Guidelines for Establishing an Information-Sharing Platform for Plastics

Preliminary Draft

(Discussion Paper)

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Executive Summary

To drive a circular economy, seamless data integration across the value chain is essential. Beyond linking manufacturing (upstream) and recycling (downstream) processes, data is key to maximizing the value of products and resources through cross-value chains collaboration.

Looking at recent trends, research and development in data integration platforms for domestic and international collaboration have primarily focused on building Digital Product Passport, starting with product information linkage. While some data on material and their circulation data is incorporated, integration in this area remains insufficient.

This guideline defines the essential data elements and standards needed to develop a data integration platform for circular economy of plastics, as part of the Cross-ministerial Strategic Innovation Promotion Program (SIP)[1], Phase 3 theme 'Development of a Circular Economy System (SIP-CE)'. The goal is to establish a standardized set of terms and definitions for this initiative.

Plastics are made from various materials, such as PP, PE and PET, each serving a wide range of applications. These guidelines specifically address plastic used as raw materials and their application in industries, such as automotive. As a result, they do not necessarily apply to all plastics, plastics products or their uses. Some aspects of the data items and definitions also remain open for discussion.

While acknowledging that some areas remain open for discussion, we aim to accelerate the broader societal dialogue on data linkage for plastics (materials) by releasing these guidelines early. Additionally, as materials and products move across borders, it is essential to establish globally consistent data definitions to ensure seamless circulation. We welcome active feedback on this guideline, including any additional points for discussion.

Finally, these guidelines have been developed as a part of the SIP-CE research. We sincerely appreciate the valuable insights provided by a wide range of stakeholders, including those from the supply and recovery sectors, government agencies, and others who shared their perspectives on needs and challenges. We also extend our gratitude to the experts involved in SIP-CE for their contributions to compiling these guidelines.

[1] The Cross-ministerial Strategic Innovation Promotion Program (SIP) is a national project led by the Council for Science, Technology, and Innovation (CSTI), established by the Cabinet Office of the Government of Japan, to promote innovation in science and technology through collaboration across ministries and sectors.
In SIP, CSTI selects socially important issues that are vital to the competitiveness of Japan's economy and industry, appoints a Program Director (PD) to lead the solution of these issues, and adopts an integrated system to promote the process from basic research to practical application and commercialization.

1 Preface

1.1 Understanding circular economy

A circular economy is an economic model that, in addition to the traditional 3Rs (Reduce, Reuse, Recycle), focuses on optimizing the use of existing resources and products while minimizing resource inputs and consumption. It also seeks to create new value through services and other measures to maximize efficiency, minimize resource use, and reduce waste generation.

Conventional industrial and economic practices, driven by extensive resource exploitation, have significantly caused a range of environmental issues, including climate change, resource depletion, and biodiversity loss. These practices also generate vast amounts of waste and disrupt natural material cycles. As a result, transitioning to a circular economy that prioritizes sustainable resource use is essential for addressing these challenges and promoting long-term environmental resilience.

1.2 Environmental and social issues caused by plastics

These guidelines focus on petroleum-based plastics, which are lightweight, easy to process, and cost-effective. These resins are found in a wide range of everyday items, from food containers and plastic bottles to household electronics, automobiles, airplanes, and even buildings. Since the invention of the world's first plastics by American chemist Leo Baekeland in 1907, global plastic production has skyrocketed to around 390 million tons annually, a trend primarily fueled by the expansion of the petrochemical industry.

Much of the improperly disposed plastics cannot be returned to nature and persists in the environment for an exceptionally long time, leading to numerous environmental problems. For example, plastics that end up in the ocean not only threaten marine life but also disrupt the fishing, aquaculture, and tourism industries. It is estimated that wasted plastics causes global economic losses of up to 13 billion USD (1,430 billion JPY) each year.[2]

1.3 Challenges in achieving a Circular Economy

Realizing a circular economy requires not only the implementation of regulations or technological advancements by individual companies but also collaborative efforts across the entire value chain. This includes both the manufacturing (upstream) and recycling (downstream) industries.

Promoting collaboration across the value chain requires seamless integration and sharing of data related to materials and products. The lack of coordinated data across stakeholders in the value chain often means that information about the composition, characteristics, usage history, and chemical substances of materials is unavailable to recycling (downstream) actors. This lack of transparency complicates the recycling of materials and products while preserving their value, leading to increased recycling time and costs, as well as inconsistent quality. Therefore, companies frequently resort to cascade (or phased) recycling or disposal. Likewise, the composition and properties of recycled materials produced during the recycling process are often unclear, preventing manufacturing (upstream) actors from effectively utilizing them.

Research is underway worldwide on designing systems to connect information platforms managed by different operators and administrators, making data-sharing more seamless. One key initiative in this area is the development and introduction of the Digital Product Passport (DPP), which aims to streamline data-sharing for specific products.

Plastics covered in these guidelines are used in many products and are expected to be reused across different products and value chains as part of a circular economy. To support this, a system for sharing material data is needed. However, there are currently very few examples of such systems worldwide.

1.4 Role and purpose of these guidelines in SIP-CE

The SIP program, titled "Developing of a Circular Economy System," focuses on establishing an effective system managing plastics, whose usage is expected to grow, in alignment with the mission outlined in Figure 1.

1.5 Structure of these guidelines

Figure 1 outlines the five missions of SIP-CE. Mission 1 aims to establish a digital platform for information sharing (PLA-NETJ), considering on Europe's advancements in data integration. Mission 2 focuses on developing technologies to enable data linkage between manufacturing (upstream) and recycling (downstream) industries. Mission 3 seeks to create an environment conducive to fostering innovation and promoting sustainable practices within the circular economy. Mission 4 centers on aligning with international standards, while Mission 5 aims to drive societal adoption of circular economy practices by influencing the awareness and behaviors of both consumers and producers.

In particular, for Mission 1, efforts are underway to establish information-sharing from the perspective of materials (plastic), involving two major initiatives, "(1) Development of PLA-NETJ" and "(2) Creation of rules regarding information to be shared", as

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[2] Organisation for Economic Co-operation and Development (OECD)
Improving Markets for Recycled Plastics.PDF https://www.oecd.org/en/publications/improving-markets-for-recycled-plastics_9789264301016-en.html（2018/May/24）

illustrated in Figure 2, aiming to create a mechanism to promote resource circulation by connecting the entire life cycle of materials through digital information.

These guidelines are developed as a part of the initiative (2) described above. While preparing the guidelines, we conducted interviews with stakeholders involved in plastic recycling to identify challenges and needs related to resource circulation and information flow and considered data items that should be shared, considering relevant international trends.

These guidelines will be updated gradually and in parallel with the development of PLA-NETJ (1), maintaining close integration. PLA-NETJ will serve as a platform for stakeholders involved in plastic recycling to conduct small-scale demonstration experiments. The findings and challenges identified through these experiments will be reflected not just in PLA-NETJ, but also in subsequent updates to these guidelines. Through this iterative process, the guidelines will continue to evolve alongside PLA-NETJ.

However, while (1) focuses on initiating efforts based on currently feasible requirements, these guidelines are designed to envision the ideal model for information-sharing to be aimed for in the future. In addition, these guidelines outline various challenges and ideas and actively seek a wide range of opinions and suggestions from all relevant stakeholders.

