D8.7: Demonstrator synergies report

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Contents

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List of abbreviations

Abbreviation	*Explanation*
AR	Augmented Reality
B2C	Business-to-Consumer
B2B	Business-to-Business
CMS	Circular Manufacturing Systems
GA	General Assembly
ICT	Information and Communication Technology
OEM	Original Equipment Manufacturer
UI	User Interface

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Executive Summary

This deliverable is reporting the work carried out in task 8.5. The aim of Task 8.5 was to manage the synergies and cross-fertilization opportunities between the White Goods and Automotive Parts demonstrators. As both demonstrators belong to different industrial sectors implementing circular business models with different levels of control over their value chains, several potential synergies and cross-fertilization opportunities have been identified based on the learnings from the circular methodologies and tools used in both demonstrators specifically in the area of business model, product design, supply chain, and ICT infrastructure. The synergies in both demonstrators are related to the "ICT platforms to support Product Service Systems" , "knowledge of legislation and policies" related to the circular economy. The ICT platforms can complement each other to enable the successful implementation of circular business models in both demonstrators. For example, the White Goods demonstrator can use the Part Data Management Platform to manage reverse logistics for its used washing machines and to build a reliable supply of used parts from the market. Both demonstrators can also benefit from the knowledge of legislation and policies related to data collection during the use phase of part/product and cross-border taxations for reverse logistics and remanufacturing. In addition to these synergies, many cross-learnings and cross-fertilization opportunities for business model, product design, supply chain and ICT are identified for both demonstrators.

Cross-learnings for White Goods demonstrator:

- the cross-fertilization opportunities for the ***business model*** are related to the development of a circular business model based on the concept of transferable core/used parts-return options enabled by a digital platform that results in optimization of reverse logistics, and management of material and financial flows.
- the cross-fertilization opportunities for ***product design*** are related to the product packaging for both forward and reverse logistics. Packaging should be designed for ease of reverse logistics, product protection, and product identification throughout the whole process.
- the cross-fertilization opportunities for the ***supply chain*** are related to the bundling/consolidated collection of cores which may reduce both the operational costs such as core collection, transport and process cost as well as the CO2 emitted during these activities. Also, the White Goods demonstrator can learn from the Automotive Parts demonstrator how to build reliable supply for used washing machines from the market to ensure the reverse flow of spare parts.
- the cross-fertilization opportunities for ***ICT*** are related to the technology behind the automotive Platform which enables scalability, security, efficiency and customization.

Cross-learnings for Automotive Parts demonstrator:

- the cross-fertilization opportunities for the ***business model*** are related to understanding of how to write and manage contracts for a product-service system (PSS) offering.
- the cross-fertilization opportunities for ***product design*** are related to designing modular products, which is supported by a 'wide'/horizontal spread in the disassembly to improve disassembly practices
- the cross-fertilization opportunities for the ***supply chain*** are related to the integration of IoT data in the core sorting and selection to optimize their reverse flows.
- the cross-fertilization opportunities for ***ICT*** are related to the application of AR for core sorting and selection at workshops

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1 Introduction

ReCiPSS is implementing two large-scale demonstrators of Circular Manufacturing Systems (CMS) in two industrial sectors: White Goods and Automotive Parts. The white Goods demonstrator is represented by the project partner Gorenje while the Automotive Parts demonstrator is represented by the project partners Bosch and C-ECO. Both demonstrators are taking a systemic approach where the entire value chain, i.e. value creation, delivery, use, recovery and reuse, is in the scope of ReCiPSS. As both demonstrators belong to two different industrial sectors, naturally, there are many differences in terms of business model, product design, supply chain and ICT infrastructure needed for the successful implementation of CMS. Some of these differences are listed below:

- The White Goods demonstrator is focused on both the business-to-consumer (B2C) and business-to-business (B2B) model, while the Automotive Parts demonstrator is focused on a business-to-business (B2B) model.
- In the White Goods demonstrator, the products are traditionally designed and built for a single life cycle and single ownership whereas in the case of the Automotive Parts demonstrator, the products have been built for much longer lifetimes and multiple ownerships.
- The White Goods demonstrator relates to a tightly connected value chain where the OEM is in full control of the entire product throughout all stages whereas the Automotive Parts demonstrator relates to a more complex value chain where the OEM does not have full control and needs to involve other stakeholders (i.e. logistics provider, remanufacturers etc.)
- The Automotive Parts demonstrator has been practising reverse logistics for many years whereas the White Goods demonstrator has yet to establish such processes.

