D7.1- Data management platform deployment report

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Therefore the information contained herein may change.

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List of abbreviations

Abbreviation	*Explanation*
RBAM	Robert Bosch Aftermarket Solutions GmbH
API	Application Program Interface
C-ECO	Circular Economy Solutions GmbH
CE	Circular Economy
COVID-19	Coronavirus disease 2019
CRI2-18	Common Rail Injectors 2-18
ERP	Enterprise resource planning
NSC	New Selection Client
STR	Striebig
VAT	Value Added Tax

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1. Executive Summary

This deliverable is reporting task 7.1. Deploying the part data management platform which deploys the data part management platform developed in WP5 - ICT Platforms for Multiple Life cycles in a production environment accessible by various trade levels (automotive part dealers). At this stage, the complexity of providing the platform also to workshops is determined as very high. The remaining infrastructure of the automotive part demonstrator (inspection centres, software infrastructure, logistics, remanufacturing) is already in place with C-ECO, BOSCH and STR; therefore it does not have to be developed in the scope of this project, and this allows WP7- Automotive Parts Demonstrator to start at M20 (in contrast with WP6- White Goods Demonstrator, where Gorenje needs to set up all the reverse supply chain, maintenance and remanufacturing activities needed for the white goods demonstrator and started at M1).

Additionally, the use case of the re-selection of 60.000 Bosch Common Rail Injectors CRI2-18, for the collection of additional data and all the necessary steps to set up the second selection and inspection of these cores is described in the document.

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2. Introduction

This document is a result of task 7.1 “Deploying the part data management platform”. The current business case of the automotive aftermarket is presented, while the vision of the platform deployment describes how the platform will change the situation by reducing complexity, decoupling financial and physical reverse logistics of the cores and of course implementing a more circular business approach for the automotive aftermarket stakeholders.

As the first deliverable report of the demonstration work package, this report includes all the necessary actions to start the demonstration phase of the project. The transfer of the “right-to-return a core” among different stakeholders in the platform is the main goal of this phase. To do so, except of the platform which was developed under the WP5, it is needed to include the users who actively participate in the platform, and also the ones who manage the ICT platform as administrators and support users. The demonstration will be applied to wholesalers from different markets. Besides these roles, other actors of the demonstrator are the inspection centres, the clearing house, the logistic providers, as well as the remanufactures. Additional profiles, such as core-brokers or workshops, are investigated through demonstration.

Main activities through the demonstration are creation of an option, transfer of an option and exercise of the option through the ReCiPSS platform. The existing infrastructure of software solutions and hardware as the selection stations provided by C-ECO, logistic services by Striebig and remanufacturing by Bosch will be used during this phase.

Technical deployment including access and security, user registration process, as well as the internationalization of the platform, are described; while the organizational deployment tries to address legal, privacy and data protection and commercial and financial issues in the platform, as well as to define a subscription model for making the platform sustainable.

Finally, a reference to the need of the collecting as many data as possible for supporting circularity is made through the example case of the re-selection of Bosch common rail injectors. Innovative ways to attach data in the products are presented, and the way of extracting these data after the end of life of the product is demonstrated by providing additional data to the cores and support a more efficient remanufacturing. The use case can prove that by including data with digital marking or other ways on the products it will be possible to support circularity not only in the automotive industry and automotive parts but in every industry.

2.1. Document Scope

This deliverable is reporting task 7.1. which deploy the software platform developed in WP5 and the tasks 5.2 and 5.4, in a production environment accessible by various trade levels (automotive part dealers). The submission date of this deliverable is the 29th of May 2020. This report is part of the WP7 of ReCiPSS project and linked to the Milestone MS7: “Demonstrator deployed” due in M29.

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2.2. Methodology

In the following chapters, an overview of the current situation of the automotive demonstrator to run the demonstration is described. The use case of the demonstration is presented followed by extended scenarios of other stakeholders using the platform as users.

The way that the legal and privacy policy should be conducted is presented, while potential ways for commercializing the platform are listed and could be further investigated under the WP2 - Circular Business Models.

A literature review on the innovative data collection for CE and the use of these data on circular economy is followed by the presentation of the use case of the second selection and inspection of 60.000 used cores.

At the end, the conclusions of the report are presented and also the following steps of the demonstration phase are described.

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3. Automotive Demonstrator setup

3.1. Overview of the current situation

In the OEM-independent automotive aftermarket, traders are organized in different setups, depending on the customer-structure and behavior, logistic development and geographical needs resulting from their target market. For the demonstrator within ReCiPSS, the French and German markets are targeted. As to the time of creating this report, no French automotive dealer could be involved, the below said largely focuses on the German market and the wholesaler who will work in the automotive-demo of ReCiPSS.

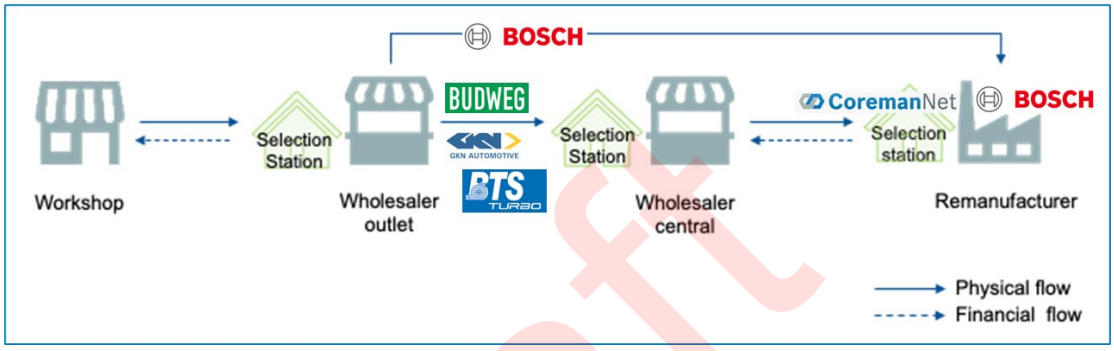

Figure 1: Current physical reverse logistics of cores and financial flows of surcharges in the automotive aftermarket

In today's setup as shown in Figure 1, the German wholesaler is purchasing remanufactured parts from 20-30 different suppliers, Bosch being the most relevant one. For the forward logistics, these parts are delivered from the remanufacturers to the wholesalers' central warehouse. From there, the outlets order the needed parts into their local storage, which is located closer to the workshops in order to provide prompt deliveries to their workshop-customers. In case a workshop needs a reman-part to repair a car, they order it at the wholesaler and get it delivered from his outlets usually a couple of hours later on the same day. The used part which is then dismantled from the car is returned in the box of the reman-part ("Back-in-box"-system) from the workshop to the wholesaler's outlet after the repair, using the same logistic relation during the next days. In the outlet, a dedicated employee is analyzing the parts using printed documents provided from the different reman-suppliers and decides whether the part should be accepted, and the core-surcharge can be credited to the workshop or not. This employee usually has very little digital support on that job. The documents from the remanufacturers are print-outs, which might be outdated already, not showing the latest criteria to be applied. Also, the possibilities of identifying the core are usually limited to the information which can be taken from the product-box solely. Remanufacturers usually restrict the acceptable core-types per reman-part. This cross-reference is not accessible to the employee at the outlet. For the commercial acceptance-check, the employee is relying on the workshop-customer to return a copy of the original invoice of the reman-part with the core, basing on that, he is filling an internal acceptance document together with the core-information, which is then

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handed over to a colleague in the office who is doing the financial booking in the company's ERP-system.

Due to the various procedures of different suppliers and the poor support available, the responsibility of checking the used parts often lies on few, sometimes only one single employee, per outlet who have collected long-term experience in that. That overall setup bears the risk that parts are not identified or evaluated correctly, or procedures are delayed in case the key-employees are not available.

The rejected parts are returned to the workshop-customers together with a print-out of the criteria applied as documentation. The accepted parts are put in pallets to be transported, usually back to the central-warehouse of the wholesaler or as exception directly to the remanufacturer as indicated by the product-box. Currently, that only applies to Bosch at some bigger outlets. As standard, all cores are returned to the wholesaler's central warehouse. There, dedicated employees are unloading the boxes from the outlets, re-inspect the parts and sort them by remanufacturer. Here all requirements with respect to logistic procedures of the various remanufacturers have to be addressed. Depending on the reman-supplier, correct packaging must be provided and used, different documents to be created and different freight forwarders to be contacted for pick-up.

