D9.5 Standardization and interoperability report

This is a draft document and subject to approval for final version.
Therefore the information contained herein may change.

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List of abbreviations

Abbreviation	*Explanation*
ACES	Aftermarket Catalog Exchange Standard
API	Application Programming Interface
APPLiA	Home Appliance Europe
APRA	Automotive Parts Remanufacturer Association
BS	British Standard
BSI	British Standard Institution
CAG	Chairman's Advisory Group
C-ECO	Circular Economy Solutions GmbH
CG	Content Groups
CLEPA	Comité de Liaison Européen des Fabricants d'Equipements et de Pièces Automobiles (European Liaison Committee of Manufacturers of Equipment and Auto Parts)
GVA	Gesamtverband Autoteile-Handel e.V.
DIN	Deutsches Institut für Normung (German Institute for Standardisation)
EC	European Commission
ERP	Enterprise Resource Planning
EN	European Standards (from the German: "Europäische Norm" - "European Norm")
KTH	KTH Royal Institute of Technology
ISO	International Organization for Standardization
ISO/TC	ISO Technical Committee
NBA	National Standards Body
OEM	Original Equipment Manufacturer
PIES	Product Information Exchange Standard
SDG	Sustainable Development Goal(s)
UPS	Universal Product Codes
WD	Working Draft
WG	Working Group
XML	Extensible Markup Language

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1. Executive Summary

The deliverable report D9.5 “Standardization and interoperability report” reflects the consistency of developments and adoptions of the project towards existing remanufacturing standards and related terminologies. Therefore, KTH Royal Institute of Technology (KTH) monitored the evolution of BS 8887-220:2010 and reported changes in the standard, and Bosch interacted with the Automotive Parts Remanufacturer Association (APRA) to review its remanufacturing terminology for automotive parts. The report also includes the contribution made by the ReCiPSS project in the development of the Circular Economy standard through the involvement in the ISO Technical Committee, ISO/ TC 323 by KTH. Furthermore, as a member of Home Appliance Europe (APPLiA), Gorenje has been involved in defining the future position and direction of the white goods industry regarding the circular economy. Last, the Circular Economy Solutions GmbH (C-ECO) has examined the potential to integrate two data exchange formats, PIES, and TecDoc, into the automotive demonstrator.

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2. Introduction

In 2021, on July 29, humanity had already consumed as many natural resources as the planet can regenerate in one year (Global Footprint Network, 2021). As resources around the globe are increasingly overexploited, the negative impacts of climate change and resource scarcity are intensifying.

With the agreement on April 21, 2021, the EU Parliament and EU states responded to the threat of climate change by committing to the first European climate law that Europe's economy and society will become climate neutral by 2050. To achieve this transformation, emissions reductions, investments in green technologies, and protection of the natural environment must ensure that net-zero greenhouse gas emissions are achieved across all EU member states (European Commission, n.d.).

In this context, circular economy is one possible solution that can contribute to economic growth and concurrently satisfy sustainability ambitions. It tackles the root causes of global challenges such as climate change, biodiversity loss, and pollution. Compared to the current economy, which is dominated by a linear approach to consumption and production, a circular economy is a regenerative system by design based on optimizing resource consumption and reducing waste (BSI, 2022). The circular economy is thus at the service of sustainable development and can enable socially responsible economic activity within ecological limits.

Norms and standards can actively support the introduction of circular products, services, and business models in companies by standardizing terminology and interfaces. Norms and standards can ensure clear communication and appropriate information exchange between the different market players in the circular economy, e.g., through requirements for recyclable products and precise material classification for manufacturers and recyclers. European standardization can also support the transition to circular systems, e.g., by providing uniform definitions of terms and establishing links between standards and relevant legislation at the European level. Furthermore, standards contribute to a broad social acceptance of circular products, a prerequisite for circular offerings to become an economic success model. However, only a few norms and standards address the circular economy concept.

Hence, this deliverable report reflects the consistency of developments and adoptions of the project towards existing circular economy standards and related terminologies. The report also includes the contribution made by the ReCiPSS project in the development of the Circular Economy standard through the involvement in the ISO Technical Committee, ISO/ TC 323.

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3. Monitoring the evolution of BS 8887-220:2010

The British Standards Institution (BSI) is the independent national body responsible for preparing British Standards. It presents the view of the United Kingdom on standards in Europe and at the international level and is incorporated by the Royal Charter[1]. This British Standard BS 8887-2020:2010 was published by the BSI and came into effect on March 31, 2010. The Subcommittee TDW/4/7, BS 8887 Design for MADE, prepared the standard under the authority of Technical Committee TDW/4, Technical product realization.

3.1. Background information on BS 8887-2020:2010

The standard BS 8887-220:2010 "Design for manufacture, assembly, disassembly and end-of-life processing (MADE)" is a British Standard that specifies requirements for the remanufacturing process. The standard lists the steps required to restore a used product to a like-new product with at least the same performance and warranty as a comparable new replacement product (refered to as "remanufacturing"). This remanufacturing process can include parts or components to be used in subsequent assembly. The standard provides ten steps for the remanufacturing process:

1. Collection of technical documents
2. Collection of core
3. Initial inspection
4. Disassembly
5. Detailed inspection of components
6. Remediation of components (both functional and cosmetic)
7. Replacement
8. Reassembly
9. Testing (both product and process)
10. Issue of a warranty

Furthermore, BS 8887-220:2010 provides instructions for identifying and marking remanufactured products. Although relevant, this standard considers the remanufacturing of products by chance and not by design. According to the definition of the Ellen MacArthur Foundation, the circular economy is based on three principles, driven by design (Ellen MacArthur Foundation, 2022):

- Eliminate waste and pollution
- Circulate products and materials (at their highest value)
- Regenerate nature

Therefore, it is essential for a circular economy to intentionally design products for multiple lifecycles and set up relevant refurbishing and remanufacturing processes to change used products into like-new products (Ellen MacArthur Foundation, 2013). Therefore, the purpose of this task is to monitor the evolution of BS 8887-220:2010 in order to understand if further developments of this series of standards cover the circular economy principles and the way they are addressed.