Figure 1: Missions comprising SIP-CE

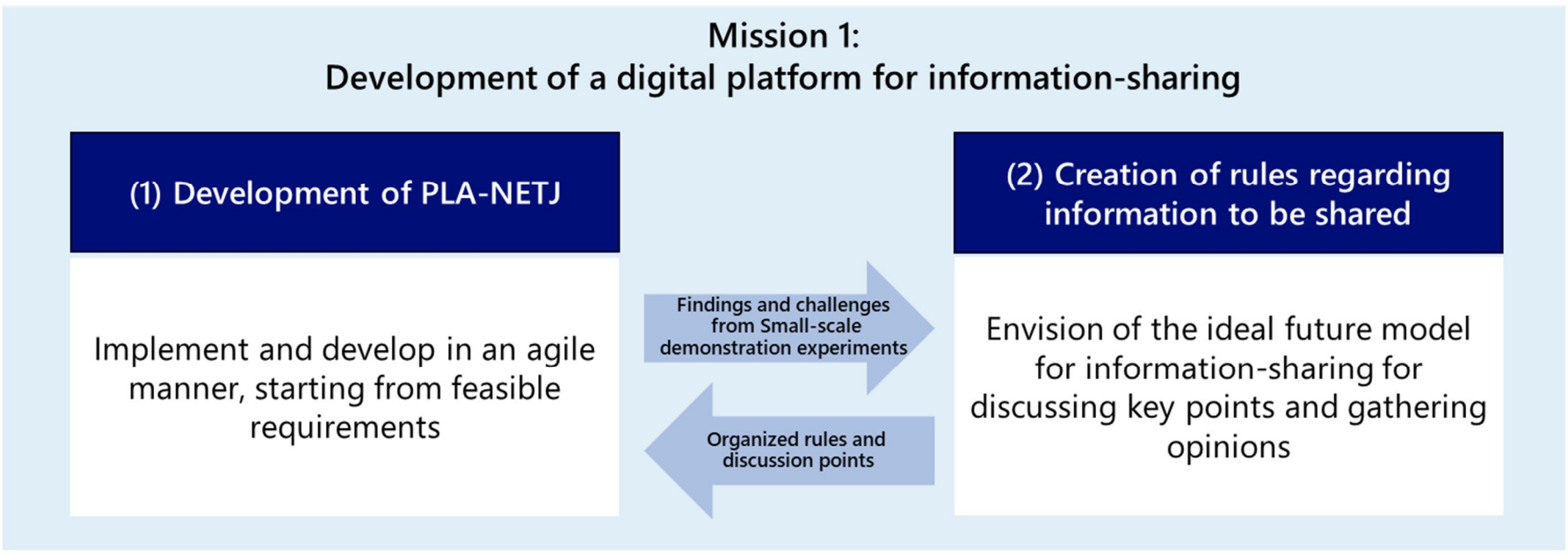

Figure 2: Components and relationship between the two initiatives of Mission 1

This is a preliminary draft; the final version will be structured around the following topics: “Needs and Challenges of Data Linkage” (Section 3), “Information” (Section 4), “Security” (Section 5), “Operation” (Section 6), and “Other Key Points” (Section 7).

This draft presents the current proposal for “Needs and Challenges of Data Linkage (Section 3)” and “Information (Section 4)”. It serves as a foundation for discussion, aiming to gather opinions from various stakeholders, and it is important to note that the content presented here is not finalized. In addition, for each data item, the draft specifies whether providing information is mandatory or optional (see Section 4 for details). However, this categorization is also provisional and subject to review. Based on feedback from stakeholders, revisions will be made, and an updated version of the guidelines will be issued.

1.6 Future schedule

Through the release of the preliminary draft, we invite feedback on key discussion points and additional challenges, detailed definitions of data items, as well as the scope of future information-sharing initiatives (identifying target products and circulation patterns, such as closed-loop and open-loop systems, etc.). Based on the feedback received, we plan to release an updated version.

As shown in Figure 3, in the first draft, we plan on providing detailed definitions for the data items deemed “mandatory” in this preliminary draft. Over the implementation period of this SIP issue (until March 2028), we will update the draft multiple times to clarify the requirements for an information-sharing platform for plastics. This effort aims to support the social implementation of the information-sharing platform, targeted for around 2027.

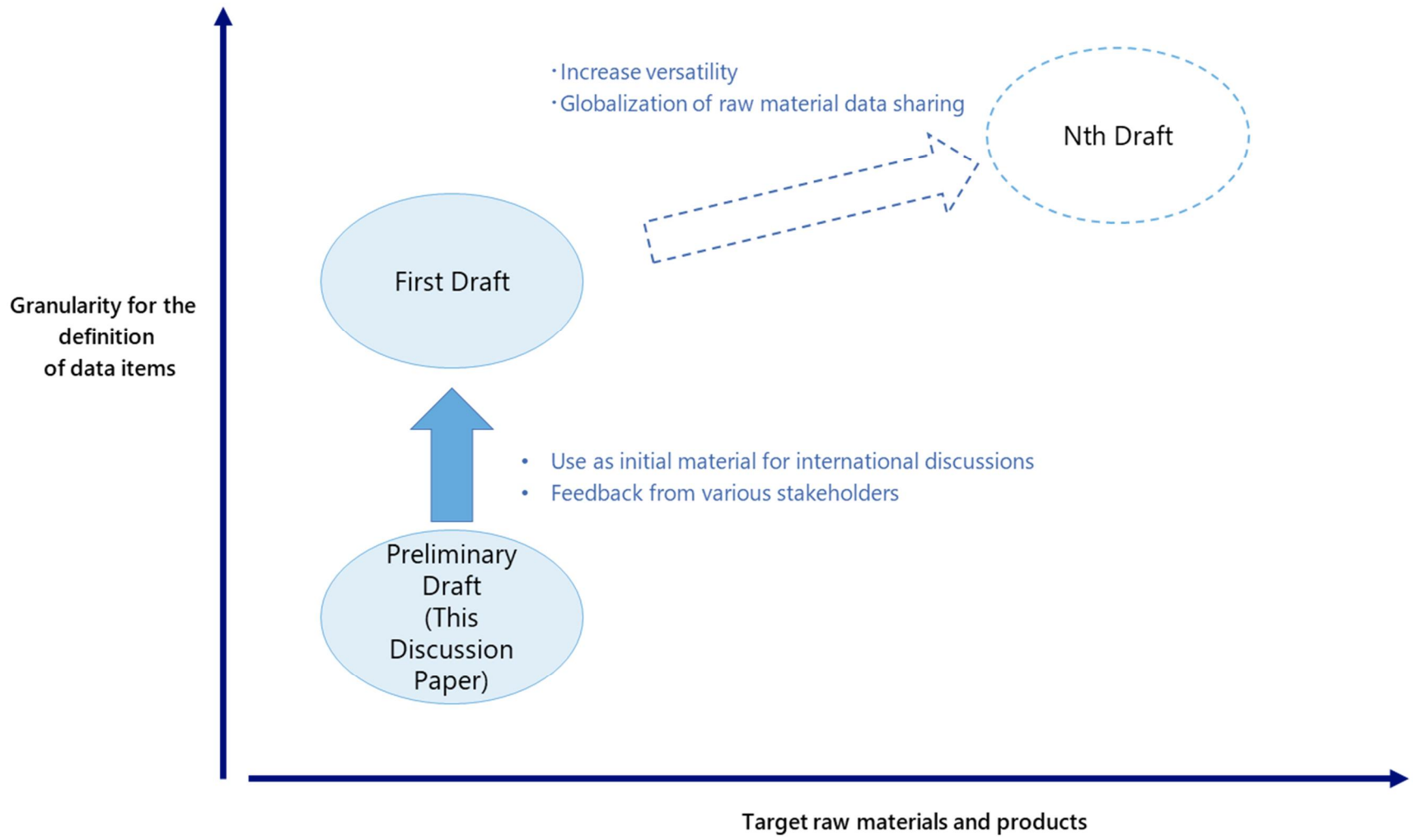

Figure 3: Plan for this document’s update

2 Positioning of these guidelines

2.1 Relationships with domestic and international information infrastructures

As mentioned above, data linkage plays a crucial role in achieving a circular economy. Various regions and countries are working to establish data spaces and architectures that enable seamless data linkage across multiple information systems, such as Catena-X in Europe and the Ouranos Ecosystem in Japan. In Europe, the Digital Product Passport (DPP) is being developed as a data linkage infrastructure for individual products like automobiles and storage batteries. However, there is also a need to explore data linkage infrastructure for each material. This presents challenges, particularly in defining the relationship between product specific and material-specific data linkage platforms.