When the cores then arrive at the remanufacturer, his employees or a service-provider on his behalf are inspecting the cores according to the current rules of the remanufacturer and decide whether the parts should be accepted and whether the wholesaler will be credited the financial incentive (core-surcharge, deposit). As the outcome of the Co-Creation-session with the wholesaler, the documentation of the results of this procedure and the criteria applied are very heterogenous. Due to this, it is very difficult for the wholesaler to keep track of core-acceptance and financial-streams and risks out of it. In general, the wholesaler finds himself in the situation of accepting cores from his customers which might then be rejected at the remanufacturer and often not having the possibility to understand why the core-surcharge will not be credited and also not being able to trace the particular core back to his workshop-customer then to hold them responsible. This leaves the wholesaler with the risk of crediting his customer and not being credited by his supplier for the same core, and not having the data to claim the particular cases.

This scenario for a German wholesaler is a simple one, compared with trade-structures in other markets, e.g. France. But already in that setup, cores are inspected 3 times from different entities by using different information. This additional effort could be justified if it would create better results for the stakeholders. But in fact, it is creating problems as these repeated decisions are bearing the risk of coming to different results to the disadvantage of an intermediary and give the burden to manage the complexity of the core-reverse-process, logistically and commercial, to every stakeholder involved.

In other European markets, more sales-steps of reman-products are conducted between producer and workshop-customer. An example would be buying-groups which are solely combining the purchasing-power of their members towards a supplier in order to achieve better purchasing conditions. Here, the purchasing process is handled via the account of the buying-group. Physical delivery can be done to a central warehouse or warehouses of the members. The members are usually independent companies, making their own business decisions and

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running their own structures with central warehouses and outlets, comparable to a wholesaler as described above. They are purchasing in parallel parts originating from the same producer not only via the buying group but also via other wholesalers or buying-groups or even via their own customer-account directly from the producer. In today's setup, a logistic optimization of the return-flow, overjumping the various sales-steps of the forward-flow is hardly possible as the financial incentive is exclusively granted to the respective business-partners. As this right is neither documented in a standardized way nor being transferable, that results in a situation that the return of a core and financial clearing associated to it is only possible between the original business-partners of the reman-sales.

3.2. To-be-setup (vision)

To overcome the hurdles described before, the vision for the development of the platform and service has been that the right to receive the financial incentive when returning a core can be incorporated in a standardized way. The digitally incorporation of that right is then called an option and the entity where it exists is the ICT-platform. This makes their individual options-portfolio accessible by all stakeholers and enables them to transfer their options to other platform-users in the event of a reman-purchase or independent from it. By that, it is possible to decouple the financial and physical flow and to optimize the logistics independently. This will allow to create transparency on the financial obligations resulting from the granting and holding of return-rights to all stakeholders. The entity allowing to create, transfer and report core-return-options is the ReCiPSS clearing-house platform which has been developed within the project. The connection of this platform to the existing CoremanNet-infrastructure allows CoremanNet (a C-ECO-brand) to execute the options digitally supported and to offer physical fulfilment of core-reverse-logistics and core-inspection as a service for platform-users. By the public interface for options-management, all stakeholders can connect the ReCiPSS-platform to their ERP-systems. By this, it is possible for stakeholders like wholesalers and buying-groups to outsource the complete physical core-return-procedures to a service-provider and to gain transparency and more control at the same time. The inspection and evaluation can be handled by specialized service-providers running an optimized infrastructure for that purpose. The relevant data for a core needs to be collected only once, redundant core-inspections and decision can be avoided. Cores will be marked with a unique ID or use an existing ID (see chapter 0) of the core for tracking. Executing the inspection-process digitally, supported in a homogenous quality everywhere by an independent entity, based on the most recent data, makes it possible that the same data can be used to the benefit of all stakeholders without having the risk of applying criteria differently or using outdated versions. The cores can be sent to the inspection-centers or picked up from any step and location in the return-process as long as the owner of the core is participating in the ReCiPSS-platform.

By the central options-management in the clearinghouse-platform, ID's of cores can be linked to options of various stakeholders in one step to build a digital "chain-of-options". This enables to determine all stakeholders and their financial compensation associated with the particular core-return right in the event of the single inspection of the core without having the necessity to send it to all stakeholders physically. By that, it is possible to determine the endpoint of the

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supply-chain of that core and optimize return-logistics independent from financial clearing and forward logistics. Therefore, it is also possible to streamline the payment-process and re-direct it as well via a central instance, which can be the same as the ReCiPSS-platform but does not have to be. So, financial-clearing and bundling can also be supported enabling business between stakeholders who could not rely on an existing business relationship yet, e.g. workshops and remanufacturers (see Figure 2).

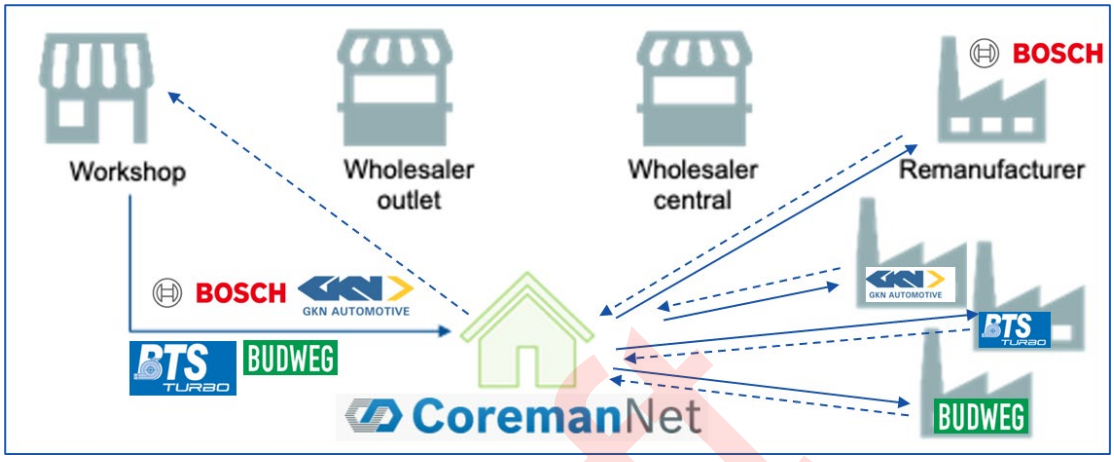

Figure 2: Future scenario

To deploy the ReCiPSS-platform and associated service-offers as an industry-wide approach, trust is a very critical issue. So, on the one hand, the ability to offer physical fulfilment is key to develop the market for core-management in order to relieve the stakeholders from that burden. At the same time, the physical cores being present in the organization of the stakeholders are associated to a certain extent with the feeling of controlling the business. So for a successful outsourcing-offer, transparency and control have to be given to a customer via the digital platform. The challenge of the deployment of the platform as an industry-wide solution is to create trust for the stakeholder to make sure that the platform is acting independent and not in favor of certain stakeholders. They have to be convinced that by using the service, they are still or even more in control of their business, while not being able anymore to “go downstairs to the warehouse” and count the physical cores. In conclusion, a major aim in the demonstration will be to validate and develop instruments that are capable of creating this trust.

3.3. Demonstrator setup within the project

The aim of the demonstrator is to show that the concept of incorporating the “right to return a core” and make it transferable can be applied to the remanufacturing parts in the independent automotive aftermarket and that it is capable of generating the expected benefits. For that purpose, a demonstration will be applied to wholesalers from different markets. Even though the aim is to come as close to the visionary scenario described above, some restrictions apply, which make simplifications necessary. This is also illustrated in Figure 3.

