waste audits and monitoring provide valuable data and insights that guide the development of tailored recycling programs and help identify areas for waste reduction. By conducting waste audits, businesses gain a clear understanding of their waste composition, enabling them to implement targeted recycling initiatives. Regular monitoring and reporting of recycling rates allow businesses to track their progress, set goals, and make informed decisions for continuous improvement. Ultimately, waste audits and monitoring contribute to the efficient management of waste and the advancement of sustainable recycling practices within commercial establishments.

5.6 Regulatory Framework

A strong regulatory framework is crucial for driving the implementation of recycling practices among commercial waste generators. By establishing or enhancing regulations, governments can create a structured approach that mandates businesses to prioritize recycling and sets clear targets for recycling rates. This regulatory framework creates a level playing field and ensures that recycling becomes an integral part of business operations.

Regulations mandating recycling practices provide a clear signal to commercial waste generators about the importance of sustainable waste management. They communicate the expectation that businesses should take responsibility for their waste and actively participate in recycling efforts. By making recycling a requirement, regulations remove any ambiguity and establish a baseline commitment to environmental sustainability.

Setting clear targets for recycling rates is an effective way to measure progress and encourage businesses to meet specific recycling goals. These targets can be based on industry standards, environmental considerations, or waste reduction objectives. By defining achievable but ambitious recycling targets, regulations motivate businesses to allocate resources and implement strategies to improve their recycling performance. The targets provide a benchmark against which businesses can assess their progress and evaluate their compliance with the regulatory requirements.

Penalties for non-compliance are an important component of the regulatory framework. They provide a strong incentive for commercial waste generators to adhere to the recycling mandates and meet the established targets. Penalties can take the form of fines, fees, or other punitive measures, which create a financial disincentive for non-compliance. The prospect of facing penalties encourages businesses to invest in recycling infrastructure, train employees, and develop efficient waste management systems to avoid penalties and maintain regulatory compliance.

Additionally, regulatory frameworks can incorporate mechanisms for monitoring and enforcement to ensure compliance with recycling requirements. Regular inspections, audits, and reporting mechanisms can be implemented to assess businesses' adherence to recycling regulations. This monitoring process helps identify non-compliant entities and provides an opportunity for corrective action and support to improve their recycling practices. By actively monitoring and enforcing

compliance, governments can uphold the integrity of the regulatory framework and maintain a sustainable recycling ecosystem.

It is worth noting that alongside regulations and penalties, governments can also provide support and resources to facilitate compliance. This can include offering guidance documents, conducting training sessions, or providing financial incentives to assist businesses in implementing recycling practices. Such support helps businesses navigate the transition towards recycling and encourages their active engagement in the process.

A robust regulatory framework is essential for driving recycling practices among commercial waste generators. Establishing or enhancing regulations, setting clear targets for recycling rates, and imposing penalties for non-compliance create a framework that ensures recycling becomes a fundamental aspect of business operations. This regulatory approach promotes environmental sustainability, encourages businesses to invest in recycling infrastructure, and establishes a level playing field for waste management. By combining regulations with monitoring, enforcement, and supportive measures, governments can foster a culture of recycling and drive long-term sustainable waste management practices among commercial waste generators.

5.7 Public-Private Partnerships

Public-private partnerships play a crucial role in addressing the challenges faced by commercial waste generators and driving sustainable waste management practices. These partnerships involve collaboration between government entities and private sector organizations to invest in recycling infrastructure, develop innovative technologies, and implement effective waste management systems.

One of the key benefits of public-private partnerships is the ability to leverage the expertise and resources of both sectors. Government entities bring their regulatory knowledge, policy frameworks, and understanding of the local context, while private sector organizations contribute their technical expertise, innovation capabilities, and financial resources. By combining these strengths, public-private partnerships can develop comprehensive and tailored solutions to address the specific challenges faced by commercial waste generators.

Investing in recycling infrastructure is a critical aspect of public-private partnerships. Both the public and private sectors can pool their resources to establish or upgrade recycling facilities, such as sorting centers, recycling plants, and waste treatment facilities. This collaboration ensures that the necessary infrastructure is in place to support efficient waste management and recycling processes. Public-private partnerships can help fund the construction, operation, and maintenance of these facilities, ensuring their sustainability and effectiveness.

In addition to infrastructure investment, public-private partnerships foster the development of innovative recycling technologies. The private sector often drives technological advancements, and by partnering with government entities, these innovations can be harnessed to address the unique challenges of commercial waste generators. This collaboration can lead to the development of new recycling methods, waste-to-energy technologies, or advanced sorting systems that improve recycling efficiency and increase the recovery of valuable materials.

