LOWINFOOD

Multi-actor design of low-waste food value chains through the demonstration of innovative solutions to reduce food loss and waste

GA No. 101000439

D2.7 Report on demonstration – Leroma

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LIST OF PARTNERS THAT HAVE CONTRIBUTED TO PRODUCE/REVISE THE DELIVERABLES

ISUN, LER, UNIBO, BOKU

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LOWINFOOD Consortium

N.	Full name of the organisation	Short name	Country
1	Università degli Studi della Tuscia	UNITUS	Italy
2	Alma Mater Studiorum Università di Bologna	UNIBO	Italy
3	Sveriges Lantbruksuniversitet	SLU	Sweden
4	FH Munster University of Applied Sciences	ISUN	Germany
5	The James Hutton Institute	JHI	United Kingdom
6	Universitaet Fuer Bodenkultur Wien	BOKU	Austria
7	Tampereen Korkeakoulusaatio SR	TAU	Finland
8	Charokopeio Panepistimio	HUA	Greece
9	Osterreichisches Okologieinstitut	AIE	Austria
10	Elhuyar Fundazioa	ELH	Spain
11	Matomatic AB	MATO	Sweden
12	Unverschwendet GmbH	UNV	Austria
13	Akademie Deutsches Baeckerhandwerknord GGmbH	ADB	Germany
14	Foresightee (terminated on 30/01/2023)	FOR	Belgium
15	Leroma GmbH	LER	Germany
16	Mitakus Analytics UG	MITA	Germany
17	Kitro SA	KITRO	Switzerland
18	Regione Emilia Romagna	RER	Italy
19	Pianeta Cospea srl	PICO	Italy
20	Cogzum Bulgaria OOD	COZ	Bulgaria
21	Uppsala Kommun	UPP	Sweden
22	Recuperiamo srl	REG	Italy
23	Antegon GmbH	FT	Germany
24	Confederazione Nazionale dell'Artigianato e della piccola e media impresa Associazione di Viterbo e Civitavecchia	CNA	Italy
25	Assemblee des Regions Europeennes Fruitieres Legumieres et Horticoles	ARE	France
26	L.V.L Anonymi Emporiki Toyristiki Kksenodoxeiaki Kataskevastiki Etaireia	BLU	Greece
27	Iridanos-Inabelos Anonymi Etaireiatouristikes Ksenodoxeiakes Kai Agrotikes Epixeiriseis	THA	Greece
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Summary

The deliverable is about the use of the Leroma innovation in the fruit and vegetable sector as part of the LOWINFOOD project.

Leroma is a B2B platform to connect raw material suppliers with buyers, offering an exchange platform for surplus materials that would otherwise be wasted. The platform consists of a search engine for raw materials, a surplus marketplace, and activities driving a circular economy. The platform focuses on trading food raw materials from the first stages of the value chain, addressing issues such as excess stock, approaching best-before date, and by-products. The Leroma platform was continuously improved over the course of the project in terms of technical functionality, design and IT quality and continues to develop constantly.

The aim of the demonstration phase of Leroma in the LOWINFOOD project was to move forward with the technical development of the Leroma platform and to evaluate the efficacy of Leroma in the fresh fruit and vegetables (F&V) supply chain. Despite successes in reducing food waste in various sectors, Leroma has faced challenges in mediating perishable goods and attracting users from the fruit and vegetable sector, although great efforts were made in acquisition and, in particular, diligent PR work. This required adaptations in testing strategies: A qualitative approach through expert interviews was chosen as an alternative strategy for obtaining at least rudimentary data.

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Introduction to the deliverable

LOWINFOOD is a project committed to co-design, together with actors of the food chain, low-waste value chains by supporting the demonstration of a portfolio of innovations in a set of value chains particularly concerned by food loss and waste (fruits & vegetables, bakery products and fish), as well as in at-home and out-of-home consumption. Each of these value chains corresponds to a single Work Package (WP) of the project.

The innovations are selected among promising solutions that have already been developed and tested by some partners of the consortium, with the aim to provide the necessary demonstration and upscale to allow market replication.

The LOWINFOOD consortium comprises 27 entities, located in 12 different countries, and ranging from universities and research institutes to start-ups, foundations, associations, and companies working in the food sector. During the 52 months of the project, the partners are committed to complete 30 tasks and to deliver 60 outputs (deliverables).

The deliverable describes the testing of the Leroma innovation in the fruit and vegetable sector as part of the LOWINFOOD project. It first presents what Leroma is and how it was tested in LOWINFOOD. Then it shows the outcomes of the demonstration phase, before it ends with an outlook and a conclusion.

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1. About Leroma and how it was tested in LOWINFOOD

Leroma is a B2B platform for food raw materials, creating a digital bridge between raw material suppliers and food producers. The platform features a database of raw materials, which can be filtered by specific criteria to facilitate the quick identification of suitable suppliers. Additionally, it offers a surplus exchange, providing the industry with a marketplace for leftover stock.

Designed for food processing companies, Leroma enables these businesses to easily find buyers for surplus raw materials (such as leftover ingredients from development projects, incorrect purchases, or raw materials nearing their expiry date that cannot be used in time within the company). Without this platform, these excess materials would typically be discarded, as they cannot be utilized further. Leroma offers a valuable solution for repurposing these resources by matching suppliers and purchasers.

What's the idea?

Leroma was developed for food processing companies as a digital bridge, it is a raw material sales platform between raw material suppliers and buyers. With the help of Leroma, companies can more easily find customers for surplus raw materials (such as leftover raw materials from development projects (trial projects for new product lines that are being tested in smaller quantities), incorrect purchases, raw materials nearing their best-before date that can no longer be used in time within the company). Otherwise, these surpluses would be discarded, as they can no longer be used and would be sensibly repurposed through the platform.

Leroma was founded in November 2019 and is led by Marina Billinger (CEO and founder), Alexander Yanchin (CTO), Florian Casalino (Sustainability Manager), and Aliaksandra Kharoshka (Co-founder and food analyst).

According to the slogan "Simplify the future of change", the motivation to found Leroma was to offer innovative solutions that enable customers to implement change efficiently and smoothly. More concretely, the highly analog and inconvenient raw material procurement process is digitized by Leroma, as well as the redistribution of residual raw material. The aim is to reduce complexity in order to facilitate the transition to new methods, technologies or ways of working, making solutions intuitive, be user-friendly and easy to implement.

This motivation is also reflected in the company's goals:

- **The future of food commodity trading is digital**
  Leroma is committed to continuous innovation to provide customers with the best tools and technologies and to drive digitalisation in the industry. A key component is the online B2B platform for food raw materials, which allows customers to quickly find specific products using filter criteria. In addition, web crawlers (programmes that

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automatically browse the internet for web indexing) are used to display further relevant offers. In the future, further functions such as analysis tools will be introduced to make sourcing commodities even more efficient.

- **Sustainable solutions for the food industry**
  Leroma pursues a holistic sustainability strategy that focuses on sharing surplus raw materials through the platform and participating in sustainable funding projects such as Lowinfood. In addition, Leroma acts as a driver for the circular economy by promoting collaboration between the food industry and neighbouring sectors. Leroma achieves the goal - reducing food waste - by motivating the food industry to be more responsible and sustainable.
- **Customized offers for your success**
  Leroma strives to provide their customers with an efficient and professional service that supports their business success. From order processing to communication, Leroma keeps things efficient and smooth so that our customers can make the best use of their time and resources. With Leroma's expertise and years of experience, they offer tailor-made solutions - manually through their team and digitally via the online B2B platform that enables a targeted and filtered search.

Behind everything is the vast foodwaste problem. Leroma aims to combat the problem at the beginning of the value chain.

Structure of the Leroma platform

Leroma consists of three pillars:

- A search engine for raw materials: The search engine for raw materials is a digital procurement tool for food ingredients that contributes to the digitization of sales and purchasing processes. The purpose is a shortened and more efficient search for ingredients. The product specifications displayed to potential purchasers correspond to those shown in Figure 2.
- A marketplace for surpluses: The marketplace for surpluses aims to reduce food waste at the beginning of the value chain by organizing the sale of surplus materials and remaining stock. Customers can also be from sectors outside the food industry.
- Acitivities for driving the awareness for a circular economy: Speeches and publications serve the purpose of driving the circular economy. Specifically, this is about the mediation of side-streams, resource efficiency, and motivation for cross-industry upcycling by communicating the latest technologies, trends and application examples.