As part of SIP-CE, these guidelines take into account the European Commission's End of life Vehicles (ELV) directive as a key consideration and propose draft set of data items that envision the use of recycled materials in vehicles. This initiative, referred to in SIP-CE as "X to Car," uses "X" to represent plastic materials collected and separated from non-automotive products. In preparing the proposed requirements for data items, we have organized them as mandatory requirements based on relevant international standards, definitions of data items in the precedent DPPs, and industry standards. On the other hand, we have also categorized items whose necessity is not yet clear (e.g., future expectations or specific applications, etc.) or those that cannot be achieved immediately due to technological limitations, as optional. Particularly, for requirements that are not immediately feasible, we will develop a roadmap to outline the expected timeline for realization and the requirements to achieve them.

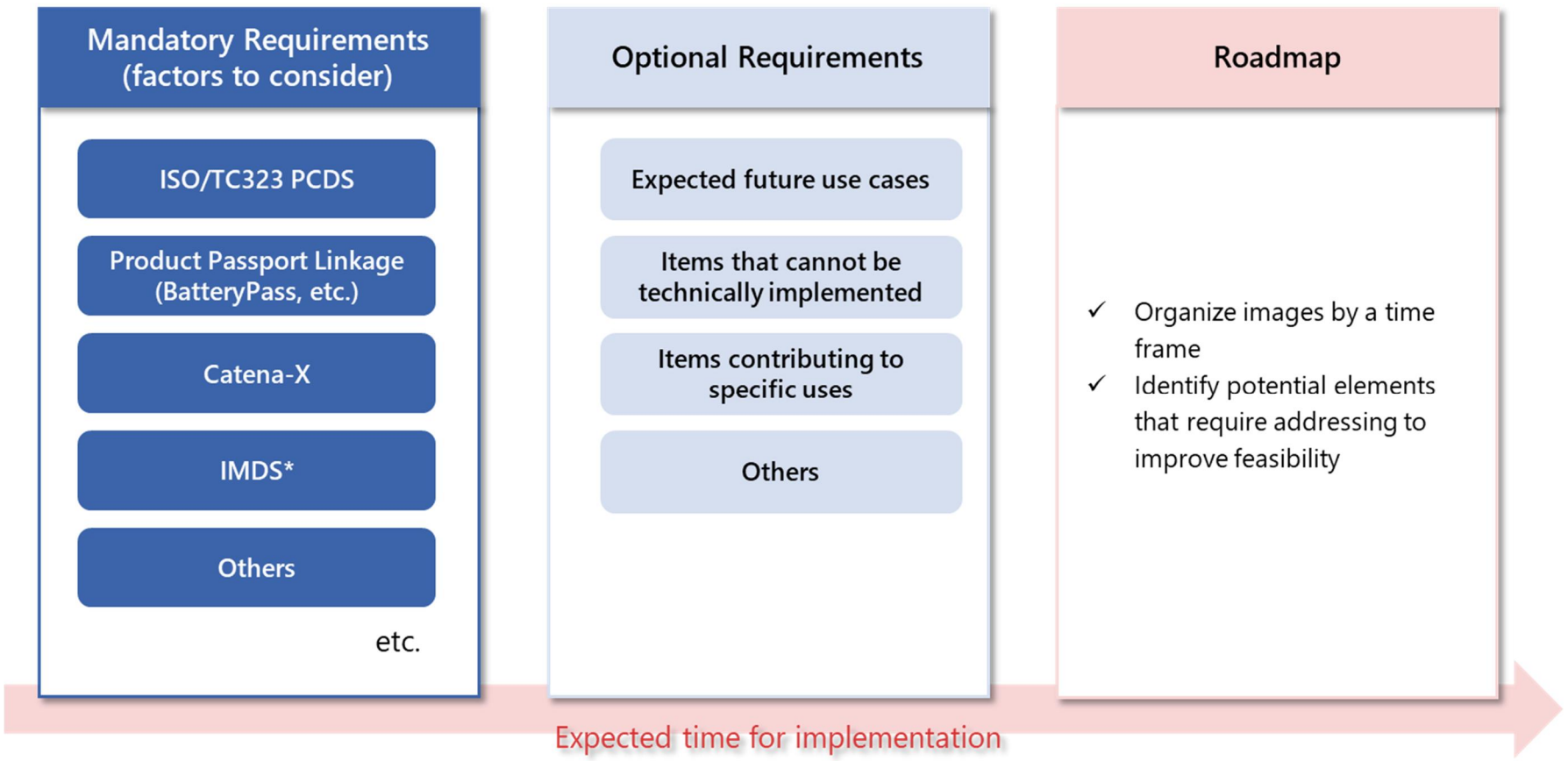

Figure 4: Data item requirements

1) ISO/TC323 PCDS (59040) is currently considering the international standardization of product circularity data sheets.
2) Catena-X is a platform for exchanging and sharing data across supply chains of the automotive industry.
3) IMDS (International Material Data System) is a material data system for the automotive industry.

2.2 Scope of data linkage in these guidelines

These guidelines introduce "X to Car" as an approach to incorporating recycled materials in automobiles, with "X" representing plastics sourced from non-automotive products. Additionally, as it becomes easier to identify and specify the types of used plastics being collected as raw materials for "X" (based on factors such as, original product, its application, or related material information), these items will be classified and examined as "X-specified materials." For example, withing the sub-themes of SIP-CE, efforts are being made to separate and collect plastic items such as bottle caps and tofu containers, which are typically disposed of as household waste. These items can now be more easily identified during collection, with ongoing initiatives to gather necessary information through data linkage with manufacturers and post-collection analysis.

