Smart Service Engineering
Data Product Design

Collection of Case Studies
from CAS Course Participants

Zurich University of Applied Sciences (ZHAW)
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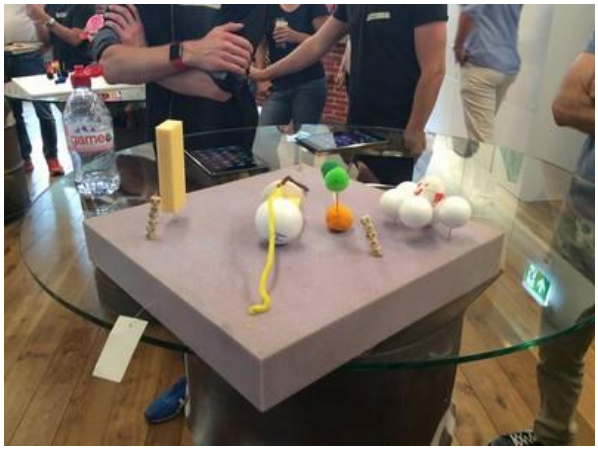
CAS Smart Service Engineering - Data Product Design



The following questions are the in focus of the CAS Smart Service Engineering:

- How to develop new services, products, and product-service systems based on data with added value for users / customers (value creation) and providers (value capture)?
- How to find the relevant, user-specific value proposition for a data product?
- How to turn these value propositions into smart services or smart product – service systems?
- How to develop a sustainable service ecosystem and service business model for a smart service?
- Which aspects of data protection, law, and ethics have to be considered?

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Foreword

This informal ebook encompasses the short papers describing the case studies conducted by small groups of students during the CAS (certificate of advanced studies) Smart Service Engineering (Data Product Design).

At the beginning of the course, a sound understanding of the problem through the lens of service design thinking is at the core of the attention. As the course progresses, we bring in more and more data science driven approaches and look repeatedly over the fence into the field of data analytics without getting into the technical details. The CAS Smart Service Engineering (Data Product Design) consists of the following modules, which unfold over 16 days:

1. Module A "Smart Service und Data Product Design"
   This module is intended to show students how Data Product Design takes up the findings of data science and thus generates benefits for users (e.g., internal or external customers).
2. Module B "Data-specific Business Model Design"
   This module is designed to show students how to develop service business ecosystems and economic business models for smart services.
3. Module C "Practice-Workshop"
   In this module students are given the opportunity to apply the learning contents of the modules "Smart Service and Data Product Design" and "Data-specific Business Model Design" in a moderated way in a coherent case. The focus is on prototyping and testing of the mutual value creation concepts.
4. Module D "Data Protection and Data Security"
   This module is designed to teach students the basics of data protection and data security in the context of Smart Service Design. We also have a special focus on data ethics in this module.

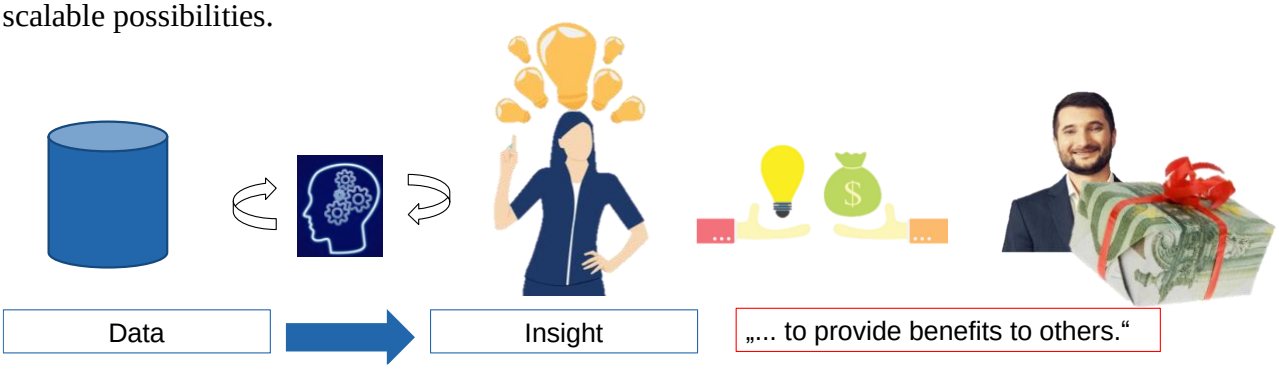
The ambition of the course is to convey the systematic methods of data-driven service design and engineering to the participants in a scientifically sound yet always directly applied way. To do so, the classes are split in small working groups at the very start of the course. The groups choose users with a real-world challenge which they want to support by design of a new data-driven service during the entire evolution of the course. The only requirement was that the case should have the potential for a solution with a data-driven service and a B2B focus. The case studies are continuously developed across the four modules and the content taught in short theory blocks is continuously applied – from data-driven value design over business model design up to data ethics, data protection, and security. The challenges are chosen by the participants themselves and the service concepts are developed independently, whereby the course instructor is only there to advise and coach. In this sense, this informal living ebook has the character of a garage report and the papers are the work of the participants. I.e., the instructor has no claim or responsibility for their content. However, it is always fascinating to observe how the participants drive the cases with a lot of passion and professionalism and how service concepts are developed whose implementation in a real business can be of great benefit. A big thanks goes to the ZHAW School of Engineering for enabling this course, to the numerous industrial guest speakers, and to the members of the jury for their feedback in the elevator pitches. Many thanks also to *Ina Goller* for guiding us through the practical workshops and pushing our cases forward and to *Fabrizio Laneve*, managing director of the *Mobiliar Forum Thun*, for enabling the workshop infrastructure.

The deliberately short papers reflect only a small part of the concepts developed and shall only allow a brief insight into the work without any aspiration to completeness.

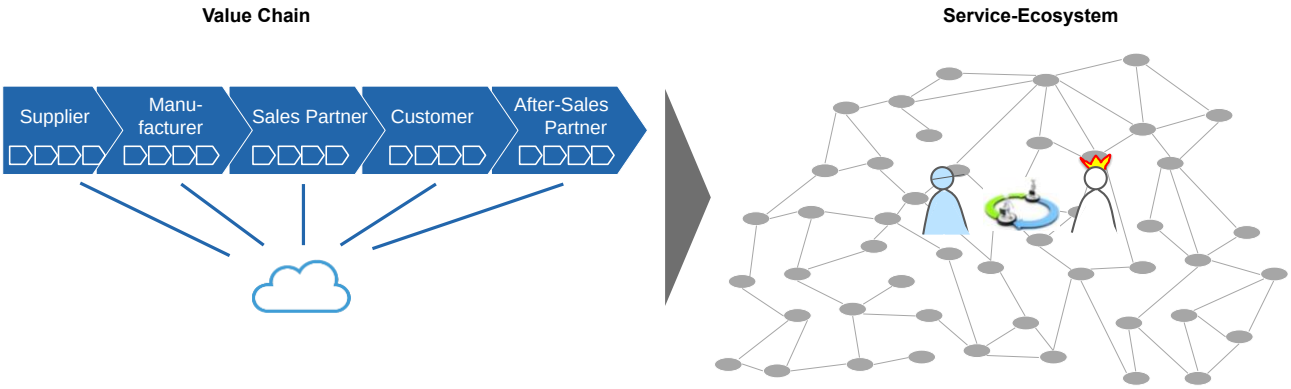
The Importance of Smart Service Engineering

Which tasks or challenges of customers or users can be improved by smart (data-driven) services and how can these services be implemented in practice?

With the spread of advanced technology over the last years, digitization has reached wide areas of society and the economy. Administrative processes are already largely digitalized and efficiently designed. However, the customer-centered development of services that solve relevant problems in the everyday life of users still has great potential. With the broad availability of sensors, data, networks and cloud infrastructures, a basis is now available for this change, which offers new and scalable possibilities.



The service benefits must be consistently oriented towards the users and customers and generate added value for their business processes.



Data-driven service engineering focuses on the design and description of the customer's service ecosystem. In which contexts and ecosystems does the customer have to accomplish its jobs? What are the problem points ("pains") that a service can solve for the customer? So-called "value propositions" can be created for the customer. The processing and analysis of data helps both to identify suitable value propositions and to design their content.

Properly and carefully designed smart services thus have the potential for mutual value creation for internal or external customers, for businesses, and for society as a whole.

Zurich, July 2022
Jürg Meierhofer

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The Course of the Year 2022

We had four very interesting cases in 2022. For one of them, it was decided not to publish the paper for internal reasons. Yet, it was a very sophisticated and well elaborated case, too. Without wanting to prioritize the cases, they are put into a sequence here:

Against the background of the potentially challenging energy supply situation in the near future, two of the projects focus on this issue in the B2B building sector:

- Honeycomb: Smart Energy Management for Buildings Workplace User Experience
- Smart Energy: Our ambition is to disrupt the property insurance market.

Additionally, there was a very interesting case tackling the highly complex question of data platforms for maintenance services in manufacturing:

- Smart Plant Systems

There was again very high engagement by the participants this year. The cases were developed and sharpened over numerous design iterations and in the two-day *Mobiliar Forum Thun workshop*. Many thanks to *Ina Goller* for her excellent moderation of this workshop, and many thanks to *Fabrizio Laneve* for enabling to class to attend this wonderful workshop location.

At two distinct moments in the development, i.e., after the development of the value proposition including digital prototypes and after the development of the service business system, the participants presented their cases to a high-profile ***expert jury*** consisting of industry representatives, entrepreneurs, and scholars. We would like to express our gratefulness to these experts here for dedicating their time and experience: *Fabrizio Laneve, Ina Goller, Lukas Schweiger, Marc Rennhard, Melissa Stucki, Nadine Charlon, Rolf Günter* (alphabetically by first name). Their challenging feedbacks were essential for driving the cases to the next level.

Honeycomb
Smart Energy Management for Buildings

Camillo, Karolina, Oliver, Rico, Xaver

Abstract

Energy optimization in buildings has become increasingly important in the present world. High energy prices, climate change, ESG reporting requirements and sustainability certifications demand our buildings to be more energy efficient. The need to improve energy performance of buildings in Switzerland is substantial. More than one million buildings are in urgent need of energy-related renovations.[1] Moreover, up to 15% of a building's energy consumption can be saved only by optimizing the installed technology [2]. The technology needed to achieve this is now available on the market. Buildings can generate and store their own energy. However, new comprehensive solutions are just emerging. The upcoming regulations[3],[4] as well as the growing societal awareness regarding energy, fossil fuels and CO2 emissions affect the real estate sector. Building owners and facility managers are looking for competent partners who can cope with the increasing complexity of energy systems and who can operate their buildings in the most efficient way - both economically as well as ecologically. With our product, Honeycomb, we provide smart energy management for buildings. It is a data-driven service that helps property owners and facility managers to measure and optimize the energy performance of their buildings.

Key words
Energy management, energy transition, smart building, energy optimization, sustainability

[1] "Den Angaben auf «Das Gebäudeprogramm» zufolge sind mehr als 1 Million Häuser nicht oder kaum gedämmt und damit energetisch dringend sanierungsbedürftig, drei Viertel der Gebäude werden heute noch immer fossil oder direkt elektrisch beheizt." https://www.raiffeisen.ch/casa/de/immobilien-sanieren/sanierungsplanung/sanierungsstau/energiestrategie-2050-interview.html

[2] Energate Messenger Schweiz: "Bfe Sieht Gebäude Als Die Kraftwerke Der Zukunft" Mario GRAF, 03.03.2022 "

[3] Swiss Energy Strategy 2050 https://www.bfe.admin.ch/bfe/de/home/politik/energiestrategie-2050.html/

[4] Revision des CO2-Gesetzes 2022 https://www.bafu.admin.ch/bafu/de/home/themen/klima/recht/totalrevision-co2-gesetz.html

1. Which Challenge Do We Solve?

Energy management in buildings is changing due to two main factors. On the one hand, environmental awareness is increasing and customers, investors and the government are demanding proof of ecological management of resources. On the other hand, increases in energy prices are forcing companies to be more cost-efficient.

Energy optimization is a challenge for everyone involved. Companies are already suffering from a shortage of skilled employees and are often missing expertise in energy optimization. In most buildings, the infrastructure to collect the data required to make informed decisions about energy does not exist. If it is available, there is still no way to process, report and analyze it effectively.

Figure 1: StoryBoard in short

Our Customers

Based on 10 semi-structured in-depth interviews with different stakeholders in the field of energy and property management, we concluded there is no single customer segment that we can address. People responsible for energy management work on the side of building owners, portfolio managers, facility managers or major tenants. We identified three main personas: building owner (figure 2), major tenant and facility manager, each with slightly different motivations, pains and gains. Although the role of energy manager is not always explicit, it can be one person or a department, there is always someone in charge of energy bill with an incentive to optimize it. These people are our potential customers.

Figure 2: One of Personas, Customer Segment: Building Owner

2. By Which Data-Driven Service Approach Do We Solve the Challenge?

Honeycomb creates value by supporting customers with easy-to-understand advice on how to optimize energy use in their properties, as well as taking care of the day-to-day energy optimizations automatically. This enables them to meet and exceed the expectations of their stakeholders. Enabling our customers to focus on their core strengths is an important pain reliever. At the same time, Honeycomb allows the energy manager to comply with SLAs mandated by their (internal or external) customers and gives planning security to their customers.

We generate value in three dimensions:

- Functional: Energy Monitoring and Optimization
- Financial: Saving of Energy Costs
- Economical & Social: Reducing CO2-Foodprint & Obtaining Sustainability Certification

From The Value Proposition To The Service

Figure 3 shows the service overview. Honeycomb services cover the areas of generation, consumption and storage of electricity, water, heat and waste. Data from existing or new sensors is used and is combined with further data from other customers and from publicly available data (Open Data). The data is analyzed using state-of-the-art algorithms to generate optimization suggestions tailored to the specific building and customer requirements. The data is then processed and presented to the customer in a clear and easy to understand dashboard (figure 4).

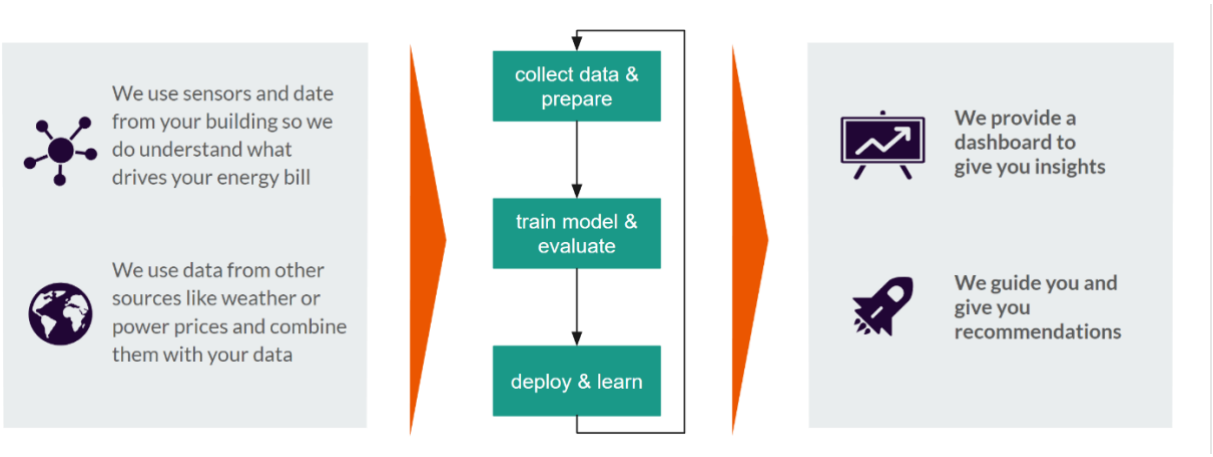


Figure 3: Service Overview

Three Areas For Optimized Energy Consumption

Recommendations generated by Honeycomb cover energy optimization for short as well as long term improvements. The dashboard shown in figure 3 represents a possible overview of all services. Short term solutions can be implemented automatically by Honeycomb or with minimal manual effort, such as changing the temperature or deactivating unused devices. For improvements that require planning and financing, such as for example improving insulation or installing photovoltaic panels, Honeycomb will calculate the business case, including required investment, amortization and NPV.