During this demo-phase, for the demo-companies, it is planned to physically handle and return up to 80.000 cores towards their reman-suppliers. In project-proposal, it was planned to pick-up the cores directly from the workshops. This needed to be adapted as by learnings from the

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Co-Creation-phase. Wholesaler-outlets are delivering car parts to their workshop-customers up to 3-5 times a day. On the return journey of those deliveries, the freight-forwarders bring back cores to the wholesaler outlets. As by that, the logistic service for core-returns between workshop and outlet could hardly be any better, cheaper, or more efficient. It would not make sense, neither economically nor ecologically, to go pick up cores from the workshops with a dedicated transport just for that. Therefore, it was decided that the cores will actually be physically picked up from the wholesaler outlets as a starting point.

The wholesaler-outlets will be equipped with access to CoremanNet´s selection-system, enabling the employees in the outlet to inspect and evaluate the cores by using the data and knowledge incorporated in this system. After the information to the core has been entered into the selection-system, it will directly contact the ReCiPSS-platform to build the "chain-of-options" and allocate the core to it. This is done to determine which stakeholders are involved and whether they have a valid option that can be used as acceptance for the core. The endpoint of the chain-of-options will be a remanufacturer, which is by that directly determined as also being the logistical endpoint of that core. This information is instantly available while the core is still located in the wholesaler-outlet enabling a direct shipment from there to the remanufacturer if this makes sense from a logistic point of view. With this information, the wholesaler is able to credit his workshop-customer, as well as all further stakeholders towards the remanufacturer are able to be credited, as long as all of them are participating in the platform. Regarding direct shipments, it must also be considered that every direct shipment location needs a separate pallet/box consuming space in the outlet. Also, minimum quantities have to be considered for the economic and ecological sense of a separate transport. Therefore, it does not make sense to aim for direct shipments for every core. In the demo-scenario bundled transports of mixed cores from the outlets are planned to be evaluated in more detail. When the resulting streams are more clear, direct shipments to relevant destinations can be introduced.

The mixed cores will be shipped from the outlets to the project-partners Striebig and RBAM to be inspected again. This will be done by scanning the unique marking of the core given in 1st inspection at the outlets. With this step, Striebig and RBAM will either confirm or revise the information already entered, and the system will file this data also with reference to the single core. In the same step, the cores are sorted with reference to remanufacturer to be transported to them afterwards or to be prepared for pick-up. Technically a 2nd inspection of the cores would not be necessary. All relevant information for the financial clearing can be retrieved already in the 1st inspection at the outlet. Nevertheless, it will be done during the demo-phase with the background of generating trust (see Figure 3).

The wholesaler will still handle his own cores during the demo-phase. He will be able to have his internal employee inspecting and evaluating them and use this data to determine whether he should credit his customer or not. By that, the wholesaler is still in full control, but receiving much better support of the inspection-activity by the access of CoremanNet's inspection-system. At the same time, data on the core is collected and filed in a structured way to make it accessible for further usage or analysis.

The 2nd-inspection and evaluation of the project-partners RBAM and Striebig, also using CoremanNet's inspection-system, makes it possible to have another independent party to do

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the same evaluation on the core as the wholesaler did. Those results will also be filed in the system.

By this setup, the detailed inspection and evaluation data of every core entered by different entities can be compared with respect to deviations in the results. As trust should not be unilateral, analyzing these deviations and working on their resolution are relevant measures to create trust in the setup at the end of the wholesalers as well as for CoremanNet. Only minor differences in the evaluation results will prove for the wholesalers that an independent service-provider is capable of doing the operation on their behalf. So, this can give them the confidence to outsource that activity without being afraid of disadvantages. On the other end, a minor deviation would also be a valuable evidence to CoremanNet to have confidence in working with data created by an involved party who would theoretically benefit from influencing the results in their favor. Publishing the results and measures taken to avoid deviations will not only create trust within the demo-phase but can also be used to document the benefits of participation in ReCiPSS-setup to future users. This is relevant to convince other stakeholders to participate for further exploitation, and to upscale the solution as follow up of the implementation during the project.

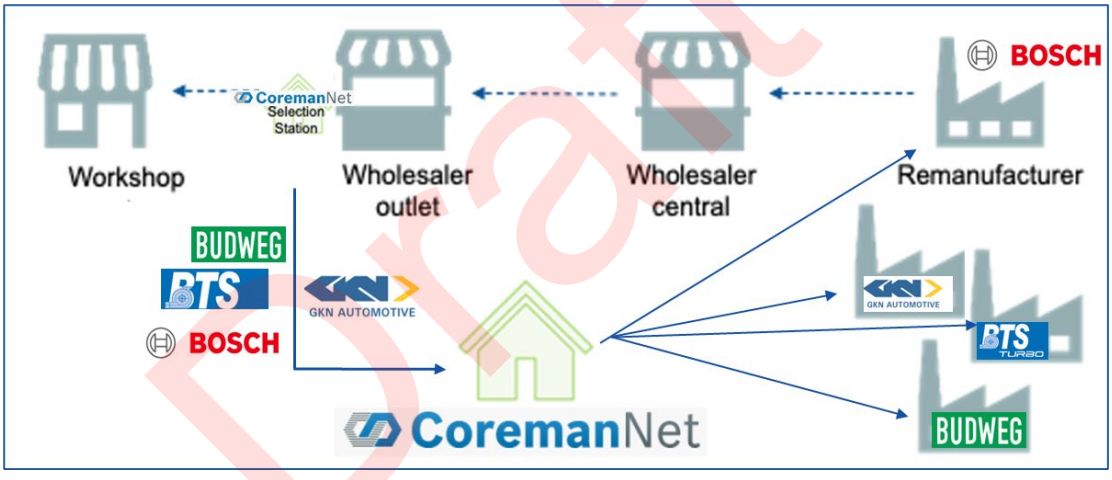

Figure 3: Demonstration scenario during ReCiPSS project

3.4. Communication

The demo-wholesalers are not project-partners. They are not directly benefitting from any funding, nor are they obliged by a contract to participate. This means that they must be motivated to participate. This can only be achieved if the business case is offering them benefits . We must also succeed in communicating the positive aspects to potential users and customers.

As in today's environment, intransparency and high complexity is common due to involvement of various suppliers in the automotive aftermarket; the stakeholders are often not fully aware of currently existing risks and potential benefits. For wholesalers core-handling is rather seen as a logistic effort to be avoided than a commercial risk which needs to be controlled or even considered as a business –opportunity. The effort of core-management (logistically and

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commercially) is most often handled internally as a “side-topic”. By that, the internal costs associated with it are not clear or visible. This would change in case an outsourcing of the activities to an external service provider is targeted. For a service-provider, this brings up the challenge to justify that his costs are reasonable and lead to a relief from internal effort and costs. To get stakeholders involved in that idea, it needs extensive communication on the benefits and advantages for them, combined with the challenge of avoiding or “hiding” the general complexity of core management activities in order to simplify things for them and make their life easier. This challenge is already an obstacle in the demo-phase as it makes it hard to convince wholesalers to participate as a demonstrator, it will also be the case for further exploitation. C-ECO is constantly working on that challenge, supported by the project-partners. Also, C-ECO has conducted a master-thesis to elaborate a sales-concept for the service with respect to the access and communication towards decision-makers in wholesaler-organizations.

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4. Deployment to stakeholders

4.1. Wholesaler in the demonstration phase

Compared to the other stakeholders like remanufacturers or core-brokers, the deployment to the wholesaler must already be done for the demonstration phase. And compared to potential future users that might take part in the ReCiPSS platform only with some elements of the functionality, the wholesaler demonstrator needs to be integrated with the maximum on interfaces.

The first step is to get to know all his reman suppliers. In his ERP system, he will use dedicated supplier numbers that will later be used for transmitting data to create options on the clearing house. In the clearing house those supplier numbers need to be established as suppliers that are linked to our demonstrator. For this purpose, we have created a so-called company-mapper where anonymous ERP-data can be translated into real company names. The clearing house can also work with the anonymous ERP-data as the logic of the clearing house is not touched by that. But the company-mapper provides improved visualization to the end-user who will work with the platform. The platform user will then be able to see the company names, for example, as an option writer instead of just supplier numbers.