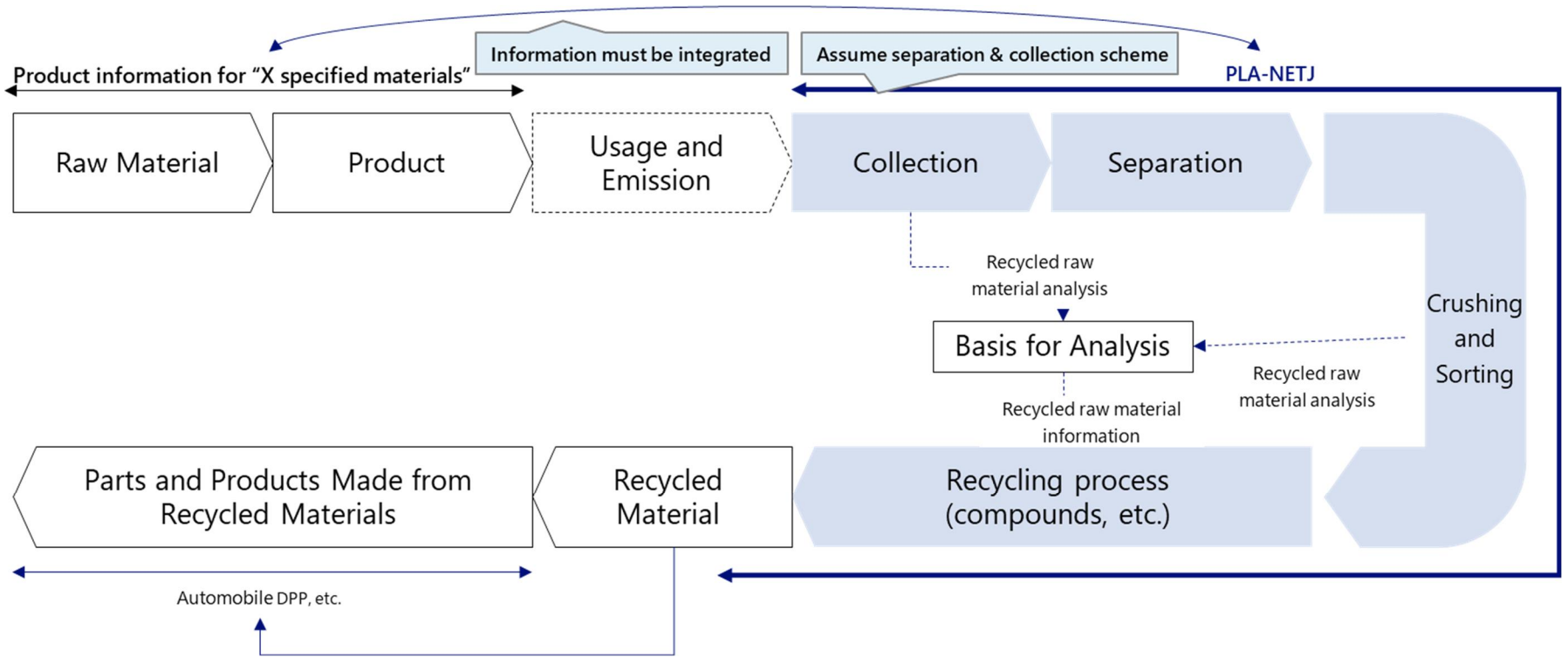

Figure 5: Positioning of PLA-NETJ assuming X-specified materials

Product and raw material information is expected to be integrated through data linkage through DPP. However, the scope of PLA-NETJ may extend beyond the aforementioned areas since there are products for which the DPP is either not implemented or not mandated. Additionally, it is anticipated that process information from various stages of recycling, along with details on the physical properties of recycled materials, will be shared from PLA-NETJ to the automotive manufacturing information platforms (such as DPP).

These guidelines assume linkage with the analytical processes (Recycled Material Data Base, etc.) currently under consideration with SIP-CE for understanding the physical properties of recycled raw materials or recycled materials. (In the future, as the analytical framework diversifies, it is expected that analytical data will be consolidated within PLA-NETJ)

Plastics collected under the existing Law for Promotion of Sorted Collection and Recycling of Containers and Packaging are expected to be increasingly utilized in material recycling. However, as of this draft, despite advanced sorting processes in the recycling stage after collection, the mixing of various types and qualities of plastics remains inevitable. This is partly because of the use of composite materials in the original containers and packaging. Therefore, defining data items for use cases is considered complex. Such mixed raw materials will be classified as "X unspecified materials" and will be positioned as an issue for further discussion after the first draft. To address this, discussions will focus on promoting eco-design such as mono-materialization of materials and products, improving physical recycling technology, and advancing digital technology.

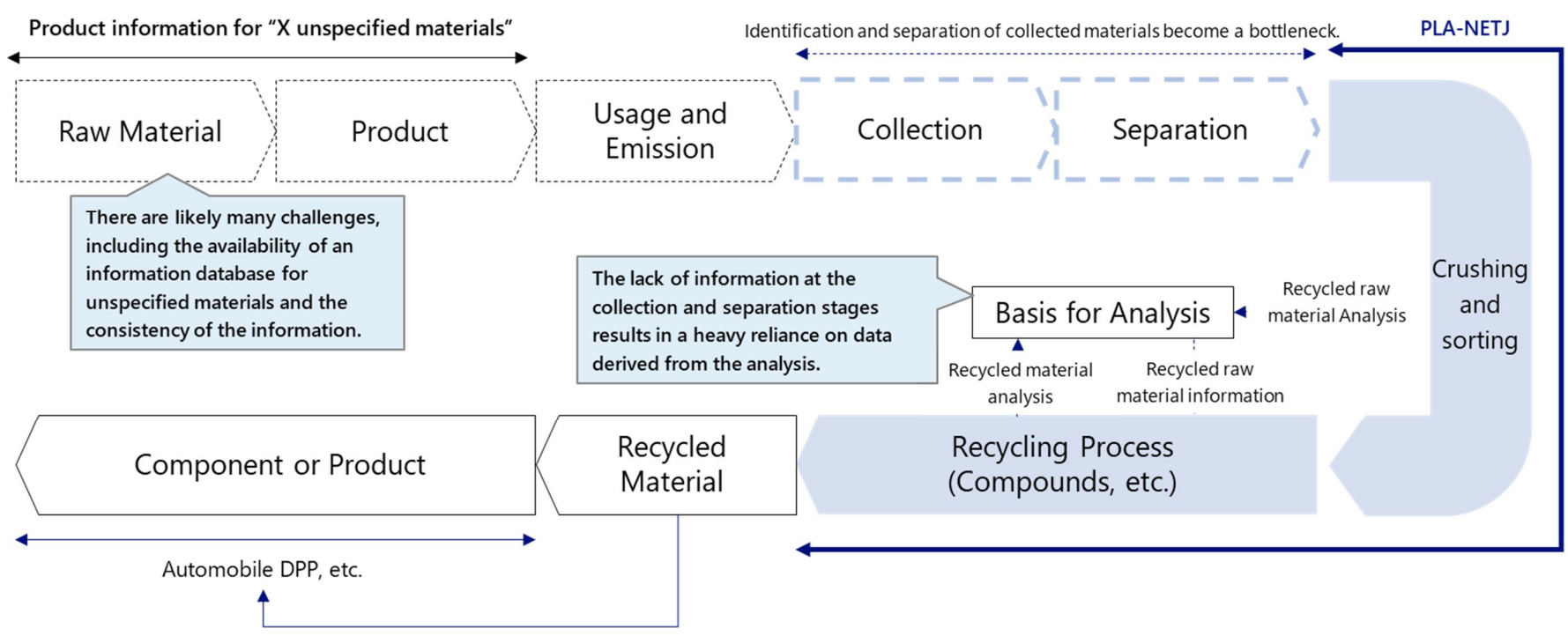

Figure 6: Positioning of PLA-NETJ assuming X-unspecified materials

For X-unspecified materials, data utilization during collection and separation is limited because of issues like missing product information or inconsistent data. Therefore, data linkage will primarily focus on the flow of information from the recycling (downstream) processes, such as crushing, sorting, and recycling stages, along with analytical data on recycled raw materials or

recycled products collected at each stage to manufacturing (upstream) actors.
In these guidelines, PLA-NETJ is expected to facilitate data entry and linkage across key stages of the product value chain, including collection, separation, crushing/sorting, and recycling. For the manufacturing (upstream) value chain—encompassing raw materials, product manufacturing, usage, and disposal—the development of a Digital Product Passport (DPP) is anticipated. PLA-NETJ would also be considered for integration with DPP to enable seamless data linkage between the two systems.

2.3 Relationship between these guidelines and PLA-NETJ implementation

SIP-CE is developing a data-sharing system (PLA-NETJ) for plastic circulation, with this guideline being created and updated in parallel. While system development and the guideline are closely coordinated, for example, insights and issues from small-scale PLA-NETJ demonstration experiments are incorporated into guideline updates as needed, it is challenging to reflect all system requirements in real-time. As a result, some discrepancies may occur during intermediate stages.