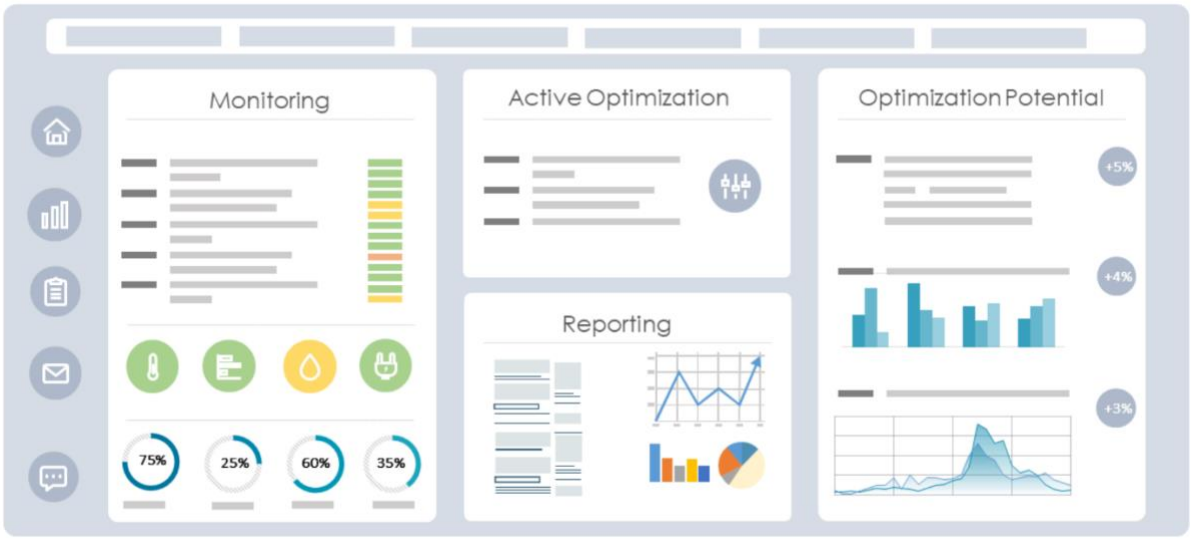


Figure 4: Smart Energy Management Dashboard

The service consists of three components. In the first area, the consumption is shown. This gives the customer an overview of all relevant figures at any point in time and they do not have to collect or prepare them manually. In the second area, simple optimizations are done automatically, and the savings are shown transparently. In the last area, suggestions for possible optimizations are provided. To have an overview of investments and savings, a slide controller is implemented. This allows dynamic comparison of values with each other in real time. If required, improvements can also include certifications by 3rd parties (e.g. Minergie).

The service falls into the Asset Efficiency Service (AES) classification[5]. While there are some processes that can be automated and are run entirely through the service, there are still key processes that are run with and by the customer. At the same time, while consulting and diagnostic are an important part of the service, most of the value lies in the promised performance of the building in regard to energy.

[5] Kowalkowski, C., & Ulaga, W. (2017). Service strategy in action: A practical guide for growing your B2B service and solution business. Service Strategy Press.

3. What Does Our Target Service System Looks Like?

To be able to provide the service, different actors make up the ecosystem. These range from sensor manufacturers to capital providers. Figure 5 shows the service ecosystem for overview purposes.

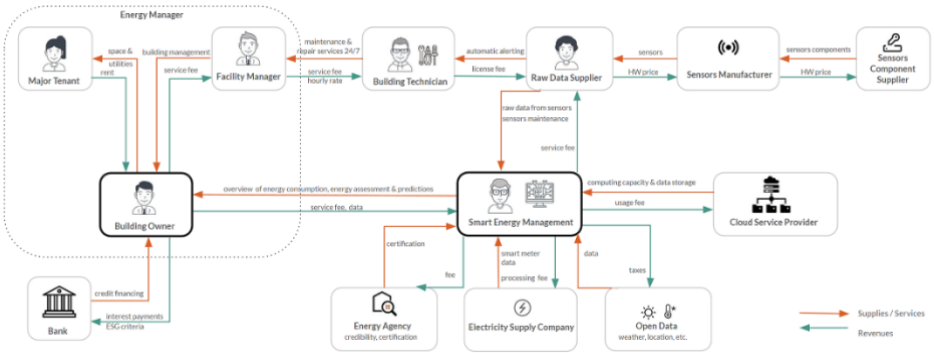


Figure 5: Overview of the service ecosystem

Create And Capture Value For And From Our Customers

In figure 6 the value capture and value creation are shown. We offer our customers monitoring and short-term as well as long-term optimization. With our complete package, customers no longer have to worry about energy management and they can focus on their core responsibilities. They always have an overview of the consumption and control over the optimizations. They can also save costs through efficiency gains and achieve their sustainability goals.

The monitoring is paid as subscription. For the optimization proposals, a one-time fee is due depending on the amount saved, and consulting is billed per hour. In addition to the payment, another important value is received; the data from the customers allows us to further optimize our model and the service can be improved over time.

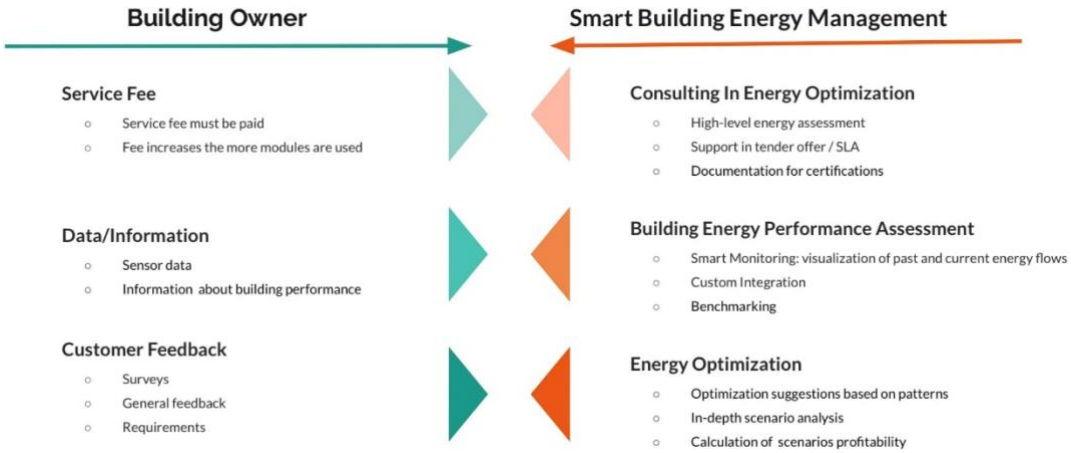


Figure 6: Value Capture and Value Creation

Providing The Solution With Help From Partners

We rely on several 3rd party providers for our service. To get the data we need, we work with sensor manufacturers. We also obtain data from the electricity supplier and other public data. We pay a service fee for some of these. Customer data is stored in the cloud and a fee per usage is paid. We cooperate with experts in energy consulting to provide one solution for our customers but with the experience and knowledge of our whole ecosystem.

4. Discussion and Outlook

We presented our service to several potential customers and received positive responses. It became clear that there is a real need for such a service and that the solution has great potential. The clients were interested in having all energy related topics covered by one provider. For some parts of energy management there are already solutions on the market. However, we provide a unique and integrated solution with dashboard, reporting and recommendations in terms of CAPEX and OPEX. We can answer the most important questions from our customers and support them on their journey towards better management of energy consumption in their buildings.

One Role For Multiple Functions

We encountered many different constellations among companies. In some, the person responsible for energy was part of facility management. In others, decisions are made by the owner or tenant. There are also companies where responsibilities for energy management and sustainability are split between different departments. Because of the different structures, it was difficult to identify one specific customer type. Therefore, we settled on the role of responsible for energy management as the customer for our solution.

Verifying The Hypotheses With Our Customers

We are confident that our service can fit with customer needs. To validate our assumptions, we formulated a series of hypotheses (figure 7), which we aim to test before or during release. They include: “there is a motivation to optimize energy among potential clients”, “we can meet the expectations for optimizations” and “we position ourselves correctly financially”.

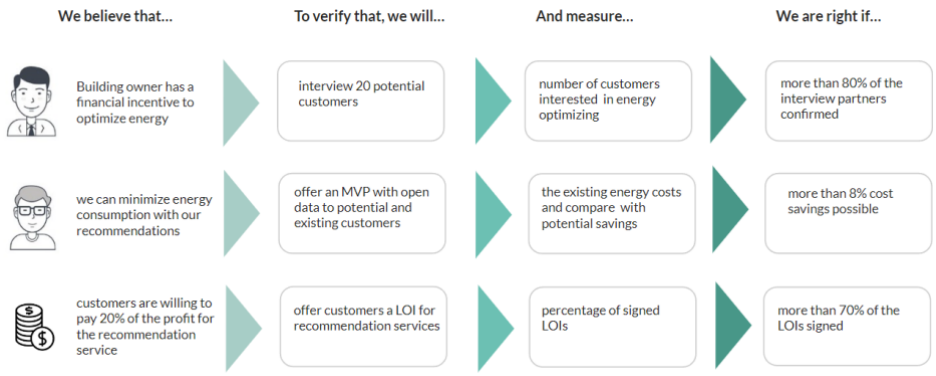


Figure 7: Hypotheses

How We Plan To Enter The Market

We plan to enter the market through consulting. This allows us to build relationships with potential clients without requiring a long-term commitment from them. In this way we can gather experience and customer data. Initially, the model will be created using only publicly available data. As more data from buildings becomes available, the models are refined continuously. We saw that some potential customers are already working with sensor manufacturers. This opens a further entry opportunity through cooperation with them.

Smart Energy

Our ambition is to disrupt the property insurance market.

Team Overview
Ebru Dulak
Fabio D'Elia
Markus Konz
Melanie Sauerbier
Stefan Hegetschweiler

Abstract

Protection against lack of solar irradiation

Insufficient solar irradiation can put solar panel owners under immense pressure. To protect them from financial losses resulting from this threat, the spinoff Smart Energy has developed an innovative index-based insurance service, focusing on small insurance companies, which in turn can offer this service to their customers.

Key words
Sustainability, renewable energies, reinsurance, smart energy, energy price stability

1. What challenge are we solving?

We aim to disrupt the property insurance market with a platform supporting a product innovation related to renewable energy. The product innovation is to protect a shortfall of energy production, caused by unfavorable weather conditions. A shortfall can be calculated based on historical data of radiation in combination with geo data.

Small insurance companies have the pressure to grow based on product innovations and according to our conducted interviews, they only have limited resources that can be invested into technology. Most insurance companies as well as customers have a strong interest in renewable energies and the solar business premium volume increase is 600% in the last 10 years. The market is a highly profitable niche with a loss ratio of approximately 56% (source: Swiss Re).

In general, solar production is subject to strong fluctuations. The daily production and effectively gained power vary per day and depend on the weather conditions. Bad weather periods can strongly influence the energy gained.

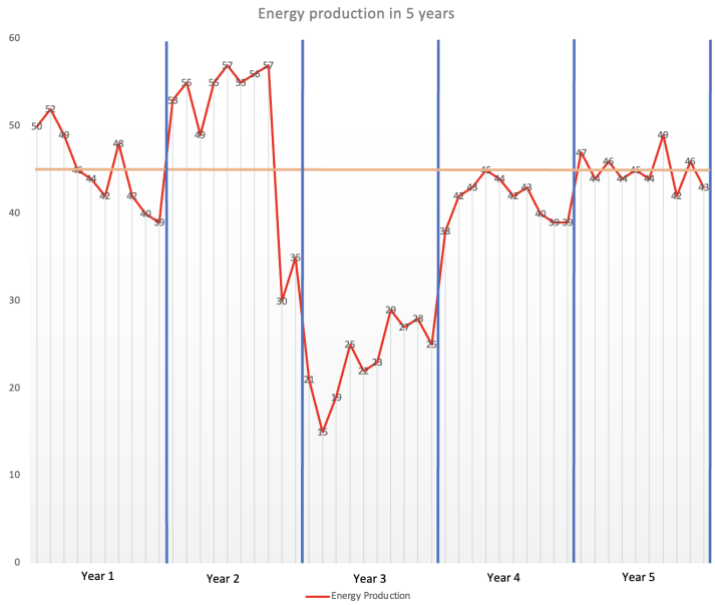


Figure 1 - Energy production

The example shows the energy production over 5 years on an aggregated daily basis. In this example, the years 1 and 5 are average and year 2 indicates an overproduction. The years 3 and 4 are below expectations.

A solar panel owner invests in the technology by calculating the expected average energy that needs to be produced by the system so that no additional energy has to be purchased on the market.

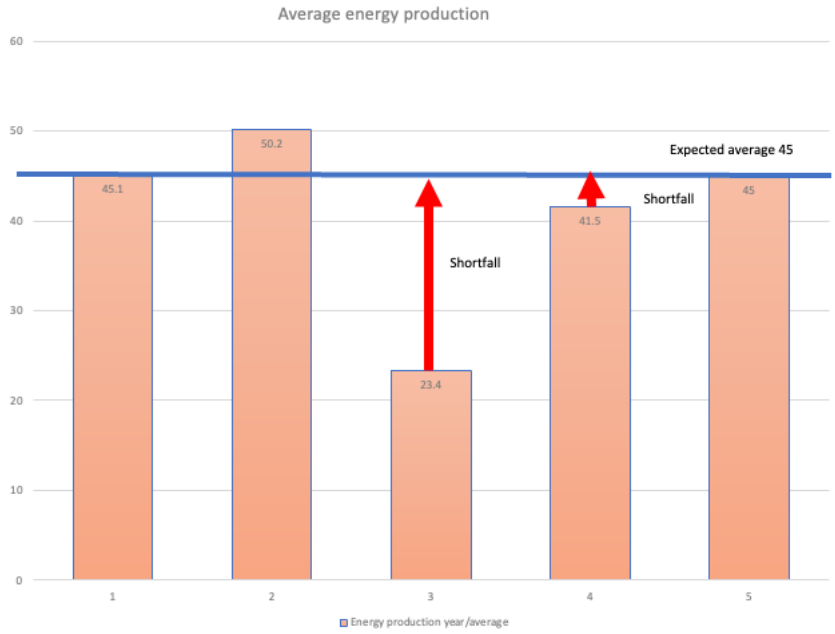


Figure 2 - Average energy production

The example above shows an expected average of 45 kWh produced energy and a shortfall in the years 3 and 5. The owner has to buy energy on the market to compensate the shortfall and with that, suffers from a financial loss. At the same time, the amortization of the investment continues and will even increase over the years.

Our offered data service contains radiation data of the last 50 years for regions and with that an index can be produced to calculate the probability of a shortfall in the next 50 years.

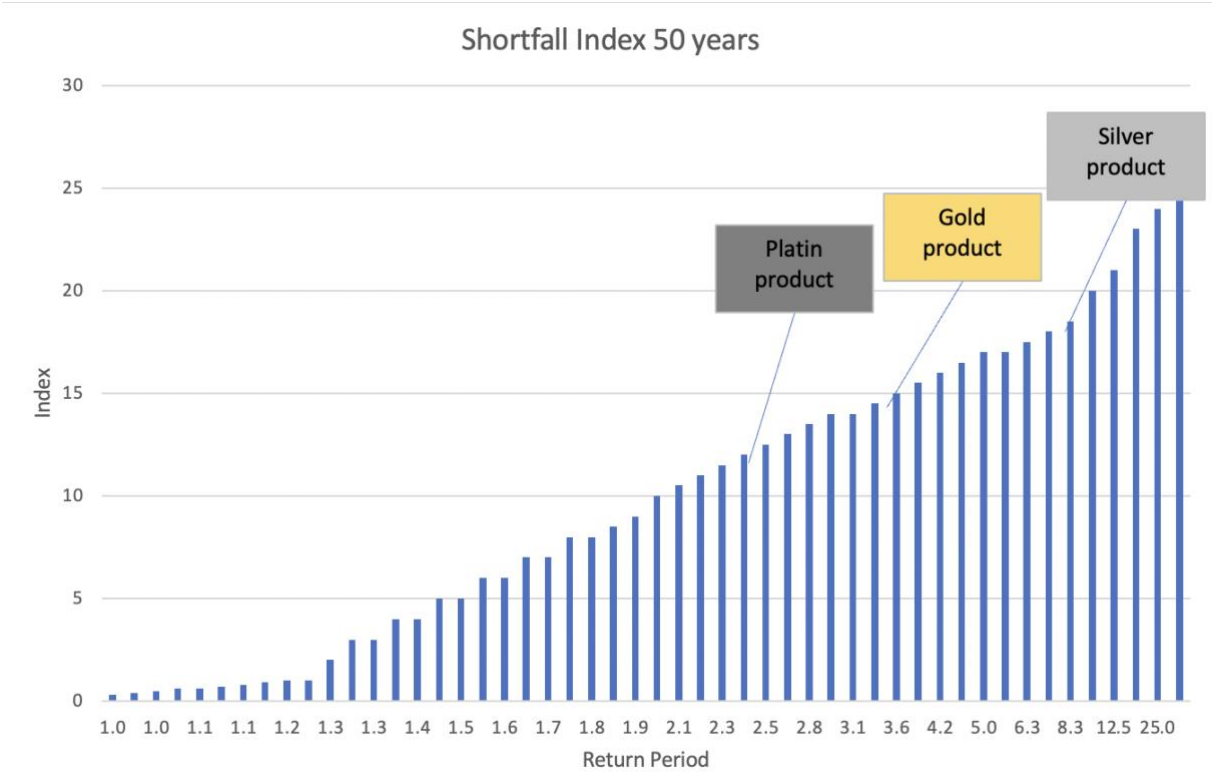


Figure 3 - Shortfall index

The example given shows how products can be designed. A 'platin product' is designed in such a way that the shortfall is paid out every 2.4 years, while a 'silver product' is paid out every 8.3 years. The difference between the 'gold' and 'silver product' is that even smaller shortfalls are more often covered and with that, more regular payouts reduce the gap between expected average and effectively produced energy. The insurance company can design its products according to its own preferences and the customers' needs. The shortfall can be paid out automatically e. g. after one year. The energy costs are agreed annually between the insurer and the policyholder to calculate the financial loss.