Regardless of these differences, both demonstrators started with the ambition to become circular resulting in many similarities in their objectives. Some of these similarities are listed below

- Setting up new integrated circular supply chains to serve the needs of both the forward and reverse logistics
- Designing and developing products by considering the requirements of new circular business models and associated information flows (i.e. financial, product/material information)
- Synchronizing material and information flows to support circular business models
- Establishing new partnerships with customers driven by the type of business model selected by OEM and the resulting value proposition for its customers.

Given these differences and similarities between the two demonstrators, many synergies, learnings and cross-fertilization opportunities can be identified. ***Synergy*** refers to a situation where demonstrators' activities complement each other to generate a greater impact whereas **cross-learning or cross-fertilization** refers to a situation where findings from one demonstrator's activities can be exploited to get better results in the second demonstrator. To manage the synergies and cross-fertilization opportunities between the demonstrators a dedicated task (Task 8.5) was created as part of the work package 8. To implement this task, a joint task force was created which organized synergy workshops during ReCiPSS General Assemblies (GAs). The first plenary session was organized during the 3rd GA (Delft, May 21-22, 2019) where the synergies and cross-fertilization opportunities between the White Goods and Automotive Parts demonstrators were discussed. The project partners decided to have a dedicated session on synergies and cross-fertilization opportunities in each GA. Furthermore, it was decided to categorize the synergies and cross-fertilization opportunities between the demonstrators under the respective CMS pillars (business model, product design, supply chain, and ICT).

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2 Methodological approach

To identify synergies and cross-fertilization opportunities between the demonstrators, a task force was established at an early stage of the project. The main responsibility of the task force was to conduct dedicated workshops and create templates to communicate the results on synergies and cross-fertilization opportunities. In this regard, five workshops with project partners have been organized during different GAs of the project. Each workshop was moderated and the project partners were divided into four teams where they discussed possible synergies and cross-fertilization opportunities between the demonstrators for business model, product design, supply chain, and ICT.

Table 1 List of synergy workshops and their agenda

GA	Date	Agenda of Synergy workshop
3rd	21-22 May 2019	**Reverse logistics** - How do the reserve logistics of C-ECO, Gorenje, and Homie compare? - What learnings can be gathered from this? - How to create a service that has added value for different stakeholders in the value chain? - What are practical ways of integrating customer insights in (service) design? **Reman Readiness** - What can Gorenje learn from the barriers and enablers that Bosch/C-ECO encounters in setting up a reman line? - What (systems need to be considered now (e.g. data tracking) to enable and simplify potential reman in the future? How can this be achieved?
4th	20-21 Nov 2019	- Identify synergies and cross-fertilization opportunities between the demonstrators - Discuss the learnings in terms of business model, product design, supply chain, ICT and define synergy action - Discussion based on the results of the synergy session held during the 3rd GA
7th	18-19 May 2021	Identify synergies and cross-fertilization opportunities between the demonstrators using the web application Mural. - Business model - Product design - Supply chain - ICT
8th	16, 18 Nov 2021	Identify synergies and cross-fertilization opportunities between the demonstrators using the web application Mural. - Business model - Product design - Supply chain - ICT
9th	17-18 May 2022	- Discussion on identified synergies and cross-fertilization opportunities between the demonstrators in terms of business model, product design, supply chain and ICT - Feedback from all WPs on 1st draft of the D8.7 report to finalize the deliverable

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A template was created to collect and communicate the identified synergies and cross-fertilization opportunities. The template was used by the participants of the workshops to list the possible synergies and cross-fertilization opportunities for each pillar. The participants then discussed them one by one to create action points. The synergies and action points to foster cross-fertilization were then communicated to all the project partners. Figure 1 shows a screenshot of identified business model synergies and planned actions to foster cross-fertilization.