3 Needs and challenges of data linkage

3.1 Approach to collecting and organizing needs and challenges

When defining the requirements for data items, organizing use cases for data utilization is crucial. This helps stakeholders understand the necessity and benefits of the data they will provide.
Organizing use cases helps identify necessary data items and evaluate the feasibility of data linkage (input, disclosure, etc.). That, in turn, enables discussion on key issues, such as mandatory versus optional requirements, conditionality, etc.
Based on this context, we interviewed stakeholders from the plastics circulation value chain. These interviews covered a wide range of participants, including materials and product manufacturers, local governments responsible for city-wide collection, and recyclers and compounders engaged in separating, sorting, and processing collected materials. While industrial and social infrastructures, such as collection systems, play a significant role in shaping the ideal state of plastic circulation, these factors vary by country and region. For this study, we concluded that using Japan’s current situation was the most appropriate approach. Consequently, the interviews were conducted exclusively with stakeholders based in Japan.
Each stakeholder was interviewed on the following two items:

- Data utilization (data items): Data items that stakeholders believe should be shared, including the specific stakeholders responsible for sharing them and the intended purposes for their use. (refer to section 3.2)
- Challenges: Data items that stakeholders believe should be shared with other stakeholders, but face obstacles such as difficulty obtaining or concerns over confidentiality. (refer to section 3.3)

3.2 Data utilization (data item needs)

Data items fall into two broad categories mentioned below:

- Process information: Data related to manufacturing, collection, treatment process, and other operational processes
- Evaluation and analysis information: Information related to the physical properties of recycled raw materials and recycled materials, including standards, environmental indicators, and other relevant metrics.

The data item needs from stakeholder interviews are categorized based on the categories mentioned above, with their intended purposes outlined in Table 1 5. However, as mentioned earlier, this draft is intended to be used as a discussion paper to gather feedback from a broad range of domestic and international stakeholders, therefore the structure presented here is not absolute, and may be refined based on the feedback received.

Table 1: Relationship between data utilization and data items for each process

Purpose		Process Information					Evaluation & Analysis Information	
		Materials Manufacturing	Product Manufacturing	Collection	Intermediate Processing	Compounding	Material Properties & Analysis	Recycled Materials & Specification
Traceability		Material name Recycled material history (Sub) Company information (Sub)		Derived from recycled materials Collection method Collection volume Collection source/Collector	Intermediate treatment processes Material balance by process Collected material by process Company information (Sub)	Raw material name Processed material balance Ratio of recycled materials used Number of recycles Company information (Sub)	Company information (Sub)	Recycled raw materials & recycled material standards (Sub)
Collection and Separation		Resin material (Sub) Recycled material ratio Dyeing agent information (Sub) Additives (Sub)	Material name Recycled material history (Sub) Product image(Sub) Disassembly and sorting information(Sub)	Collection Rule (Mid)		Raw materials and additives (Sub) Number of recycles		
Recyclability and Recycling Method		Resin material (Sub) Recycled material history (Sub) Dyeing agent information (Sub) Additives (Sub)	Material name Recycled material history (Sub) Product image(Sub) Disassembly and sorting information(Sub)	Product type of collected material Composite material Composition ratio Separation status	Intermediate processes Contamination status/response	Raw materials and addition agents (Sub) Number of recycles		
Material Properties and Standards Compliance		Additives (Sub)		Product type of collected material Composite material composition ratio	Disassembly and sorting (Sub)	Processing conditions (Sub)	○	○
Recycled Content Certification		Recycled material history (Sub)		Product type of collected material Composite material composition ratio		Raw materials and additives (Sub) Recycled materials information (Sub)	○	○
Recycled Material Utilization	Possibility of raw material utilization	Resin material history (Sub) Recycled material ratio Dyeing agent (Sub) Additives (Sub)	Products and parts Composition information (Sub)	Grade		Raw materials and additives (Sub) Processing conditions (Sub)	○	
	Recycling Advancement	Resin material properties (Sub) Ratio of recycled material	Disassembly and sorting information(Sub) Recycled material history (Sub)	Composite material Composition Ratio				
	Recycled raw materials/recycled material quality (Forecast)	Resin material (Sub)	Disassembly and sorting information (Sub)	Product type of collected material	Material Balance by process Collected material by process	Raw material processing method Processing conditions (Sub)	○	
	Visualization of resources			Amount collected Collection site	Material Balance by process Collected material by process Processing site	Processing site		○

*The data items for this use case are organized in detail in Section 4. Also, data items marked with "(Sub)" correspond to "data items (Sub-category)" of Section 4. Items marked with "○" are to be discussed in the future.

Traceability:

This is a detailed record of the circulation process for each product, part, or material, tracking how it was recycled into raw or reusable material. It ensures the recycled material's history is accurately documented and seamlessly integrated into the next manufacturing cycle, enabling efficient reuse in future recycling loops.

Collection and separation (efficiency):

This constitutes information on identifying products and materials during collection and determining whether separation or pretreatment is required at the product level to optimize the recycling process.

Recyclability and methods (processing efficiency):

This constitutes information about the product or its components to support recycling efforts. It outlines the details needed to define recycling processes, such as disassembly, crushing, and sorting, as well as the specific conditions required for their effective execution.

Material properties and compliance:

This outlines information on the presence of regulated substances, the status of additives, and adherence to recycled material standards both before and after recycling, ensuring support for the effective use of recycled materials.

Recycled material certification:

This information verifies the percentage of recycled content in a product, the number of recycling cycles it has undergone, and its traceability, ensuring proof of the material's origin.

In addition to the data utilization methods mentioned above, we have also outlined methods related to the usability of recycled materials, such as enhancing material circulation.

Raw material usability:

This information assesses any conditions that may restrict the use of recycled raw materials when processing them into new products.

Recycling optimization:

This data helps evaluate the need for pretreatment, recycling process (disassembly, crushing, and sorting), and the processing conditions to enhance the quality of recycled raw materials and minimize costs.

Quality of recycled raw materials/recycled materials (forecast):

This information helps predict the quality of recycled materials based on collected products, the materials used, and recycling processes applied.

Recycled raw material tracking and forecasting:

This information provides a clear view of specifications, quantities, and locations of recycled raw material, helping to forecast and monitor raw material procurement and distribution.

3.3 Discussion points

The data utilization methods for the data items shown in Table 1 are classified into two categories - data items that are assumed to pose no major challenges to provision and distribution by data providers and those that are assumed to present such challenges. Examples of data items presumed to involve no major challenges include material names, and company information. In contrast, data items that may present challenges are likely to do so for reasons such as:

（1）Technical or cost-related difficulties in obtaining information

（2）Highly confidential information that cannot or is difficult to share to maintain a competitive edge

Examples of (1) could include information related to material balance, recycled material ratio, or evaluation and analysis information. Since providing detailed information for each recycled material may be challenging, it may be necessary to provide and distribute information by grouping it into certain units, such as by lot or batch. Alternatively, simplifying the information's granularity, through methods like process certification or omitting certain details while maintaining a reasonable level of assurance, could be considered as potential solutions. Examples of (2) could include technical details, such as processing conditions.

This type of information is often a key source of competitive advantage for businesses, making the provision and distribution complicated. However, challenges in this area can be addressed through measures such as using encryption technologies which restrict access to authorized parties and limit the scope of reference, ensuring the security of sensitive data.

4 Information

4.1 Data item considerations

This section defines the information required by each stakeholder within the value chain, as shown in (1) through (5) below. For cases such as (1) and (2), where data linkage on the product side has been established, it is a pre-requisite for data to be linked with PLA-NETJ. Additionally, items (6) through (8) refer to information items related to analysis, recycled material standards, and environmental indicators and labeling, which are expected to be defined in the future.
For items (1) through (8), the units at which the respective data items are assumed are also described.

(1) Material manufacturing: Information items per shipment unit of material
(2) Product and parts manufacturing: Information items per product
(3) Collection (including separation): Information items per product unit collected
(4) Intermediate treatment process (crushing and sorting): Information items per unit (products or materials) for both crushing and sorting
(5) Recycling process (compounding): Information items per shipment unit of recycled material after compounding
(6) Material properties and analysis: Information items per target material
(7) Recycled material standards: (Further discussion is required, and specific data items are currently undefined.)
(8) Environmental indicators and labeling: (Further discussion is required, and this may apply to both material and product units.)

*These guidelines focus on viewing information linked from manufacturing (upstream) and recycling (downstream) supply chains, so data items related to distribution and usage are not organized within its scope.