Small Insurance companies can benefit from product innovation by reducing their RnD (Research and Development) activities and benefit from faster time to market. Low implementation costs help testing a target market and the end-to-end solution provided covers the full lifecycle.

2. Which data-driven service approach do we use to solve the challenge?

Two value creation logics are present in our business ecosystem (figure 4). Between the final customer and our clients (the primary insurance companies) exists the classical *goods dominant logic* (GDL), in which the customer transfers their own risk to the insurance company for a premium payment which is higher than the expected loss of the customer. This risk transfer is either agreed between customer and insurer directly or via a broker or agent. This is, in many markets, a prerequisite for banks to grant loans. Therefore, the banking industry is an important partner for the insurance companies. However, between Smart Energy and the primary insurance company the value creation follows a *service dominant logic* (SDL), in which Smart Energy assists the client in their own value-creation processes. We exchange technology, data and expertise for fees, market access and market knowhow. This allows the clients to enter into new markets faster with more innovative products at lower costs, while Smart Energy benefits from the local market expertise and access to local customers.

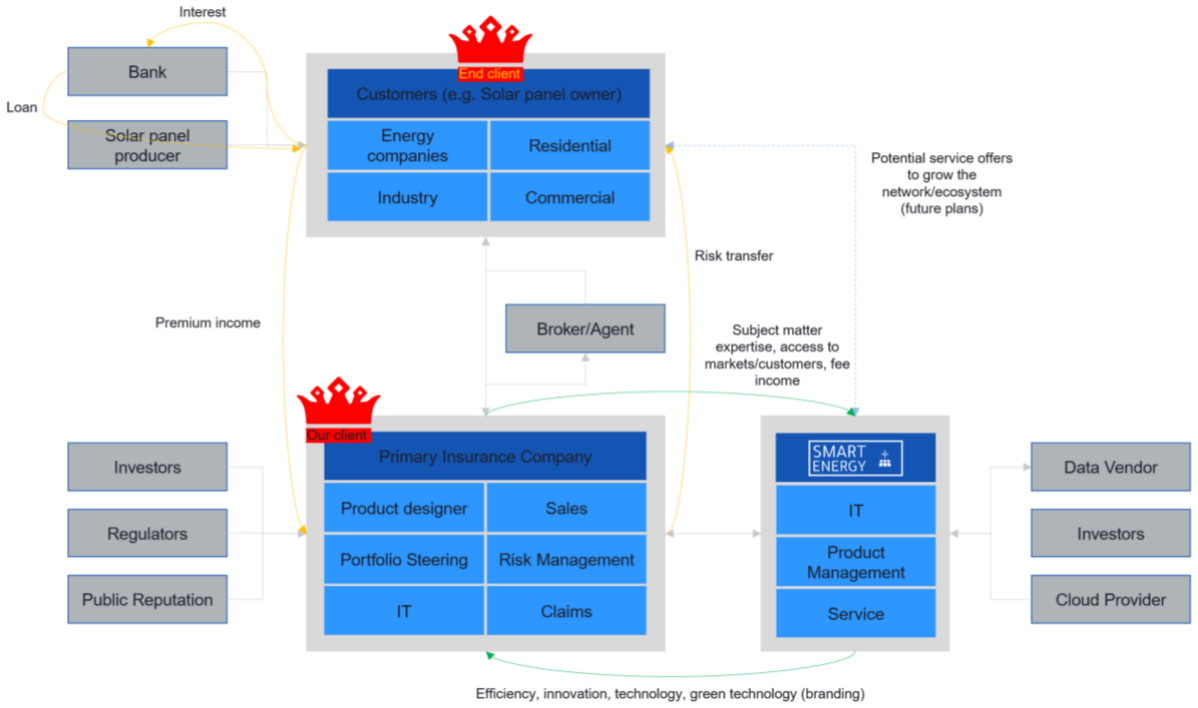


Figure 4 - Business ecosystem and partner network

Our solution enables the client to master all relevant steps from product design to portfolio management. The design process is essential when it comes to new product development. Here, we offer the five steps outlined in figure 5 to our clients. They can use our map service to identify locations, then follow the guided process to design the new parametric product, which can be reviewed and signed-off by a third stakeholder (4 eye principle). Once designed, the products can be monitored with our robust data pipelines which provide near-to-real-time data updates of solar radiation. Finally, the clients can steer their portfolio with the help of our portfolio analytics capabilities.

Figure 5 - 5 step procedure to design and operate a new parametric solar energy product

The above-described value proposition is delivered through 4 highly integrated business models.

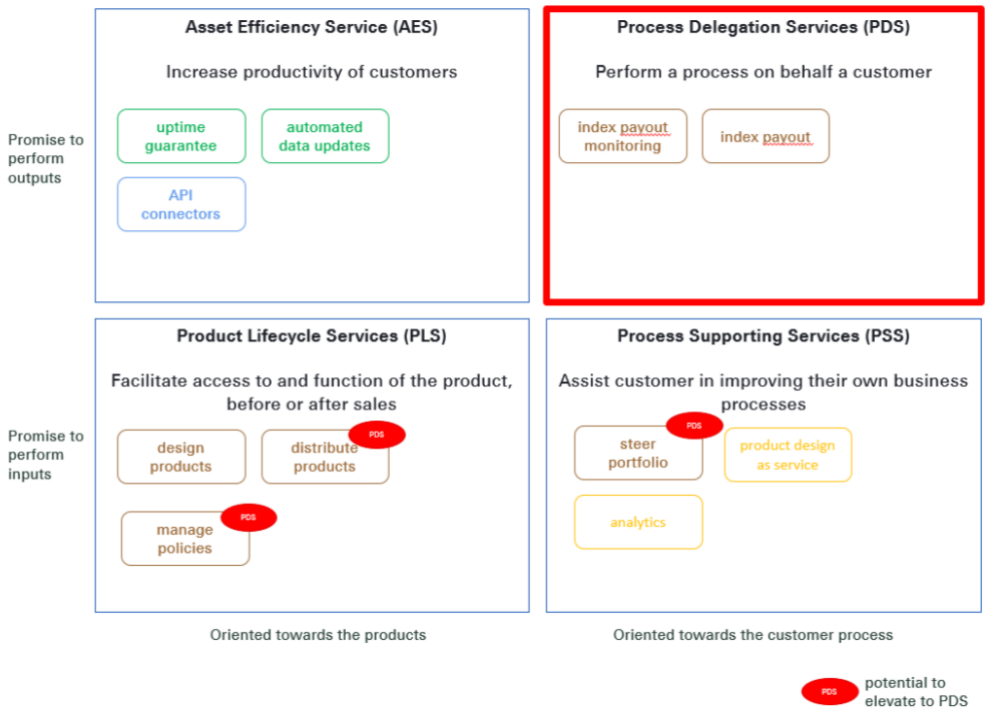


Figure 7 - Data service value proposition. We offer a well-diversified value proposition with potential to grow the process delegation services (PDS) further

Guaranteed Availability:

parametric products require 100% uptime of underlaying data delivery systems. We provide global coverage of state-of-the-art weather and climate data through well recognized weather service organizations, ECMWF and NASA.

Both organizations provide near-to-real-time data

- A new radiation scheme for the IFS | ECMWF
- MERRA-2 (nasa.gov)

which we integrate in our service offering either through the web platform or via API services. This service is renumerated via a base fee.

Solution Provider:
Our e2e solution provides the full insurance value chain of parametric products in a box. Client's design and distribute parametric products, manage policies and steer the portfolio through our systems. Once the policies are sold, the payouts are calculated in real time and monitored on daily basis. Renumeration of this service will happen in two ways: free of charge design features, which enable co-creation (hence allow us to get deep into the client's ecosystem) and fee-based services for distribution and portfolio management.

Consulting:
The free of charge elements of the service offering mentioned in the section above open the doors for consulting services on fee basis. These can be product design as service or any types of analytics (e.g., identify the best region for a specific product; streamline the sales/distribution process, etc.).

Add-on:
Last but not least, our services are available as API connectors which allow clients to integrate our solutions into their inhouse systems. This service comes at fee and is linked to consulting services for integration support.

Figure 7 summarizes our value proposition with respect to the service classifications. The goal must be to play in the PDS field, because:

- clients are bound
- clients value the service more
- almost natural growth opportunities with new services
- access to data

3. What does our target service system look like?

Service Blueprint

Our target service system can be visualized according to the following **service blueprint**, outlining the most important steps in the customer journey focusing on the primary insurance company. Additionally, it nicely visualizes the front as well as the back stage activities as well as the 3rd party providers needed to provide our end-to-end platform-based solution from the 'Product Design' to the 'Portfolio Management'.

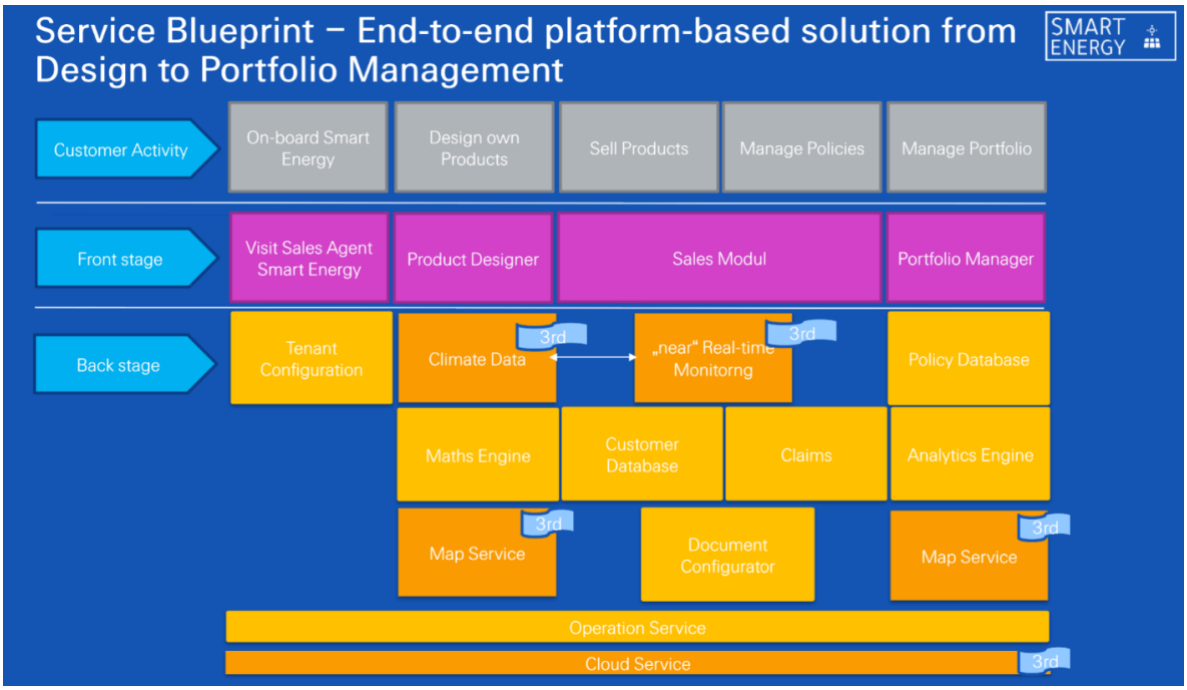


Figure 8 - Service Blueprint

Data integration

External providers are listed as 3rd parties and they are the providers of climate data, maps as well as Cloud services.
The climate data is used for the initial set-up of the parametric product and to monitor it on a regular basis. In addition to that, the map service can be used to identify locations. We use 'Infrastructure as a Service' (IaaS) offering essential compute, storage, and networking resources on demand, on a pay-as-you-go basis. With that, we have the flexibility to scale the IT resources up and down depending on the demand.

Value creation

Our model creates value for the customers in the following manner:

- There is no need for big RnD (Research and Development) investments as the customer can benefit from our technology, data and expertise.
- This enables our customers to enter new markets faster with more innovative products at lower costs and this generates a competitive advantage.
- The customization of the product ('Product Designer') and the end-to-end process handling (from the 'Sales Module' to the 'Portfolio Manager') enables our customer to become the partner of choice for sustainability topics.

4. Discussion and Outlook

Verifying our four hypotheses

We set up four hypotheses which we validated with the interviewer. The interviewer was an expert in the position of product underwriter from a private insurer as we identified this user group to play a crucial role for our market entry.

The **first hypothesis** we had to test was that end-customers have a strong need to protect their solar panel infrastructure and to have stable energy costs. The hypothesis got confirmed and we found even market data showing the growth opportunities for that topic (see section 1 - What challenge are we solving?).
The **second hypothesis** was that the private insurer has interest in sustainable energy or has pressure to grow through innovative products. This was clearly confirmed: Sustainability plays a major role in the insurance business. Many resources are invested in the development of sustainable products. In the case of major customers or tenders, sustainability is even directly demanded in some cases.
The **next hypothesis** that we put to test was weather index services are used by private insurers. This was confirmed: Index and data services play an increasingly important role, especially when usage-based data is incorporated into a product.
The **last hypothesis** was that innovation comes from partnerships. This was denied since private insurers often have their own experts assigned to such problems. It is unusual to bring in external partners for this.

Additional markets

Similar services can be rolled out in other markets. This is conceivable for energy markets where energy is generated from wind and hydropower.
The data situation in these cases however still needs to be evaluated.

What remains to be solved?

As we offer a service in a niche whereas the market itself is highly specialized, entering with new solutions might be challenging. Therefore, we need to ensure that we find partners interested in our service and able to push that service to the market, ideally by leveraging their already existing network.

Smart Plant Systems

Niklaus Dähler
Sandra Furter
Alvaro Garcia-Lopez
Robin Meli
Lena Neschenz

Abstract

Machines require maintenance regularly. But even the most sophisticated maintenance schedule can only partly limit the unplanned machine downtime. Nowadays machines are built with a powerful PLC (programmable logical controller) or IPC (industrial personal computer). Combining sensors and actors, a lot of data is generated. Our value proposition is to create a data model that predicts required maintenance and spare part replacements to avoid unplanned outages. As a machine manufacturer we can use our in-depth machine knowledge in combination with the collected data to make predictions about required maintenance to avoid unplanned outages/breakdowns.

Predictive Maintenance anticipates the equipment needs to avoid costs associated with unscheduled downtime. By connecting to devices and monitoring the data, we can identify patterns that lead to potential problems or failures. Those insights can be used to address issues before they happen. This ability to predict when equipment or assets need to be maintained allows us to optimize equipment lifetime and minimize downtimes.
In order to handle and use this technique we need various data from the machines in production. In our case study we are looking at a machine manufacturing company willing to accelerate its servitization process. The machine manufacturer proposes a structured framework that considers a dual perspective (asset and service), aims to address unplanned outages/breakdowns and improve maintenance decision-making.

Key words
Predictive maintenance, machines, manufacturing

1. Which Challenge Do We Solve?

Manufacturing companies are widening their offering by adopting the Product-Service-System (PSS) business model. This model consists of the joint offering of products and services to satisfy specific customer needs.

Usually, unplanned downtimes are a big pain for every manufacturing company. Most of these downtimes are caused by worn out parts and maintenances which are not based on facts (data) and scheduled within a fixed time interval. For this reason, it could happen that a part fails, producing an unscheduled downtime right after a scheduled maintenance.

With our service, we propose to mitigate the financial loss caused by an unplanned downtime, using predictions of failures and timely replacements of this deteriorated parts. These predictions allow to plan maintenances ahead when they really make sense. In addition, the spare part management and storage could be reduced on the customer side because we would be able to tell our customers **which** part is going to be needed and **when**.

Our main beneficiary is the production engineer who has the responsibility to run the production line. He spends most of his time guaranteeing the equipment efficiency and yield (quality). The quality of the produced goods is impacted by the equipment condition which can cause a yield-loss (unusable goods) growth during the production process.

Another big topic for the production engineer is the machine knowledge. Usually, only a small number of workers know the machine in detail. This poses a big risk to the company, especially if such an equipment specialist leaves the company. When the production engineer can rely on our manufacturer knowledge, this risk is no longer significant.

