CRM efficient PaaS demonstrator 3

Introduction

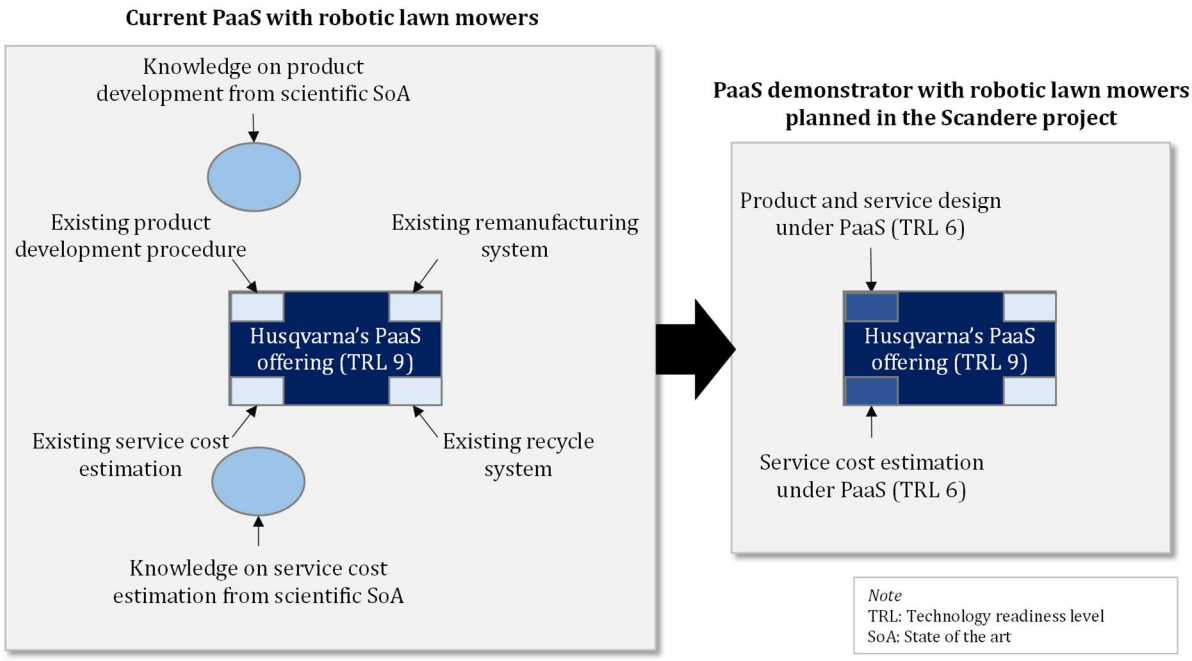
This document represents Deliverable 1.3 CRM efficient PaaS demonstrator 3 of the Scandere project with a robotic lawn mower. The objective has been to improve a PaaS with robotic lawn mowers up to TRL 6, including remanufacturing. LiU via Mistra REES research program (**MRR**), as a Scandere supporting organization, communicated with a PaaS (product-as-a-service) provider with robotic lawn mowers and collected relevant information of PaaS businesses with robotic lawn mowers.

Overview of current business

LiU developed a description by analysing a current PaaS with robotic lawn mowers in European markets using publicly available information, as shown in the attachment. The description is an abstracted version of the description of a PaaS offering with robotic lawn mowers by Husqvarna https://www.husqvarna.com/se/tjanster/husqvarna-care/ .

Improvement opportunities for demonstration

The TRL for Husqvarna's PaaS is TRL 9 today, as the PaaS is already offered to end users on the markets. The TRL 9 is, however, given to the whole offering, while several parts for the offering have improvement opportunities. After analysing potentials for the PaaS demonstration, focusing on CRMs with the lifecycle perspective, several improvement areas have been found. Among others, product development procedure and service cost estimation of PaaS providers could be significantly improved; see a figure below. To realize the improvement, scientific research is needed; the Scandere project targeted TRL 6 at the closure. This mixture of TRL levels in one offering at a point in time is often observed for PaaS offerings, because a PaaS offering includes inter-dependent products, services and systems to be orchestrated. Note that the improvement of a part of an offering will directly mean an increased profit because it is internal efficiency not affecting the PaaS revenue, and hence PaaS providers have a high motivation to implement the improvement. Other areas of improvement are leaner remanufacturing and optimized recycling.