[1]BSI's Royal Charter is essentially an enabling document that sets out the purpose and defines in broad terms the range of activities, including the functions as the UK's national standards body, as well as the ability to offer global accredited training, testing and certification services in addition to advisory consulting services The British Standards Institution (2022). See the following link to access the Royal Charter and Bye-laws: https://www.bsigroup.com/Documents/about-bsi/royal-charter/bsi-royal-charter-and-bye-laws.pdf

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3.2. Evolution of BS 8887-2020:2010

The standard "BS 8887-220:2010 Design for manufacture, assembly, disassembly and end-of-life processing (MADE)" was published in 2010 and is based on the standards "BS 8887-1:2006 Design for manufacture, assembly, disassembly and end-of-life processing (MADE)" and "BS 8887-2:2009 Design for manufacture, assembly, disassembly and end-of-life processing (MADE)". In 2011, in addition to the already existing standard, the standard "BS 8887-240:2011 Design for manufacture, assembly, disassembly and end-of-life processing (MADE)" was published. This standard deals with product reconditioning and specifies the process requirements for reconditioning. However, it does not fully address the general circular economy principles. In 2012, the standard "BS 8887-211:2012 Design for manufacture, assembly, disassembly and end-of-life processing (MADE)" focusing on reworking and remarketing of computing hardware was published. In 2017, the new international standard "BS 8887-1:2017 Technical Product Documentation. Design for manufacturing, assembling, disassembling and end-of-life processing (MADE)" was introduced. This standard is based on the original British standard (BS 8887-1:2006) and has been adapted for an international audience providing a more straightforward process for considering sustainable design principles early in the design process. The economic and ecological advantages of remanufacturing can be enhanced by already adapting the product design to remanufacturing (Lange, 2017). Design for remanufacturing aims to facilitate the remanufacturing process through product design so that, for example, disassembly, cleaning, reprocessing and reassembly are facilitated (Lindkvist Haziri & Sundin, 2020).

In 2018, the standard "BS 8887-3:2018 Design for manufacture, assembly, disassembly and end-of-life processing (MADE) - Guide to choosing an appropriate end-of-life design strategy" was published. This standard focuses explicitly on the design aspects of the products to enable their reuse. The focus is on incorporating features into the original design of products to support one of several available end-of-life strategy options. In addition, the standard intends to assist in design decisions regarding end-of-life options to prolong the useful life of the products. The environmental, economic, and market benefits of reusing materials, parts, assemblies, and complete products at end-of-life are presented, and how early design decisions influence these factors are shown. Based on the standard BS 8887-1:2006, six end-of-life options are outlined for products:

1. Remanufacture
2. Recondition
3. Reuse
4. Repurpose
5. Recycle
6. Dispose

In this context, the standard mainly describes the impact of the product design on production, focusing on the supply chain, procurement of materials and components, product use, disassembly processes, and end-of-life processing for each of the six options mentioned above. Furthermore, the implications for quality verification in a multi-lifecycle environment and the implications for service and maintenance during the use phase of the products are explained.

BS 8887-3:2018 addresses some of the principles of the circular economy. However, it focuses mainly on product design without considering the business model, the supply chain, or the ICT infrastructure needed to implement a circular economy successfully. Hence, there is still a need for standards that address the implementation of the circular economy from a systemic perspective.

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4. Development of a Circular Economy standard

Standardization aims to facilitate the exchange of goods and services by eliminating technical trade barriers. International Standards reinforce the essential principles of global openness and transparency, consensus, and technical coherence.

4.1. Background information on ISO / TC 323

ISO – International Organization for Standardization

The International Organization for Standardization (ISO) is representing a non-governmental and independent organization with a membership of 167 National Standards Bodies (NBAs) supported by a Central Secretariat in Geneva. The organization aims to plan, develop and adopt international standards. Today, the ISO has established over 24,000 international standards covering almost all aspects of technology and manufacturing. The organization is responsible for all sectors, excluding Electrotechnical (responsibility of the International Electrotechnical Committee) and most of the Telecommunications Technologies (responsibility of the International Telecommunication Union). Overall, the ISO consists of 802 Technical Committees and Subcommittees to develop standards. An ISO Technical Committee (ISO/TC) represents all interested parties, supported by a common public phase (the ISO Technical Inquiry), to develop and safeguard the international standards for a specific topic (International Organization for Standardization, n.d.–a).

ISO/TC 323 – Technical Committee on Circular Economy

ISO/TC 323 aims to develop standardization in Circular Economy to maximize organizations' contributions to sustainable development, especially to implement Circular Economy in their activities and collaboration with partners and key stakeholders. This includes the development of frameworks, guidance, supporting tools, and requirements for implementing activities of all involved organizations. Aspects on the topic of Circular Economy that are already covered by existing committees are excluded.

ISO/TC 323 promotes the broadest participation of ISO and liaison members. Currently, the TC consists of experts from 85 countries. There are 71 participating members (see Figure 1, blue) and 14 observing members (see Figure 1, orange) directly responsible for developing 6 ISO standards. As Circular Economy is a worldwide topic, the number of participants is expected to grow. The first meeting of the ISO/TC 323 with over 120 experts from 47 countries was held in Paris in May 2019. The TC includes important representatives from developed countries, developing countries, and countries with economies in transition in all major geographical regions (International Organization for Standardization, 2018).