4.2 List of data items

Division	Classification	Main Category	Sub-Category	Specific Data Points	Summary (description, examples, etc.)	Information Provider ○ / Viewer ●						Mandatory/ Optional	User classification and permissions	Data format and unit	Conditions
						Raw material manufacturing	Product and component	Distribution and utilization	Collection	Dismembering ,Crushing	Compound				
(1) Raw material	Material information	Material/ composition	Resin material	Material	JIS K 6899-1 category	○	●	●	●	●	●	Mandatory			
				Composite material name	Carbon fiber, glass fiber, aluminum, paper, other resins, etc.	○	●		●	●	●	Mandatory			
				Composite material utilization rate	Weight and ratio of composite materials	○	●	●	●	●	●	Mandatory			
				Combining method	Adhesion, vapor deposition, kneading, creating multi-layers, etc.	○	●		●	●	●	Mandatory			
			Recycled material history	Recycled material ratio	Ratio of recycled material used as raw material. JIS A 5741, etc. can be utilized	○	●	●	●	●	●	Mandatory			
				Origin of recycled material	Origin of recycled material used as raw material (derived from used products, manufacturing processes, etc.). JIS A5741, etc. can be utilized	○	●		●	●	●	Optional			
				Recycled material specifications	Specifications and recycling count of recycled materials used as raw materials. JIS A 5741, etc. can be utilized	○	●		●	●	●	Optional			
			Dyeing agent information	Name of dye	Names and colors of inks/colorants				●	●	●	Optional			
				Application amount	Application amount of inks/colorants				●	●	●	Optional			
				Possibility of de-inking	De-inking possibility and methods	○	●			●	●	Optional			
			Additive agents	Name	Name of additive agents	○	●			●	●	Mandatory			
				Quantity and concentration	Information managed by additive agent name	○	●				●	Mandatory			
		Historical data	Transportation	Means of transport	Means of transportation of materials	○	●					Optional			
				Distance	Distance traveled	○	●					Optional			
	Company information			Manufacturing code	A unified code to verify manufacturer, manufacturing location, date and time of manufacturing, lot no., etc.	○	●			●	●	Mandatory			
				Manufacturer's name	Name of the company that manufactured the raw material	○	●			●	●	Mandatory			
				Manufacturing location	LEI code of the country, region, and manufacturer of the raw material	○	●			●	●	Mandatory			
				Manufacturing date	Date of manufacturing of the product	○	●		●	●	●	Optional			
				Lot no.	Manufacturer's management lot no.	○	●		●	●	●	Optional			
(2) Product	Product information	Products and parts information	Products and parts composition information	Material name	JIS K 6899-1 category		○	●	●	●		Mandatory			
				Material ratio	Weight ratio of the specified resin to the total weight of the product		○	●	●	●		Mandatory			
				Weight	Weight of the specified resin in the product		○	●	●	●		Mandatory			
				Recycling history	Whether or not recycled materials are present		○	●	●	●		Mandatory			
				Resin weight	Total weight of resins in the product	●	○	●	●	●	●	Mandatory			
				Manufacturing code (Material)	Retention of the manufacturing code from the material side		○		●	●	●	Optional			
			Product image		Image of the product (URL assumed)		○	●	●	●		Optional			
		Material/composition	Disassembly and sorting information		Methods, etc., to separate and collect materials as single components during disassembly and sorting		○			●		Optional			
	Company information			Manufacturing code	A unified code to verify manufacturer, manufacturing location, date and time of manufacturing, lot no., etc.	●	○			●	●	Mandatory			
				Manufacturer's name	Name of the company that manufactured the product	●	○	●		●	●	Mandatory			
				Manufacturing location	LEI code of the manufacturer *assumed to be utilized by the Ouranos Ecosystem with a standardized approach to LEI codes	●	○			●	●	Mandatory			
				Date of manufacturing	Date of manufacturing of the product	●	○	●		●	●	Optional			
				Lot no.	Manufacturer's management lot no.	●	○	●		●	●	Optional			
(3) Collection (Separation is included)	Collection information	Collection rules and routes	Collection rules	Original purpose/product	Define original purpose or product name (set for each packaging type)	●	●		○		●	Mandatory			
				Manufacturing code (product)	Read and transfer the manufacturing code on the product side				○	●	●	Optional			
				Grade	Define the grade of collected materials (e.g., whether collected material is single or mixed, specified for each packaging type)				○	●		Mandatory			
				Collection method	Specify collection rules and routes for general waste, packaging materials, sorting centers, etc.			●	○			Mandatory			
				Amount collected	Weight for each packaging type (assumed to be measured after collection or separation)				○	●		Mandatory			
				Product type of collected materials	Information that can identify the product when the collected item is single-material				○	●		Mandatory			
				Composition ratio of composite material	Calculate based on manufacturer information (raw materials, product specifications, etc.)				○	●		Optional			
				Separation status	Whether separation is required after collection, and method of separation (assume level-based categorization)				○	●		Mandatory			
				Storage conditions during collection and transportation	Standardize rules (such as, whether it was exposed to external elements, etc.). Consider increasing pattern rules in the future		●		○	○	●	Optional			
				Collection site	Location of collection site				○	●		Mandatory			
	Company information (Some of them are expected to work with e-manifests)			Collection source/collector	Name of collector (municipality, company, etc.)				○	●	●	Mandatory			
				Carrier	Carrier name				○	●	●	Mandatory			
				Collection date	Date when the items were consolidated at the collection site				○	●	●	Mandatory			
				Handover date for processing collected materials	Date of handover for intermediate treatment process					○	●	Mandatory			
(4) Intermediate processing (crushing & sorting)	Intermediate treatment information	Implementation status of disassembly to sorting	Disassembly and sorting history	Intermediate treatment process	(Whether conditions should be set for each processing facility instead of entering them each time) Whether sorting (or separation), compression, stain removal, disassembly, crushing, etc. should be included or not				○	●		Mandatory			
				Condition and response to contamination	Dealing with water-soluble/non-water-soluble materials and response during treatment processes				○	●		Optional			
				Method of disassembly (process information)	Can we consider disassembly levels, etc. in the future?					○	●	Optional			
				Crushing machine	Name of the crushing machine					○	●	Optional			
				Crushing conditions	Setting output conditions for crushing (speed, particle size, etc.)					○	●	Optional			
				Sorting methods	Wind power, specific gravity, optics, etc.					○	●	Optional			
				Sorting conditions	Selection criteria for the targeted materials					○	●	Optional			
				Material balance by process	Quantitative information on inputs and collected materials for each intermediate treatment process					○	●	Mandatory			
				Collected materials by process	Qualitative information on inputs and collected materials for each intermediate treatment process (whether to set conditions for each processing facility instead of requiring input each time)					○	●	Mandatory			
	Company information			Processing code	A unified code to verify information such as business operator, processing location, date and time of processing, lot no., etc.					○	●	Mandatory			
				Name of processor	Name of the company performing intermediate treatment process					○	●	Mandatory			
				Processing site	LEI codes of processing plants					○	●	Mandatory			
				Processing date and time	Date and time of intermediate treatment process					○	●	Mandatory			
				Lot no.	Management lot no. of items after intermediate treatment process					○	●	Mandatory			