Concepts for demonstration

The Scandere project as a whole worked on various areas pointed out above but aimed to demonstrate the TRL6 achievement with the PaaS case robotic lawn mower demonstrator focusing on the cost aspect. The insights in this deliverable are not specific to any product data but in common to various product types for PaaS.

Implication

In the paper, Vogt Duberg and Sakao (2024) as a deliverable in the Scandere project, a developed financial assessment model is outlined to support the transformation of original equipment manufacturers (OEMs) to PaaS business models. This model is directly applicable to the life cycle costing (LCC) assessment of the robotic lawn mower, providing insights into the profitability and feasibility of the transformation. The paper focuses on two different perspectives, the provider (OEM) and user (customer). When transforming from traditional one-off sales towards PaaS, there is a shift of cost burden from the user to the provider, and vice versa, meaning that the value of the business model setup also shifts. Therefore, it is important to include both perspectives in assessments.

For the provider, transforming from traditional sales towards PaaS changes the financial dynamics. Under a PaaS, the provider retains the ownership of the robotic lawn mower throughout its life cycle. This means that the provider not only incurs the initial manufacturing costs but is also responsible for all costs associated with the product's maintenance, repair, refurbishment, and remanufacturing operations. The LCC is valuable in this context, as it enables the provider to assess the new cost structure and relationship to make informed decisions whether to implement a certain PaaS setup or modify it further. By retaining the ownership of products through PaaS, the robotic lawn mower provider gains greater control over the product's life cycle and can extend its usable life through remanufacturing and refurbishment processes. In the traditional one-off sales, the provider had no access to the product after end-of-use, and therefore no possibility to retain the value of older products on the market; products that were unattractive for the user but still were of sufficient condition for restoration. Since these end-of-use treatments were shown as more environmentally friendly than manufacturing new robotic lawn mowers (Anehagen, 2021), extending the product life cycle with additional cycles enabled by PaaS also reduced the environmental impact of robotic lawn mower as a product offering. With support of the model presented in Vogt Duberg and Sakao (2024), the robotic lawn mower provider was able to estimate the remanufacturing and refurbishment costs using historical data on repair and maintenance, as well as assess the financial performance of PaaS with a bottom-up-based LCC approach.

For the user, one of the main concerns is the total cost of ownership (TCO). In a traditional one-off sales product offering, the user would bear the cost of purchasing the robotic lawn mower outright, as well as covering the expenses related to the product usage, for example, maintenance and repairs. However, under PaaS, these responsibilities were shifted to the provider. The user avoids significant upfront costs and can benefit from predictable regular payments over the use phase. The TCO is primarily based on the PaaS fee in this setting (i.e., the regular payments), meaning that the attractiveness of the offering is partly dependent on its value. If the provider can reduce the product life cycle costs, it implies that a lower PaaS fee can be offered to its customers which could trigger higher level of engagement. The calculation model showed that this relationship between the provider and user is critical to get right, otherwise, at least from a cost perspective, the user can view the PaaS as less financially attractive than traditional one-off sales, causing poor profitability of PaaS and prevents its environmental benefits. This relationship is depicted in Figure 1.