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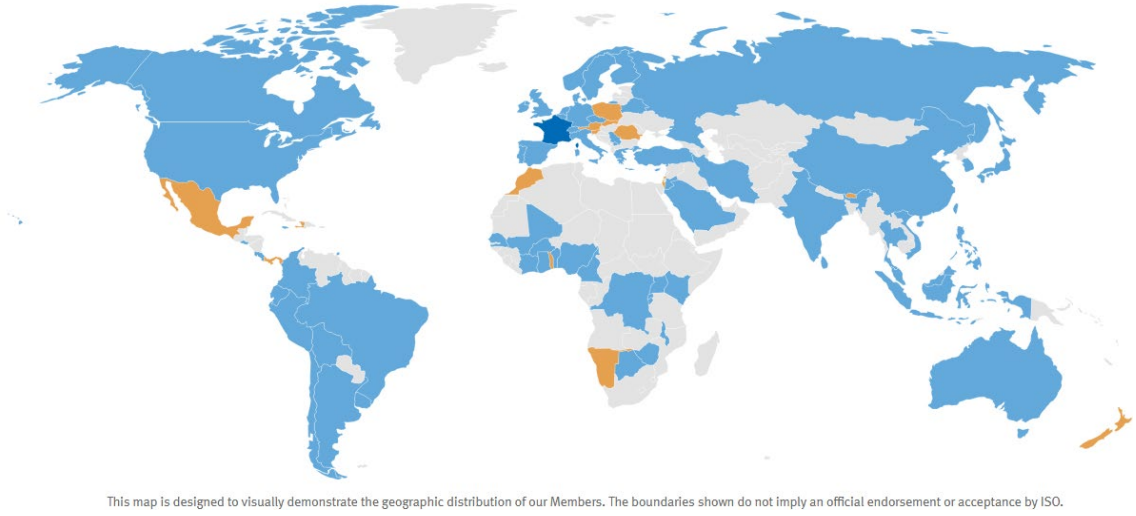

Figure 1: **Participating members (blue, n=71) and observing members (orange, n=14) of ISO/TC 323 (International Organization for Standardization, n.d.–b)**

The standards to be developed of the ISO/TC 323 address directly or indirectly the majority of the 17 Sustainable Development Goals, established by the UN (Figure 2) by answering to resource and biodiversity depletion, the social gap between people, way of production, consumption and behavioral change as well as climate change (International Organization for Standardization, 2018).[2]

Figure 2: Overview of the 17 Sustainable Development Goals of the United Nations (International Organization for Standardization, n.d.–d)

The ISO standards generally address all 17 SDGs in various ways. Figure 3 provides an overview of the number of ISO standards that apply to each SDG.

[2]See https://sdgs.un.org/goals for a description of the SDGs and their targets and indicators.

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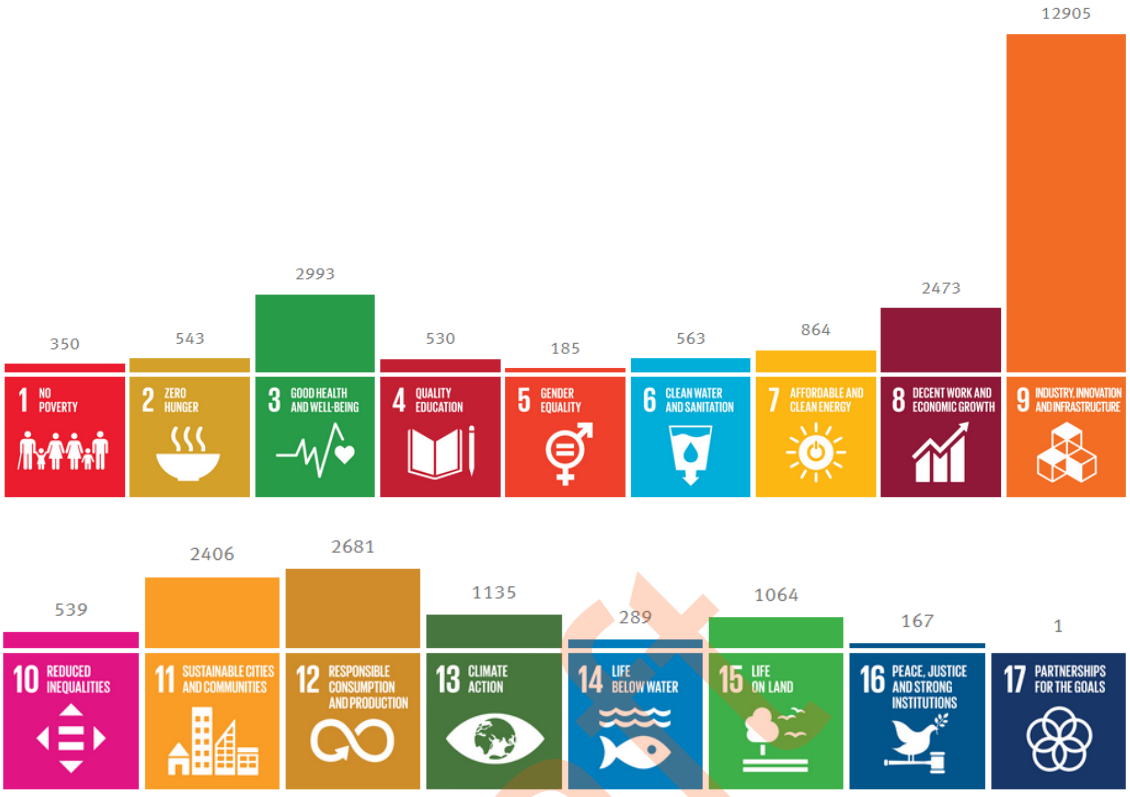