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Leroma business model

Users register for the search engine, registration is free. If, as a result of the contact between advertisers and searchers mediated by Leroma, a transaction occurs, it takes place outside of Leroma and is therefore free of costs. So far only the free basic package is available, paid packages are being developed.

The situation is different with the marketplace for surpluses. Leroma charges the seller 10 % commission on a sale. The listing itself is free, the commission is only applicable in case of a sale.

Kind of food products traded at Leroma

In the following explanations, we focus on the surplus exchange because this service is most relevant in the context of FLW avoidance. Food raw materials from the first three stages of the value chain (see Figure 1) are being uploaded and bought daily on Leroma's "Surplus Exchange". This is, for example, pea protein texturate, chopped mushrooms, parsley powder, oat flakes, cacao butter or pumpkin seeds. There are several reasons for food raw materials to get labelled a "surplus"[1]. Sometimes, for example, it happens that companies simply buy too much because they had planned with more production volume, which in the end turns out to be less. In such a case, it rarely happens that companies are able to use the surplus material in another production line because all other production lines have been planned separately regarding required raw materials. Another example could be a short or even an expired shelf life. Food guidelines are very strict, which often means that these raw materials are no longer allowed to be used in production. In most cases, a minimum shelf life of six to twelve months is required at the start of production.

Lastly, there are by-products or side streams emerging from producing primary products, such as nuts. Side streams, such as nut shells, in this case, can't be used in the primary production process but could be forwarded to other non-food industries, that uses these shells for different purposes such as wooden pellets production or sandblasting material.

[1] The definition of the European Commission also helps to understand what a surplus product is: *"Surplus food consisting of finished food products (including fresh meat, fruit, and vegetables), partly formulated products or food ingredients, may arise at any stage of the food production and distribution chain for a variety of reasons. Foods that do not meet manufacturer and customer specifications (e.g., variations in product color, size, shape), as well as production and labeling errors, can generate a surplus in the agricultural and manufacturing sectors for instance. Difficulties in managing supply and demand can lead to over-ordering and cancelled orders."* (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52017XC1025(01))

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Figure 1: Value chain stages that are within Leroma's scope, showing quantity and value of food that is wasted every year globally (source: leroma.de)

All of these examples happen on a daily basis in food production companies and are the cause of many tons of food waste. Leroma's surplus exchange works well because it provides an infrastructure for these, otherwise wasted products – an infrastructure that had not existed on a larger level before.

How does the surplus exchange work?

Virtually everybody has used an online platform like eBay or Amazon before. On this platforms, all important criteria and information of products that users are looking for are visible and can be accessed through a few clicks. On Leroma's surplus exchange, it works similarly, with the difference of Amazon being a B2C (Business to customer) platform and Leroma being a B2B (Business to Business) platform.

Here is a concrete example: A food producer bought 20 tons of pea protein powder at the beginning of the year because a specific end product, a vegan protein bar had been planned. Throughout the year, the production plans have changed due to market research results saying that consumer's interest is not as assumed. In this case, there is no alternative production use for this specific protein powder, which makes it a surplus product. Only on rare occasion it is possible to use specific raw materials in different production lines than previously planned. These 20 tons can now be uploaded onto Leroma's surplus exchange. An upload might look something like shown in Figure 2.

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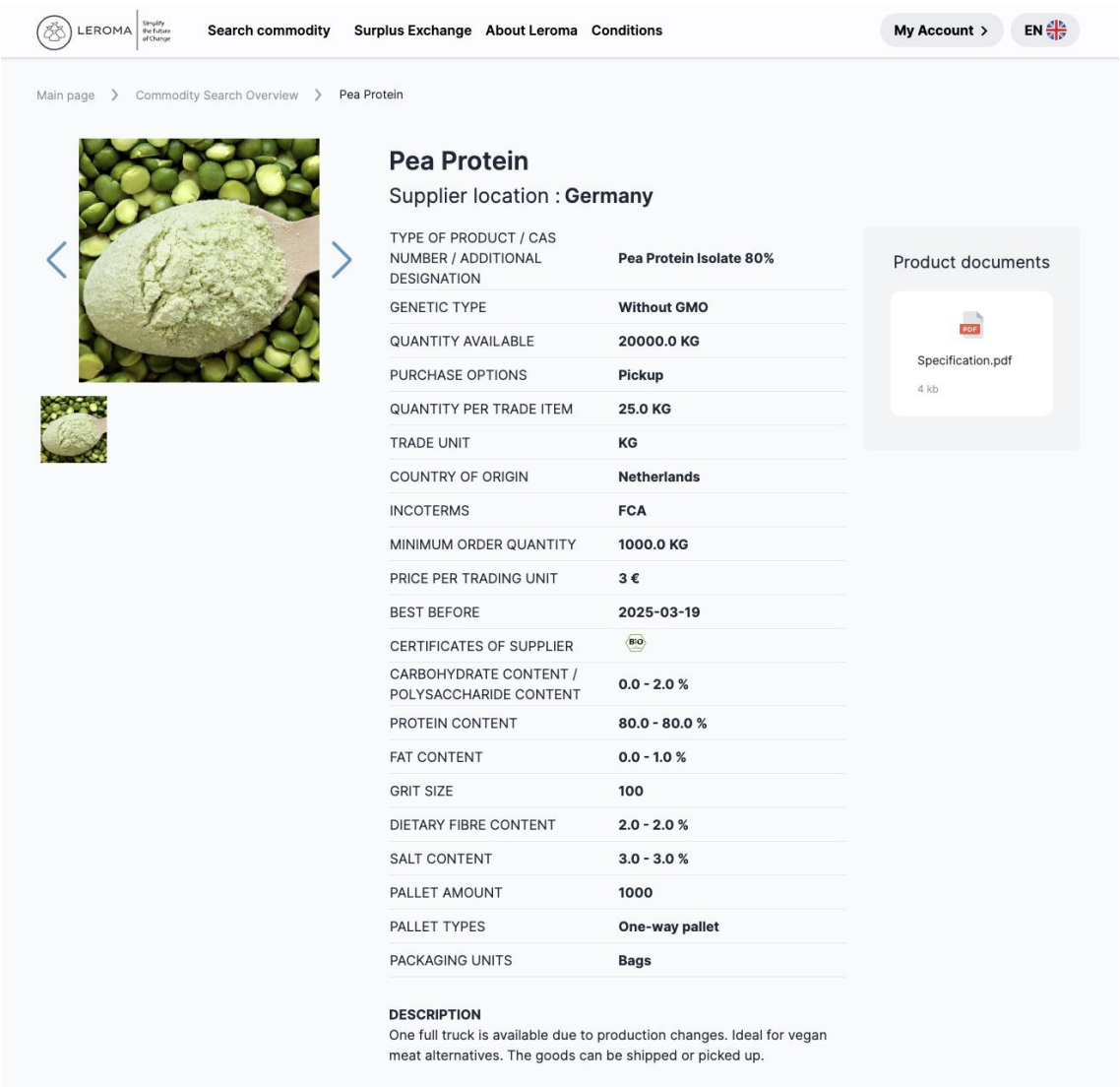

Figure 2: Exemplary upload (source: leroma.de)

A potential buyer who might be interested in receiving more information about this raw material can simply contact the supplier on the platform. Currently, the final process or the "Check-out-process", where payment is organized is not fully automated but is to be implemented in the future (probably after the end of the LOWINFOOD project). The final confirmation of details and closure of the deal is made with the help of Leroma's employees.

Opportunities of Leroma

In the dynamic and often unpredictable food industry, companies regularly face a range of unforeseen challenges. These can include sudden changes in contracts, the bankruptcy of a customer, damage to goods during transport, and discrepancies between analysis values

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and customer guidelines. Such spontaneous issues underscore a significant gap in the industry's infrastructure, as there is typically no existing system within companies to efficiently address these problems.

Leroma emerges as a response to this gap, providing a platform for surplus exchange that aims to mitigate these challenges. The service facilitates the connection between companies with surplus goods and potential buyers, offering a solution that is both practical and applicable across a wide range of scenarios. Through Leroma, various functional raw materials, such as thickening and preservative agents, have been successfully mediated to customers in several European countries, including Poland, Latvia, France, Italy, Spain, the Netherlands, and Germany. An example of a recent transaction of surplus food is shown in the box below.

Exemplary transaction: carrageenan

In December 2023, Leroma attended the FI Europe (Food Ingredients Europe), a widely known trade fair in Frankfurt, that is an important event for each food company. At the FI, Leroma met a German chemical dealer who was very interested in the surplus exchange and said that he also had food surpluses in stock. More specifically, it was about a raw material called carrageenan, which is obtained from algae and is used in foods as a functional raw material because it has good structuring and thickening properties. At the time there were 6,000kg in storage that still had a long shelf life. A customer who originally wanted to buy this product dropped out, leaving the retailer stuck with the goods.