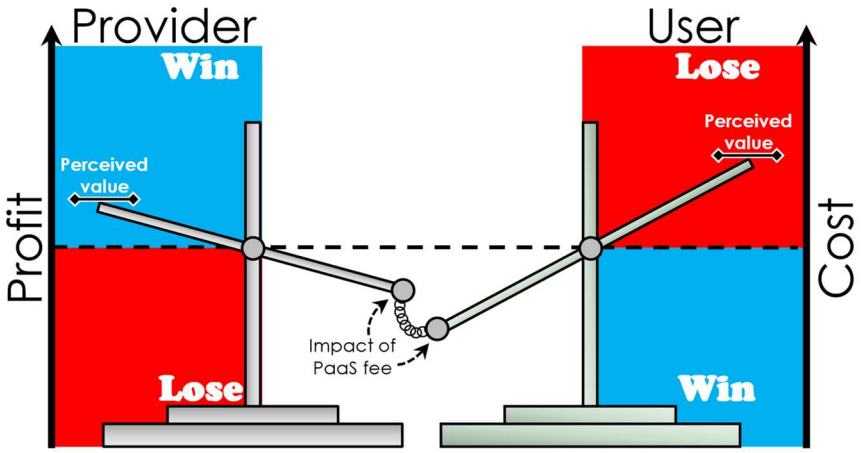


Figure 1. The libra of PaaS for achieving a win-win state. The weight of the PaaS fee shifts the balance relative to the perceived value for both provider and user, moving the perceived value into either the win or lose area. The provider can always increase the PaaS fee to cover costs, but this triggers a linked counterreaction in the user's perceived value. A balance is necessary to achieve a win-win state from both perspectives, meaning the provider must minimise its costs to offer a product under a PaaS fee that is reasonable for the user.

To create the systems and life cycle perspective needed to assess the financial performance of PaaS, the following parameters (costs) were included in the assessment: all types of transport (reverse: including core acquisition, repairs, etc., and forward: including manufacturing and sales), spare parts for non-remanufacturable parts, salaries for workers, inspection equipment and auxiliaries such as heating and lighting, rent and other facility-related aspects, remanufacturing, maintenance, repair, employee training, administration of PaaS contracts, interest rates to financial institutions, recycling, and inventory holding (related to spare parts, cores, remanufactured/refurbished products, products under repair, etc.). For the assessment of the robotic lawn mower, all costs that were shifted to the provider, and costs not included in the traditional one-off sales business model, were crucial. The most influential parameters in PaaS compared to the traditional one-off sales model were the administrative costs of managing PaaS contracts, as well as end-of-use treatments, as these were not part of the previous product offering. Maintenance and repair costs are critical as well, though less so, as they also appear in the one-off sales business model. In one-off sales, these costs are directly incurred by the user's choices.

Attachment

- Description of conceptualizing a PaaS with robotic lawn mowers

Acknowledgement

The SCANDERE (Scaling up a circular economy business model by new design, leaner remanufacturing, and automated material recycling technologies) project has been granted from the ERA-MIN3 program under the grant number 101003575.

Author team

Tomohiko Sakao tomohiko.sakao@liu.se , Linköping University, Tel: +46-73 620 9472. Corresponding author.
Johan Vogt Duberg johan.vogt.duberg@liu.se
Project communicator, Theresa Apelqvist theresa.apelqvist@liu.se

References

Anehagen, M., 2021. Cutting emissions with remanufacturing: A comparative life cycle assessment of Husqvarna's manufactured and remanufactured robotic lawn mowers (Master's thesis). Lund University, Lund, Sweden.

Vogt Duberg, J., Sakao, T., 2024. Supporting the Transformation to Access-Based Business Models in a Circular Economy with a Practical Model for Calculating the Costs of the Provider, in: Advances in Transdisciplinary Engineering. Volume 52: Sustainable Production through Advanced Manufacturing, Intelligent Automation and Work Integrated Learning, Advances in Transdisciplinary Engineering. IOS Press, Trollhättan, Sweden, pp. 532–542. https://doi.org/10.3233/ATDE240195

The Business Model Canvas

Designed for:

Designed by: JVD

Date: 2022-08-11

Version: 2.1

Key Partners

Who are our Key Partners?
Who are our key suppliers?
Which Key Resources are we acquairing from partners?
Which Key Activities do partners perform?

MOTIVATIONS FOR PARTNERSHIPS
Optimization and economy
Reduction of risk and uncertainty
Acquisition of particular resources and activities

Retailers
- Sells products
- Perform service and repair
- Marketing
- Provides product support
- Communicates with product users
- Possess key product knowledge

Suppliers
- Providers of components and spare parts

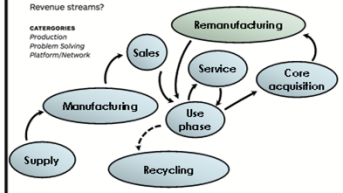
Financial body
- To secure cash flow if leasing

Remanufacturer
- Retailers if multiple decentralised remanufacturing facilities
- Inhouse at the OEM

Key Activities

What Key Activities do our Value Propositions require?
Our Distribution Channels?
Customer Relationships?
Revenue streams?