Figure 3: ISO standards applying to each SDG (International Organization for Standardization, n.d.–d)

The standards implemented by the ISO/TC 323 aim to (International Organization for Standardization, 2020):

- Promote improved and shared understanding of Circular Economy;
- Provide a framework to support organizations integrate Circular Economy principles and strategies in their activities;
- Develop tools to assess circularity performance;
- Facilitate dialogue, communication, and collaboration amongst different actors at international, regional, and national levels;
- Show concrete benefits and actions that interest potential stakeholders and contributors;
- Provide guidelines for the creation of an enabling environment for collaboration within and among sectors and value chains;
- Making products accessible to more consumers through circular-based business models;
- Facilitate exchanges and feedback on experiences;
- Provide easy to use documents to implement Circular Economy and avoid a proliferation of standards.

These deliverables of the standardization are aimed at all organizations from private and public sectors to enable the implementation of Circular Economy principles and strategies in their policies, management, operations, and business model.

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The objectives of the ISO/TC 323 can be summarized as follows (International Organization for Standardization, 2020):

- To develop impactful standards that support and encourage organizations to adopt Circular Economy through a time-efficiency process;
- To promote an alternative and collaborative economic model that is more sustainable and facilitate the transition from a linear to a Circular Economy;
- To promote broad and effective participation from countries all around the world;
- To maximize the contribution to Sustainable Development;
- To develop high-quality standards for all types of stakeholders.

To achieve these goals, the ISO/TC 323 consists of six working groups listed in Table 1. To ensure consistency, to support the Technical Committee and avoid duplication between Ad Hoc Groups and Working Groups or between ISO/TC 323 and other Technical Committees, the ISO/TC 323 decided to create a Chair Advisory Group (CAG).

Table 1: Working Groups of ISO/TC 323 (International Organization for Standardization, 2018)

Working group	Title
ISO/TC 323/CAG	Chairman's Advisory Group
ISO/TC 323/W.G. 1	Terminology, principles, frameworks and management system standard
ISO/TC 323/W.G. 2	Practical approaches to develop and implement Circular Economy
ISO/TC 323/W.G. 3	Measuring and assessing circularity
ISO/TC 323/W.G. 4	Circular Economy in practice: experience feedback
ISO/TC 323/W.G. 5	Product circularity data sheet

The following table shows an overview of standards currently developed by the ISO/TC 323. The development status of the listed standards can be found in the appendix.

Table 2: ISO standards under development under the direct responsibility of ISO/TC 323 (International Organization for Standardization, n.d.–c):

Number	Title	Stage
ISO/WD 59004	Circular economy — Framework and principles for implementation	20.60: Close of comment period
ISO/WD 59010.2	Circular economy — Guidelines on business models and value chains	20.20: Working draft (WD) study initiated
ISO/WD 59020.2	Circular economy — Measuring circularity framework	20.60: Close of comment period
ISO/CD TR 59031	Circular economy – Performance-based approach – Analysis of cases studies	30.00: Committee draft (CD) registered
ISO/DTR 59032.2	Circular economy – Review of business model implementation	30.60: Close of voting/ comment period
ISO/AWI 59040	Circular Economy — Product Circularity Data Sheet	20.00: New project registered in TC/SC work programme

In the following section, the preparation of ISO 59010:2023 and the involvement of the KTH Royal Institute of Technology in Stockholm are presented in more detail.

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4.2. Creation of the ISO 59010:2023 "Circular Economy - Guidelines on Business Models and Value Networks" standard

To develop a Circular Economy standard, KTH joined ISO/TC323 Working Group (WG) 2 in June 2020. The WG 2 is instructed to develop ISO standard 59010:2023 "Circular Economy – Guidelines on Business Models and Value Networks" for Circular Economy implementation concerning frameworks, guidance, supporting tools, and requirements to maximize the contribution to sustainable development. As an active committee member, KTH participated in several meetings and workshops, contributed to creating the working documents, and provided feedback to the consortium partners on the developments of the Circular Economy standard. The committee agreed that the scope of the paper provides guidelines for an organization or interlinked organizations seeking to transition its business models and value networks from linear to circular ones. The document applies to any organization dealing in a product or service regardless of its size, sector, or region. In addition, the standard may be followed by other requirement standards, such as ISO 14001 or ISO 9001, to ensure widespread use in the initial phase. The structure of ISO 59010:2023 "Circular Economy – Guidelines on Business Models and Value Networks" is as follows:

0. Introduction
1. Scope
2. Normative References
3. Terms and definitions
4. Set the scope
5. Identify gaps and opportunities for improvement
6. Transitioning an organization's business model into a more circular one
7. Transitioning the value network's business model into a more circular one
8. Review

In addition, the committee agreed that the standard proposes methods but not tools and focuses on Circular Economy transition by focusing on the area of activities and value network. Furthermore, the standard should be applicable to existing and new business and organizational models and value networks. Thereby, the standard suggests definitions and potential actions for a company to increase circular activities.

In general, KTH reviewed documents and commented on the working drafts (WD 1-3) of ISO 59010:2023 "Circular Economy – Guidelines on Business Models and Value Networks". Furthermore, KTH volunteered to participate in the Content Groups CG-6 "Transforming the value network from linear to circular" and CG-7 "Transforming in-house business from linear to circular". In addition, KTH organized three workshops with the ReCiPSS partners to collect relevant inputs. For the workshops, both industry partners and research partners were invited. KTH then suggested the collected inputs to the technical committee during ISO meetings and workshops.