Carrageenan is a raw material used in many industries and so can be widely applied. Leroma received all the information and started the search for possible buyers. Such a search typically looks like this: on the one hand, Leroma employees actively search for end buyers in their network, i.e. companies that process the goods themselves. On the other hand, Leroma is also looking for traders who offer an additional network of buyers and thus increase the chance of additional customers.

Furthermore, the Surplus Exchange is used as another means. Leroma's customer had advertised the product so that it was visible to a large number of potential buyers. Ultimately, Leroma found a buyer in Poland who could still use the carrageenan himself and was willing to buy the entire quantity.

At this point, a price was agreed upon, with Leroma acting as mediator. The seller's asking price was communicated to the customer by Leroma, whereupon the customer submitted his counteroffer. After a quick agreement, Leroma bought the raw material in order to then resell it to the end customer with a small margin. After everything contractually agreed, the buyer picked up the goods from the seller by commissioning a shipping company.

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A notable issue in the industry is the absence of a dedicated network for companies to efficiently find buyers for their surplus products. The process of locating potential buyers is often time-consuming and not prioritized by companies. In fact, a large majority of companies does not have an employee dedicated solely to managing surpluses. This task is frequently handled by working students, interns, or the sales department when they can spare the time. Leroma's surplus exchange addresses this challenge by offering a solution that saves time, recognizing that for many companies, the speed of finding a buyer can be as important as the transaction price.

Global events have also highlighted the value of surplus usage. For example, the blocking of the Suez Canal led to delays in shipments from China, prompting companies to seek alternatives. European products, a usually less attractive option due to higher prices and higher labour costs had to be looked to in these times. In this context, surplus goods offered a cost-effective alternative to meet immediate needs without having to pay expensive European prices.

In essence, Leroma provides a novel approach to addressing the inherent unpredictability of the food industry, facilitating a more efficient and potentially sustainable management of surplus goods. However, the journey highlights both the platform's successes and the ongoing challenges in fully integrating the surplus exchange into the industry's practices.

Target groups of Leroma

Leroma aims at providing a sustainable network in the first steps of the food value chain, meaning farmers, fishermen, raw material suppliers and food producers. All of these parties can benefit from the surplus exchange by selling and/or buying leftover raw materials to and from other companies. Figure 3 shows schematically some exchange options.

Figure 3: Schematic representation of different exploitation options for different target groups (source: leroma.de)

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As for surplus buyers, it is noteworthy that Leroma can work in a cross-industry fashion. More precisely, if a food raw material is not fit for human consumption anymore due to an expired best-before-date, for example, it might still be usable in a technical industry. A great example is soy protein texturate. This raw material gives structure to vegan meat alternatives, such as vegan burger patties, vegan minced meat, etc. Due to its good water absorption abilities, Leroma managed to find a buyer in the building industry who could use it in a concrete mix. This and more examples of connecting supply and demand of surplus can be seen in this video by the German TV show "Galileo": https://www.youtube.com/watch?v=T0a3JjzjbfY&ab_channel=Galileo

Additionally to this example, Leroma and its general idea are introduced to the audience. According to a Polish client of Leroma, the report was not only shown on German TV but also on the Polish version of Galileo.

Aim of the demonstration of Leroma within LOWINFOOD

In the LOWINFOOD project, Leroma is tested in two work packages that address food loss and waste (FLW) in the fruit and vegetable (F&V) sector and the fish sector. In addition to the process-related goal of further developing and improving the technical basis as well as functions and design of the platform, the aim is to attract business partners from fresh food supply chains, to expand the platform with fresh surplus products and to find out whether and to what extent Leroma can contribute to a reduction in FLW in fresh food supply chains (in this work package: in the F&V value chain). In this context, the original approach was to assess the environmental, social, and economic effects as well as the user-friendliness and utility of the platform for the F&V sector through the administration of a survey to test-users.

Original approach

Customer acquisition at Leroma (as a necessary condition for obtaining questionnaire-based data from test users) works in such a way that the producers and purchasers from various industries (vegetable processing, packaging, cosmetics industry) are reached by target group specific marketing activities (personal calls, presentations on fairs, etc.). They register on the platform and market the products they wish to sell, which then can easily be found by purchasers. Data concerning the functionality and the efficacy of the platform is gathered by administering a survey to users. This survey is either automatically integrated into the buying process or completed by telephone interviews with purchasing staff.

To get users from the F&V sector to participate, the same approach was followed. However, this turned out to be very difficult, as shown in chapter 2.

For the purpose to assess the environmental, social and economic effects as well as the user-friendliness and utility of the platform for the F&V sector through the administration of a survey to test-users, several questionnaires have been created, for example for

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- Users (buyers and sellers) from the fruit and vegetable sector when registering
- selected buyers from the fruit and vegetable sector at the beginning of the case study (to determine the status quo ante)
- selected sellers from the fruit and vegetable sector at the beginning of the case study (to determine the status quo ante)
- one detailed questionnaire for selected sellers and one for selected buyers (for covering parameters for the evaluation of environmental, social and economic effects as well as user-friendliness and usability)

Adaption: Merging questionnaires

When it became apparent that it would be difficult to attract test users from the F&V sector and to convince potential users from the F&V sector to fill out questionnaires, some questionnaires that had originally been created separately were merged in order to reduce the burden on potential respondents and increase the chance that someone would fill them out. However, no companies could be recruited to fill out the merged questionnaires. Therefore, further simplification was attempted.

Single question after every transaction

In order to obtain at least rudimentary quantitative data, the strategy was that after each transaction of F&V products, sellers should be asked a single question: "What would you have done with the products if you had not sold them on Leroma?". This counterfactual question was intended to fundamentally determine whether Leroma can actually contribute to reducing and avoiding FLW in the F&V sector (or perhaps simply leads to shifts in sales channels and distribution channels). Unfortunately, due to a lack of transactions of F&V products, no further data could be collected in this way. (Incidentally, the same adjustments were also made in WP4, where Leroma was supposed to be tested in the fish sector, but exactly the same difficulties arose there.)

For this reason, the decision was to collect additional qualitative data.

Adaption: Additional qualitative data collection

The difficult situation in attracting users from the fruit and vegetable sector was intended to be compensated to a certain extent by conducting interviews with experts in the field of fruit and vegetable value chains. This approach should at least collect some qualitative data on the FLW problem in this sector and assessments of the possibilities and limitations of an innovation like Leroma in this context. At the end an interview with a scientist from a German research institute could be carried out, the conclusions of which are presented in chapter 2 (last subchapter *"Adaptations made to the original approach of testing Leroma in LOWINFOOD")*. The scientist is a recognized expert, particularly in the field of horticulture, and carried out a

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research project ("REFOWAS"[2]) on FLW in the F&V sector a few years ago. Further interviews, including with actors from practice along the value chain, with whom we could have explored further perspectives, could not be conducted due to a lack of interest from potential interviewees.

Overview over Public Relations Work

Leroma has put in a lot of work to spread the word and make the platform more popular in the food industry. Here is a list of PR activities:

Presence on TV:

- Leroma managed to get a spot on one of Germany's well-known TV shows called "Galileo" by the network "ProSieben" (https://www.youtube.com/watch?v=T0a3JjzjbfY&t=30s). The show has large national popularity which has already led to more recognition of the platform.