The company mapper does not only map suppliers, but it can also map the customers. As the wholesaler is sitting in the middle of the trade channels, he does not only want to improve the traceability and facilitate the options handling towards his supplier but also to his customers – even though the business to the customer is not seen as a real problem. But to make the clearing house fully operative, both directions need to be considered. As soon as the customer numbers form the ERP system are mapped, the end-user can see the customer names, for example, as option holders.

In addition, to know the company constellations, we also need to know the details of the option's underlyings. As we do not yet implement or use the generic underlying logic, we will, in the first step, stick to the part number logic that the wholesaler is used to work with as of today. To do so, we need to know every part number with its core surcharge value and its return criteria defined by its supplier.

For the clearing house those part numbers will – per definition of an option – just be one element of the whole option that does not need context within the clearing house. On the other hand, the selection systems do need the context of the part numbers as the selection with identification and evaluation will result in exactly such a part number. As a consequence, we need to make all part numbers of the demonstrator known to the selection system of CoremanNet.

As one of the key elements of the clearing house concept is to gather all relevant information to the core as early as possible in the process, it is planned that the german wholesaler-demonstrator will use the CoremanNet software in dedicated outlets. By that, the employees in the outlets will be systematically supported with a guided dialogue, up-to-date criteria including pictures to take a neutral decision whether a core should be accepted or not from the workshop

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customer. So that the core is assigned to the right workshop customer, those customers do not only need to be mapped in the company-mapper as described above, but they also need to be created in the CoremanNet system. And parallel to the workshop customer, also the suppliers need to be introduced to the CoremanNet system, at least to sort the cores according to their final destination as early as it makes sense from a logistic point of view.

The above-mentioned dedicated outlets to use the CoremanNet software have to be created as entities in the CoremanNet network of selection stations. This virtual activity needs to be followed by the physical equipment of those outlets with the relevant hardware (computer with peripherals, e.g. scanner, printer, …).

Not only do we have to modify and update systems within the C-ECO environment, but also on the side of the demonstrator itself. To create options in the clearing house we enable the stakeholder to do so by himself via the so-called “create options API”. The ReCiPSS project provides a public API, which can be used by customers to transmit data in an automated way. This API needs to be implemented once on behalf of the demonstrator and gives him the advantage to be independent from the provider of the ReCiPSS platform in case the parameters for the options must be changed. When the API is implemented and tested, the customer has the control to transmit options to the clearing house.

The customer is able to create options with one of his suppliers as the option writer (linked to reman parts that the wholesaler bought from his suppliers) as well as setting himself as the option writer (linked to reman parts that he sold to his workshop customers). As soon as the options are entered in the clearing house, we need to differentiate between those two types of options – not only because they have different option writers. The other reason to treat them differently originates from the fact that an option can be compared with a kind of contract. The entity of an option can only be taken for granted if it has been created by the option writer. Even though the question if an option will lead to a subsequent financial transaction is being answered at a later stage – in case the option will be exercised, expired or further transferred – the label of being a “real” option or only a “statistical” option will be given right at the entry to the clearing house. This label will be one of many parameters linked to the option within the clearing house platform, but it will also be visible to the end-user on the ReCiPSS platform itself.

The surcharge value linked to an option needs to be paid out to the customer as soon as an option is exercised. Therefore, a payment process needs to be triggered in the ERP system. Today, each returned and accepted core results in an individual credit note that is released by an employee based on a returns number assigned to the accepted core. When all the systems are connected, the clearing house will send the relevant information to the ERP system. This automatism will replace the fully manual work that is being carried out today. As touched in the section above, this can only be done for “real” options. When a “statistical” option is exercised, the ReCiPSS platform can only be used for reporting to give transparency towards the (statistical) option writer. By that data, the (statistical) options holder is enabled to argue towards the original writer of the option regarding reimbursement of the cores or in case of insufficient feedback about core acceptance.

Before the clearing house is able to exercise the options, it needs to be connected to the CoremanNet selection system (NSC). Every time a core is being identified, and as a result, a part

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number is being defined at the end of the selection process, NSC then needs to "ask" at the clearing house if there is an existing option for this variant (a combination of part number, state of health, etc.). Then the clearing house will give feedback to NSC and the selection tool can trigger the next steps – most probably either gathering additional information needed from the original writer of the option or just sorting it into the box for the final destination. As soon as the core is finally sorted, the information will go back to the clearing house that will exercise the option in the end. Depending on either this was an "real" option (option-writer is participating in ReCiPSS-platform) or only a "statistical" option (options-writer is not participating, data for option originating from the holder), the information of being exercised will trigger a transaction into the ERP of the wholesaler as in the second case it will just be relevant for transparency and reporting.

The clearing house needs to be configured for the demonstrator by setting up the company profile of the demo-wholesaler with address data as well as other business data as the VAT-number. A company administrator will be created by one of our ReCiPSS platform administrators. The company admin is then able to create company users that will work on the user interface of the platform. The process of having the company admin create the users with dedicated roles safeguards that only the right people are able to see or to work on the options portfolio of the demonstrator actively.

For all the above-mentioned systems, interfaces and processes, well-described documentation needs to be available. For the CoremanNet systems currently already in use (e.g. NSC), the documentation is available. For all new developments, the existing information needs to be collected and upgraded into a proper document targeted for the information needs of the users. For all involved people that will work with either one or more of the described components, we will do an onsite training to guarantee that the systems and processes are understood and can be operated by the dedicated employees. The training documents will be a guideline for the training and a work of reference for the daily job.

4.2. Other Stakeholders in to-be-scenario

Any other stakeholder as a remanufacturer, core-broker, workshop and also wholesaler that wants to participate in the ReCiPSS platform does not have to be integrated with the same modules and interfaces as the demonstrator itself.

If a stakeholder wants to participate actively on the platform, the minimum of system parametrization and integration includes the connection to the clearing house via the "create options API" to transmit options from suppliers, customers or both.

A remanufacturer might not find it necessary to integrate an external selection tool as most often, an internal solution is already implemented. A switch to the CoremanNet selection tool would potentially result in a big project that could be seen as a barrier to benefit from the ReCiPSS platform overall and could limit the chances. One way to eliminate that barrier could be to enable the transmission of the selection results from other selection tools than NSC. By that, the exercise of the options could be booked in the clearing house, although there is no real-time connection.

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This could also be applied to other wholesalers, but as already described in other reports, on the other hand, it would be very interesting for a lot of wholesalers to outsource their physical activities related to cores which would lead to full integration with NSC. As we have assured the connection between NSC and the clearing house, no additional system integration is needed.

4.3. Already existing infrastructure integrated

The infrastructure integrated can basically be distinguished between physical infrastructure for logistics of the cores and the IT-systems and processes to manage the flow.