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5. Ensuring a data exchange format for the auto parts demonstrator

An important driver for automotive remanufacturing is the availability of relevant data. This especially applies to material master data on vehicle spare parts since there are many Original Equipment Manufacturers (OEM) and an even higher number of spare-part producers worldwide. Spare parts are available from the OE parts supplier and many other companies that supply these products in widely varying quality. This complexity is difficult for manufacturers, dealers, and workshops, especially for companies in the remanufacturing business. To repair a car, a workshop needs access to material master data to determine which parts will fit to the damaged part, in order to be replaced, and selects from various suppliers and distributors offering products for replacement of the original. As the complexity of the material master data is high, the major OEMs are not able or willing to maintain this database independently. Also, this would only contain the material data of their products, leaving potential auto parts buyers again with the burden to find the fitting spare parts. The following section will describe how this complexity is dealt within the ReCiPSS project regarding standardization.

5.1. Background information on TecDocs and PIES

For the automotive workshops, a database is needed, which not only documents the product range of a single parts producer but in the best case for all parts producers. This has led to the creation of initiatives, organizations, and companies whose core business is to collect, manage, and aggregate this data and make it available for use by all types of automotive aftermarket catalogs or ordering systems. In the following, two important data formats for exchanging these data, PIES, and TecDoc, are described and analyzed in terms of their integration potential into the Automotive Demonstrator.

5.1.1. PIES: Product Information Exchange Standard

The Product Information Exchange Standard is an industry-standard of the automotive aftermarket, published by the US-based Auto Care Association, to manage and exchange product data of automotive parts and accessories. According to the description on their website, the Auto Care Association represents a wide range of aftermarket-stakeholder in North America. It provides its members market research, data services, and legal support, among other services. Auto Care Association claims themselves an independent organization that aims to provide knowledge and support to all stakeholders in the automotive aftermarket.

PIES is the aftermarket industry data standard for managing and communicating product information with a strong focus on the US, including more than 20.000 product types organized by 25 product categories. The standard part type taxonomy is part of the Product Classification database, covering product classifications. PIES data include product attributes, brand ID, prices, dimensions, weights, kits, digital assets, marketing content, Universal Product Codes (UPS), information concerning hazardous material, and country of origin. PIES defines an XML-based interchange format for exchanging product information between data providers (usually car-part producers) and data receivers (usually workshops or part dealers). The technical documentation of the standard format for the interface is publicly available for everybody via Auto Care Association website (Auto Care Association, 2022).

PIES is directly related to the Aftermarket Catalog Exchange Standard (ACES), also maintained by Auto Care Association. PIES and the ACES work together so that subscribers get access to part

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numbers and fitment data. PIES is focused on spare parts, while ACES links these parts to vehicles so that users can find matching spare parts by searching the equipment of vehicles (AutomotiveAftermarket, 2022).

5.1.2. TecDoc

The TecDoc Information Systems GmbH has been founded in 1994 in Cologne from major replacement parts manufacturers and the GVA (Gesamtverband Autoteile-Handel e.V.) trading association. Nowadays, TecDoc operates in the network of TecAlliance. TecAlliance is owned by multiple shareholders consisting of 29 international OEM car parts manufacturers (TecAlliance, 2022b).

Figure 4: TecAlliance's international shareholders (TecAlliance, 2022b)

These companies, representing a major share of the international automotive aftermarket suppliers, are the owners of the TecAlliance and act as "data providers" by supplying detailed technical information on their products directly to the TecDoc database. TecAlliance uses this data to create commercial digital solutions for all kinds of data-users, such as automotive part-dealers, workshops, or fleet customers. The TecDoc database includes around 8.8 million products from the global automotive aftermarket grouped in 134 product categories. However, access to the data is granted only via commercial products and is not publicly available (TecAlliance, 2022b).

TecDoc provides a data package that offers original reference data and catalog data of parts manufacturer's replacement parts. The data contains information on vehicle equipment, the exchangeability of products between different car-parts suppliers, and predecessor-successor-relations.

Additional to TecDoc, TecAlliance also offers an "order-to-invoice-solution" called TecCom for automotive dealers and workshops. This solution incorporates the complete ordering process from availability check of spare parts, ordering, dispatch advice, warranty-handling to invoicing. TecCom is the de-facto-standard for order-processing, supplying dealers and car-parts producers among many workshops (TecAlliance, 2022a).

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5.2. Evaluation of PIES and TecDoc for compatibility to ReCiPSS platform

Since the PIES exchange standard definition is publicly available, it was possible to access and analyze the technical documentation. In principle, it offers the possibility to exchange data in the following areas in addition to basic product numbers and price information:

- Packaging, including dimensions, weights, etc.
- Barcodes / product identification
- Product descriptions
- Extended product information
- Kit component information
- Warranty information
- Shipping information
- Information and links to product data sheets and safety information
- Information and links to product images

It is necessary to analyze the definition of the exchange format and the integration of the companies' data into the PIES standard to assess the compatibility of PIES with the RECiPSS platform. Unfortunately, it was impossible to access any of these databases for free. However, according to the information about the small database on automotiveaftermarket.org and the strong focus and use of PIES mainly on the North American market, a prioritization of integrating PIES into the ReCiPSS platform was not pursued further. However, due to the well-described XML structures, it is in principle not a problem to ensure compatibility with any interface.