Presence in audio media:

- Leroma was invited to take part in a podcast in October 2023 about the company in general and details about the platform and business model. The podcast was hosted by the Cologne-based start-up "foodforecast" and can be found under this link: https://open.spotify.com/episode/1HXRiepfYS4xfpKXfu4t6v?si=cc5e9ec239884db6

Presence in text-based media:

- Leroma has continued to put in PR work and got published in more articles, online and offline:
- "Reducing disruption as food waste solutions", Food Management Today, 2022, online as print on the Leroma website
- "LEROMA: Verwerten statt verschwenden", Starting Up, 2022, https://www.starting-up.de/geschaeftsideen/gruenderstorys/leroma-verwerten-statt-verschwenden.html#:~:text=Marina%20Billinger%2C%20die%20Gr%C3%BCnderin%20von,reduzieren%20und%20den%20Rohstoffbeschaffungsprozess%20optimieren.&text=Laut%20Sch%C3%A4tzungen%20der%20Weltgesundheitsorganisation%20(WHO,6%20Milliarden%20Tonnen%20Lebensmittel%20entsorgt.
- „Lebensmittelverschwendung: „Überschussbörse" auch für Seafood", Fischmagazin, 2022, online as print on the Leroma website
- „LEROMA opens doors for ingredients suppliers and buyers", Food engineering & ingredients, 2022, https://fei-online.com/leroma-opens-doors-for-ingredients-suppliers-and-buyers/
- "Leroma offeriert Xanthan-Ersatz", Sweets Processing, 2022, https://www.sweets-processing.com/de/news/20221027-leroma-offeriert-xanthan-ersatz-
- "New additive as an alternative to scarce xanthan gum", innovations in food technology, 2022, https://innovationsfood.com/wp-content/uploads/2022/11/FOT1122SMA.pdf

[2] Funded by the German Ministry of Education and Research as part of the FONA funding scheme, https://refowas.de

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- "Was mit überschüssigen Lebensmitteln passiert", RP Online, 2022, https://rp-online.de/nrw/staedte/duesseldorf/plattform-aus-duesseldorf-was-mit-ueberschuessigen-lebensmitteln-passiert_aid-77920277
- „Leroma launches Xanthan replacer", innovations in food technology, 2022, https://innovationsfood.com/leroma-launches-xanthan-replacer/
- "Ökonomische und ökologische Schäden mit Hilfe von LEROMA vermeiden", Deutsche Molkerei Zeitung, 2022, online as print on the Leroma website
- „Fresh Ideas from Düsseldorf #05", Vivid Magazin, 2023, https://www.vivid-magazin.de/story/de/fresh-ideas-from-duesseldorf-05-de
- "LEROMA und UpRePP suchen zuckerhaltige Rest- und Nebenströme aus NRW", Bioökonomie Revier, 2023, https://www.biooekonomierevier.de/index.php?index=2070
- „The new product at the LEROMA platform: Modified tapioca starch", innovations in food technology, 2023, https://innovationsfood.com/the-new-product-at-the-leroma-platform-modified-tapioca-starch/
- "Verwerten statt verschwenden", Besseres Obst, 2023, https://www.besseres-obst.at/fachartikel/verarbeitung/2023/verwerten-statt-verschwenden.html

Social Media activities:

- Leroma has been working steadily to improve online visibility through multiple channels. For example, Leroma's LinkedIn account has gained more than 3.000 followers who receive regular content and are kept up to date with all major news and achievements. LinkedIn proves to be an effective tool for growing an active customer network.

Participation in events (e.g. fairs)

- In September 2023, Leroma took part in a trade fair called "Ideenfutter", organised by the food hub NRW, where Leroma hosted a round table discussion with stakeholders along the value chain. The focus lied on finding out what each link in the value chain requires to act as sustainably as possible.
- Leroma took part in the ANUGA trade fair in Cologne in October 2023 where the platform and specifically the surplus exchange was advertised among food producers internationally.

Awards:

- On October 23rd, 2023 Leroma won second place at a big regional start-up competition called "MUT – Der Gründungspreis NRW. It got a lot of media attention and was mentioned in a German TV report.

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2. Outcomes of the demonstration phase

In this chapter we describe how the platform was technically improved and further developed during the test phase of Leroma in the project, what possibilities of Leroma became apparent, what measures were taken to attract users from the F&V sector, what challenges were encountered in implementing Leroma in the F&V sector and what adjustments were made to the original approach for testing Leroma in LOWINFOOD.

Technical Improvement of Leroma

An important result of Leroma's test phase is the constant further development of the platform.

Improvement of the design

The first step in further development was an improvement of the design. For example, the drop-down menu has been improved for a better overview. Overall, work was done on a simpler and cleaner overview. In addition, a cleaner design of the upload/product area was developed, as shown in Figure 4 and Figure 5.

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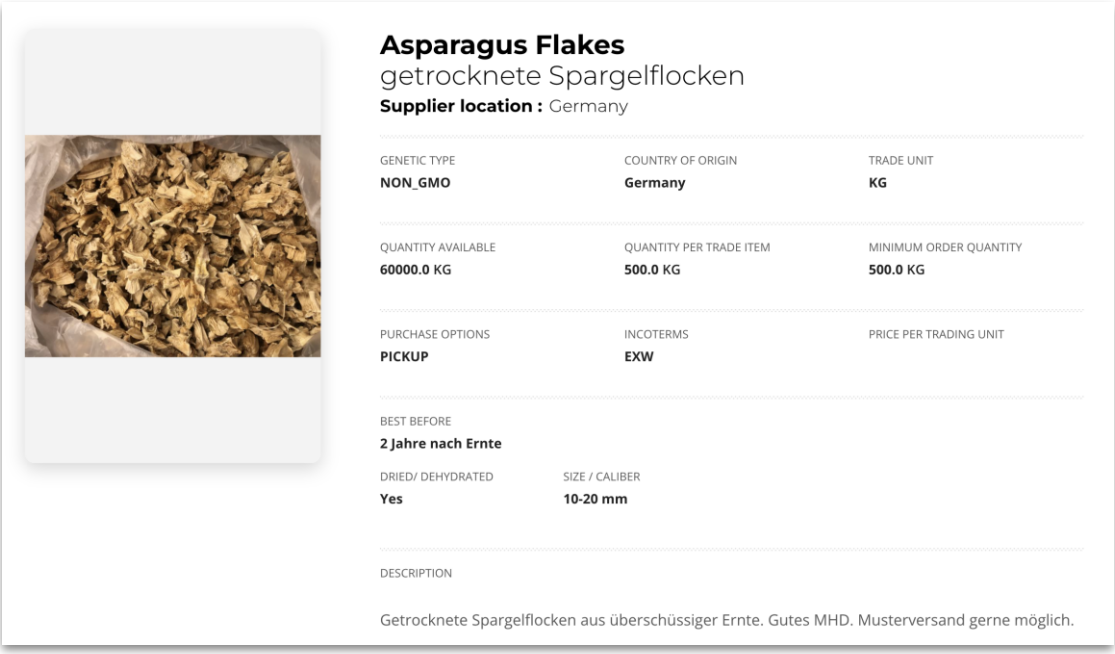

Figure 4: Before: Upload area in old design (source: leroma.de)

Figure 5: After: Upload area in new design (source: leroma.de)

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Creation of custom landing pages

In addition to the improved design, further technical improvements were implemented. For example, Leroma, as the operator of the homepage, now has the possibility to create custom landing pages . This was also used for charity purposes, for example for a campaign in which donations could be made to maintain the food supply in Ukraine after the Russian attack.

Creation of a valorization forum for surplus buyers and sellers

In the area of surplus exchange, the opportunity was created to communicate directly with a large community (primary producers, procurement side of food producers, potential buyers) about surplus products and food waste. This was implemented in the form of a forum ("Valorisierungsforum" means "valorisation forum"), see Figure 6.