Division	Classification	Main Category	Sub-Category	Specific Data Points	Summary (description, examples, etc.)	Information Provider ○ / Viewer ●						Mandatory/ Optional	User classification and permissions	Data format and unit	Conditions
						Raw material manufacturing	Product and component	Distribution and utilization	Collection	Dismembering ,Crushing	Compound				
(5) Recycling process (compound)	Compound information	Recycled raw materials composition	Raw materials and additives	Raw material name	Name of compound raw materials and additive agents	●	●		●	●	○	Mandatory			
				Additive amount	Amounts used or added for each compound raw material	●	●		●	●	○	Mandatory			
				Additive concentration	Percentage of additive by weight of the raw material	●	●		●	●	○	Mandatory			
				Biomass	Percentage of biomass content in the product	●	●		●	●	○	Optional			
			Processing conditions	Temperature range	Maximum and minimum temperatures during processing	●	●				○	Mandatory			
				Raw materials processing method	Processing details, such as kneading, pelletizing, etc.	●	●		●	●	○	Optional			
				History of heat treatment	Number of heat treatments applied	●	●				○	Mandatory			
				Cleaning conditions	Indication of whether cleaning processes are implemented, along with the methods employed	●	●				○	Optional			
				Drying conditions	Indication of whether dyring processes are implemented, along with the methods employed	●	●				○	Optional			
				Processing material balance	Quantities of input materials, recovery rates, waste, and other relevant data for each processing method, along with material balances during post-processing	●	●				○	Optional			
		Recycled material properties	Physical properties	Tensile breaking stress		●	●				○	Mandatory			
				Tensile breaking strain	Provide the median of the attainable values. Record the median value and indicate the error range as a percentage (e.g., ±5%). *List the items for which data is available, such as tensile yield stress [MPa] and tensile fracture strain [%]	●	●				○	Mandatory			
				Tensile elongation at break		●	●				○	Mandatory			
				Mesh count	Specify the mesh size of the finest filter that can be used, as well as the mesh size typically used in standard plastic recycling processes	●	●				○	Mandatory			
				Tensile breaking stress		●	●				○	Mandatory			
				Tensile breaking strain	Provide median of attainable values. Record the median value and indicate the error range as a percentage (e.g., ±5%). *List items for which data is available, such as tensile yield stress [MPa] and tensile fracture strain [%]	●	●				○	Mandatory			
				Tensile elongation at break		●	●				○	Mandatory			
				Mesh count	Specify the mesh size of the finest filter that can be used, as well as the mesh size typically used in standard plastic recycling processes	●	●				○	Mandatory			
		Recycle rate	Recycled material information	Circular material use rate (CMUR)	Percentage of recycled and virgin raw materials	●	●		○	●	○	Mandatory			
				Source of recycled material	Car to Car, PIR/PCR, etc.	●	●		○	●	○	Mandatory			
				Number of recycles	Number of times raw material is recycled (Calculate based on information on the origin of raw materials, assuming that at least a certain percentage of raw materials are recycled)	●	●		●	●	○	Optional			
	Company information			Processing code	A unified code to verify the operator, processing location, processing date, lot number, etc.	●	●				○	Mandatory			
				Processor	Compound manufacturer	●	●				○	Mandatory			
				Location of processing	LEI (Legal Entity Identifier) code of the processing plant	●	●				○	Mandatory			
				Date and time of processing	Date and time of processing	●	●				○	Mandatory			
				Processing environment	Temperature, humidity, etc.	●	●				○	Optional			
(6) Material properties & analysis	Material properties & analysis	Analysis data		Type of resin		●	●			○	○	Optional			
				Percentage of resins		●	●			○	○	Optional			
				Pellet color L*		●	●			○	○	Optional			
				Pellet color a*		●	●			○	○	Optional			
				Pellet color b*		●	●			○	○	Optional			
				Odor emission (Odorometer)		●	●			○	○	Optional			
				Density (Archimedes principle)		●	●			○	○	Optional			
				Molecular weight (Gel permeation chromatography)		●	●			○	○	Optional			
				Tensile modulus (tensile test)		●	●			○	○	Optional			
				Yield stress (tensile test)		●	●			○	○	Optional			
				Tensile strength		●	●			○	○	Optional			
				Bending strength (bending test)		●	●			○	○	Optional			
				Bending modulus (bending test)		●	●			○	○	Optional			
				Charpy impact strength		●	●			○	○	Optional			
				Izod impact strength		●	●			○	○	Optional			
				Fatigue life (Fatigue tester)		●	●			○	○	Optional			
				Viscosity of solids (DMA)		●	●			○	○	Optional			
				Glass transition temperature (DMA)		●	●			○	○	Optional			
				Glass transition temperature (DSC)		●	●			○	○	Optional			
				Melting point (DSC)		●	●			○	○	Optional			
				Crystallinity (DSC)		●	●			○	○	Optional			
				Molecular structure and composition (Infrared absorption spectroscopy)		●	●			○	○	Optional			
				MFR (Melt Flow Tester)		●	●			○	○	Optional			
				Melt viscoelasticity (Rheometer)		●	●			○	○	Optional			
				Decomposition temperature (TG/DTA)		●	●			○	○	Optional			
				Name of spherulites and foreign bodies (polarized light microscope)		●	●			○	○	Optional			
				Number of spherulites and foreign bodies (polarized light microscope)		●	●			○	○	Optional			
				Degree of lamellar structure formation (SAXS)		●	●			○	○	Optional			
				Crystal orientation		●	●			○	○	Optional			
				Resin composition ratio		●	●			○	○	Optional			
				Amount of impurities		●	●			○	○	Optional			
				Amount of voids/foreign matter Name		●	●			○	○	Optional			
				Amount of voids/foreign matter Number		●	●			○	○	Optional			
	Company information			Analyst name	Name of the Institution that performed analysis	●	●			○	○	Mandatory			
				Analysis location	LEI code of analysis location	●	●			○	○	Mandatory			
				Analysis date	Date of analysis commencement	●	●			○	○	Mandatory			
				Analysis environment	Temperature, Humidity, etc.	●	●			○	○	Mandatory			
(7) Recycled raw materials and recycled material standards	Recycled raw materials and recycled material standards			To be discussed	(Discussion needed in the future)	●	●	●	●	●	○	To be decided			
(8) Environmental indices & representation	Indices	Environment indices		Recycling rate		●	●	●	●	●	○	Optional			
				CO2 emissions		○/●	○/●	○/●	○/●	○/●	○/●	Mandatory			
				CO2 emission unit	Weight, capacity of products	○/●	○/●	○/●	○/●	○/●	○/●	Optional			
				CO2 emission factor	Output level	○/●	○/●	○/●	○/●	○/●	○/●	Optional			
				Primary data percentage of CO2 emissions		○/●	○/●	○/●	○/●	○/●	○/●	Optional			
				Biogenic carbon content of CO2 emissions		○/●	○/●	○/●	○/●	○/●	○/●	Optional			
				Recycled material usage rate			○	●	●	●	●	Optional			
				Biomass plastic raw material	Ethylene, ethanol, etc.	○/●	●	●	●	●	○/●	Optional			
				Crops used as raw materials for biomass plastic	Sugarcane, etc.	○/●	●	●	●	●	○/●	Optional			
				Production area of crops that are raw material	Latitude and longitude information, addresses, polygon data, etc.	○/●	●	●	●	●	○/●	Optional			
				Use of crops that are raw material		○/●	●	●	●	●	○/●	Optional			
				Required production area per amount of raw material crops used	Surface area of plot required to produce the amount used	○/●	●	●	●	●	○/●	Optional			
	Representation	Label representation			Future discussion required *Necessity of representation standards at the stage of distribution, discharge, and separation		○	●	●	●		Optional			

4.3 Identification (ID and code)

To uniquely identify a company, user, product, or material within the system, an ID/code must be assigned to each and used commonly throughout the system.
If there are existing ID/code systems that can be utilized, leveraging those would be efficient for both users and operators.
Examples of existing ID and code systems include the following.

- Corporate identifier: LEI (Legal Entity Identifier) code
  The LEI code is an international code to identify parties (corporations, funds, etc.) involved in transactions of financial products. The proposal to use the LEI code was also included in the "Draft Guidelines for Data Linkage Mechanisms in the Supply Chain (Related to Storage Battery CFP/DD)" by Ouranos Ecosystem.
- Corporate/Business identifier: GS1 GLN (Global Location Number)
  The GS1 GLN identifier is used to uniquely identify organization and their location globally in domestic and international business-to-business transactions.
- Product identifier: GS1 GTIN (Global Trade Item Number)
  The GS1 GTIN is a unique identifier for products used in both domestic and international business-to-business transactions. The JAN code is also a part of the GTIN system.