Regarding TecDoc, TecAlliance is the curator and provider of the TecDoc database and not only defines an exchange standard. Furthermore, the company directly integrates producers as data suppliers via its ownership structure and assures the consistency and distribution of the data exchange format. Hence, the analyses and compatibility check of the standard is much easier than with PIES, as PIES only maintains an open standard for exchange.

As the standard is not publicly available and incorporated in commercial products, C-ECO approached TecAlliance directly to check compatibility and identify further potential and synergies to connect with ReCiPSS. For this purpose, a series of workshops with the top management of TecAlliance and C-ECO were conducted. The TecDoc-data has been analyzed to check its compatibility and completeness to build core return options within the ReCiPSS platform. In principle, the database of TecDoc provides a good basis to build core return options as it incorporates all the current product assortments of a majority of car-parts producers. However, there are certain deficits concerning remanufacturing.

1. It is currently impossible to distinguish between exchange/remanufacturing and non-remanufacturing/new products in the material database. This means that without additional information from outside of TecDoc database, it is impossible to identify only the relevant share of circular products that require a core return.
2. Not all data suppliers provide the core surcharge values to the TecDoc database.
3. The pricing information does not contain a separate field for the core surcharge value. Since the core surcharge is the relevant value for defining the nominal option value, this limits the data use for creating options.

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Despite these shortcomings, TecDoc remains a desirable data source. With the support of TecAlliance, compatibility of ReCiPSS with TecDoc can be achieved, but currently, the missing information does limit the benefits. It is more challenging to extract the relevant share of exchange/remanufacturing products from the database and enrich it with the missing information than to proceed on the remanufacturing specific database C-ECO has built from its CoremanNet service and the activities in ReCiPSS Task 7.1. However, C-ECO and TecAlliance will continue to examine how relevant information on the use of circular products can be added to the TecDoc database.

During the workshops between the two companies, another opportunity for collaboration has been identified. As a result of the developments in the project, C-ECO created and published a public API which allows companies to connect their ERP systems directly to the ReCiPSS platform to create core return options (Resource-efficient Circular Product-Service Systems). To connect to this interface, companies need to set up IT infrastructure within their organization or outsource it to a technology provider. In either case, it is an additional effort to motivate them to use the ReCiPSS-platform. As described in section 5.1.2, TecAlliance offers the “TecCom” product and an “Order-to-Invoice” system that is widely used between auto parts manufacturers, wholesalers, and workshops. The data generated in the order process is a complete set of information for creating core digital take-back options, as stored on the ReCiPSS platform. All relevant information for the creation of core return options could be extracted from the TecCom orders. This means that TecCom users can reduce the effort required to integrate with the ReCiPSS platform. Companies do not have to worry about data availability, technical connections, etc. This can drastically lower the threshold for wholesalers to join the ReCiPSS platform and enable much easier scaling of the service.

The companies involved in the automotive demonstrator in ReCiPSS are operating on TecCom. Therefore, to evaluate the potential of TecCom integration for standardization option interfaces, C-ECO and TecAlliance have agreed to conduct a proof-of-concept based on data from these companies.

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6. Update remanufacturing terminology of automotive parts

Due to climate change and the resulting political and social pressure, sustainability is gaining more attention in the automotive sector. Automobile manufacturers and suppliers are therefore dependent on finding solutions for their business models that are feasible, cost-effective, and environmentally friendly at the same time.

Remanufacturing offers ecological benefits compared with a new part production, as the use of, e.g., primary raw material, energy, and operating materials can be reduced to a large extent. Due to the aforementioned savings in material and energy and material costs as the most significant cost block in manufacturing products, costs can be saved, or higher profit margins can be achieved in remanufacturing.

In general, there are different standards for remanufacturing processes and product quality. However, there is a lack of official and (inter-) nationally accepted standards that define and benchmark the remanufacturing process, establish specifications that distinguish remanufacturing from other practices, and address the impact of remanufacturing processes on product safety.

6.1. Background information on APRA

The Automotive Parts Remanufacturing Association (APRA) was founded in 1941 by R. A. Van Alen and Harry Lester in Los Angeles and today represents the interests of automotive remanufacturing companies. Today APRA includes around 1,000 member companies all around the globe with headquarters in Washington DC and bases in Europe and Asia (APRA, 2021; APRA Europe, 2021).

As a non-profit association, APRA provides various products, services, workshops, and information for educational purposes. APRA Europe promotes remanufacturing as an integral part of the circular economy and represents the industry's interests, including free trade, an independent aftermarket, open access data, and legal certainty. Members benefit from the close integration of other industry associations, obtaining guidance and support for business matters.

6.2. Evaluation of the definition of remanufacturing

APRA provides a document entitled 'Remanufacturing Terminology - Remanufacturing Term Guideline' that explains the relevant terms frequently used in connection with the remanufacturing business (APRA Europe, 2012). The standard refers to BSI British Standards Design for manufacture, assembly, disassembly, and end-of-life processing (BS 8887-2:2009) and DIN EN standards to describe the terms.

The term 'remanufacturing' is defined in the document as follows:

"Return a used product to at least its original performance with a warranty that is equivalent or better than that of the newly manufactured product.

> **NOTE 1** From a customer viewpoint, the remanufactured product can be considered to be the same as the new product. If we have, with in this borderline, divagating specifications, they can be named Reman Level 1 / Reman Level 2
>
> **NOTE 2** With respect to remanufacture:

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- Manufacturing effort involves dismantling the product, the restoration and replacement of components and testing of the individual parts and whole product to ensure that it is within its original design specifications;
- Performance after remanufacture is expected to be at least to the original performance specification (out of customer perspective); and
- Any subsequent warranty is generally at least equal to that of new product.