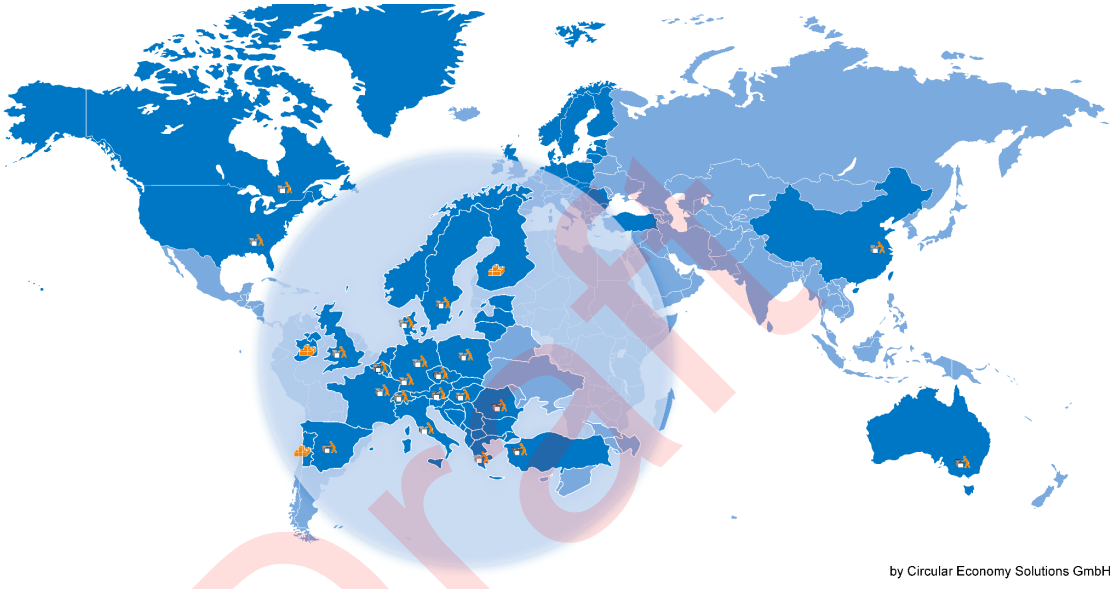

Figure 4: CoremanNet network

Under the brand of "CoremanNet", C-ECO is offering the return, evaluation and sorting of used car-parts to remanufacturers. For that purpose, C-ECO is running a worldwide network of logistic-points (Figure 4: CoremanNet network) where the cores are delivered, inspected and sorted for further usage. These so-called "inspection-centers" are equipped with C-ECO's selection-system, which provides a user-friendly interface for an operator inspecting the cores to collect the needed information and to decide about the acceptance in the name of the remanufacturers who are C-ECO's customers. For that, the system provides the technical criteria needed to evaluate the cores and background information on the acceptable cores. The cores are then pre-sorted with respect to the next destination and after that forwarded to 3 enlarged central inspection-centers in Germany, Czech Republic and in the United States. At these locations, the cores are sorted in detail as per the needs of reman-production and they are stored in warehouses until they are actually needed in production. The logistic service-offer of C-ECO is pick-up transport from wholesalers, inspection, sorting, warehousing and on-demand delivery to reman-production. The processes and the data are incorporated in C-ECO's IT-systems. All logistic operations are sub-contracted to logistic service providers and freight forwarders. Striebig and RBAM are running such inspection-centers in Germany and France.

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For the IT-infrastructure C-ECO is hosting all its systems in the MS Azure Cloud. Also, the implementation of the ReCiPSS-platform is hosted there in order to integrate effectively with the existing systems. In Figure 5: ReCiPSS platform architecture, the general IT-infrastructure setup for the ReCiPSS-platform in the context of the existing components of the CoremanNet-service is shown. The ReCiPSS platform must be connected to C-ECO's selection system in order to support the exercising of options. This is needed to provide detailed information on the type and condition of the core referenced to the unique ID of an option-exercised. For the options-handling, the platform must be connected to the existing ERP-systems of the demonstrator-companies. The API interface for that is developed and will be published. Nevertheless, the specific connection to that public interface might need a dedicated component on the side of the user-company (demonstrator). This component is referred to as connector in the picture and its task is to do the translation of the data provided and received from the ERP in the form or the public interface to be exchanged with the ReCiPSS-platform. This component, in general, should be under the control of the user-company as it is their decision on which data options shall be created. Nevertheless, Siveco and C-ECO will offer support to the demonstrators in establishing this connector. It might also be a possibility to use the existing CoremanNet-backend-system to function as a connector as such e.g. for supplying additional master-data for the options-management.

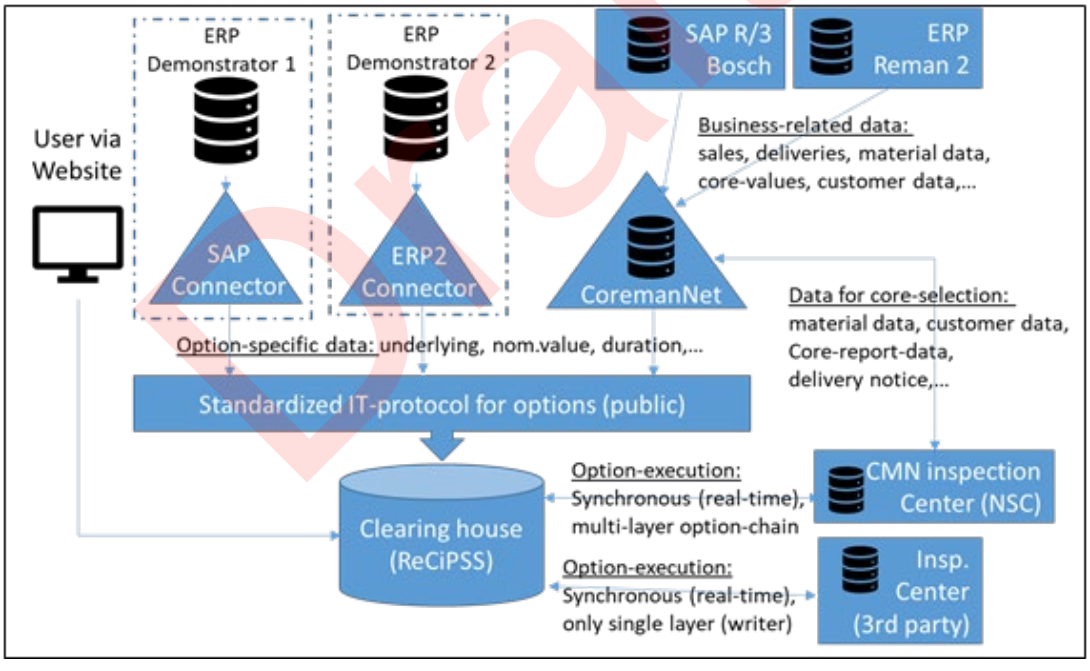

Figure 5: ReCiPSS platform architecture

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5. Technical deployment

5.1. Access and Security

For accessing the ReCiPSS platform and functionalities, the user must have a valid account and to be logged in. If the user has been logged in successfully, he could navigate on the platform 24 hours without any other login process. After these 24 hours, for security reasons, his session expires, and he must log in again. The information about when the user has been logged in and when his session expires are stored in cookies and in his access token, which is attached and checked on every action that user does on the platform.

Besides user accounts, the platform requires specific roles and permissions for each action. These permissions and roles are stored in the user access token. Before each action that the logged user wants to do, first, the platform checks if he is authorized to do that by looking on his permissions and roles. If the user is not authorized, he will receive specific error messages to understand what happens.

There are specific roles and permissions for each type of action on the platform. There are permissions for creating options and container of options, for transferring, sharing, viewing and confirming the execution of options or for creating new users to an existent company and updating company information and so on. These roles and permission are strongly checked before each user action.

The user access token is very important in the authorization process. It contains information about user sessions, permissions, roles and more. It is crucial for this token to be secure and unchangeable by attackers. That is why the platform uses jwt (JSON Web Tokens). These tokens are Base 64 encoded and signed with a private key using an RSA algorithm. The user token is sent in the Authorization Header on each request made by the user and it is verified in the backend part with the secret key. Any changes or updates to the jwt user token from attackers is detectable in the verifying process and will result in verification failure and unauthorizing the user.

For security reasons, each user has an email address attached from the creating account process. The password policy makes sure that users choose a strong password.

5.2. User-Registration process

The user-registration process is used to create the users for the companies inside the platform. When creating the user, a set of permissions is given to the user newly created. This set of permissions is awarded to the user depending on the type of the user that initiated the creation process. As an example, an admin can only create company admin users and company admins can create company users.

The ReCiPSS Admin is the one that creates the company and the company admin, which contains completing some information about the details about the company, the address of the company, the email of the admin and the VAT ID. Then the company admin account will be

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created and the newly created company admin will receive two emails. The first one is a welcome email and the second one is to set a password for his account.

When the admin of the company logs on the platform, he will be able to create new users for his company. The admin is always directed to the page of the company information and besides that, he can see some technical documentation.

After the user creation process is done by the company admin, the newly created user receives an email that contains a welcome message and a second email to set a password for the new account and login on the platform. This allows the user to enter automotive parts into the database (by creating an option) with certain specifications (name, price, expiration date, number of products available of the same type).

The authorization process means not only to create and to validate the user, but also to have the proper permission and role for any actions that these types of users need.

5.3. Internationalization

Internationalization is the process of designing and preparing the platform to be usable in different languages and with different currencies.

As the demonstrator will cover the collection, identification, evaluation and sorting of 80,000 cores in 2 European countries (France, Germany), during the demo phase, the platform will support the languages and the currencies of the demonstrators.