The ID/code system will be developed progressively after the release of the first draft.

5 Security

Since this would be a system that provides confidential information from various companies, ensuring security is crucial.

As a security measure, the issues outlined in Table 2 clarify the rationale and objectives that must be addressed as system requirements. This approach shifts the focus from PLA-NETJ-specific details to broader system-level considerations.

Table 2: Discussion points on security

Category	#	Discussion points	Details
Confidentiality	1	User classification	Classification of users (e.g., authorities, supply chain stakeholders, general consumers) to grant appropriate permissions based on group assignments
	2	Access rights	Necessity of granting authority to each data item at the organization level and user level other than the above user classification and user classification
Integrity	3	Falsification	Measures required to prevent falsification
Availability	4	Disruptions/failures	Measures to ensure that access to information is not disrupted by obstacles or disasters
Authenticity	5	User identification	Measures to verify that the user accessing the information is an authorized individual
Traceability, accountability	6	Audit logs	Measures to clearly record who performed what actions and when on the information
Reliability	7	Errors/defects	Strategies to ensure that information processes are executed without errors

These will be addressed progressively after the release of the first draft.

6 Operation

In addition to data items and security measures, further discussions are needed for the operation of the information distribution platform (PLA-NETJ). Key points are listed in Table 3.

Of these, points #4, 5, 6, 7, 10, and 11 are expected to be addressed in these guidelines and will be progressively refined from the first draft onward. As for the other points, discussions on the standardization of global resource distribution are necessary. However, due to reliance on national laws and regulations, they are presented only as points for discussion in this guideline.

To effectively utilize the information distribution platform, it is necessary to analyze the material flow of plastics in each country. Material flow refers to the process from the collection of plastic waste to its recycling, product manufacturing, and reuse. For efficient flow, waste classification and traceability are crucial, and digital technologies and data sharing play a key role. This approach will promote higher recycling rates and market transparency, contributing to the realization of a circular economy. International initiatives, led by the European Commission, are underway, aiming to reduce environmental impact and promote the efficient use of resources. These issues will be addressed in the subsequent drafts.

Table 3: Discussion points related to operation

Discussion points			Relevant Stakeholders
Category	**#**	**Specific points of discussion**	
Operating entities and costs	1	Who will handle the operation: a public agency, private agency, or other entities?	Value chain stakeholders & government agencies
	2	How will the operational costs associated with maintaining and updating the platform be covered?	Value chain stakeholders & government agencies
	3	How extensively should the operational scope, especially interfaces with other platforms, be defined?	Value chain stakeholders & government agencies
Information management	4	How should the information input by various stakeholders be linked together?	Stakeholders in the value chain, SIer
	5	How to ensure traceability?	Stakeholders in the value chain, SIer
	6	How will alignment with physical items in the	Stakeholders in the value chain, SIer

		recycling process be ensured?	
	7	Can certification features based on information management (e.g., recycled material quality certification) be implemented?	Stakeholders in the value chain, SIer
Accessibility	8	Can the distributed information be treated as public property?	Government agencies
	9	Should conditions be established for the use of services or solutions developed by private entities using the distributed information? What should these conditions be?	Government agencies
Linkage with other platforms, etc.	10	What public and private platforms or databases will be considered for interoperability?	Stakeholders in the value chain, SIer
	11	How should such interoperability be achieved?	Stakeholders in the value chain, SIer

SIer: System integrator responsible for building the infrastructure that enables information linkage.

7 Other discussion points

In addition to the points outlined in the previous section, there are several other points that can be considered, for example, those shown in Table 4. As with the operational points discussed in the previous section, these points are largely dependent on the intentions, policies and status of administrative agencies in each region. Therefore, these guidelines are intended to present them as points of discussion only.

Table 4: Other discussion points

Discussion points			Relevant Stakeholders
Category	#	**Specific points of discussion**	
Handling diverse products and materials	1	To what extent should differences in form and characteristics, etc., between material units and product units be considered?	Value chain stakeholders & government agencies
	2	To what extent should the potential expansion to materials other than plastics be considered?	Value chain stakeholders & government agencies
	3	Should differences in properties based on the type of plastics (olefinic, carbon fiber, prepreg, etc.) be considered? If so, should multiple patterns be organized or standardized based on material properties?	Value chain stakeholders & government agencies
	4	Should differences in properties based on product types (e.g., automotive, home appliances, containers, packaging, etc.) be considered? If so, should multiple patterns be organized or standardized based on product characteristics?	Value chain stakeholders & government agencies
Premises for defining information items	5	How to consider the relationship between process-related information (e.g., sorting methods) and material-related information (e.g., recycled material ratios, additive quantities)?	Value chain stakeholders & government agencies
	6	To what extent and in what way do the cost-benefit analysis and feasibility assessments factor in the evaluation of each item when distinguishing between mandatory and optional items?	Value chain stakeholders & government agencies

8 References

References	URL	Relevant Section
The Cross-ministerial Strategic Innovation Promotion Program (SIP)	https://www.erca.go.jp/sip/english/	Executive Summary
PE-PLASTICS-THE-FACTS	https://plasticseurope.org/wp-content/uploads/2022/12/PE-PLASTICS-THE-FACTS_FINAL_DIGITAL.pdf	1.2 Environmental and social issues caused by plastics
SIP Program: "Development of a Circular Economy System"	https://www.erca.go.jp/sip/english/	1.5 Structure of these guidelines

9 Glossary

Term/Phrase	Meaning
Digital Product Passport (DPP)	Part of an initiative proposed by EU. Refers to the data encompassing the entire lifecycle from raw material procurement to recycling.
Catena-X	A platform for exchanging and sharing data among supply chains in the automotive industry.
Ouranos ecosystem	A generic name for initiatives to share and utilize data across companies, industries, and national borders through collaboration between industry, government, and academia.
IMDS (International Material Data System)	A material data system for the automotive industry.
Material balance	Indicates the input of energy and resources in business activities (input) and the environmentally hazardous substances (output) generated by these business activities.
GS1	An international organization for the management of distribution codes and setting global standards for distribution.
GS1 identification keys	International standard identification keys established by GS1. These identification keys have been established for various purposes, including the JAN code for identifying goods and services, as well as for identifying companies, business locations, packaging, and assets.
LEI Code /Legal Entity Identifier	A 20-character alphanumeric code, established by the International Organization for Standardization (ISO) under ISO 17442. It can uniquely identify entities (companies, funds, etc.) participating in financial transactions and other formal interactions.
Olefin/polyolefin resin (Polyolefins)	A collective term for unsaturated hydrocarbons, such as ethylene, propylene, and butadiene, which are high-molecular-weight compounds. Being composed of carbon and hydrogen, they do not emit harmful gases such as hydrogen chloride upon combustion. Typical examples include PP (polypropylene) and PE (polyethylene).
Prepreg	Intermediate material pre-impregnated with resin, such as carbon fiber, glass fiber, etc.
Carbon Fiber/Carbon Fiber Reinforced Plastics (CFRP)	Composite materials made of carbon fibers and a plastics matrix.

PLA-NETJ (PLAstic Networking for Environmental Transformation)	A decentralized plastic information distribution platform is being developed under SIP-CE to establish rules concerning shared information (such as resource recovery routes and the quality of recycled materials) among various stakeholders in industry, academia, government, and the private sector. It also ensures traceability from resource recovery to the production of recycled materials.
System Integrator (SIer)	Refers to companies that undertake the contracted development of systems, including planning, design, development, maintenance, and operation, to address their clients' issues.

10 Comments and inquiries regarding these guidelines

Please direct any comments or inquiries regarding this guideline (discussion paper) to the following address.

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*Please convert [] to @