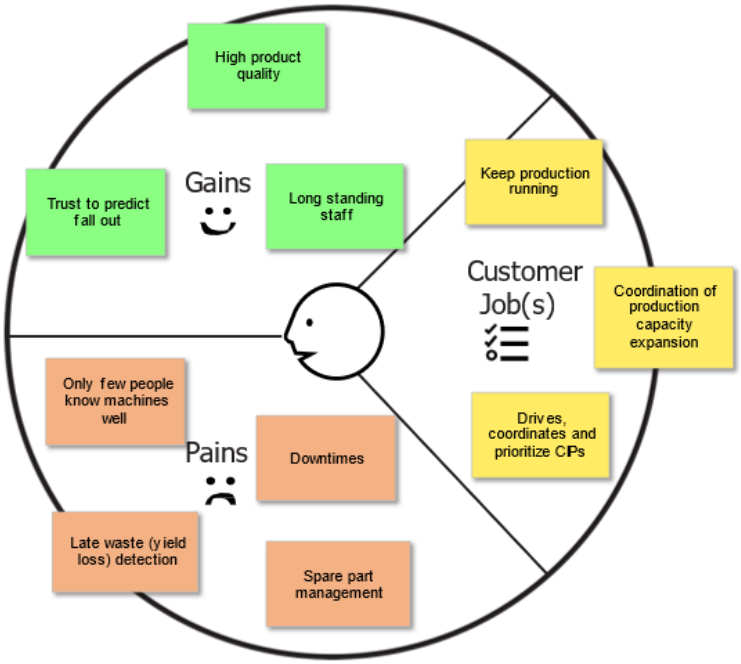


Figure 1 – Customer profile

2. By which Data-Driven Service Approach Do We Solve the Challenge?

We offer our customers security and knowledge about the maintenance of their machines. With our service, our customers can focus on their core activity, the manufacturing, and less on maintaining their machines. Furthermore, they would be able to save on personal and recruiting costs, spare part management and storage.

The production engineer could increase the machine efficiency easily without specialized staff if he is able to fully rely on our machine knowledge and the insights of similar machines around the world.

The data sources are our own machines which are in use at our customer's plants, collecting a huge amount of data. The new machines already have a lot of built-in sensors and actors which are collecting data but if required, we could equip older machines with additional sensors to be able to collect the same data. With an encrypted connection, this information will be sent to our secure online data storage hosted by a 3rd party provider.

Our approach is to create a smart data model, able to predict when a machine is not running smoothly. Using machine learning, our data model will get smarter and will be able to tell why a machine is not running properly and when a failure is going to happen. Is a specific part causing the problem? With this approach the customer would be able to replace the part before the machine is failing. Our data also tells the customer how frequently he needs to schedule maintenance to avoid unplanned downtimes and make production environments much more efficient.

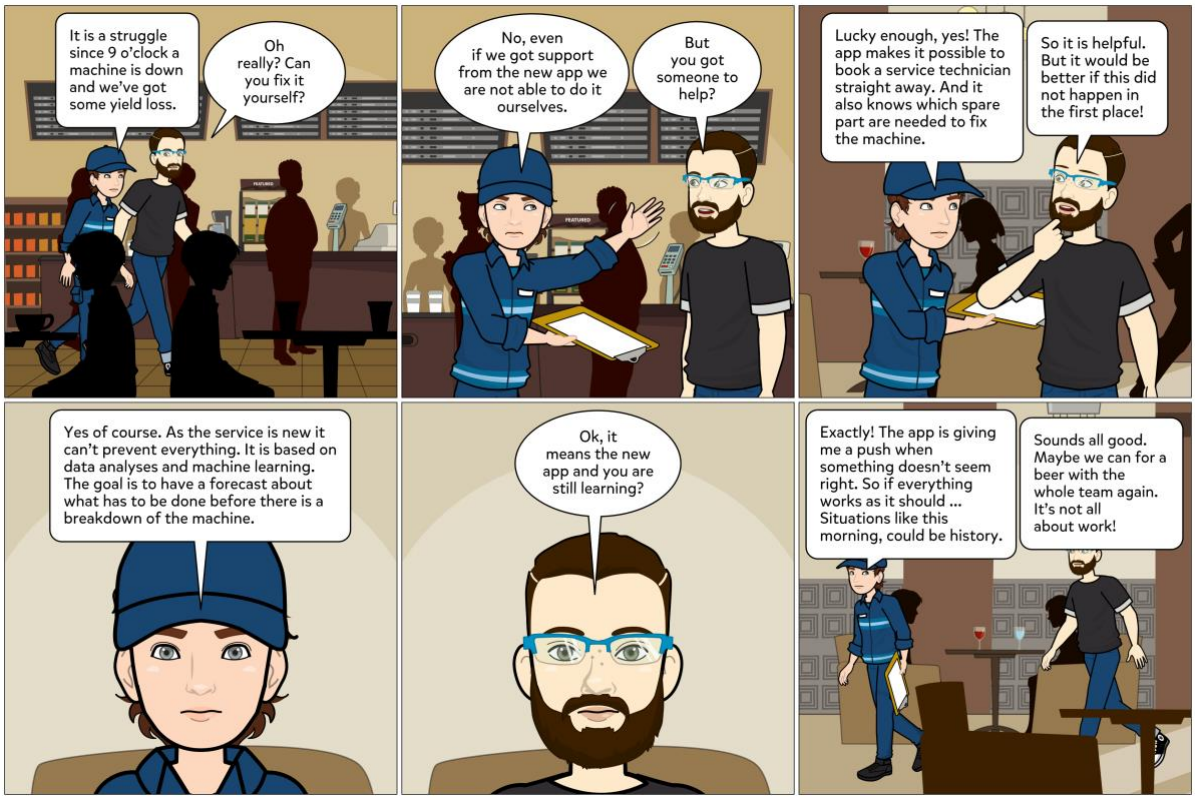


Figure 2 – Storyboard

Our service can be classified according to the scheme of *Ulaga and Kowalski*. The figure below (Figure 3) shows the different categories we can serve. During the product lifecycle we already provide remote support in case of failures, on demand service visits and delivery of spare parts.

In a first step of ramping up our service, we can provide our customers tools to increase their efficiency (AES). This happens mostly by visualizing the current machine state, which is based on current data. We can assist them with schedules to allow preventive maintenance. Finally, after our data model gets more advanced using the experience and data from our customers, we will be able to predict maintenances.

Thanks to our deep machine knowledge we can assist our customers during his process optimization (PSS). This is done by suggestions about how to optimize the machine. Additionally, we suggest which spare parts the customer might need next and generate a spare part offer automatically.

In the most sophisticated version of our service, it would be possible for our customers to outsource the whole machine maintenance (PDS). In this case, our technicians would take care of the customer's machine. We do not explicitly guarantee an uptime but an incident response time which could be low thanks to our failure predictions.

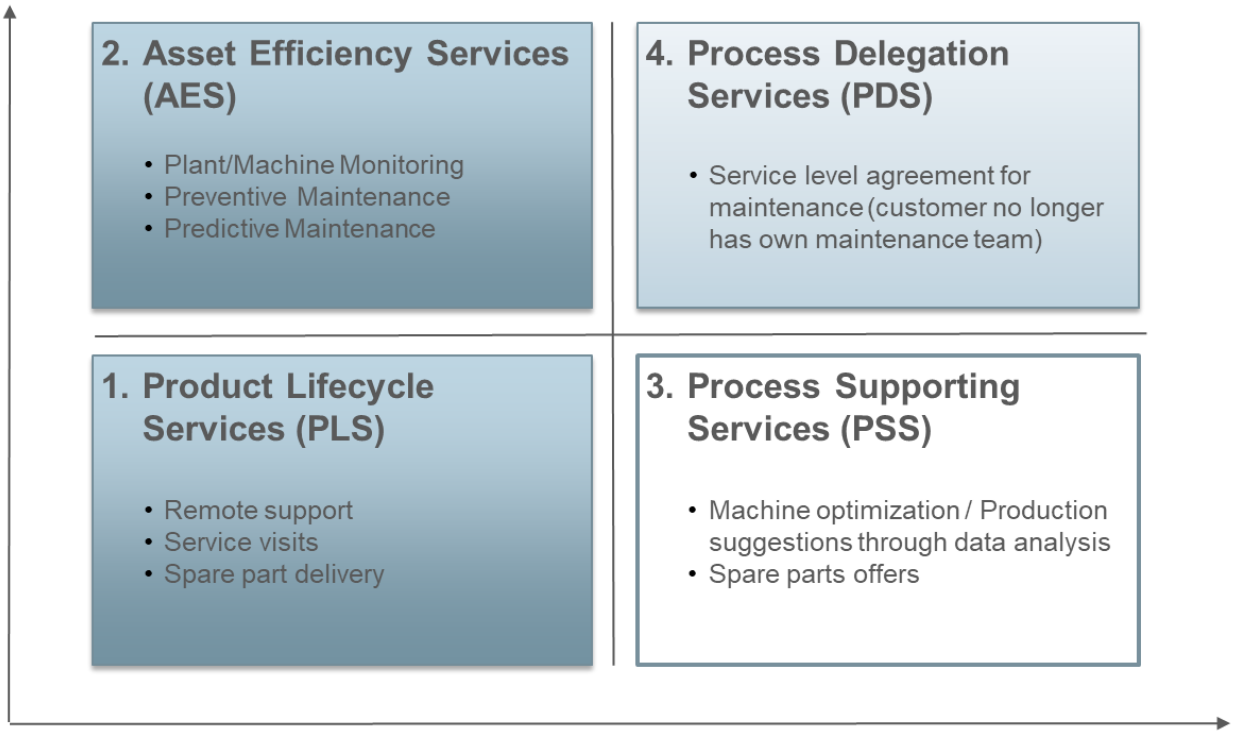


Figure 3 – Adaptation of the B2B Service classification (Kowalkowski "Service Strategy in Action")

3. What Does Our Target Service System Look Like?

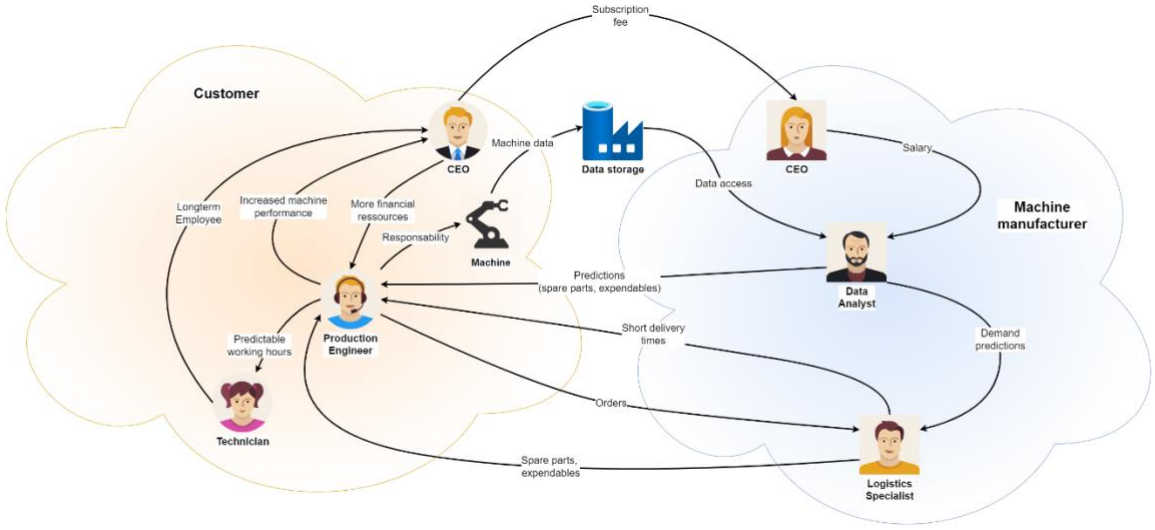


Figure 4 – Service ecosystem with the main actors

Value Creation

The customer benefits on various levels from our service:

Role/Persona	**Benefit**
Production Engineer	Does not have to worry about sudden machine failures as much.
	Is able to plan jobs more accurately (and stick to them).
	Has less yield-waste (unusable produced goods).
	Is able to increase production.
	Has to rely less on people (who get sick, leave, are late, etc.).
	Does not have to maintain a spare parts storage.
	Can use our data to find out how to better setup and tune the machines.
CEO	Can save costs (personal and spare parts management).
	Can produce more revenue due to increased production efficiency.
Technician	Has less overtime on account of less machine failures.
	Is more satisfied with the job.

The value for the customer is created using the data-based predictions. This results in a better machine performance with less internal resources and a higher output per machine, which at the end increases the company profit.

Value Capture

As a service provider we capture value by receiving a lot of data from our machines. This allows us to create insights that we can use for research and development of our next generation machines. In addition, the direct financial value is coming from the service payments performed by the customer.

4. Discussion and Outlook

According to our case study interviews, there is a strong need to use predictions to reduce downtimes and manufacturing costs. When we presented our value proposition to the same people we had interviewed at the beginning, we received valuable feedback:

- The suggested fees for our service were perceived as reasonable but the profitability depends on each customer's manufacturing cost and region.
- Our in-house domain expertise (development engineers or product engineers) is a big benefit to define detailed requirements for data analysis and reliable predictions.
- There is no one-size-fits-all solution for how this data is shared and managed and our smart service needs to be customized for individual companies.

Despite of the general positive feedback, we discovered several challenges related to the proposed "Smart Service". Our data-challenges could be grouped in three categories:

(1) **Trust** challenges. The customer is not convinced that it is possible to create a reliable data model able to predict unplanned outages.
(2) **Process** challenges related to data handling, e.g., capture, clean, integrate, transform, store, visualize, etc.,
(3) The biggest challenge is the **secure data management** infrastructure, e.g., security, privacy, information sharing, operational costs, data ownership, governance and ethical concerns. The manufacturing data, as well as quality and reliability information gathered during these processes is one of the customer's key secrets and has a direct impact on the company's business such as direct cost, warranties and liabilities.
Therefore, effective data management using appropriate expertise and secure infrastructure are necessary for Data analytics to support smart and sustainable manufacturing.

The Course of the Year 2021

We had six very interesting cases in 2021. Without wanting to prioritize the cases, they are put into a sequence here:

Given the background of the ongoing pandemic, three of the cases were centered around the organization and optimization of remote or hybrid office work or office infrastructure:

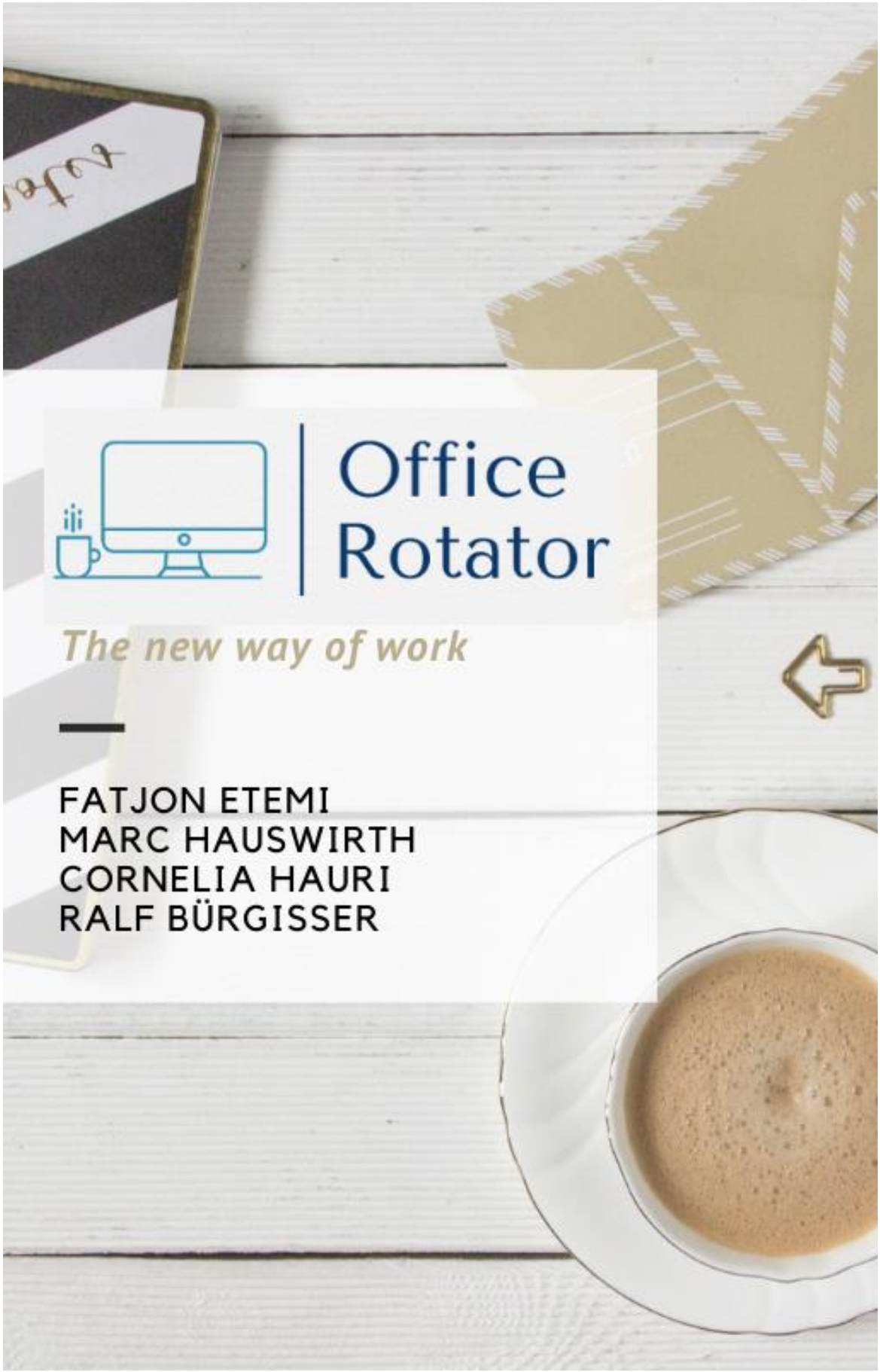
- Office Rotator
- Workplace User Experience
- Café Claro

Additionally, there were three cases in the area of optimization of work processes, such as the optimization of a workflow in a lab environment, the optimization of IT cloud utilization, or the optimization of shelf management processes in retail:

- eLogbook
- Cloud Infrastructure Optimization
- Smart Shelf: Digitale Erkennung von Obst & Gemüse mit ungenügender Qualität

There was again very high engagement by the participants this year. The cases were developed and sharpened over numerous design iterations and in the two-day *Mobiliar Forum Thun workshop*. Many thanks to Katrin Hasler and Ina Goller for their excellent moderation of this online workshop.