Effective waste management systems require coordination and collaboration between various stakeholders. Public-private partnerships provide a platform for aligning interests, sharing best practices, and implementing integrated waste management approaches. By working together, government entities and private organizations can develop comprehensive waste management strategies that encompass waste reduction, recycling, reuse, and proper disposal. These systems can optimize waste collection routes, improve collection efficiency, and ensure that waste is properly sorted and processed.

Financial resources are often a significant challenge for commercial waste generators when implementing recycling initiatives. Public-private partnerships can help address this barrier by facilitating funding mechanisms. Governments can provide grants, subsidies, or low-interest loans to incentivize private sector investment in recycling infrastructure or technology. The private sector, in turn, can contribute its financial resources and expertise to ensure the success and viability of these projects. By leveraging financial resources from both sectors, public-private partnerships make it more feasible for commercial waste generators to adopt and sustain recycling practices.

Overall, public-private partnerships bring together the strengths and capabilities of the public and private sectors to drive meaningful change in waste management. These collaborations enable the development of tailored solutions, investment in recycling infrastructure, and the adoption of innovative technologies. By leveraging the expertise, resources, and funding from both sectors, public-private partnerships can accelerate the transition towards sustainable waste management practices among commercial waste generators.

5.8 Data and Reporting

Improving data collection and reporting systems is crucial for effectively tracking and monitoring recycling rates among commercial waste generators. By implementing robust data management practices, governments and relevant stakeholders can gain valuable insights into the effectiveness of recycling initiatives, identify areas for improvement, and make informed decisions for future policy and program development.

One of the key aspects of data collection is establishing a standardized methodology for measuring and reporting recycling rates. This involves defining consistent metrics and indicators that accurately capture the quantity of waste being recycled by commercial waste generators. By adopting a unified approach to data collection, it becomes easier to compare recycling rates across different businesses, sectors, or regions, enabling more accurate assessments of progress and identification of best practices.

Data collection systems should also be designed to capture relevant information beyond just recycling rates. This may include data on waste composition, sources of waste generation, recycling methods employed, and the environmental impacts associated with recycling activities. Collecting this comprehensive dataset allows for a deeper understanding of the waste management landscape, facilitates targeted interventions, and enables evidence-based decision-making.

To ensure accurate and reliable data, it is essential to establish clear reporting requirements for commercial waste generators. These reporting obligations can be mandated through regulations or voluntary agreements, depending on the specific context. Businesses may be required to submit regular reports on their recycling activities, including the types and quantities of waste recycled, the methods employed, and any challenges or successes encountered. Such reporting not only provides valuable data for monitoring purposes but also promotes transparency and accountability among commercial waste generators.

Utilizing technology can significantly enhance data collection and reporting systems. Implementing digital platforms or software solutions allows for streamlined data entry, automated data analysis, and real-time monitoring of recycling rates. These technological advancements simplify the reporting process for businesses and improve the accuracy and timeliness of data collection. Additionally, incorporating data analytics tools can enable the identification of trends, patterns, and areas for improvement, facilitating evidence-based decision-making.

The collected data can be analyzed and used to derive meaningful insights. By evaluating recycling rates and trends, policymakers and relevant stakeholders can assess the impact of existing recycling initiatives and identify areas where interventions are needed. The data can reveal factors that

contribute to successful recycling programs, such as effective communication strategies, targeted incentives, or tailored recycling infrastructure. This knowledge can guide the development of future policies and programs that are more responsive to the needs of commercial waste generators and maximize recycling outcomes.

Furthermore, the data collected can be used to establish benchmarks and goals for recycling rates. Governments can set ambitious targets based on the current recycling performance and use the data as a baseline for evaluating progress over time. Regular monitoring of recycling rates against these benchmarks provides a mechanism for accountability and supports evidence-based decision-making regarding the allocation of resources and implementation of targeted interventions.

In summary, improving data collection and reporting systems is essential for effective monitoring and evaluation of recycling rates among commercial waste generators. By implementing standardized methodologies, establishing reporting requirements, leveraging technology, and analyzing the collected data, governments and relevant stakeholders can gain valuable insights, identify areas for improvement, and make informed decisions to advance recycling initiatives. Ultimately, robust data and reporting systems contribute to evidence-based policy development and the promotion of sustainable waste management practices.

By implementing the recommendations, the recycling rates among commercial waste generators in Jordan can be significantly increased. It requires a multi-faceted approach that combines awareness, education, incentives, collaboration, and supportive policies. With concerted efforts from businesses, government entities, and stakeholders, Jordan can create a sustainable recycling ecosystem that benefits the environment, the economy, and society.