NOTE 3 This assumes that remanufacture applies to like-for-like products."

"A remanufactured product fulfils a similar function to the original part. It is manufactured using a standardized industrial process in line with specific technical specifications. The industrialized process incorporates defined core management standards. A remanufactured spare part is warranted as a new spare part." (CLEPA, 2011)

The standard was reviewed and discussed in a joint workshop with experts from the remanufacturing sector and APRA members. The experts agreed that the definition of remanufacturing is still valid and does not require any further adaptation or modification.

However, a standard to define a common understanding of remanufacturing processes to which remanufacturers can refer and commit would be beneficial. Compliance with defined requirements can thus lead to certification of the remanufacturing company, whereby, comparable to ISO 9001 on quality management systems, requirements are set for the organization and not the result. The results of this joint exchange were also included in the Policy Brief (Deliverable report 9.7 of the ReCiPSS project).

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7. Update remanufacturing terminology of home appliances

The Circular Economy Action Plan aims to reduce the EU's consumption footprint and increase the EU's circular material use rate over the next decade while boosting economic growth. This will be done in full cooperation with stakeholders and businesses (European Commission). In this context, the European Commission plans to present several legislative proposals. Thereby, APPLiA intends to work actively with the EC to develop an environmentally sustainable legislative framework suitable for the Green Deal while protecting the EU's competitiveness. To advance the Steering Committee's deliberations, APPLiA should assess and update the association's position on circular economy issues in light of the current and future policy framework of the European Green Deal.

7.1. Background information on APPLiA

Home Appliance Europe (APPLiA) is a trade association that supports the home appliances industry in advancing the lifestyles of Europeans. The voluntary code of conduct expects its members to promote fair and sustainable standards regarding working conditions, social conformity, and ecological performance.

APPLiA aims to achieve a sustainable lifestyle through its innovative and resource-saving appliances and promoting sustainable growth. Thereby, APPLiA is working closely with the European regulatory authority to accomplish the goal to contribute to a sustainable lifestyle by establishing a circular economy in the industry. In addition, APPLIA aims to realize the connected home by developing connected, modern, smart devices for more sustainable and comfortable European households. Furthermore, APPLiA supports the principles of a free, balanced, open, and fair trading system for the European Single Market and trade with third countries to maintain economic growth and competitiveness. APPLiA is committed to promoting a European strategy focused on keeping markets open, and trade flows to achieve this goal.

7.2. APPLiA's position on Circular Economy

APPLiA's strategic orientation and positioning on the topic of the circular economy was discussed in various workshops. Thereby, the subjects sustainable products, empowering consumers, and sustainable chemicals from the Circular Economy Action Plan were considered further.

Regarding the subject of sustainable products, the aspects of circular design, ecodesign requirements, product footprinting, design for recycling of products and recovery of materials were considered in more detail. Thereby, APPLiA's vision for sustainable products by 2030 was defined. To reach the goal that all products are optimized for sustainability, the consortium will build upon the sector's good practices and develop a concrete set of indicators to measure the sustainability of the products. Furthermore, actions to implement these indicators are identified, and recommendations regarding standardization are submitted to policymakers.

Also, discussion on information to consumers on repair/lifespan of products with regards to labeling, right to repair, and substantiating green claims were lead under the topic empowering consumers. According to APPLiA, if labeling is introduced, attention should be paid to ensuring that it is based on a transparent methodology. Moreover, the methodology must be measurable, enforceable, and based on standards.

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In addition, the members of APPLiA discussed a sustainable chemicals strategy, which will further address the interface between chemicals, products, and waste legislation, and strengthen synergies with the circular economy.

Furthermore, together with APPLiA members, a base document summarizing the most important positions of the association and guidelines for the development of the future strategy was elaborated. For this purpose, general APPLiA principles for a sustainable product policy were first defined with the Circular Economy experts, based on the members' initial assessment of current and future EU legislation.

The members agreed on 20 key principles that should be taken into account for the future EU policy framework. These principles have already been shared with the European Commission to respond to the initial Roadmap on the Sustainable Products Initiative. The members set the following principles:

1. **Preserving the Single Market and improving its functionality**
   European economic growth and competitiveness depend on a free, balanced, open, and fair trading system. Hence, measures to promote the circular economy must be ensured uniformly for the entire EU to create fair competition.
2. **European legislation should be the preferred option over national legislation**
   APPLiA supports EU-wide legislation on the circular economy as it will harmonize the Single Market and create incentives for more sustainable and innovative products across the EU.
3. **Innovation for European competitiveness**
   A future EU framework for sustainable products should promote innovation and competition.
4. **Market driven circularity**
   APPLiA considers the circular economy an opportunity to transform the industry to climate neutrality and increase competitiveness in the long term.
5. **Many routes to circularity**
   Future legislation should encourage traditional and new business models that contribute to a sustainable industry. Manufacturers should be able to decide for themselves which approach to more sustainability is best for them while ensuring innovation, competition, and customer satisfaction.
6. **A smart future**
   By interconnecting smart products, energy and resource efficiency is to be increased in the future, for example, by offering incentives for consumers to use their products as sustainably as possible.
7. **Avoid double regulation**
   European home appliance manufacturers are increasingly subject to a conflicting regulatory landscape. However, these regulations often impose double or cascading ecodesign requirements on a single product category. Hence, these requirements increase products' costs without creating additional environmental benefits.
8. **Reduce inconsistency and avoid overlaps in legislation**
   Policy objectives, policy choices, and incentives across all policy areas must be clear and consistently implemented, including potentially inevitable trade-offs, to create the

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market for sustainable circular business models and opportunities from a product lifecycle perspective.