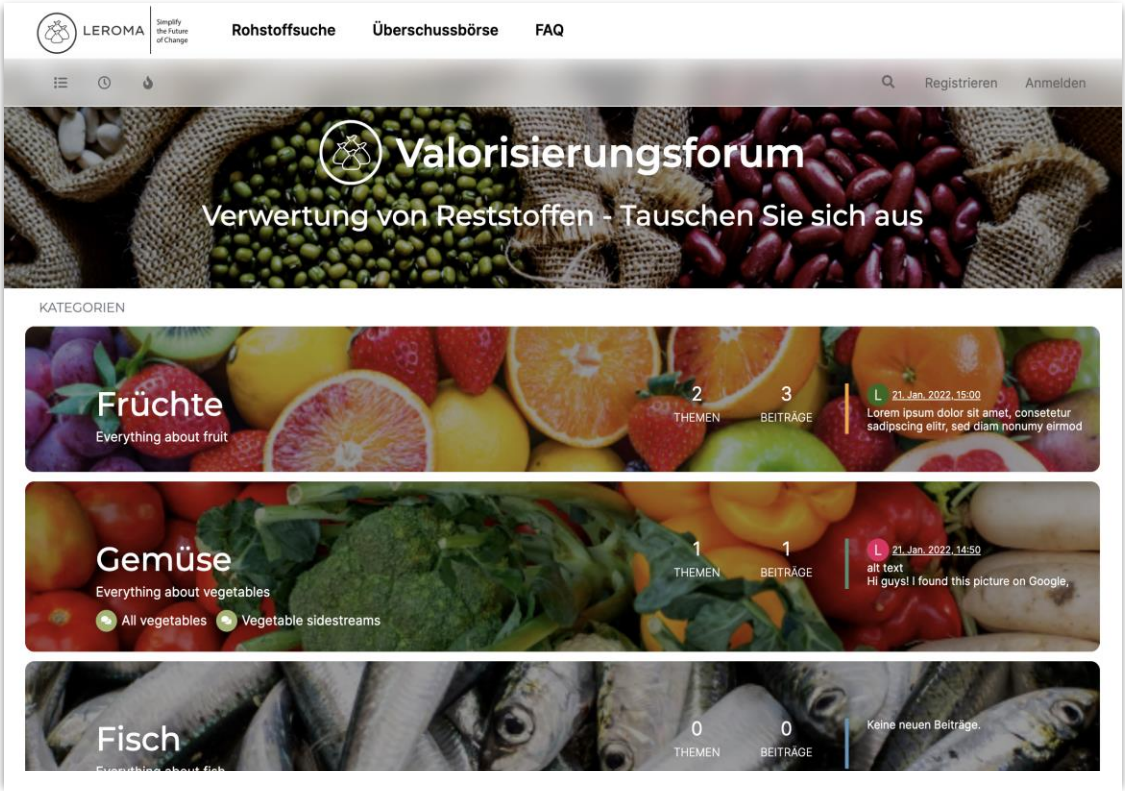

Figure 6: Valorisation forum (source: leroma.de)

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Figure 7 shows a fictional example of an entry in the valorisation forum.

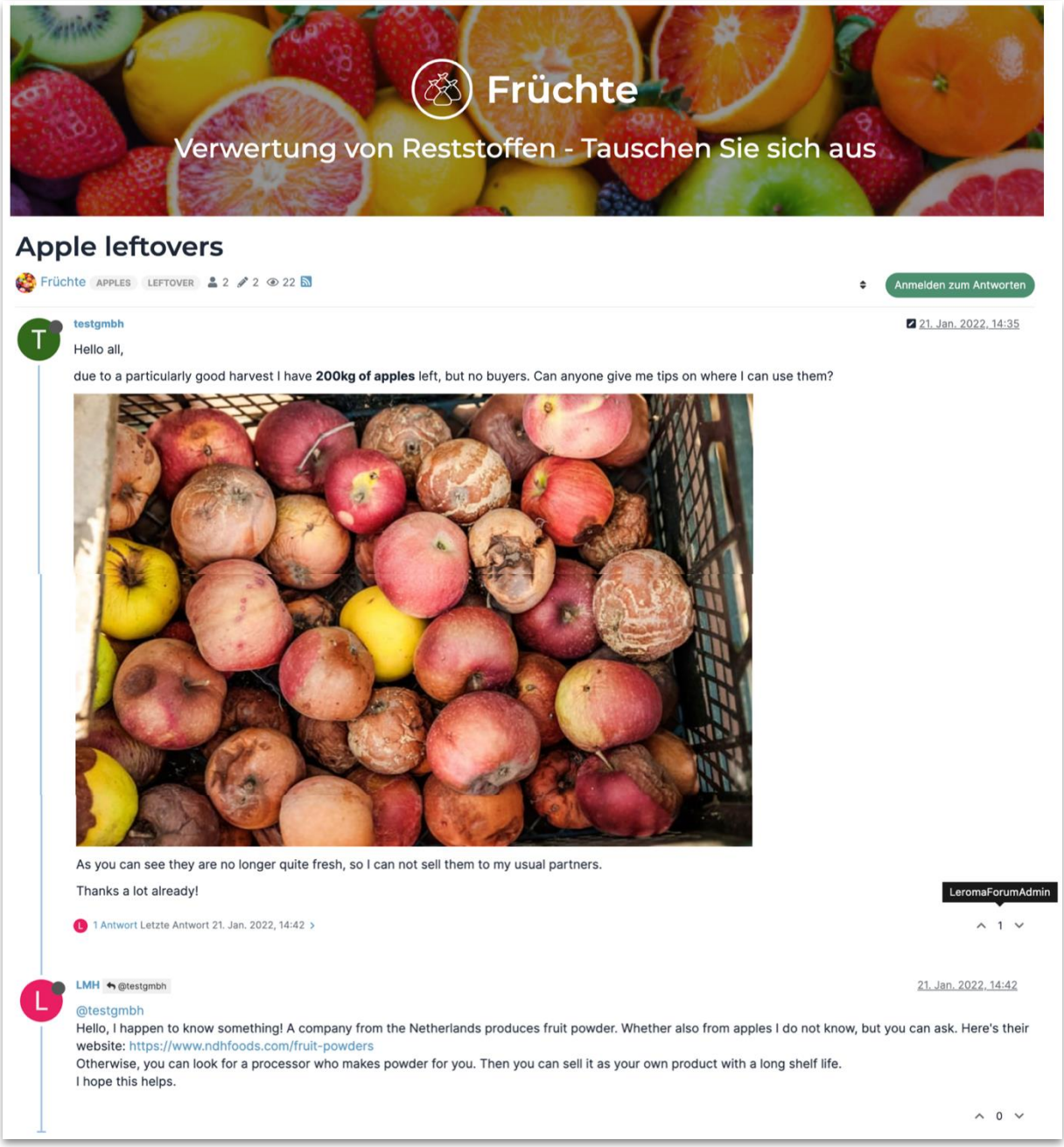

Figure 7: Fictional example of an entry in the valorisation forum on the topic of fruit (source: Leroma)

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Optimization of the account area

Furthermore, the account area, especially the overview of personal company information, has been optimized.

Integration of topic specific content

In addition, the technical requirements were created to integrate topic specific content. Figure 8 shows an example from the fish sector.

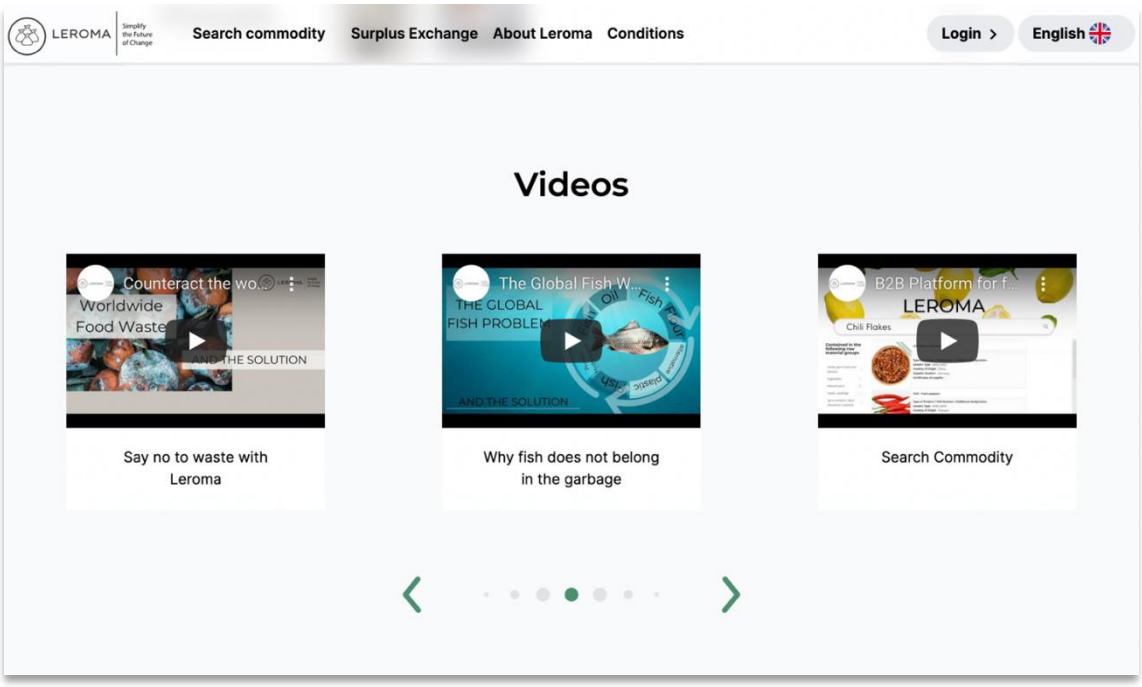

Figure 8: Topic specific content on the example of the fish sector (Source: Leroma.de)

Improvement of IT quality

Last but not least, the level of IT quality was significantly increased during the project period. This is particularly true in the last six months. Leroma noticed that, for example, the SEO (search engine optimization) performance had gone down. Thanks to a new employee who is an SEO expert, those problems could be mitigated. In addition to sales work, Leroma has put a lot of effort into IT development in the last few months to make the platform better. A major improvement has been achieved in the "backend", for example the workspace for Leroma employees, where all statistics and movements on the platform are visible. It is the source of valuable data that helps Leroma identify opportunities and problems at a glance. This data is necessary to see what activity there is on the platform and where there is still

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room for improvement. Here are the before and after comparisons of the backend area. Figure and Figure show a before and after comparison.