- Supported languages:
  - English
  - German
  - French
- Supported currency:
  - Euro (€)

The platform default language is ENGLISH, but the localization module, using the browser's language, translates the platform to the browser's language if the language is German.

After the demo phase of the project, more languages and currencies will be added to the final product gradually.

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6. Organizational deployment

6.1. Legal

Business data must be kept confidential and not shared with anyone. For that reason, a contractual relationship between users and a neutral independent third-party is needed. An independent third party offers transparency to the ecosystem.

As third parties could be considered the following partners:

- Inspection centres
- Monetary institution servicing the clearing house
- ICT provider who issues protocols, reports (e.g. CoremanNet)
- Data controllers

Contracts must be signed between every user of the platform and the third parties offering their services.

6.2. Privacy and Data-protection

Data Confidentiality, Privacy and Trust are going hand in hand as it is shown in figure 6. To achieve a good standard in all of these three areas a combination of technical and organizational measures is needed. A privacy policy reflecting that must be defined under the scope of the platform. The privacy policy must take into consideration all the aspects for protecting users and stakeholders from loss, misuse, leakage, or other personal and/or company data. The privacy policy must be in line with GDPR and also the national legislations across Europe.

The privacy policy should address the following issues when it comes to data management and personal data:

- What/when/why data is collected?
    - anonymization and pseudonymization
- how long is it stored?
    - right to erasure
- who processes it (Data Controller/Data Protection Officer)?
- how is data protected?
    - encryption
    - updates
    - repositories
- what are user's rights?

Based on these questions, the privacy policy of the ReCiPSS platform is created and published.

According to GDPR, it is necessary that users give their informed consent to the collection, processing and storage of the data they are providing to the platform and that they are informed about the purpose of doing so. As per the creation of this report, to our analysis, the user only

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needs to give personal data, which is needed actually to run the platform such as name and email-address. This means by providing this data to create a platform-account, the user gives his informed consent that this data will be used for the operation of the platform. During further development and demonstration, implications of changes to the platform are re-evaluated and in case the need arises, the user will be given the possibility to opt-in to additional data collection, processing or storage. Consent forms will be sent to users when they sign up.

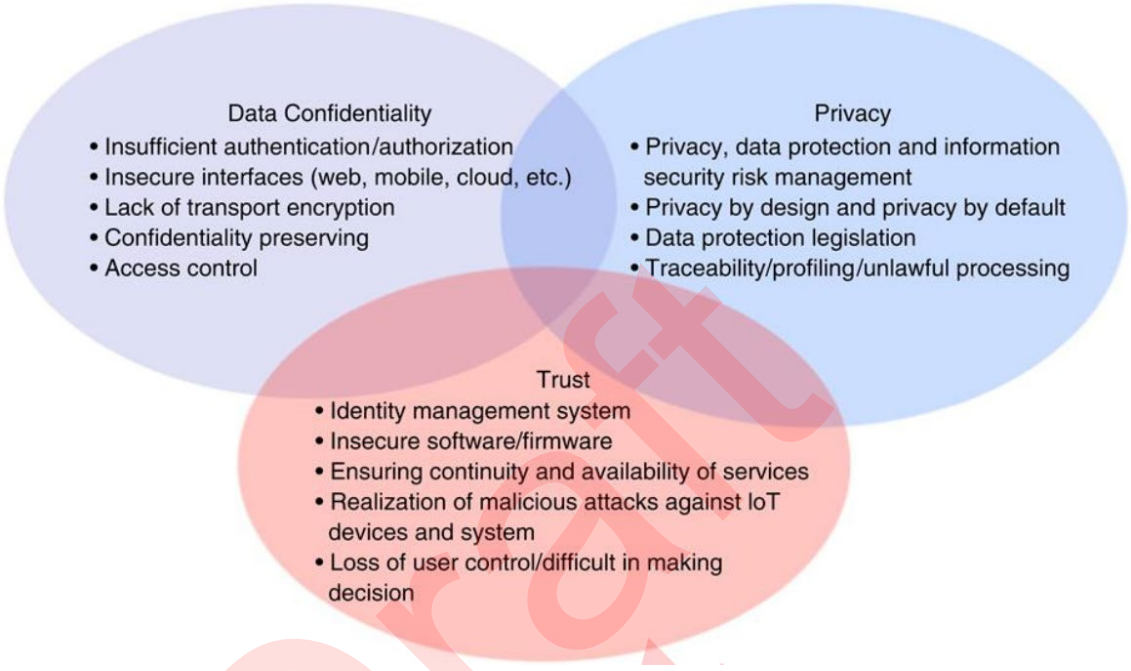

Figure 6: Security issues in IoT (D2.1. Defining the current baseline and the target/ improved circular business)

The ReCiPSS Platform is created, taking into account all principles of Privacy by Design (PbD) approach. The privacy implications were considered before writing the first line of code being a core function of it, not an add-on.

The ReCiPSS platform does its best to protect the users from attacks on their privacy, their dignity, and even their safety.

The users' passwords are not stored in a database in clear text. If an attacker was to break into the database and steal the passwords table, the attacker could then access each user account. Taking that into account, ReCiPSS never stores passwords in clear text. Passwords are always hashed and salted using bcrypt. Additionally, data encryption is offered at rest and in transit by using TLS with at least 128-bit AES encryption.

The platform requires minimum personal data for creating a new company: a (company) email address, a company name, address and VAT ID. All this data is required for security reasons: logging into the account and checking and authorizing the company. All this data is stored safely in the database. The email address and profile data of the logged in user is encoded in a jwt token with a private key.

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It does not require unnecessary app permissions (contacts, microphone) or personal data (birthday, gender) just email address and the profile data (avatar and name) when the user is logged in the first time.

The platform does not share any personal data with third parties and does not require social media registration. It removes the data of users whose accounts have been closed or deleted.

Each data created on the platform (company users, options, containers, reports) are stored safely and uniquely identified.

There is end-to-end lifecycle protection using Azure services like: Storage Accounts, App Services. The platform is divided into small parts that are deployed on Azure in Storage Accounts and App Services. Azure Storage encrypts user's data automatically when it is persisted to the cloud. Data is encrypted and decrypted transparently using 256-bit AES encryption.

Azure provides tools for web vulnerability scanning too. In this way, we can prevent all kind of vulnerabilities as SQL injections, cross site scripting and more

The privacy policy can be found in under "Privacy Policy", linked on the log-in-page of the platform. It provides all required information for users structured by the following headlines.

- Data Protection Notice
- Controller
- Processing purposes and legal bases
- Log files
- Data transfer to other controllers
- Service providers (general)
- Duration of storage; retention periods
- Usage of cookies
- Management of cookies and tracking mechanisms
- Deactivation of all cookies
- Rights of Data Subjects
- Right to information and access
- Right to correction and deletion
- Restriction of processing
- Data portability
- Objection to data processing based on the legal basis of "legitimate interest"
- Withdrawal of consent
- Data Protection Officer
- Right to lodge complaint with supervisory authority
- Changes to the Data Protection Notice

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6.3. Commercial/Financial

- In the ICT platform, different user roles will be created. The different roles will have different interests in the use of the platform.
  Remanufacturers, wholesalers and potentially core brokers could act as option writers and sellers. Workshops could use the platform in the future.
  On the other hand, operator of the the clearing house should be a neutral actor/ stakeholder/ company.

- There are 9 main elements on the business model canvas which have been described on the Deliverables 2.1 and 2.3:
  - Customer segments
  - Value proposition
  - Distribution channels
  - Relationship with clients
  - Key resources
  - Key activities
  - Key partners
  - Cost structure
  - Revenue channels

- Different revenue channels can be investigated under the scope of the ICT platform business model. As mentioned on D2.1 and 2.3, revenues will be created by the new services provided by the ICT platform. Some models that could be used are the following:
  - transaction-based fees for the use of the platform e.g. for the exercise of options, for the creation of options, or for the transfer based either on a percentage (commission, transaction fee) or on fixed fees.
  - Subscription-based/Membership: Freemium (services free of charge but some features/ services/ products are charged).