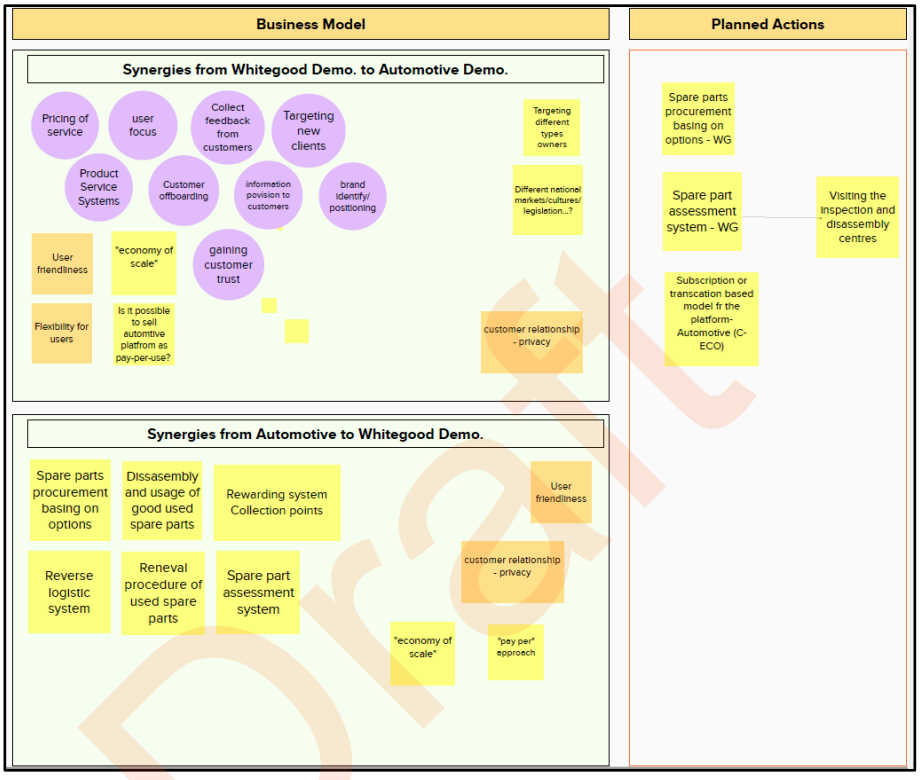

Figure 1 Sample Screenshot of template to identify synergies and cross-fertilization opportunities for business model

In addition to these workshops, the project partners were asked to provide the list of methods and tools used for each demonstrator in the ReCiPSS project, with an explanation of their purpose, and the key findings/learnings for the other demonstrator. Based on the synergy workshops and the input provided by the project partners, section 4 provides a list of methodologies and tools used for each demonstrator and section 5 provides a list of learnings and cross-fertilization opportunities between the demonstrators.

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3 Circular methodologies and tools used in ReCiPSS

For both demonstrators in the ReCiPSS project, different methods and tools are used to design and develop circular business models, circular products, supply chains, and ICT infrastructure, resulting in several findings and learnings for both demonstrators. In this chapter, we provide the list of methods and tools used by both demonstrators along with their purpose.

3.1 Circular methodologies and tools used in Automotive Parts demonstator

3.1.1 Methodologies and tools used to develop business model

To develop circular business model for the Automotive Parts demonstrator a combination of methods and techniques are used. Table 2 provides the key methods/tools used and their purpose.

Table 2 Methods and tools used to develop the business model of Automotive Parts demonstrator

Methods/tools	Purpose
Systematic literature review of circular business model, business model innovation, and transition towards circular ones	To understand the substance of circular business models and their innovation and to summarize and evaluate the appropriate tools (methods, strategies, approaches, models, frameworks etc.) that could be used for the new circular business model development
Environmental scanning and market analysis that involved a **literature review** of the automotive aftermarket business and reverse logistics of cores	To get a comprehensive overview of • the current situation and market challenges for the circular business of cores. • The need for innovation in the current business model to become circular • the knowledge of driving forces and barriers for implementing circular business models focused on reverse logistics and remanufacturing of cores • the role of digital platforms in implementing circular business models in the automotive aftermarket.
Qualitative content analysis of the interviews, on-site observations, document analysis	To understand the internal environment (strengths and weaknesses) and key issues from the external environment of the demonstrator as perceived and understood by the key informants and experts from the company. Knowledge of these factors helped to develop the circular business model of Automotive Parts demonstrator in more detail.