At two distinct moments in the development, i.e., after the development of the value proposition including digital prototypes and after the development of the service business system, the participants presented their cases to a high-profile ***expert jury*** consisting of industry representatives, entrepreneurs, and scholars. We would like to express our gratefulness to these experts here for dedicating their time and experience: David Hess, Fabio Rovelli, Ina Goller, Katrin Hasler, Kurt Stockinger, Lukas Schweiger, Marc Rennhard, Markus Marti, Nadine Charlon, Rolf Günter (alphabetically by first name). Their challenging feedbacks were essential for driving the cases to the next level.


Office
Rotator
The new way of work
FATJON ETEMI
MARC HAUSWIRTH
CORNELIA HAURI
RALF BÜRGISSER

Abstract

During the Covid 19 pandemic, many employees had to work from home. The working situation of office employees has changed abruptly, giving the topic of New Work an enormous boost. In the future, the workplace will probably no longer be fixed in one place. New challenges are opening up. To whom and in what form will office space be rented? How can employees find a suitable workplace? Office Rotator offers a platform on which office space can be rented flexibly for short or long periods without having to sign a long-term contract. As an attractive employer, companies can offer their employees a free choice of location independent offices and meeting rooms via Office Rotator. The smart use of data such as location, user behavior, weather data, ratings, etc. makes Office Rotator unique. The offers are adapted to the user. For multi user collaboration, requirements are combined to provide the appropriate space. Partnerships ensure that the processing (online and on site) is secure, smooth and fast.

Keywords
Home Office, New Work, Work Live Balance, Shared Workspace, Job

1. What challenge does Office Rotator solve?

The pandemic turned the working world upside down. Suddenly, many employees were ordered to work from home and had to reorganize themselves. This change brought new momentum to the way we work together and opened up opportunities for more modern working models. In addition, the Rundstedt[6] study shows that employees want more flexible working conditions.

Figure 1 Problem definition

This event has shown that the time has come to establish new working models and that the world will not return to its former normality. On the one hand, there will be employers who own office space that incurs monthly costs but is not used entirely by their own staff. On the other hand, there

[6] https://www.rundstedt.ch/wp-content/uploads/2021/03/Whitepaper_Smart-Working_2021_DE-1.pdf

will be employees who want to avoid the long commute to the office. However, the personal living situation often does not allow for a home office in the long run. This is exactly where Office Rotator comes in. A platform that brings office space owners and office space users together for a new and uncomplicated experience.

Figure 2 Gains, Pains, Jobs

On the one hand, Steven benefits. He owns office space that is not being used. He can rent them out on the Office Rotator platform by the hour, day, week or longer. On the other hand, Robert Company wants to be an attractive employer and offer his employees not only on side office and home office, but also the countless possibilities of office space from Office Rotator. Robert is a business customer of Office Rotator. His employees can book an office of their choice via the platform. The costs are handled by the company. The office user Katy benefits from the Smart Service. As an employee, she can rent a suitable office at the desired location on Office Rotator.

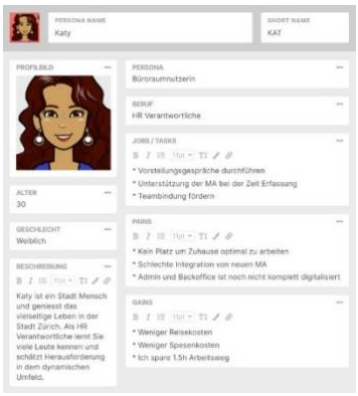


Figure 3 Persona Katy

The vision of Office Rotator:
Flexible office rental for any customer need at any time in any place.

2. What data-driven service approach do we use to solve the challenge?

Office Rotator "the Airbnb for office space" is based on the following value propositions:

Generate revenue by offering your office space

Customers who have a lot of vacant office space due to the new forms of work can offer it via the Office Rotator platform. You can publish an advertisement in just a few clicks. Tips from Office Rotator on how to better present office space will help to get more inquiries. Qualitative photos, equipment and availability are just some of the features that the office space providers can add to the post. The algorithm analyzes this data and suggests the space to suitable customers.

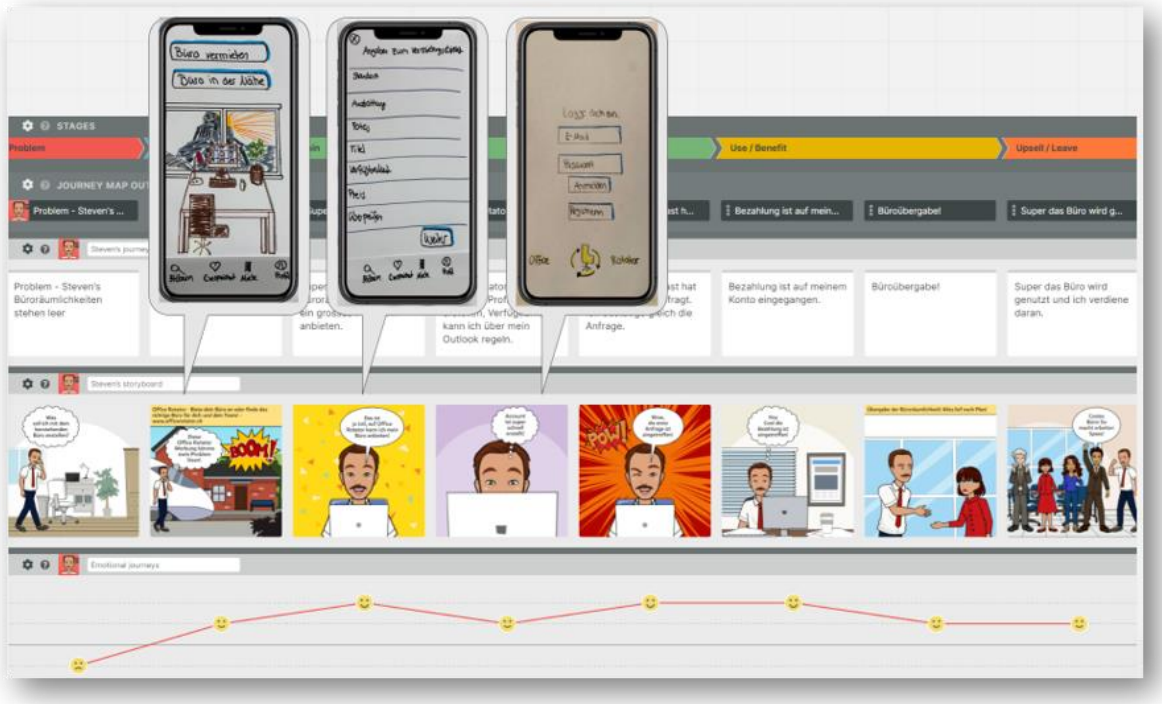


Figure 4 Customer Journey Office Space Landlord

Find office space quickly and easily in your area

Employees who do not find enough peace to work in their home office or who would like to meet their colleagues, but do not want to have a long commute, have come to the right place at Office Rotator. Office Rotator offers them the office space that suits them best. The data stored by the providers, as well as other data such as location, past bookings, ratings and weather data are analyzed. In addition, the platform offers the possibility of organizing meetings in order to find the appropriate space.

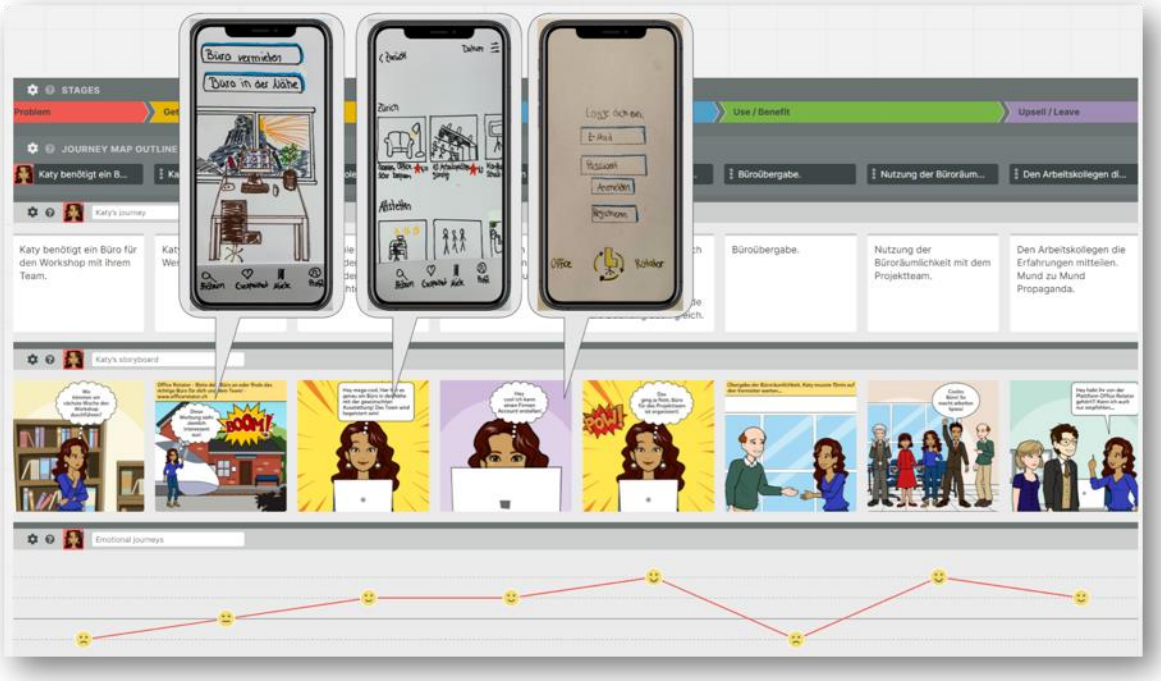


Figure 5 Customer journey office tenant

3. What does our target service system look like?

As described above, Katy and Steven interact with Office Rotator through various touch points. Initially, Office Rotator will engage with its customers through social media. The advertising can be personalized on the social media platforms and the reach is large. Figure 6 shows the Blue Print service from Steven.

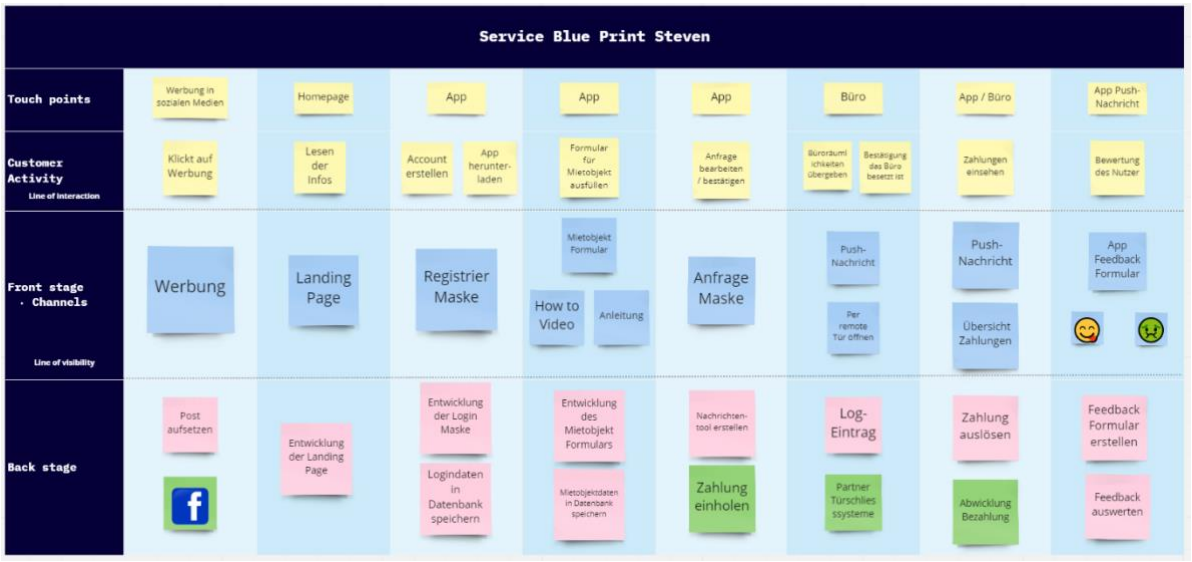


Figure 6 Service Blue Print Office Space Landlord

The interactions take place via an app. This allows the user to conveniently organize a work location for the next day while they are on the move. Customers must register before making their first booking. Identity data is recorded for personal security and fraud protection. Notifications are made either via "push notification" or e-mail. The backend runs the usual services such as payment processing, scheduling, database queries, approval processes, etc. Steven is offered additional services such as an automatic locking system.

The Blue Print service for Kathy shows many similarities to that of Steven. Figure 7 shows the Blue Print service for Kathy.

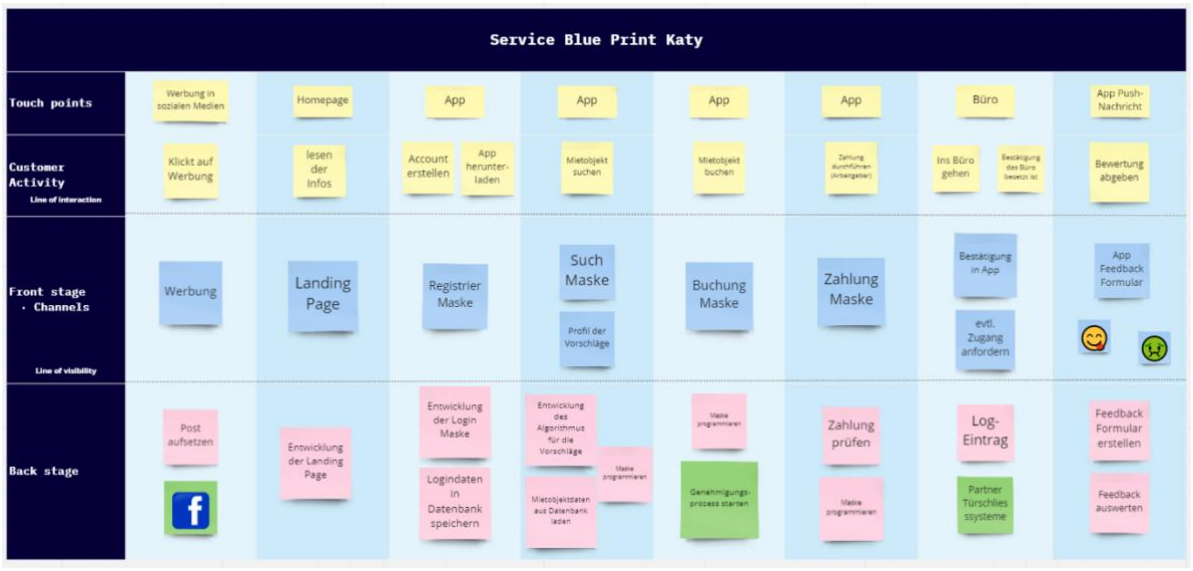


Figure 7 Service Blue Print Office Tenant

Data integration

Partnerships are expanded over time. Weather data can be used, for example, to suggest office space with optimal train connections in the event of snowfall. Initially, the focus will be on Katy's and Steven's personal data, such as calendar data, location, etc., in order to provide a user-centric service. In order to provide a user-centric service.