6.4. Payments through the platform and subscription for platform usage

6.4.1. Payments

IPayments between users will be supported in the ReCiPSS ICT platform, e.g. between option writer and option holder. In any case, supporting of financial transactions must ensure security in every stage of the process.

Security issues and compliance issues must be defined before implementing transaction processes in the platform. The need for an intermediate such as a monetary institution like banks or PayPal should be investigated in detail. Additionally, the option of supporting direct payments from one user to another must also be investigated.

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Other payments, such as the costs of reverse logistics and the costs of inspection, could be directly invoiced by the service provider. These services are considered as services provided outside the platform as part of the original CoremanNet services. Table 1 is providing an overview of payment relation for different business-cases.

Table 1: Different payments between platfrom users

Service	Who is paying …	…whom	…and how
Exercise of option	Option writer	Option holder	Nominal value (once) via Admin or directly by invoice/ via bank
Trading of options	buyer of option	Option holder	Market value of option
Inspection centre	- Option writer and/or - Option holder	Inspection centre operator (e.g. C-ECO/CoremanNet-NSC)	Pay by core

6.4.2. Subscription for platform usage

The main roles in the ICT platform are listed below.

- Platform-operator and Admin (C-ECO)
- Inspection centre operator (C-ECO)
- Logistic operator (C-ECO: sub-contracting a logistic service provider)
- Remanufacturer
- Wholesaler
- Workshop
- Core-broker
- Option writer
- Option holder
- Clearing house

The “pricing policy” of the offered services is listed below. Each service can be charged to the users as mentioned in Table 2: Payment model of ReCiPSS platform by service and user. Different ways of charging the services should be investigated on D2.3.

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Table 2: Payment model of ReCiPSS platform by service and user

Service	Who is paying …	…whom	…and how	
Flat fee for using the platform fees for access/ use/ support/ maintenance/ updates/ +++	Everyone	Admin	Monthly/ Annually by invoice/ credit card	
Flat fee for using the Clearing house fees for access/ use/ support/ maintenance/ updates/ +++	Everyone	Clearing house	Monthly/ Annually by invoice/ credit card	
Service packages / Freemium e.g. Bronze, Silver, Gold e.g. Bronze: 100 free option exercise per month, Silver: 500 free…	Who is interested	Admin or Clearing house	One time	Optional
Extra user per company account	Who is interested	Admin	Extra monthly fee per new user	Optional
Setting up a connector between ERP of the customer to the IT-protocol	Who is interested	Admin	One time payment/ + service fees for support/ maintenance/ updates/ +++	
Fee for the exercise of an option	Option writer	Clearing house	Once per option by % of the option value (e.g. 0.5%, 1%, 5%, …) or a fixed price per option. How does the option writer pay clearing house? Invoice monthly calculating the amount of the options, pay after each transaction, etc.	

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Fee for the trading of options	Previous option holder or new option holder or 50%-50% w/previous option holder	Clearing house	Once per option (or per container) by % of the option value (e.g. 0.5%, 1%, 5%, …) or a fixed price.

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7. Innovative Data-collection for CE

As described above, the inspected cores are marked with a label in the inspection centers with a unique ID created in the event of the inspection of the core. This ID will then be used to link the returned core to options at options-exercising and also for tracking the core in further processing. Within ReCiPSS, the approach has also been undertaken to make use of a permanent marking already applied to the product in initial production as a "data carrying"-ID for the further process. This is basing on the example of Bosch's CRI 2.18 injectors and the process to handle that has been included in C-ECO's selection-system.

7.1. Making use of permanent markings for data-collection over several life-cycles

After leaving the factory, all the products contain several information and data in several forms (numbers, codes, barcodes, QR-codes, etc.). Product data management (PDM) is the use of software or other tools to track and control data related to a particular product. The data tracked usually involves the technical specifications of the product, specifications for manufacture and development, and the types of materials that will be required to produce goods. The use of product data management allows a company to track the various costs associated with the creation and launch of a product. Product data management is part of product lifecycle management and configuration management, and is primarily used by engineers.

Within PDM the focus is on managing and tracking the creation, change and archive of all information related to a product. The information being stored and managed (on one or more file servers) will include engineering data such as computer-aided design (CAD) models, drawings and their associated documents.

PDM serves as a central knowledge repository for process and product history, and promotes integration and data exchange among all business users who interact with products — including project managers, engineers, sales people, buyers, and quality assurance teams.

Bosch uses PDM with several forms (number-coding, and also 2-dimentional codes (QR-codes), see Figure 7) in many product categories in order to attach important information and data into the final product. A QR code (abbreviated from Quick Response code) is a 2-dimentional machine-readable optical label that contains information about the item to which it is attached. In practice, QR codes often contain data for a locator, identifier, or tracker that points to a website or application. A QR code uses four standardized encoding modes (numeric, alphanumeric, byte/binary, and kanji) to store data efficiently; extensions may also be used (Wikipedia, 2020). With such a labeling (QR codes), remanufacturing can always be linked to the initial production phase.

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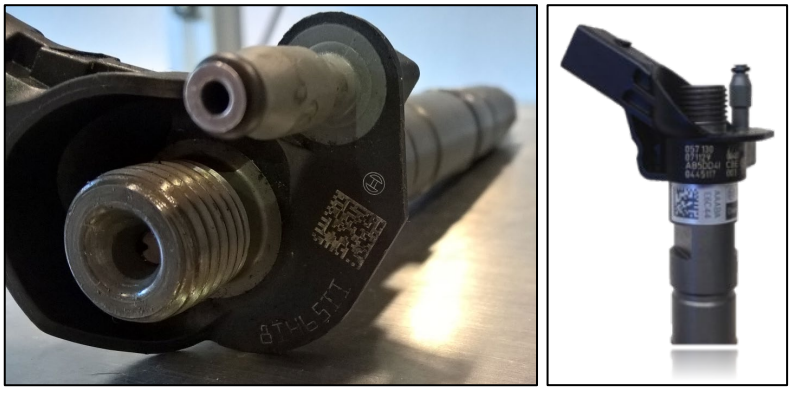

Figure 7: QR-code and product technical specifications in Bosch common rail injectors

In circular economy and more specifically remanufacturing, the need for digitalizing traceability is key to enabling circularity. For that reason, it is very important that all the information about the product stay attached to the product during its whole lifecycle. For enabling circularity, the easy identification of the products is crucial, as without this, the product is not appropriate for remanufacturing (Fig.8). Additionally, when the marking is following the product in the next life cycles, this allows the traceability and supports multiple life cycles for each product.

But the original data of products are not always enough, as other related to products' life data are very important when the products are coming back to the remanufacturers. For instance, mileage or date of the end-of-life can be important for the remanufacturers, but to collect these data not only the engagement of other the stakeholders in the supply chain is needed (e.g. the workshop where the information can be extracted from the car) but also the technical infrastructure to support the collection of all these data.

Figure 8: Return criteria for common rail injectors based on the identification information (CoremanNet, 2020)

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7.2. Supporting data-collection in CoremanNet

To support the collection of data that have not been taken into consideration during the first inspection at the selection stations, a second inspection of common rail injectors (CRI2-18) will take place under WP7. Those CRI might be subject to a new remanufacturing project – depending on the overall profitability. And the data will support the remanufacturer in taking that decision.

The collection of this additional data was not possible during the initial inspection, so in order to be able to collect additional information from the cores, such as the scanning of the QR codes which are placed in the CRI2-18 or the level of the corrosion of the cores, an updated version of CoremanNet was launched (see figure 9). In the updated version and with the support of additional equipment of a scanner, the employee is able to scan the QR-code and also to enter the additional information such as the level of the corrosion of every core, the original production plant, the original production date and the initial date of the core being put to stock.