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In-depth interviews with the wholesalers and core brokers at the German and French market	▪ To get a better understanding of the attitudes, perceptions, experiences and expectations of involved parties related to the employment of the digital platform for the core collection, sorting and the other reverse logistics activities. ▪ To get a broad overview of focal points of the business domain of the interviewees like process structure, IT systems in use, interaction with other stakeholders, problems and expectations ▪ To identify common points, structures and weaknesses as input into business-model development. It was used to verify or falsify hypothesis which has been taken for customer groups and market structures.
Business model canvas adapted for a circular business model (reverse logistics and digitalization of core-related reverse logistics processes within the product-service system).	To compile all the learnings from the interviews and the co-creation sessions into a new offer to the identified stakeholders. That was done not only to describe how the stakeholders should be addressed and by what value proposition but also what needs to be undertaken to do so.
Customer profiles/Personas	To develop a better understanding of traders in the aftermarket and their specific needs and roles in the circular approach for returning products for remanufacturing
Co-creation sessions	To understand the specific needs of the potential service-users and to include their needs in the development process. This created a deep understanding of market stakeholders, their interests, needs and pain-points

3.1.2 Methodologies and tools used for product design

Table 3 provides methods and tools used for product design in Automotive Parts demonstrator.

Table 3 Methods and tools used for product design in the Automotive Parts demonstrator

Methods/tools	Purpose
Circular Product Readiness	To evaluate the progress of implementing a circular design in products and identify opportunities
User-Testing of Design of Report and Platform UI/Frontend	To test the concept of using transferable core return options in a digital platform to manage and drive circular processes

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3.1.3 Methodologies and tools used for supply chain

Table 4 provides methods and tools used for supply chain design in the Automotive Parts demonstrator.

Table 4 Methods and tools used for supply chain design in the Automotive Parts demonstrator

Methods/tools	Purpose
Multi-method modelling and simulation comprising agent-based, system dynamics and discrete event modelling techniques	▪ To understand how reverse flows of cores can be made more efficient in the aftermarket of France and Germany ▪ To identify the best geographical location, based on the trade-off between cost and environmental impacts, for consolidated core collection and which processes such as core sorting and core evaluation are most feasible on which logistic hubs in the German or French market

3.1.4 Methodologies and tools used for ICT

Table 5 provides methods and tools used for ICT development for the Automotive Parts demonstrator.

Table 5 Methods and tools used for ICT development for Automotive Parts demonstrator

Methods/tools	Purpose
Agile Development Process	▪ To ensure changes can be made quicker and throughout the development process by having consistent evaluations ▪ To keep the project transparent by having regular consistent meetings that allow everyone involved to access the project data and progress
Typescript based Web client that is integrated with Auth0 and utilizes microservice-based architecture	▪ To make the application reliable for a large volume of data, as users work with a large number of options and these options must be viewed both in detail through interactive formats, and at a high level through statistics reports ▪ To enable easy adaption to scale and the need for high availability ▪ To allow users to adapt easily to its interface, improving their work ▪ To have an aesthetic and intuitive design

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3.2 Circular methodologies and tools used in White Goods demonstrator

3.2.1 Methodologies and tools used to develop the business model

To develop the circular business model for the White Goods demonstrator, a combination of methods and techniques is used. Table 6 provides the key methods and tools used and their purpose.

Table 6 Methods and tools used to develop the business model of White Goods demonstrator

Methods/tools	Purpose
Systematic literature review	To understand the substance of circular business models and their innovation and to summarize and evaluate the appropriate tools (methods, strategies, approaches, models, framework etc.) that could be used for the new circular business model development
Environmental scanning and market analysis that involved the adaptation of the PESTLE and competitors' analysis	Understanding driving forces, opportunities, threats, and barriers for the transition toward a circular business model
Qualitative content analysis of the interviews, on-site observations, document analysis	To understand the internal environment (strengths and weaknesses) and key issues from the external environment of the demonstrator as perceived and understood by the key informants and experts from the company. Knowledge of these factors helps to develop circular business models in more details
Pilot survey (together with the coint-joint analysis) and co-creation session with consumers. A Pilot survey was realized with the use of the online questionnaire in 4 markets with consumers as respondents. Co-creation sessions were organized by TUD.	To explore what is the laundering behaviour of consumers, what experience and attitudes do they have with renting, leasing and pay per use models; what are their perceptions and attitudes toward refurbished products, especially washing machines. The Conjoint analysis aimed to detect potential preferences of various pay per wash options. The purpose of the co-creation session was to understand the deeper association and mental barriers and attitudes of potential consumers to pay per use circular business model
Business model canvas adapted for a circular business model (pay per use and renting within Product-Service system)	To develop a circular business model for the White Goods demonstrator

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3.2.2 Methodologies and tools used for product design

Table 7 provides methods and tools used for product design in the White Goods demonstrator.