Values for the Office Rotator clientele

Office Rotator's service makes it easy for office space owners to adapt to the demands of new ways of working, offer office space, avoid vacant space and generate revenue as a result. On the side of the office space seekers a new horizon is opened by the service of Office Rotator. New forms of work are made possible. Katy finds an uncomplicated working environment in which she can concentrate better, feels comfortable and enjoys her work more.

Service hypothesis

Office Rotator assumes that enough office space owners are willing to offer their space through Office Rotator. However, owners may also fear that access to the space will be difficult, that vandalism will occur, or that the profit will be too low. Therefore, it is hypothesized that there are enough owners who will offer their office space. The hypothesis is confirmed when 20% of the owners interviewed sign a letter of intent (LoI) to cooperate with Office Rotator. Further hypotheses on business-relevant assumptions are presented in Table 1.

Table 1The most critical hypotheses

1. we believe that...	2. for verification, we will...	3rd measurement...	4. our hypothesis is correct, if...
Owners would like to share / rent their office space	LoI MVP	Share LoI	20% LoI --> Offer rooms
Office users do not want to work from home	Determine interest via social media (FB)	Download	In 8 weeks, 0.5% of viewers click on a download link.
sufficient office space combinations are available	Survey via social media (FB)	Match between survey and offer	Extrapolation of the LoI with regard to location, characteristics of the office space, etc.

4. Sources

- https://www.rundstedt.ch/wp-content/uploads/2021/03/Whitepaper_Smart-Working_2021_DE-1.pdf

Workplace User Experience

Jonas Bachmann
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Rosalie Quach
Roy Morrison
Cyrill von Senger

Abstract

Across the world, many organizations are transforming their workplace models to activity-based and hybrid working. These workplace transformation projects offer immense opportunities to reduce office space costs, enhance workplace user experience (UX), performance and, as a result, improve business outcomes. At the same time, new ways of working also lead to new challenges which increase the risk of workplace managers failing to achieve the stated objectives of the workplace transformation.

One major challenge workplace managers face is to ensure that for every workplace user and at any time, there is a desk available that optimally supports the workplace user in executing the task at hand. Secondly, workplace managers are missing the information and insight required to ongoingly assess how well the workplace fits the needs of all workplace users, so that corrective action can be taken if necessary.

These challenges can be addressed by combining data streams from workplace conditions and UX. Workplace conditions are monitored using sensors that measure noise levels, air quality, and occupational density. Workplace UX monitoring is accomplished with wearables measuring stress parameters such as heart rate, heart rate variability, and skin conductance. Machine learning generates actionable insights from these data streams. To address the first challenge, the system learns which individual setting is best for each workplace user in a given work context. To address the second challenge, the system learns how the overall optimal workplace conditions need to be for optimizing the overall workplace UX of all workplace users.

Hence, the service platform comprises two tools. The first tool – ***desk matcher*** – makes sure that each workplace user at any time finds the workspace that best suits his/her preferences and activity. With the second tool – ***workplace optimizer*** – workplace conditions and UX are continuously monitored and, if necessary, corrective actions to re-establish a fit of workplace conditions with workplace user needs are suggested.

Key words
Workplace transformation, workplace user experience (UX), sensor as a service, biometrics, workspace data

1. Which Challenge Do We Solve?

What are the biggest challenges our prospective customers – workplace managers – face? To answer this question, we interviewed workplace management decision-makers in mid-sized and large Swiss knowledge worker organizations. Our customers' job is to cost-effectively plan, provide and operate user-friendly workspaces. The interviews we conducted revealed two major pain points: Firstly, workplace managers are missing the information required to ensure that, at any time, each workplace user can perform his/her work in a workspace that is suitable for his/her activity and, if necessary, collaborate with the colleagues. Secondly, workplace managers are missing the information required to ongoingly assess how well the workplace fits the needs of workplace users to optimize the overall workplace UX.

2. By which Data-Driven Service Approach Do We Solve the Challenge?

By processing new data through sensors such as noise level, air quality, occupancy, or workplace users' stress level, our tool offers a compelling value proposition to workplace managers as well as workplace users. Workplace managers benefit from receiving previously unavailable insights and recommendations in real-time to ensure the workplace UX is ideal. For example, this allows workplace managers to adjust the air quality in specific workspaces to boost productivity.

For workplace users ***desk matcher*** offers recommendations on the optimal workspace considering the users' desired preferences and activity. The optimal workspace can therefore be a silent room, a room that allows for easy collaboration with team members or group meetings as well as phone booths.

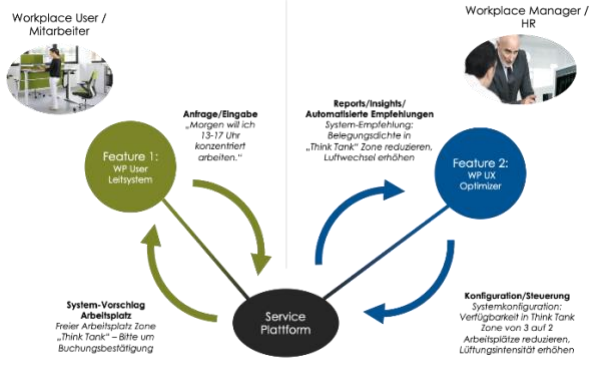

Figure 1: Ecosystem with the main actors workplace user, manager and platform

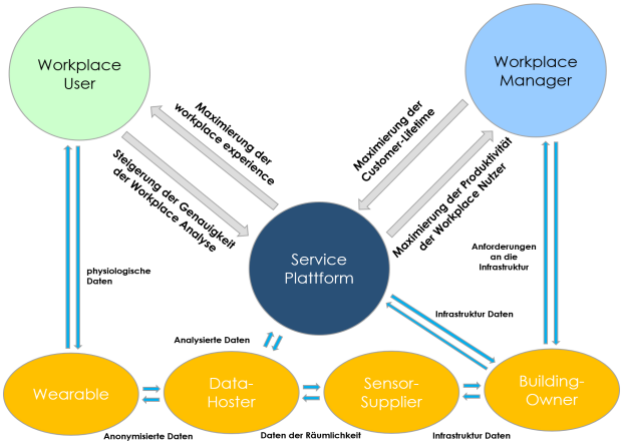

Figure 2: Ecosystem with additional actors to enable the value stream.

For the measurement of the stress level, we use biometric data such as heart rate or respiration rate. These are obtained on a voluntary basis via wearables. Based on location data via mobile and beacons, the system knows in which workspace the corresponding workplace user is located. With sensors in the respective rooms, we measure the physical room quality, such as noise level, air quality, and temperature.

We use two machine learning approaches delivering the data-based insights for ***desk matcher*** and ***workplace optimizer***:
With the first approach, the system learns which kind of setting (space, room climate, occupancy density, etc.) is optimal for each workplace user and his/her different activity. With the second approach, the system learns how the overall optimal room setting is (all workplace users) to feel most comfortable and achieve the highest productivity.
The solution provides real-time KPIs such as occupancy rates and allows the workplace manager to configure the office settings (e.g. occupancy densities per zone). The system permanently optimizes the recommendations on an individual basis (workplace users) and on an overall basis to the workplace manager (see Figure).

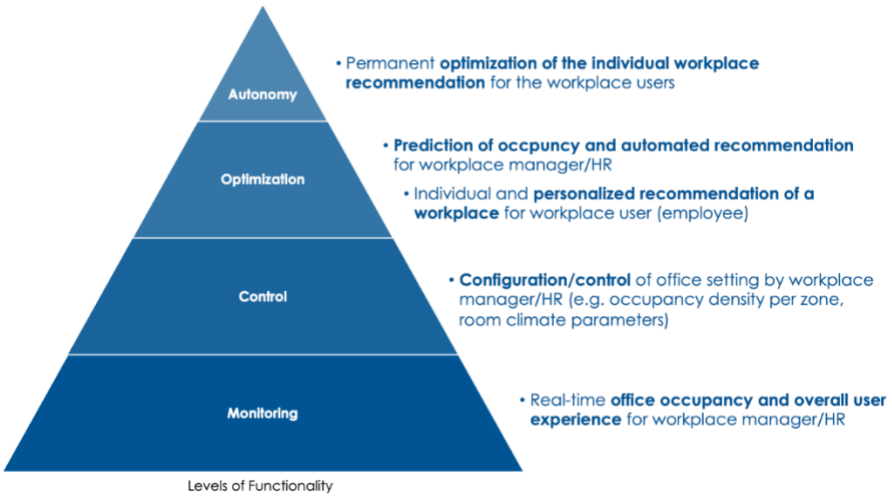

Figure 3: Levels of functionality of our service platform

3. What Does Our Target Service System Look Like?

The first tool – ***desk matcher*** – is designed to make sure that each workplace user at any time finds a workspace corresponding to his/her preferences and activity.
The second tool – ***workplace optimizer*** – is designed to continuously monitor workplace conditions and workplace UX, based on which corrective actions are suggested. If, for example, stress reactions are associated with a poor room climate or high noise level, the system sends out a message and suggests corrective measures.

Workplace managers benefit on various levels from these decision support systems. Functionally, workplace managers can better perform their job, which is to provide a workplace that optimally supports workplace users in executing their tasks. On a financial level, happier, healthier, and more productive workplace users positively impact the business outcomes and financial results of the organization. Another social benefit is that happier and more productive workplace users improve the workplace manager's standing in the workforce. In addition, a workplace manager being able to successfully measure, understand and improve the workplace based on data is going to earn additional respect and credibility from superiors. On an emotional level, success in executing his/her

job, coupled with a better standing among both, workplace users and superiors are expected to have a positive emotional impact on workplace managers.

Figure 5: Mockup of workplace user (workplace user) smartphone app

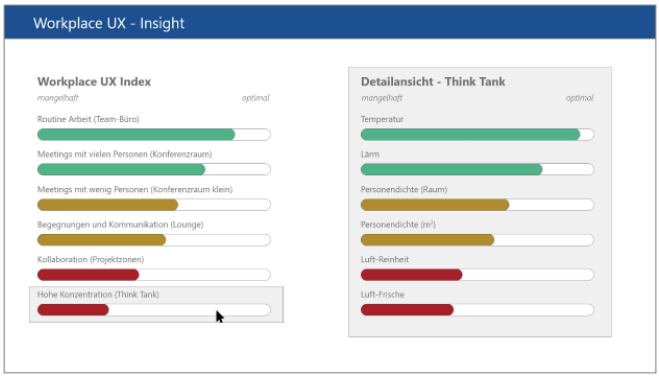

Figure 6: Mockup of workplace manager (HR) monitoring and control dashboard

In terms of business model patterns, we see three fits. First, the "Leverage Customer Data" model. We collect data on the workplace and workplace users to optimize the UX. Furthermore, the "lock-in" model suits our service platform as the various systems are closely interlinked and as the amount of data increases, we create a more precise algorithm with continuous optimizations for the workplace. Finally, we are using the "sensor as a service" model. By using sensors, we generate added value for the workplace user and manager.

When testing the most important hypothesis, we will proceed as follows:
To evaluate whether there is an actual demand for our ***desk matcher*** among our target customers we will conduct qualitative interviews. To test whether we can affect optimizations with the workplace UX data streams, we would like to set up a pilot project with ETH and EMPA NEST. They have a test environment in place to gain insights all around the workplace UX. To find out whether we will receive data in sufficient quantity and quality, we will survey our target customers on their willingness to participate.

Sources

- Figure 3: Levels of functionality: Framework based on Michael E. Porter and James E. Heppelmann: "How Smart, Connected Products Are Transforming Competition", November 2014, Harvard Business Review

Café Claro

Christina Meyer
Guido Innerhofer
Markus Bossert
Simon Stäheli

Abstract

The coffee machine's water has not been changed for days and nobody is taking care of the stacked cups in the sink. Who is not familiar with this situation? This is where the smart coffee company 'Café Claro' comes into play. We democratize coffee machines in small and medium sized enterprises and make coffee enthusiasts happy again.

Every coffee drinker is encouraged to participate in the 'Café Claro' ecosystem to keep the office environment clean and the coffee enjoyment high. A smart system periodically assigns maintenance tasks to coffee drinkers in the office and rewards the ones that execute those tasks. Free coffee and vouchers are incentives to participate. As home office has become very popular, the smart system ensures that only colleagues that are available in the office are assigned a task.

Coffee supplies such as coffee beans, milk, sugar or cleaning equipment are delivered automatically, based on the amount of consumed units. Furthermore, integrated sensors report if a coffee machine requires maintenance, which again increases its guaranteed availability. An integrated payment system makes the monthly accounting obsolete and a social media component to inform co-workers about their coffee break completes the service. With the goal, to make the coffee break enjoyable and to strengthen the team spirit.

Key words
pay-per-use, IoT, food logistics, smart ordering, gamification

1. Which Challenge Do We Solve?

About 80% of the employees are drinking one to two coffees each day. In every enterprise there is at least one coffee machine installed. For this daily coffee consumption at the office, the following tasks must be guaranteed:

- clean cups and dishes must be available
- the reordering of the coffee beans, milk and cream and the sugar must be duly initiated
- the regular decalcification of the coffee machine must be executed
- the exchange of the necessary coffee water is very important,
- the trash bin of the used coffee powder must be regularly emptied and cleaned and
- the collecting & counting of the money of each coffee user is necessary

Our interviews showed that for many small and medium-sized enterprises (SME) these are typical tasks of a person who feels responsible for them – but does not necessarily like to complete them. Unfortunately, their effort is rarely noticed and depending on the number of machines, the effort to complete all these tasks may reach up to 10% of an employee's weekly working time.

Beneficiaries of the Smart Service and Their Needs

This smart service is developed for SMEs between 20 up to 250 employees. We primarily approach the CEO of a company or – depending on its size – the person responsible for the office management. However, any (coffee drinking) employee in the company will be involved and benefit from the service, since it aims at distributing tasks amongst the employees.

The Value Proposition Canvas (see Figure) shows the major findings of the executed interviews and of our smart service 'Café Claro'. The key pains evolve around the payment concept (if SME charge for the coffee), the unfair distribution of tasks around the coffee machine (they are often completed by the same persons), the milk might be sour or not available at all or cups are dirty and no one takes care of washing the dishes (which might be especially annoying if guests are expected).

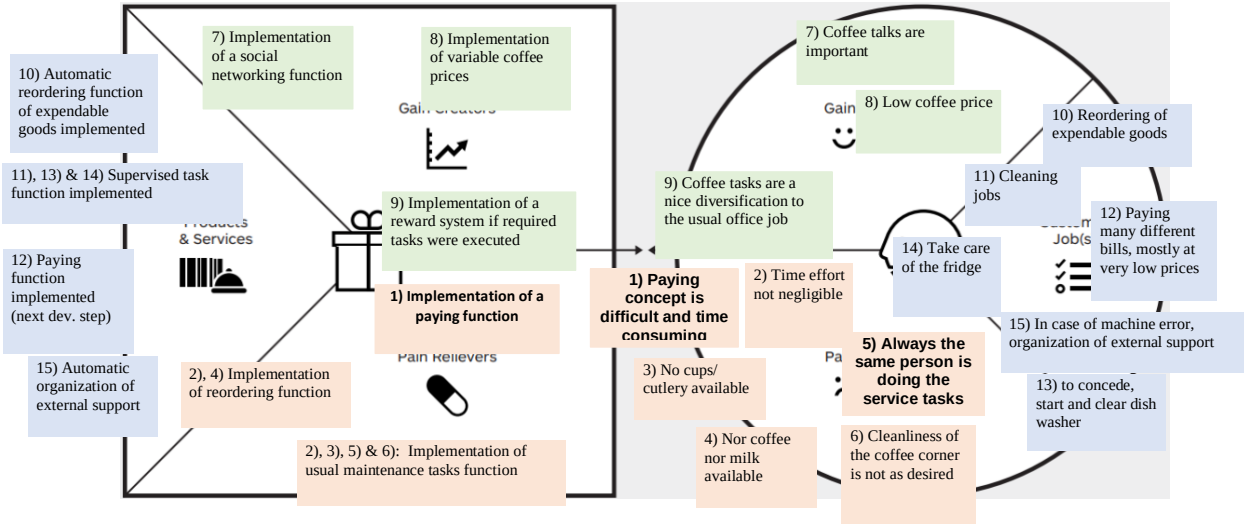

Figure 1: Value Proposition Canvas 'Café Claro'

2. By which Data-Driven Service Approach Do We Solve the Challenge?

Café Claro offers a relaxing coffee break: The 'Café Claro' smart service is a complete careless coffee package with a free coffee machine and everything employees of a SME need to enjoy their coffee. In this careless package an app is included, responsible to manage all pending tasks connected to the coffee machine. To be more precise, the following main functions are implemented:

- an overview of pending or already executed maintenance tasks,
- an overview of the next reordering of the expendables,
- a simple payment function that integrates with established payment providers
- a function to invite colleagues for a short coffee break.

The first three functions are based on collected coffee machine data and the last function covers the idea of convenient and interesting coffee breaks with colleagues.
The following table gives an overview of the supervised maintenance tasks and the required data to detect and activate them.