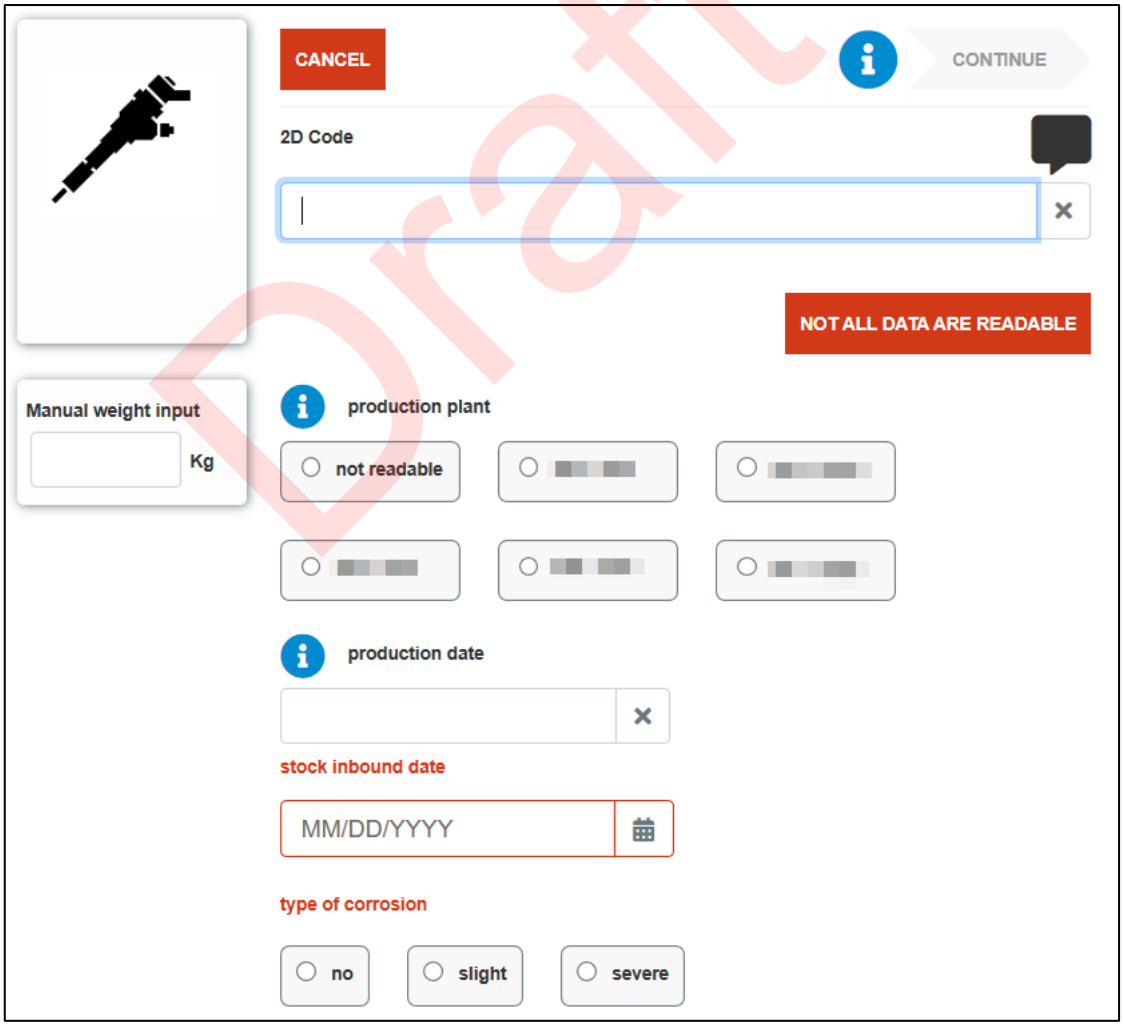

Figure 9: Collection of additional data with CoremanNet

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7.3. Use case: second selection of 60.000 Bosch common rail injectors CRI2-18

In Bosch core-warehouse in Jihlava (CZ) approximately 60.000 CRI2-18 were stored which have been moved to RBAM in Göttingen now (see Fig.10). These CRI2-18 carry additional information which needs to be collected. These data are stored in the QR-code. Additional qualitative characteristics should also be examined, such as the level of the corrosion in the cores. To collect all the missing data, a reselection of these cores is needed. To do so, the transport of the 60.000 cores from Jihlava (CZ) to Göttingen is necessary. In the selection station in Göttingen dedicated workplaces will be used for the re-inspection of the cores.

Figure 10: 60.000 CRI2-18 in boxes in the warehouse

As mentioned above, CoremanNet software solution (NSC) will be adapted for storing information for every single core with reference to core-specific ID in database, retrieving and decoding information out of QR-code (Bosch-plant-number, production-date), and providing data and analysis basing on it on request. The working place of selection station has been adapted and equipped with all the necessary tools (scanner, new software, etc.) in order to process the re-inspection of the cores.

In the re-inspection process, the cores have already been selected previously, therefore, a CoremanNet label is already attached to each core. The Bosch QR-code will be used as a reference for each core, as the code is unique for each core. The data from the first selection will also be used to gain original inbound date and, of course, not losing the original information. Bosch customers' information who initially return the cores to Bosch are clarified.

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8. Conclusions

The demonstration of the ICT platform will start with the trade level of the wholesalers. Compared to the other stakeholders like remanufacturers or core-brokers, the deployment to the wholesaler must already be done for the demonstration phase. The company-mapper will be deployed to connect ERP data of suppliers into real company names. The user will be able to see their suppliers as option writers. On the other way round, company's customers can be appeared, for instance, as option holders by their names and not as an ERP entity (number).

As one of the key elements of the clearing house concept is to gather all relevant information to the core as early as possible in the process, it is planned that the demonstrators will use the CoremanNet software in dedicated outlets. These outlets, as they will use the CoremanNet software have to be created as entities in the CoremanNet network of selection stations and to be equipped with all the necessary hardware for the core inspection.

Running up the demonstration phase in Germany, but also finding a demonstrator wholesaler for the French market are very difficult tasks at the moment, due to COVID-19 situation across Europe and the world. The efforts on approaching French wholesalers are very hard, as French market is in shutdown since February 2020. Companies are struggling with the unexpected situation, the automotive market is one of the most affected markets, and this makes the discussions with wholesalers very difficult. Their involvement in a research project at this time is not the first priority for them, so the risks should be analyzed and evaluated. Also, alternative demo-scenarios additional to wholesalers will be investigated.

Even as cores in the demo-phase are not physically picked up at workshops, the mechanics in this companies are the very first point where several information could be collected. So the involvement of this trade level could be very interesting to be investigated in the future. This information would be very important for the OEMs and the remanufacturers for supporting the circularity of cores.

Regarding the revenue model of the ICT platform, this can be based either on subscription fees or on percentage fees by transactions or on a combination of these two solutions. Different services could be charged differently and also based on the experience of other IT products this is a very common practice. Platforms have standard costs that usually are covered by subscriptions, while additional services are charged accordingly based on users' needs. The way that payments are processed should also be defined. Connection and alignment with WP2 are necessary. Further investigation and willingness to pay by the users of the platform should be investigated during the demonstration.

The use case of the second selection of 60.000 Bosch CRI2-18 for selecting additional data of the stored cores has already started. The cores have been shipped from Jihlava (CZ) to Göttingen (DE) and the re-inspection with the updated version of CoremanNet is running since M21 (February 2020). Additional data in the form of reports will be forwarded to Bosch. Based on the additional information, Bosch will is able to Improve planning of the remanufacturing-projects of CRI 2.18.

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By permanently marking the original product, for instance, with QR codes, OEMs can retrieve and connect informations from every single product over several life-cycles. With the QR-code, the information stays with the product and follows the product in every usage phase. The information from the original part is always available to the remanufacturer, who is able to export key findings for the core, i.e. the date of the first production, how many times the core has been remanufactured, the total mileage, etc. These findings will support OEMs to take the right decision for the future of each core as well as providing relevant data for future-product development.

As a result of the use case, the use of marking in the products, such as the QR-codes, could be extended in other products categories as well. Following, the inspection and collection of more data from cores could be extended in every product category. In that way, circularity is promoted, and the cores can have several life cycles based on the collected data from every part's life cycle, but also the information of the first production and the next remanufacturing processes.

Of course, product data management is a common practice in every industry and product markings are used in every product. Therefore, the extraction of the data out of the markings for supporting circularity and several life cycles could be easily extended in other products and industries, such as to white goods or other markets.

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9. References

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