Table 7 Methods and tools used for product design in White Goods demonstrator

Methods/tools	Purpose
Circular Product Readiness	To evaluate the progress of implementing a circular design in products and identify opportunities.
Product Journey Map	To create a visual overview of a product's use cycles, showing the relevant stakeholders and the changes made along the way
Disassembly Map	To create a schematic representation of a product's architecture with the goal to provide insight into the disassembly routes for its parts and optimize them for reparability or remanufacturing.
Co-creation Impact Model	To put co-creation into effective use in shifting towards increased servitization, by providing an overview of the impact of co-creation at different product-service system development phases.

3.2.3 Methodologies and tools used for supply chain

Table 8 provides methods and tools used for supply chain design in the White Goods demonstrator.

Table 8 Methods and tools used for supply chain design in White Goods demonstrator

Methods/tools	Purpose
Multi-method modelling and simulation comprising agent-based, system dynamics and discrete event modelling techniques	▪ To understand the suitable preconditions for transformation from the conventional sales model towards a service business model considering four European markets ▪ To analyse the impact of centralising and decentralising the supply chain operations mainly the collection of washing machines. ▪ To identify potential geographical locations for the product recovery operations in the light of economic benefits and CO_2 emissions

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3.2.4 Methodologies and tools used for ICT

Table 9 provides methods and tools used for ICT development for the White Goods demonstrator.

Table 9 Methods and tools used for ICT development for White Goods demonstrator

Methods/tools	Purpose
SAP Hybris eCommerce platform	▪ To enhance Gorenje's existing ICT platform so that Gorenje can support new business models for the Circular Manufacturing and Circular Economy ▪ To enable continuous communication between the washing machines and the ICT platform ▪ To create and manage merchandise portals ▪ To offer flexible solutions which can be used for both B2B and B2C markets ▪ To customize the eCommerce solution along with using the SAP Hybris embedded back-office management interface for updating the item's content without any development ▪ To easily integrate with existing systems of White Goods demonstrator, to maximize compatibility and to be able to change the content of the platform dynamically, by an admin who would manage the portal.
Augmented Reality (AR) Demonstrator using PTC's Creo Illustrate, Vuforia Studio and ThingWorx platform	To demonstrate a dynamic and visual way of combining and presenting spare parts lists and related information with 3D product design data (CAD) of the install base by reusing and orchestrating existing information from different data sources. All of this, in combination with step-by-step 3D work instructions, allows for the user to ▪ Understand the product from an aftermarket perspective ▪ Perform service and maintenance efficiently without expert guidance ▪ Efficiently educate and build install base related skills

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4 List of synergies and cross-learnings between the Demonstrators

This section provides the identified potential synergies and cross-fertilization opportunities between the White Goods and Automotive Parts demonstrators. These opportunities were highlighted and discussed in five dedicated synergy sessions organized in different GAs. The potential synergies and cross-fertilization opportunities are categorized into three main groups:

- Synergies in the demonstrator
- Learnings from the Automotive Parts demonstrator to the White Goods demonstrator
- Learnings from the White Goods demonstrator to the Automotive Parts demonstrator

4.1 Synergies in the demonstrators

This section provides synergies in the Automotive Parts demonstrator and the White Goods demonstrator

- The ICT platforms developed for both demonstrators can complement each other to enable successful implementation of their circular business models. The part data management platform developed in the Automotive Parts demonstrator can be used by the White Goods demonstrator to manage reverse logistics for its washing machines and to build a reliable supply of used parts.
- Both demonstrators can benefit from the knowledge of legislation and policies related to different elements of their circular business models. For example, the Automotive Parts demonstrator can benefit from the Gorenje's knowledge of legislation and policies regarding the collection of consumer/usage data while the White Goods demonstrator can benefit from the Bosch/C-ECO's knowledge of legislation and policies for cross border taxations for reverse logistics and remanufacturing/refurbishment.

4.2 Learnings from Automotive Parts Demonstrator to White Goods Demonstrator

This section provides the potential cross-fertilization opportunities from the Automotive Parts demonstrator to the White Goods demonstrator, which are are further categorized under four CMS pillars (business model, product design, supply chain, and ICT).