Maintenance task	Measured variable or parameter	Data owner	Analytics & Logic
Water exchange necessary	Time Water hardness	-	By the first commissioning the parameter "Water hardness" must be added by a power user. The water exchange itself will be necessary every morning. If the water has not been exchanged, no coffee can be selected.
Machine cleaning necessary	Operation time Coffee counter	Machine producer	After a certain amount of consumed coffees or after a defined operation time, this task appears.
Empty bean powder trash	Coffee counter	Machine producer	After a certain amount of consumed coffees or after a defined operation time, this task appears.
Refill coffee beans	Coffee counter	Machine producer	After a certain amount of consumed coffees this task appears.
Water collecting pan is full	Coffee counter	Machine producer	After a certain amount of consumed coffees or after a defined operation time, this task appears.
Reordering of milk	Coffee counter	Machine producer	After a certain amount of consumed coffees this task appears.
Concede and start dish washer	Time Coffee counter	- Machine producer	Task to collect the cups appears each evening. Dependent of the amount of consumed coffees and the manual input of the number of cups in the machine this task appears.
Clear dish washer	Time counter	-	Time counting starts as soon as the cleaning machine start is confirmed. This task appears after a cleaning machine dependent time factor. A standard time delay is already implemented but this factor can be adjusted by a power user.
Reordering of supply	Coffee counter	Machine producer	After a certain amount of consumed coffees this task appears.
Decalcification necessary	Coffee counter Running hours	Machine producer	After a certain amount of consumed coffees or after a defined operation time, this task appears
Regular inspection of the items in the fridge	Time	-	Once a week this task appears.
Coffee machine error available	Time Warning indication Water pressure Water temperature Grinder parameters	- Machine producer Machine producer Machine producer Machine producer	After a predefined amount of coffees or after a defined time interval a technician will be called to check the safety of the coffee machine. If a warning indication appears, the water pressure is more often outside the usual range or the grinder parameters show unusual values a technician will be called too. An additional function to schedule such visits is implemented too.

If someone has finished and confirmed such a maintenance task, a task related amount of credit points will be added to his/her app account. With these points either free coffees or another reward will be available, sponsored by the SME.

Beside this regular maintenance tasks other functions are available in the 'Café Claro' app:

Function	Measured variable or parameter	Data owner	Description
Invite colleagues for a coffee break	Knowledge of the colleagues in office	-	Implemented app function to arrange short coffee breaks with colleagues working in the office space.
Select coffee type[7] Pay selected coffee[1]	Actual machine status Warning indication	Machine producer	App function to select and pay available coffee types. This function will be limited to a certain physical distance between user and machine. If a warning is available or another coffee is in preparation the by the app selected coffee will be rejected. The Easy Pay function will always be available.
Adapt personal coffee taste[1]	Water pressure Water temperature Coffee, water ratio Grinder parameters Extraction time	Machine producer	With this app function the personal coffee taste of the user can be adjusted. Each time this user selects a coffee via the app the coffee will be prepared with his chosen parameters.

[7] These functions are concepts to implement later to increase the coffee experience with our Smart Service further

Most of the used parameters are in the property of the machine producer. Some retailers do already transfer some encrypted data via WLAN to retailer owned apps. To implement our Smart Service further negotiations to convince different retailers will be necessary. This point will be explained more detailed in chapter 3.

Storyboard & Prototype

Our data-driven coffee service is visualized in the following storyboard:

Figure 2: 'Café Claro' Storyboard

The app prototype is having the following appearance (for a clickable prototype, please visit: https://marvelapp.com/prototype/g5ga16b/screen/77820125)

Figure 3: 'Café Claro' Mockup

3. What Does Our Target Service System Look Like?

To fulfill the various functions of the smart service, different actors are involved, reaching from the machine manufacturer till the employees. The following blueprint helps to get an overview of the different steps involved.

Service Blueprint

Steps	Online Offer Smart Coffee	Order Machine	Install the Service	Buy a Coffee	Complete Tasks	Re-order Coffee & Equipment	Arrange Maintenance	Take a Break!
Physical Evidence	- SME reads about the offer online and evaluates the service	- Machine inkl. service is ordered online - Basic payment in advance (will be allcoated)	- Coffee machine and initial equipment arrives - Installation of machine and service	- Employees buy and enjoy their coffee	- Employees take over small tasks	- App shows that coffee and other equipment will be delivered	- SME is informed that maintenance is due - with possibility to book time online	- Employees meet for coffee breaks
Customer Actions	- Visiting website	- Make the order - Pay the basic payment	- Open package - Connect machine - Install app	- Chose coffe in app / on screen - Add milk or sugar	- Chose a task - Mark it when completed	- Read the info - Customize order if needed (amount)	- Read info regarding maintenance - Book time online	- Send and receive coffee break requests
Frontstage Interactions	- Show information on website	- Show order screen on website	-	- Display coffee options - Make milk & sugar available	- Show tasks and status of completion	- Show pending orders	- Show info at right time - Coordinate time slot online	- Send requests and answers
Backstage Interactions	- Design, program, host website - Deal with coffee machine manufacturer, install sensor	- Save order - Charge payment	- Coordinate delivery - Brief call center - Coordinate equipment	- Count amount of coffee - Analyse data	- Track task completion - Distribute credits	- Order is automatically coordinated with provideR - Data is registered	- Offer online booking tool - Coordinate data-based maintenance	- Set up accounts for employees - Data security - Show availability
3rd Parties	- Hosting - **Coffee machine manufacturer** - **Sensor manufacturer**	- Payment - Cloud service	- Delivery Service - **Food & Equipment Provider**			- **Food & Equipment Provider**	- **Service provider / machine manufacturer**	- Possible cooperation with Teams, Slack, etc.

Figure 4: Service Blueprint 'Café Claro'

The Value Created for the Customer and other Actors in the Ecosystem

As indicated earlier, the business model of our service is based on a pay-per-use principle. Financial value is exchanged between the different actors in the ecosystem (see the yellow arrows in Figure). When looking at the ecosystem it becomes clear that – besides the financial value – further values are exchanged: functional, emotional and social values. These values reach from information regarding service dates for technicians (functional) over the relieve not having to do all the machine tasks by yourself (emotional) to acknowledgement over the tasks completed (social). The social and emotional values are mainly found in the ecosystem actor "SME A", whilst the value reaching 'Café Claro' is mainly functional and financial.

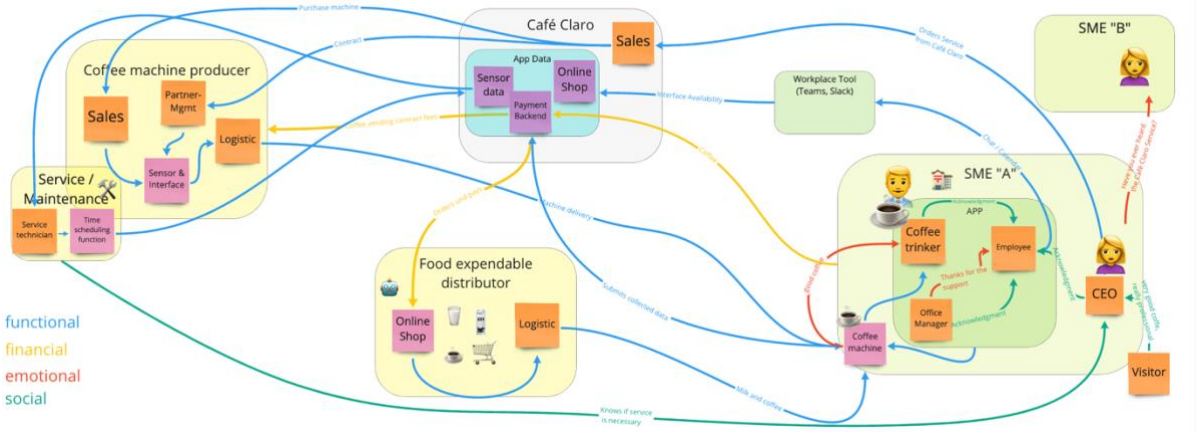

Figure 5: Ecosystem 'Café Claro'

The Riskiest Hypothesis and a Possible Test Framework

In the process of working on the Business Model Canvas we made some assumptions. They were turned into hypotheses we tried to evaluate.

Figure 6 Hypothesis #1

The most crucial hypothesis we defined is about the fact if our value proposition is recognized at all by potential customers. The main beneficiary actor, the coffee consumer, is not the same person as the decision maker that decides about such a solution. There is often not too much transparency about the actual costs of a coffee machine and its environment in a SME. Therefore, it is even more important to make sure the added value is well understood and positioned.

Besides testing the value proposition, it is also important to start negotiations with coffee machine producers early on, since our service is dependent on the data generated by their machines. This is the second hypothesis we introduced. Partnering up with a manufacturer is crucial to get our service up and running. We hope to convince a manufacturer as soon as possible – to be able to offer relaxing coffee breaks for as many SME in Switzerland as possible.

Figure 7 Hypothesis #2

4. Outlook

For a proof of concept, we kept the focus on coffee machines only. During the interviews with potential customers, it turned out that the ecosystem could easily be extended to other devices of the daily life in office kitchens. Dish washers or the fridge are perfect devices predestined for tasks that could be distributed across the entire team.

Another very interesting feature that has been discussed was dynamic pricing. A beverage from the coffee machine containing milk could become cheaper if the milk expires soon. This would go hand in hand with the above-mentioned ecosystem extension.

We believe that office kitchens have an undiscovered potential.

eLogbook

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Abstract

The eLogbook is an automated, digital logging and tracking system designed for capturing information pertaining to actors and work related to manufacturing lines. While our specific use case illustrates the service as applied to a pharmaceutical production line, it could be implemented in any scenario in which tightly controlled monitoring of production output and traceability of an end product is required or mandated by regulatory bodies (e.g. GMP environments such as cosmetic production).
At present, much of the logging data related to pharmaceutical production is still captured manually, especially in the small and medium enterprise (SME) environment. Health authorities require that the production chain of every marketed product is fully traceable. Therefore, it is key for a pharmaceutical business to be able to collect such information in a systematic, efficient, and reliable way. Primary data points could include the cleaning time of production apparatus, production batch numbers, and when a given machine was last serviced. The aim of the eLogbook service is to automate the collection, processing and storage of this data. The customer will benefit in work efficiency, quality, and transparency. In this paper, we describe the pain points the service aims to alleviate, go into the details of the data-driven approach to be employed and further describe the service in terms of its primary value proposition.

Key words
digital logbook, GMP, security, quality

1. Which Challenge Do We Solve?

The goal of this business case is to use logbooks more effectively in an industrial environment – particularly in the pharmaceutical industry.

In this regulated industry, logbooks are used for major or critical equipment. A logbook is one element of the documentation required, when manufacturing pharmaceutical products. According to the principles of Good Manufacturing Practice (GMP)[1], a logbook must contain the chronological history of production equipment, a testing device or even areas, where products are processed. The key activities to be logged by the people, who are carrying these operations out, are processed batches, cleaning, performed calibrations, maintenance or repair operations.

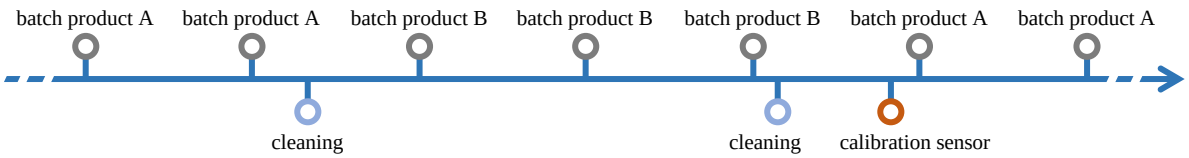

Figure 1 - Chronological logbook entries

Through the whole lifecycle of a piece of equipment, all these activities are tracked in paper logbooks (Figure) in most cases. This documentation may be consulted later as reference by the production/laboratory/maintenance staff or the quality insurance unit in order to gather some information for a specific task. For an auditor, the logbook records provide the evidence that the instructions were followed as required (e.g., correct calibration interval, clean hold time respected).

All these person groups have some benefits when using a logbook. The jobs to be done, the pains encountered and the gains they are expecting when using logbooks are summarized in the following table.

Table 1 - Customer profile

Customer jobs	o log activities accurately o check equipment/room status, check clean hold time o investigate historical records o demonstrate compliance during audits
Pains	o not logged promptly, entry could be missing o logging costs time o old entries are difficult to retrieve o log entry inaccurate, incomplete, difficult to read o not enough space for logging
Gains	o reference book o GMP compliance ensured (traceability) o logbook easily accessible for users, kept short and concise o complete documentation, coherent system o trend identifiable, frequent issues noticeable

2. By which Data-Driven Service Approach Do We Solve the Challenge?

Our service is a digital logbook (eLogbook) which can be used on mobile or desktop devices. The eLogbook will reduce the time for adding a new entry in the logbook, so that the line worker has more time for his main tasks. This can be achieved, because the user gets suggestions while adding a new logbook entry. These suggestions are based on machine learning models applied to the historical data. Additionally, the eLogbook will help the customer fulfil the GMP guidelines by leading the user during the logbook process. This ensures, that no entry is forgotten, wrong or inconsistent.

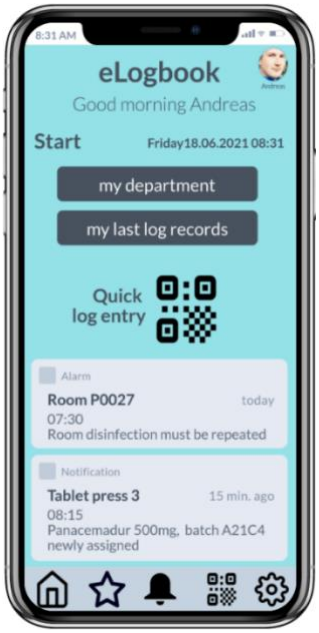

Figure 2 - Mobile prototype [2]

Table 2 - Pain relievers & gain creators

	What?	How?
Pain Relievers	o logging and checking can be done more efficiently o GMP compliance ensured (traceability)	o digital logbook has suggestions and dictation function o software leads the user based on rules. Software fulfil requirements (21 CFR part 11, FDA [3])
Gain Creators	o higher accessibility and transparency o trends detectable o safer and cheaper storage of data	o searching and filtering historical data o possible to visualize and analyze historical data o cloud is cheaper and has backup

A possible sequence of events in the day of a line operator depicted as a storyboard.

Check room and equipment status	Equipment identification	Check in product batch as log	Batch production	Equipment cleaning & logging	Check out / All logs in one place

Figure 3 - Storyboard

3. What Does Our Target Service System Look Like?

The Service Blueprint

The interactions in the service between customer, system and supporting processes is illustrated through two frequent manufacturing activities: batch production and cleaning. The diagram below provides a step-by-step breakdown of the process a line operator follows from the moment they receive a production order, through to the final check-out and cleaning of the manufacturing room and equipment. The objective of the operator is to lose as little time as possible in logging both activities. The customer interacts with the frontend, whereas the backend is the heart of the solution.

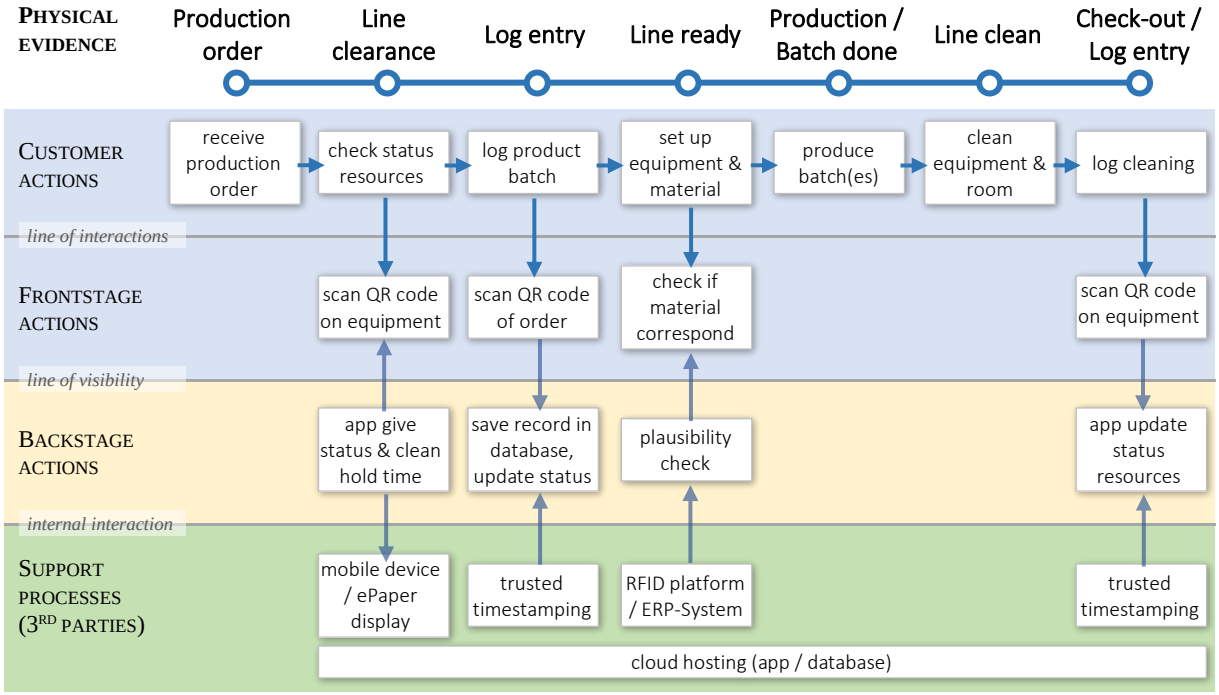

Figure 4 - Service Blueprint illustrating line operator work process for a production run

3rd Party Integrations

The eLogbook service encompasses several 3rd party actors. The basic product offering has been conceived as a SaaS solution with all data stored in the cloud. As such, one of the main 3rd party actors is the **cloud hosting provider**. Depending on the customer's needs, the application and data can be hosted on premise. However, this feature would be offered as an add-on and integration would incur additional cost to the end customer.