CATERGORIES
Production
Problem Solving
Platform/Network



- Leasing or incentives for core acquisition
- Various types of setup. E.g., decentralised or centralised remanufacturing

Key Resources

What Key Resources do our Value Propositions require?
Our Distribution Channels? Customer Relationships?
Revenue Streams?

TYPES OF RESOURCES
Physical
Intellectual (brand patents, copyrights, data)
Human
Financial

- Reliable inflow of remanufacturable cores
- Remanufacturing sites
- Leasing management system

Value Propositions

What value do we deliver to the customer?
Which one of our customer's problems are we helping to solve?
What bundles of products and services are we offering to each Customer Segment?
Which customer needs are we satisfying?

CHARACTERISTICS
Newness
Performance
Customization
"Getting the Job Done"
Design
Brand/Status
Price
Cost Reduction
Risk Reduction
Accessibility
Convenience/Usability

- Cheaper products (reman)

OR

- Environmentally benign products (reman)

OR

- Trouble-free ownership (leasing)
  - "A green lawn"p.22 https://www.husqvarnagroup.com/sites/default/files/2022-05/Sustainovate_report_2021_220330_highres.pdf
  - Product features always available
  - Broken products replaced
  - Picked up for winter storage and service

https://www.husqvarna.com/uk/services/husqvarna-care/

Customer Relationships

What type of relationship does each of our Customer Segments expect us to establish and maintain with them?
Which ones have we established?
How are they integrated with the rest of our business model?
How costly are they?

EXAMPLES
Personal assistance
Dedicated Personal Assistance
Self-Service
Automated Services
Communities
Co-creation

Maintaining sales and acquisition channels to product owners through retailers

Channels

Through which Channels do our Customer Segments want to be reached?
How are we reaching them now?
How are our Channels integrated?
Which ones work best?
Which ones are most cost-efficient?
How are we integrating them with customer routines?

CHANNEL PHASES
1. Awareness
How do we raise awareness about our company's products and services?
2. Evaluation
How do we help customers evaluate our organization's Value Proposition?

Reverse logistics
- Utilising existing logistics hubs and retailers to transport cores and products to and from product users

Retailers network, 300+ retailers in Sweden. https://www.husqvarna.com/se/hitta-aterforsaljare/

Customer Segments

For whom are we creating value?
Who are our most important customers?

Mass Market
Niche Market
Segmented
Diversified
Multi-sided Platform

Green spaces
- Private house owners (most important)
- Professional users

Customers interested in leasing or remanufactured products

Cost Structure

What are the most important costs inhe
Which Key Resources are most expensi
Which Key Activities are most expensive

IS YOUR BUSINESS MORE
Cost Driven (leanest cost structure, low price va
Value Driven (focused on value creation, premiu

SAMPLE CHARACTERISTICS
Fixed Costs (salaries, rents, utilities)
Variable costs
Economies of scale
Economies of scope

Leasing, additionals for provider
- Product failure risk
- Remanufacturing costs
- Repair & Service costs
- More foward transports
- New reverse transports
- Higher total cost of ownership for product owner unless the remanufacturing process is very cheap or products are designed to last indefinitely. Reason: embedded/additional offerings in addition to the product.

Remanufacturing, additionals for provider
- Remanufacturing yield
- Sales success ratio
- Restoration process
- Sourcing of components
- Sourcing of spare parts
- Sourcing of cores

Revenue Streams

For what value are our customers really willing to pay?
For what do they currently pay?
How are they currently paying?
How would they prefer to pay?
How much does each Revenue Stream contribute to overall revenues?

TYPES
Asset sale
Usage fee
Subscription Fees
Lending/Renting/Leasing
Licensing
Brokerage fees
Advertising

FIXED PRICING
List Price
Product feature dependent
Customer segment dependent
Volume dependent

DYNAMIC PRICING
Negotiation (bargaining)
Yield Management
Real-time-Market

Through remanufacturing with leasing the "same" product can be sold mulitple times
- Lower manufacturing cost per use cycle
- Leasing enabling ease of core acquisition and additional revenue streams for auxillary offerings to enable trouble-free ownership. However, all customers are not ready to pay extra for an already expensive offering/product.

https://www.husqvarna.com/uk/services/husqvarna-care/
https://husqvarnaconceptstore.se/aktuellt/husqvarna-care/