4.2.1 Cross-fertilization opportunities for business model

- Systemic literature review of the circular business models and business model innovation for the Automotive Parts demonstrator showed that one of the key learnings for the White Goods demonstrator is to understand the specificities and challenges of circular business models based on a digital platform. The specificities and challenges include for instance the ownership of the platform, country, where the platform is located, different management roles within the platform (e.g. control, decision making, improvements, operation of the platform as well as the quality of data, access for the users, data flow and data distribution, pricing and revenue management etc.) to fully capture the potential of circular value and

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revenues. Because digital platform development and testing of the management and functionality of the platform is the core of the demonstration in the case of the Automotive Parts Demonstrator in the project, the knowledge and experiences of the problems, barriers and best practices can be exploited by the White Goods demonstrator.

- Another key finding for the White Goods demonstrator from the environmental scanning and market analysis of the Automotive Parts demonstrator lies in the knowledge of the channel structure and channel character of the forward logistics of spare parts and reverse logistics of cores. Channel structure will probably be different when the new circular business model of pay per wash (or renting) will scale up. Keeping the ownership of washing machines and providing all needed services together with refurbishing and repair requires the adaptation of the current flow of spare parts (and other needed material items) and management of returned products and spare parts for a second life. Changes in channel structure will influence also the current channel character – new relationships, length and complexity of the channel among all.

- A key learning for the White Goods demonstrator lies in the understanding of the importance of maintaining relationships and building the trust with partners in circular business models utilizing digital platforms and knowledge of reverse logistics processes. The role of networks and the role of a digital platform for a circular business model are two learning points that were brought up in in-depth interviews with the wholesalers and core brokers and business model canvas development. Digital platform development and use for circular business model leads to the involvement of new partners in different roles and of different types (new customers, new suppliers, potentially also new service providers) and requires new relationships management that – besides other issues – requires an understanding of the factors which create and support mutual trust among partners and trust towards the platform-based business. Network relations have to be managed. The same is also in the case of the development and management of reverse logistics. Digital data network relationship management is something that the Automotive Parts Demonstrator has learnt within the project intensively.

- In the Automotive Parts case, even though a service offer has been created for specific key customers (i.e., wholesalers), there was also an effect created on other stakeholders (i.e., pull-effect on remanufacturers). Especially in circular business models, this kind of effect is extremely valuable to explore as the involvement of relevant partners/stakeholders is crucial for the success of a circular business model. A key learning for the White Goods demonstrator is to identify and involve all relevant partners/stakeholders who are either directly or indirectly related to the circular offering.

- Customer profiles/personas in Automotive Parts demonstrator highlighted that it is important to identify the relevant actors in collecting the spare parts. This finding shows that dealers are very relevant stakeholders in the circular market approach. They are bothered by the commercial and logistic complexity of circular processes but are hardly rewarded for their effort. They often feel that they have the burden to manage the circular process with their customers, but they do not receive much support from the producers to do so. Also, they feel that they bear the risk of the “one-in-the-middle” and that they lack transparency to make informed decisions for the circular process. In order to bring remanufacturing to a “mainstream” process in White Goods demonstrator, the key learning is that activities should aim to help dealers to help their customers.

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- Another learning opportunity for White Goods demonstrator is the concept of transferable core-return options and its digital representation to create transparency for market stakeholders on reverse logistics, triggering the return of specifically needed used parts by expressing reliable demand to the market. White Goods demonstrator can use options to trigger the return of components of used washing machines; with the EU's revision on labelling of products for energy-consumption also other criteria are included in the labels. For the White Goods demonstrator, this implies the duty of the producers to assure the availability of spare parts to repair also older devices for a period of 7 years minimum. The regulation describes that the spare parts have to be available for procurement within short notice, but it is not regulated that the spare parts have to be new. This gives the potential for producers to acquire used spare parts from old machines in order to comply with the regulation and at the same time not be burdened to stock all-time-demands of spare parts also for older machines which are not in production anymore. A challenge to motivate the return of used spare parts lies in the question of how to express reliable demand for specific parts to dismantlers and dealers. The options concept and digital platform could be used to create and propagate the incentives for the return of the desired parts to the dealers and dismantlers. White Goods demonstrator can learn how to offer remanufactured products without cannibalizing the current business and how to collect spare parts using the concept of the options.