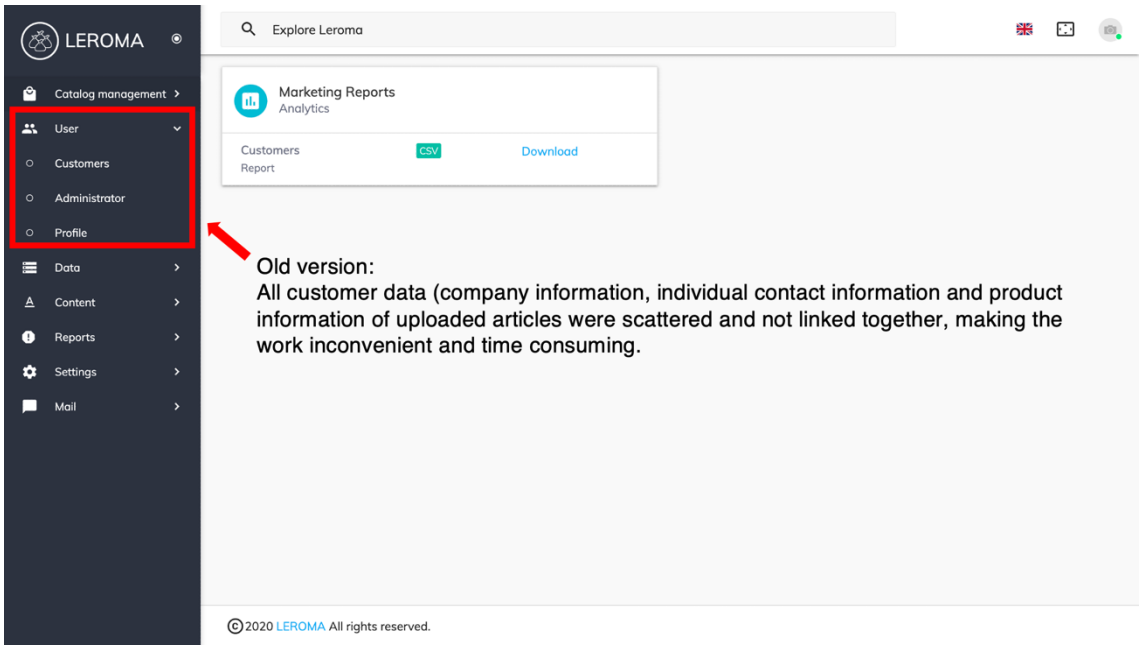

Figure 9: Before: Old backend version (source: Leroma)

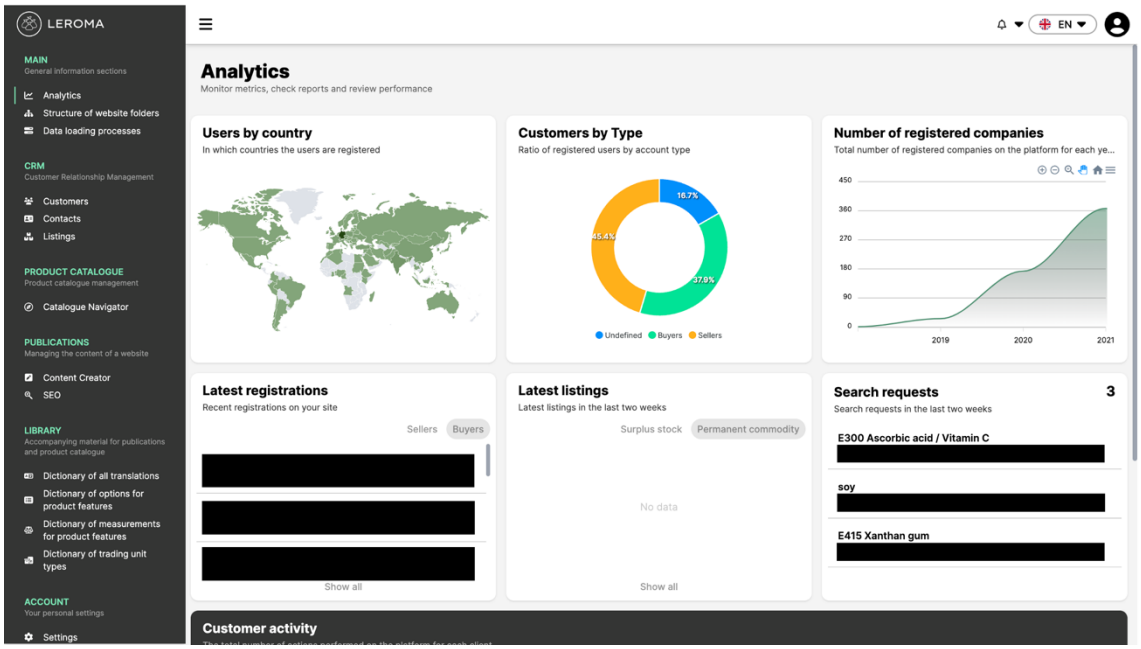

Figure 10: After: New backend version (source: Leroma)

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In addition, the customer account area and the upload process have been significantly improved. This development is constantly based on customer feedback, both critical and good. This feedback reaches Leroma in the form of emails or direct phone calls from customers and users. Since the feedback is mostly non-technical and given from the user's point of view, it has then to be translated into technical terms that the IT department can work with. The communication flow for this process is as follows: feedback (customer) -> sales department (fist contact point for customers) -> product owner (translation of non-technical customer feedback to technical terms and visualization of possible changes through mock-up designs) -> IT department (programming of changes into the framework of the platform).

Search Engine Optimization

Leroma has also hired a new employee who is an SEO expert (Search Engine Optimization). Good SEO (Search Engine Optimization) is crucial for a young internet-based company such as Leroma for several reasons:

1. Visibility and Brand Awareness: SEO helps increase a website's visibility on search engines like Google, Bing, and Yahoo. When potential customers search for products or services related to what the company offers, a well-optimized site is more likely to appear on the first page of search results. This increased visibility helps build brand awareness and credibility.

2. Cost-Effectiveness: Compared to paid advertising, SEO is a cost-effective marketing strategy in the long run. While paid ads can drive traffic to a website, the costs can be prohibitive for a startup or a young company. SEO, on the other hand, requires an upfront investment in content and site optimization but can lead to sustained organic traffic without the ongoing costs associated with pay-per-click (PPC) advertising.

3. User Experience: Good SEO practices improve the user experience. Search engines favor websites that are fast, mobile-friendly, and easy to navigate. By optimizing the site for SEO, companies inadvertently enhance the user experience, which can lead to higher conversion rates, increased customer satisfaction, and loyalty.

4. Competitive Advantage: In today's digital age, having a robust online presence is essential. By investing in SEO, young internet-based companies can gain a competitive edge over those that neglect their search engine rankings. Being visible in search results means that potential customers are more likely to find and engage with your business instead of your competitors.

5. Measurable Results: SEO provides measurable outcomes through tools like Google Analytics. Companies can track the performance of their SEO strategies by monitoring organic traffic, conversion rates, and search rankings. This data enables businesses to refine their strategies and allocate resources more effectively to areas that provide the best return on investment.

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6. Long-Term Strategy: While SEO takes time to yield results, it is a long-term strategy that can provide sustainable growth. Unlike paid advertising, which stops the moment you stop paying, SEO continues to drive traffic over time. By consistently creating high-quality content and optimizing the site, companies can build a solid foundation that supports long-term business growth.

7. Market Insights: SEO tools and analytics provide valuable insights into market trends and customer behaviour. Companies can use this information to understand what potential customers are searching for, the language they use, and how they engage with online content. These insights can inform product development, content strategy, and marketing initiatives.

In summary, for a young internet-based company, investing in good SEO is not just about improving search rankings; it's about establishing a strong online presence, engaging with potential customers, and laying the groundwork for sustainable growth and success in the digital marketplace.

Quantities of surplus food that were redistributed in the demonstration phase

Through numerous transactions, the surplus marketplace has saved over 1.000 tons of food from going to waste since the dawn of the surplus exchange in January 2021. Figure differentiates these numbers according to product groups.