9. **Conformity assessment - presumption of conformity and self-assessment**
   APPLiA supports self-assessment of their products' conformity (both design and production) to the legislative requirements.
10. **Planning certainty and stability for investments**
    Planning certainty and stability for investing are fundamental aspects of the industry. Therefore, legislation should not create legal uncertainty. It should be enforceable and be stable.
11. **Sufficient transitional periods**
    To allow new technologies, for new regulations and application of product requirements, to be developed, new legislation should provide for adequate transition times.
12. **Impact Assessment**
    Transparency is a crucial aspect of better regulation and should be ensured throughout the process of developing product regulations. In addition, new product requirements should always be preceded by detailed impact assessments.
13. **Legislation in line with the "SMERC" principles - Specific, Measurability, Enforceability, Relevance, Competition friendly**
    APPLiA supports the application of the "SMERC" principles in all considerations regarding the impact assessment and discussion about a possible extension of product-related sustainability requirements.
14. **Consumer safety first**
    Home appliance manufacturers believe that consumer protection and safety are key elements in maintaining consumer confidence. Consumers should have the right to have their products repaired "properly" by having access to repair services by professional repairers. Manufacturer-recommended self-repair for easy maintenance of the device is already widespread.
15. **Interface between chemicals products & waste**
    The industry is firmly committed to reducing the content of hazardous substances in products to support a circular economy. However, policymakers need to recognize the trade-off between chemical and product safety legislation (e.g., fire safety) and the goals of the circular economy.
16. **Provision of information on materials and substances used in products**
    Information exchange between partners along the value chain is essential to improve cooperation in a circular economy. Industry must actively participate in the development of a slick information system. Other related challenges must be considered, such as intellectual property protection, data privacy and liability, and the overall usefulness of the data.
17. **Consumer trust must be maintained - transparency of any product declaration**
    Product information must be clearly and understandably labeled to build trust and ensure the legitimacy of environmental product legislation. The environmental product declaration must be controllable and enforceable to protect the consumer from misstatements and ambiguities.

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18. **Circular Culture**
    In striving for a circular economy, there needs to be a balanced approach considering material efficiency, energy efficiency, citizen welfare, consumer choice, and affordability.
19. **Extended Producer Responsibility - producers responsible only for what they can control**
    The home appliance industry must actively fulfill its legal extended producer obligations for products and ensure an economically meaningful end-of-life strategy.
20. **Single Market for Waste**
    Companies should be able to choose the most appropriate end-of-life strategy. This requires that end-of-life products are properly collected, reported, and treated and that a sufficiently competitive business environment is created for all stakeholders.

Furthermore, the Circular Economy experts scaled down the top-level principles to a more detailed analysis of the scope of different R-strategies to measure circularity to demonstrate the environmental impacts. Thereby, the Circular Economy experts agreed on the following R-strategies and their definitions:

- **Rethink:** Make home appliances use more intensive (e.g., through product-as-a-service, reuse and sharing models, or by putting multi-functional appliances on the market)
- **Reduce:** Increase efficiency in the manufacture or use of home appliances by allowing to/consuming fewer natural resources and primary/virgin materials
- **Reuse:** Process by which an appliance or its parts, having reached the end of their first use, are used for the same purpose for which they were conceived
- **Remanufacture:** Industrial process which produces an appliance from used appliances or used parts where at least one change is made which influences the safety, original performance, purpose, or type of the appliance
- **Refurbish:** Similar concept to remanufacturing except that it does not involve changes influencing safety, original performance, purpose, or type of the appliance
- **Repair:** Process of returning a faulty appliance to a condition where it can fulfill its intended use
- **Recycle:** Recover materials from waste appliances to be reprocessed into new products, materials, or substances for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations

Concerning the ReCiPSS project and its research topic, the strategies Reuse, Repair, Refurbishment, and Remanufacturing are of particular interest. The Circular Economy experts proposed that these strategies could be considered in the Ecodesign Directive. However, the Circular Economy experts have agreed that no proactive proposal for a new directive will be proposed for the time being. Instead, the Circular Economy experts will wait for more clarity from the EU Commission regarding the Sustainable products initiative, which will revise the Ecodesign Directive and propose additional legislative measures as appropriate.

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8. Conclusion

The circular economy requires a radical change in current production and consumption patterns. In continuous cycles, products, components, and materials are recovered and restored through reuse, repair, remanufacturing, and recycling strategies. Thereby, norms and standards can help shift from a linear to a circular economy for the entire value chain. In this regard, the standards and norms must be developed by consensus of all stakeholders to create the necessary societal acceptance and confidence for widespread use.

This deliverable report reflects the consistency of developments and adoptions of the project towards existing circular economy standards and related terminologies. KTH monitored the evolution of BS 8887-220:2010 and reported changes in the standard. The consortium also influenced existing standardization efforts by interacting with APRA to update its remanufacturing guidelines and providing APPLiA standard implementation group with learnings from the white goods demonstrator. Furthermore, C-ECO examined the potential of PIES and TecDoc to integrate them into the automotive demonstrator. In addition, the consortium promoted the development of new specifications and terminologies supporting circular manufacturing systems by engaging in the ISO Technical Committee, ISO/ TC 323. The scope of this normative work includes standardization in the field of circular economy to develop frameworks, guidance, tools, and requirements for implementing activities of all organizations involved to maximize the contribution to sustainable development.

In future, an overview of the status quo of standardization in the field of circular economy has to be given, requirements and challenges have to be described, and the concrete needs for action for future norms and standards have to be identified and formulated.

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