4.2.2 Cross-fertilization opportunities for product-service design

- Co-creation sessions for the Automotive Parts demonstrator highlighted that development of a service needs very close interaction with potential service users, especially if the business domain of the potential users is not familiar. Proper documentation of the results of co-creation, where relevant insights from sessions are captured and translated into the most prominent customer need, and effective integration in the development process significantly improves the development result and customer satisfaction. Customers feel valued as they are heard and taken seriously which improves acceptance of the solution.
- The Automotive Parts demonstrator shows that product packaging becomes very important with the addition of reverse logistics. Currently, in many products, packaging plays a significant role in marketing, e.g. the perception of quality is communicated through the packaging. Therefore, it is essential for the White Goods demonstrator to consider the role of packaging when considering both forward and reverse logistics using the same packaging and how it can be designed for ease of return logistics and product identification throughout the whole process (e.g. an older part is returned in the packaging of a newer part). Moreover, designing the packaging requires taking into account the protection of the returned part.
- Another key learning for the White Goods demonstrator is to create infrastructure and processes to link product-specific data of parts at the end of the usage phase to permanent markings on the products..

4.2.3 Cross-fertilization opportunities for Supply Chain

- The automotive case shows that the bundling effect results in less transport which in turn has a positive effect on the environment. The White Goods demonstrator can get inspiration in terms of bundling/consolidated collection of cores which may reduce both the operational costs such as core collection, transport and process cost as well as the CO2 emitted during these activities.

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- Furthermore, spare part harvesting in the Automotive case highlights the requisite of ensuring that enough parts can be harvested and avoid 'losses' in the market for the White Goods demonstrator. In the Automotive case, some car parts are small but very valuable, yet still many are 'lost' in the market as they are not returned to the remanufacturer due to different reasons like going scrap yard, accidents etc. Individual components of a washing machine have a significantly lower value than these car parts and make the spare parts harvesting more challenging for the White Goods demonstrator

4.2.4 Cross-fertilization opportunities for ICT

- The technology used for the automotive platform allows the implementation of scalability and security mechanisms that can be useful for the White Goods demonstrator.
- The platform allows better management of resources, through efficient algorithms at the code level. Therefore, the Azure and Auth0 portals could bring beneficial utilities to the White Goods demonstrator's platform.
- The technologies used for the Automotive platform are open source-based, therefore it is easier to customize them for different requirements from clients.
- The other key learning points from the Automotive Parts demonstrator to the White Goods demonstrator platform development are Cloud-based microservices Architecture and Pair-Programming / Tandem Development. The Cloud-based microservices Architecture will support the easy maintenance of the platform
- The pair programming and Tandem Development were used successfully within the mixt team that worked for the Automotive Platform, leading to the best results both in the development and implementation processes.

4.3 Learnings from White Goods Demonstrator to Automotive Parts Demonstrator

This section summarizes the cross-fertilization opportunities from the White Goods demonstrator to the Automotive Parts demonstrator.

4.3.1 Cross-fertilization opportunities for business model

- In terms of business model, the White Goods demonstrator is dealing with product-service system (PSS) contracts while the Automotive Parts demonstrator is dealing with pure service contracts. In future, if the Automotive Parts demonstrator moves to a PSS offering, they can learn from the White Goods demonstrator how to write and manage PSS contracts.

4.3.2 Cross-fertilization opportunities for product design

- Outcomes from applying the Disassembly Map show that the White Goods demonstrator has products that have a modular structure, yet the subassemblies often have a very 'vertical' spread in the disassembly map, meaning that many disassembly steps may be required to reach certain parts. Building products to be modular can help improve disassembly practices, which is supported by a 'wide'/horizontal spread in the disassembly.

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4.3.3 Cross-fertilization opportunities for supply chain

- Based on the work done in the White Goods demonstrator, the Automotive Parts Demonstrator can learn how to integrate IoT data in the core sorting and selection process to optimize their reverse logistics.

4.3.4 Cross-fertilization opportunities for ICT

- One key cross-fertilization opportunity for the Automotive Parts demonstrator is related to the application of Augmented Reality (AR) to train new workers at core selection stations.
- In addition, by utilizing AR, the Automotive Parts demonstrator can develop sorting capabilities to classify cores in the workshops. This can enable to raise quality and speed of core sorting and selection operations and promote transparency among stakeholders

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5 Conclusions

The report identifies several potential synergies and cross-fertilization opportunities between the Automotive Parts demonstrator and the White Goods demonstrator. The potential synergies and cross-fertilization opportunities are related to the business model, product design, supply chain and ICT infrastructure. As the demonstrators evolve and scale-up, many of these synergies and cross-fertilization opportunities can be realized. This document will guide both demonstrators in their future developments and how they can benefit from each other to have a greater impact.

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