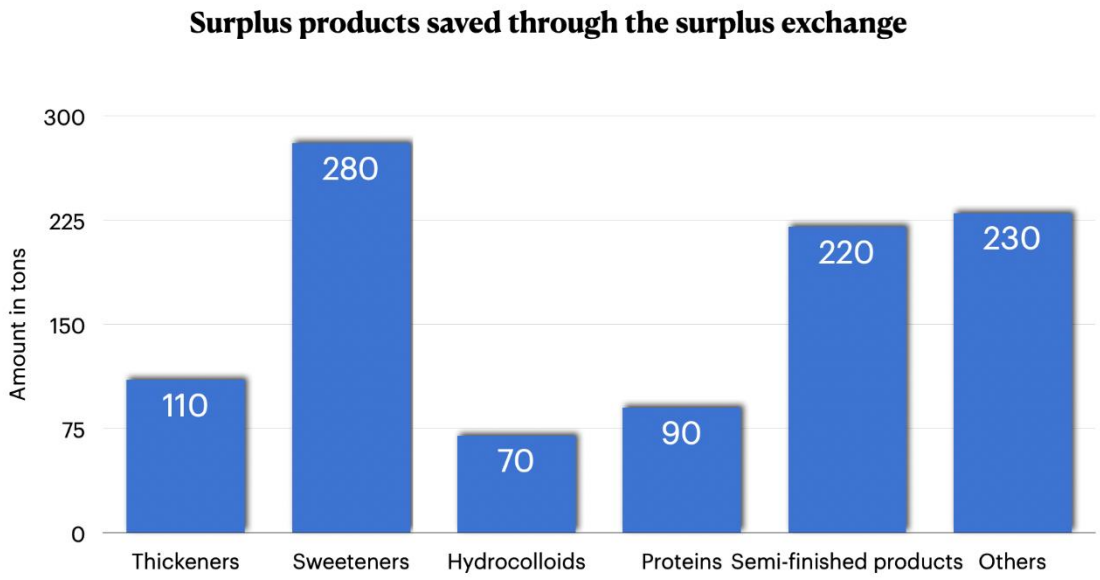

Figure 11: Amount of surplus products saved through the surplus exchange (source: Leroma)

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This underlines that Leroma works well and can make a significant contribution to mitigating the FLW problem. In a random snapshot in February 2024, 286 offers of surplus goods were listed, see Figure 12.

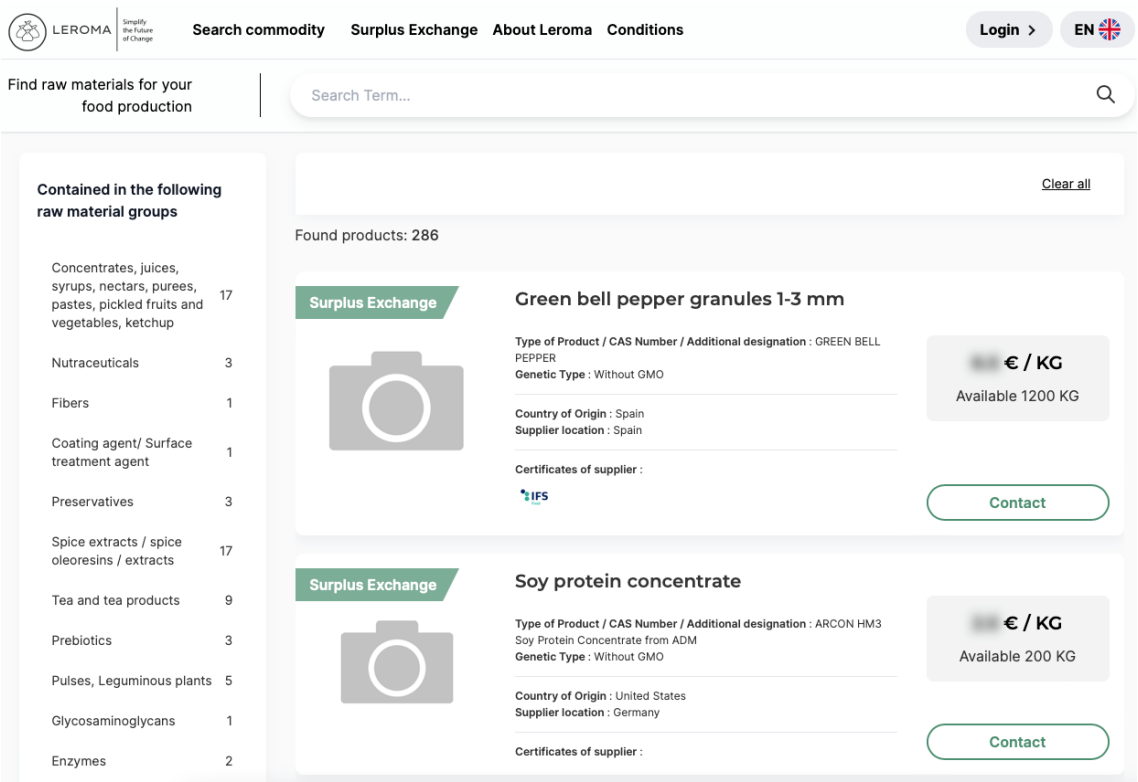

Figure 12: Snapshot of offered surplus goods in February 2024 (souce: leroma.de)

Of these 286 offers, at least 20 belonged to F&V, always in a shelf-stable and mostly in processed form such as powder, concentrates and granules, as shown in Figure 13.

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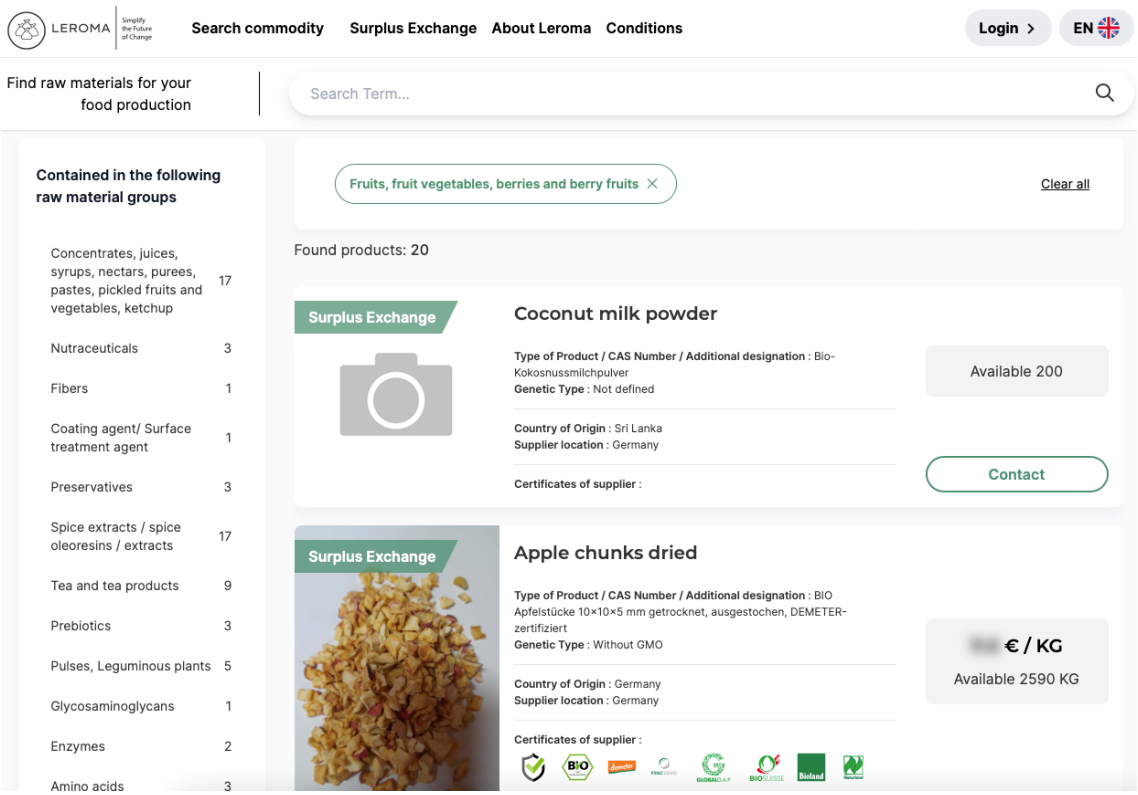

Figure 13: Snapshot of surplus F&V goods offered in February 2024 (souce: leroma.de)

In principle, it has been possible to also appeal to users from the F&V sector because of the activities within LOWINFOOD, even if no fresh products (which are the actual subject of the task) are being advertised.

Explore partnerships in the fresh F&V supply chain

Measures in general and concrete action

Looking at the fruit and vegetable sector specifically, quite some measures were undertaken to find new surplus buyers. The sales team routinely cold-called potential surplus buyers, such as raw material traders and food producers. Food producers ranged from jam producers to aroma and food colour manufacturers. Generally, the same results were encountered: there is a vast offer of surplus fruit and vegetables but little to no possibility to use or reuse them. It happened quite frequently that by asking if a company might be able to use surpluses, Leroma received more surpluses from that producer. This scheme reflects

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well the dynamics of the food industry. The supply of surpluses is very high, but the demand for them is still low in comparison. This may also be one of the reasons why many surpluses remained unsold, especially in the fruit and vegetable sector.

An additional measure to find more potential surplus buyers is to send out regular (weekly or every two weeks) newsletters containing a variety of different surpluses. The list of surpluses included all fruit and vegetable surpluses. That newsletter was being sent out mainly to Leroma's registered users and some manually selected companies.

As a concrete action, Leroma went to the "Fruchtwelt" trade fair in southern Germany and even had a small booth in the "Startup Area". The goal was to make new contacts who could help Leroma sell surpluses. The fair was mainly attended by regional farmers. It was difficult to start a conversation because none of the farmers had their own booth. The booths were mainly occupied by clubs, tool manufacturers for farmers and arborists. Some discussions with local farmers led to the well-known result, namely that there are some residues, but no sales opportunities.

An interesting contact that ultimately did not lead to any business was with a Dutch tree nursery. In total, this seller had 35,000 young cherry trees and 65,000 young apple trees as surplus. Leroma tried to sell these trees on a large scale by conducting targeted research and then sending concrete emails with offers. Unfortunately, the result was not satisfactory as no final buyer was found despite some interest.

Another current project involves an Indian mango farmer who has around 200 tons of frozen, cut mangoes in storage as surplus. This huge quantity is lying frozen in a large warehouse near Bangalore and is waiting for a new buyer with a best before date of 4 - 6 months. Although Leroma's geographical expertise lies more in the EU, the motivation to convey this quantity to a buyer is great. The challenge is to find a buyer in India or the surrounding area. Although there are contacts in the EU, the ecological footprint is significantly too high if these 200 tons have to be shipped to Europe. Even if a buyer were to be found within the EU, the redistribution is still questionable looking at the long transport distance that increase the environmental impact.

Leroma now uses multiple channels to locate contacts in India who could act as potential buyers. In order to find such buyers, experience has shown that it makes more sense to search on the Internet in the respective national language. The search results are significantly better and more extensive this way. Sometimes it takes a lot of time to find businesses and companies. Therefore, ChatGPT is also used, which can collect and sort current data from the Internet using add-ons. As always in such cases, as soon as a possible interested party has been contacted and Leroma receives a response, all necessary data such as images and the product specification are sent.

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Conclusion: Disfunctionalities in the surplus market and problematic behavior of market participants

Leroma has often reached a point where there was a seller and a potential buyer, but the deal ultimately fell through. This can be due to various reasons. In many cases, price is the deal breaker. Even though it is surplus goods, many sellers do not want to lower the price enough. This may be because the surplus market on a larger, regular scale is still young and companies do not yet have a feel for the right prices. In many cases, Leroma recommends reducing a certain percentage of the purchase price, depending on the expiry date. This approach initially deters many companies because the raw materials market, like every market, is one of profit maximization. But the surplus market is largely one of loss minimization. In addition to the costs that arise from unsold raw materials, there are also the recycling costs, which can be very expensive, especially for large quantities.

Ultimately, Leroma is trying to establish a new sense among surplus sellers for adjusted prices that buyers can work with and save large-scale remaining stock. Leroma's PR activities also contribute to this, all PR activities are listed in Chapter 1.

Recommendations for the implementation of Leroma in the F&V sector from an external expert

Conclusions from the statements regarding valorization opportunities and hurdles and the possible role of an innovation like Leroma in this context

Regarding the question to what extent Leroma could play a role in reducing FLW in the value chain for fruit and vegetables, the interviewee named two central starting points for reducing FLW in the value chain: private households, because that is where the highest losses occur, and the catering sector, because there are particularly large levers for change. Both approaches are not achievable due to Leroma's location (see Chapter 1 "What is Leroma?") in the value chain. Possible starting points that could be achievable for Leroma and challenges for the implementation of Leroma in the F&V valus chain will be briefly discussed below.

From the scientist's statements, four main challenges for the valorization of resources can be distilled: product-related, actor-related, regulation-related and economic.

The product-related challenges – for example that there are no sensible alternative valorization options for fresh lettuce – cannot be influenced by Leroma.

Actor-related challenges can consist in the fact that actors – in this case agriculture as a provider and the retail trade as a buyer – do not find each other at a certain point in time and therefore consumable products do not find their way to the consumer but are lost. At

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this point a possible starting point for Leroma is actually seen. To put it in perspective, however, it must be noted that there are already structures for valorization for certain products; a supra-regional B2B platform like Leroma does not seem absolutely necessary in this case, while the question can be asked for products for which there are no such structures why this is the case and whether it might be because there are too strong product-related or economic challenges. Possibly changed communication strategies aimed at emphasizing regionally sourced or "saved" foods during further processing could open up perspectives for new valorization paths.

In our case, the regulatory challenges are the quality requirements of the food retail sector. This aspect was cited as an important source for FLW. In principle, these requirements could be a starting point for Leroma, in which an attempt could be made to use rejected goods in other ways for the highest possible value. In view of Leroma's own assignment along the value chain (see chapter 1), the food retailer is already outside the scope of action, although in the case of rejected goods the product has not yet reached this value chain stage and could be negotiated again with primary producers. Whether further efforts on the part of Leroma to achieve cooperation at this point would actually be fruitful is a different question, since Leroma's successful market entry in the area of "dry" and processed raw materials and the previous failure in attempts to sell fresh and perishable goods such as transferring fruit and vegetables (or fish) suggests that Leroma is generally not well suited for fresh produce or is not well received by potential users in this area.

The economic challenge is always inherent in capitalistic systems and means that valorization options are generally not used if they are not economically worthwhile. A tool like Leroma has only a very limited influence on this, as the brokerage platform can only reduce transaction costs, but otherwise has no significant influence on pricing, which is based on supply and demand. If valorization options are not accepted for economic reasons, the discussion about whether they could work in principle is pointless. This would ultimately be the same conclusion that several interviewees drew in the fish value chain as part of the stakeholder dialogue in WP4.

In summary, it can be said that Leroma's successful market entry in the fruit and vegetable sector is in principle conceivable, but few concrete prospects are seen.

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3. Outlook

Leroma is in a constant process of further development, which will continue in the future. Some upcoming development steps have already been mentioned in the text: Regarding the sourcing of commodities, further functions such as analysis tools will be introduced to make sourcing even more efficient. For the use of the search engine for commodities, different paid packages are being developed; this opens up additional sources of income for Leroma and enables additional functions for users. Regarding the surplus exchange, the final process or the "Check-out-process", where payment is organized, an automation is to be implemented in the future.

4. Conclusion

Leroma is an innovative platform that has demonstrated through numerous transactions of raw materials, including a lot of surplus goods, that it is able to make a significant contribution to the reduction of FLW in various value chains. Unfortunately, this proof could not be provided specifically for F&V products as part of the LOWINFOOD project, as not enough interested parties were found in this sector and no (potential) users agreed to fill out questionnaires. Despite its successes, Leroma faces challenges in mediating perishable goods such as fruits, vegetables, fish, and meat. The platform was more successful with non-perishable items that have longer shelf lives, like powders. Finding buyers for perishable surpluses has proven difficult, as these items require spontaneous purchasing decisions that do not easily fit into the planned production processes of most companies. Through a qualitative interview, some basic information about opportunities and obstacles for the use of Leroma in the F&V value chain was collected: In principle, a successful use of Leroma in this sector seems conceivable, but there are some product-related (especially the perishability of the products), actor-related (alternative valorization structures), regulation-related (quality requirements) and economic (selling through Leroma is not financially worthwhile) F&V sector-specific challenges that stand in the way of implementation, which is why specific implementation prospects are currently not foreseeable.

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