As an additional add-on, digital monitors (**ePaper displays**) could be offered as well. A business partner will supply the hardware. The displays are intended to be used to convey information on e.g. the cleaning "state" of a room, but could also serve as data-entry terminals in areas where mobile data capture is not feasible (e.g. Ex-areas).

A further service add-on is **Trusted Timestamping** [4]. This feature ensures the tamper-proof recording of logs by way of digital signatures. Implementation of this add-on would require partnering with a 3rd party provider such as SwissSign to ensure the integrity of the log entries.

Finally, IoT and **RFID systems** are opening a tremendous opportunity in the context of "Industry 4.0" for production industries. The eLogbook leverages RFID technology to tag every product that passes through a production line.

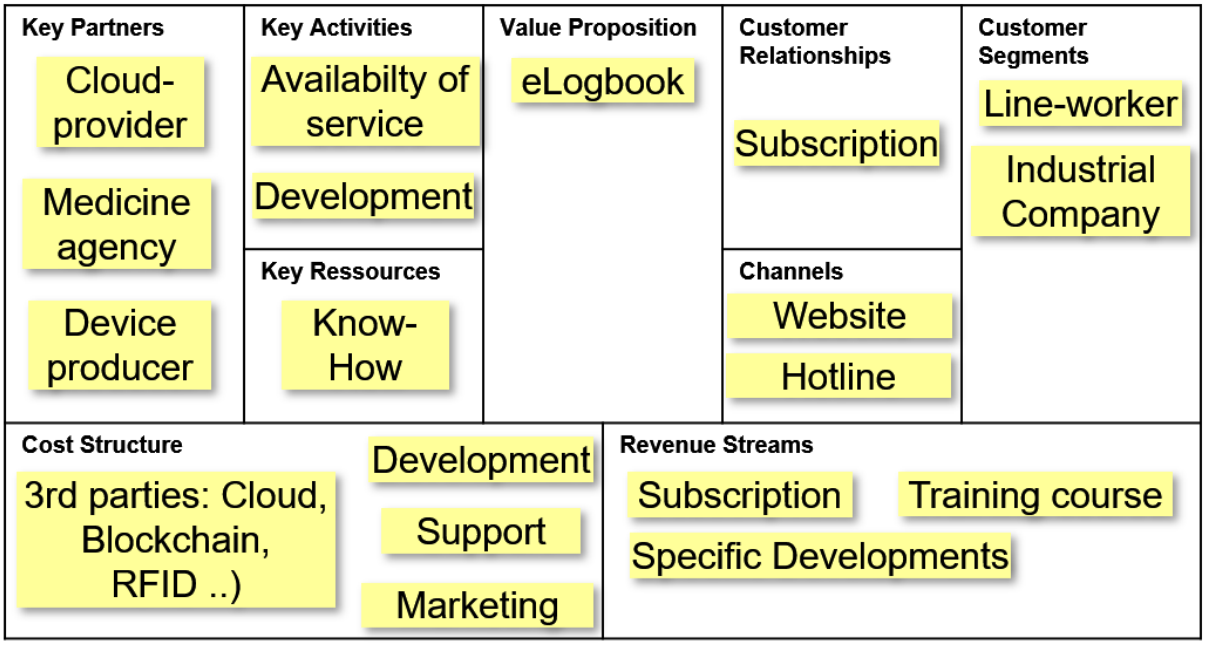

Figure 5 Business Model Canvas

Value Creation

We are convinced that the eLogbook creates value for customers, for society as a whole, and for us as vendors. Primarily, customer will benefit from gains in work efficiency, quality, and transparency. The solution offers a way for line operators and others on the shop floor to free up their time and work on more value-added tasks rather than spend time capturing logs. We expect these individual gains to produce compounding effects and allow the customer to optimise the scheduling of their production runs which in turn will lead to higher output.

Leveraging the digitisation of logs will also lead to higher quality products, as the precision and consistency of digital logs will certainly be higher than that of data points captured manually in paper-based fashion. Combined with the effect of increased transparency, the service will facilitate pre-emptive maintenance of production equipment, alerting to breaches of production procedures and potential product contamination. This benefits not only the customer, but has implications for end consumers, ensuring that they receive the highest quality and safest-possible product.

Finally, the expected increase in transparency of information throughout customers' organizations will lead to less downtime e.g. when audits are performed. Rather than tediously piecing together data from paper logbooks, digital logs can be compiled and reported upon at the touch of a key. We are certain many other new uses of the collected data will emerge over time.

Verification of Hypotheses

We are confident, that the majority of the points highlighted in the business model canvas fit with customer needs. To substantiate our assumptions, we have formulated a series of hypotheses, which we aim to test in due course. As an illustration, one hypothesis we believe to be critical is as follows:

Table 3 - Hypothesis check

	We believe it is critical to our customers that they can rely on customer support, which is available 24/7.
	To verify that, we will conduct interviews with potential customers
	and measure the percentage of customers, who agree with the hypothesis.
	We are right if, 80 % of the potential customers agree.

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CAS Smart Service Engineering 1/2021

Abstract

More and more medium-sized and large enterprises are taking the step into the cloud. Often this goes hand in hand with the IT transformation from the old hierarchical structures to agile software development – costs are no longer just a manager topic. This leads to a new situation where Product Owners (PO), Business Owners (BO) and many others also need an overview of the costs and consumption of their cloud assets to manage them properly. Many of these organizations are currently struggling with this task or must spend a lot of resources to manage these costs.

Our solution enables all responsible parties to have the same view of the cost and consumption data of their clouds, without having to deal with the provider-specific details of the different cloud providers.

Our service will provide customers with an easy-to-use self-service platform to optimize the cost and consumption of cloud services. Initially, we will offer these analytics to our customers as a service for the three currently most popular cloud providers (Microsoft Azure, Google Cloud, and Amazon Web Services). In addition, we also intend to use self-developed machine learning algorithms for all our customers to identify patterns and further optimize cloud infrastructure.
Overall, we want to give our customers the assurance and confidence that their cloud costs and cloud consumption will be managed in the best possible way if they only subscribe to our service.

Key words
Data Analytics, Automation, Optimization, Machine Learning, Cloud Infrastructure

1. Which Challenge Do We Solve?

Companies are more and more moving their local IT infrastructure into cloud environments. Most of them do not limit themselves to just one provider, because every of the large players has its own advantages. Those multi cloud environments bring complexity in generating reports with regards to cost and consumption. Although each provider offers its own reporting, it is laborious for a controller or IT PO to handle the different data structures and generate truthful reports.

Also, the optimal mix between costs and performance of the infrastructure puts the product owner in distress. If the infrastructure is oversized, costs will exceed budget. On the other hand, if its undersized, performance issues may occur. In daily business the IT PO also needs to handle with unplanned releases. In the end, he finds himself in a triangle of internal customers, his superior and controlling, in which he tries to please everyone, but with his current possibilities he may fail.

Figure 1 - Storyboard

2. By which Data-Driven Service Approach Do We Solve the Challenge?

With the entire value proposition, we clearly address the main pain points referring Figure 2: lack of knowledge in terms of the running IT-resources and balancing the IT costs and consumptions.

The core function of our digital service is a centralized user portal, which displays the current cost/consumption situation of the IT resources and offers a cost comparison service. The value proposition is therefore divided in three main services:

- Dynamic cost and consumption reporting
- Cost comparison, based on the current hardware demands between the three most popular cloud providers
- A consumption planner for the forecasted IT demands

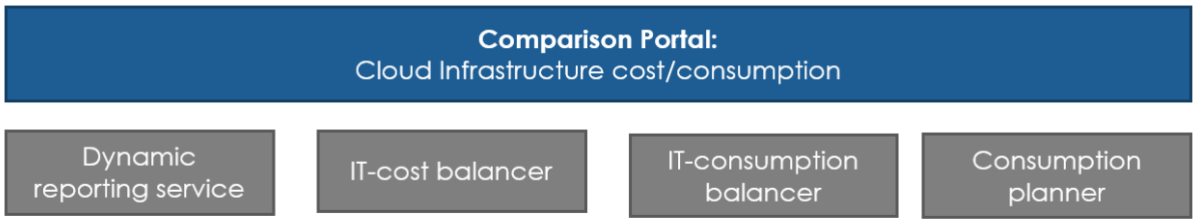


Figure 2 - Value Proposition

In fact, users have today the possibility to compare the costs of the IT-providers by themselves. But the main value of our service comes to play when the demand for IT-resources is changing with high frequency. On our comparison portal, the users have access to a meaningful report, which can be generated in seconds. That leads the user to take the right decision concerning IT-resources sizing and generates transparency overall.

To run the service, we are gathering cloud infrastructure data, in detail: cost/hardware consumption and idle state information. These data enable insights, which are required to compare the overall costs of the onboarded cloud providers. Especially the historical trend data of customers enables us, to evolve the algorithm continuously, which leads to more precise IT-resources recommendations.

3. What Does Our Target Service System Look Like?

As mentioned in the previous section, the service is designed as a platform for users. Figure shows the entire service blueprint.

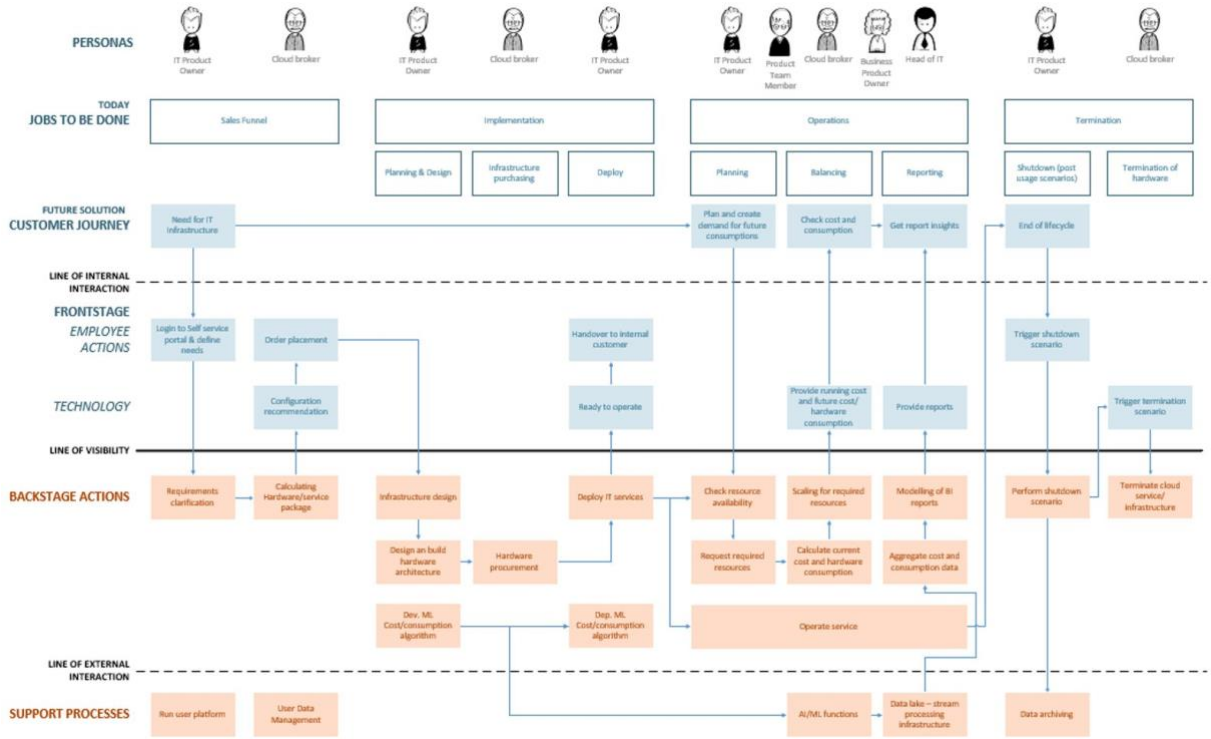


Figure 3 - Service Blueprint

Main interactor is the IT PO which starts the process in the portal. By entering the requested parameters, the portal gathers information, plans, designs and eventually proposes optimal design. After signing off the proposal, the service communicates through an API with the respective cloud provider and orders the requested infrastructure. There will be no human interaction after the signing

off step – all will happen in an automated way. Once the order is ready to be deployed, the portal informs all involved parties and deploys the order for operative state. During operations, the IT PO as well as other stakeholders have the possibility to get reports. Furthermore, the IT PO can further plan consumption through an interactive dashboard as well perform balancing measures for the current running infrastructure to avoid bottlenecks.

The service enables the IT PO to manage and operate the entire IT infrastructure of a company through one portal. It integrates multi cloud provider environments into one single point of engagement. Reporting is simplified and no manual interference is needed to get the correct information for development- /product teams or management.

We developed three critical hypotheses as potential showstoppers which need extended testing. These have been rated as paramount to reach a mature state of the product. The testing is designed to get best possible insights with regards to technical feasibility as well as customer perspective for such a service.

The identified hypotheses are:

1. Development of the platform algorithm to generate insights for infrastructure cost/ consumption/ planning (current as well as future demand)/ infrastructure design
    a. An MVP definition of the algorithm will be developed– what are the key elements for the first version of the product?
    b. Design and execute a feasibility study – is it possible to achieve our vision of the portal?
2. Acceptance for interaction with the three most popular cloud providers
    a. Create a formal request to interact with their platform via API
    b. Perform research about pitfalls when using provider data for further paid services (legal as well as technical)
3. Acceptance resp. willingness of customers to pay for such a service
    a. Field study – interviewing decision makers as potential customers about pains and desired solutions
    b. Perform online research (competition/reviews of existing products/user groups)

4. Sources

How to Manage and Optimize Costs of Public Cloud IaaS and PaaS (gartner.com)

Smart Shelf: Digitale Erkennung von Obst & Gemüse mit ungenügender Qualität

Christoph Rüeger, Daniel Konrad, Krister Koplimets, Markus Baumann

Abstrakt

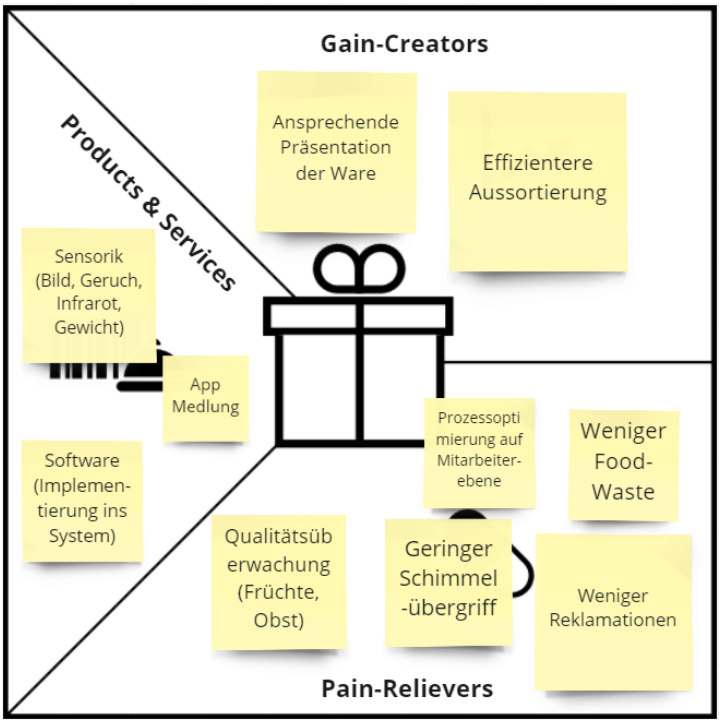
In diversen Detailhandelsläden wird das Obst & Gemüse nach der Anlieferung am frühen Morgen meist direkt in den Verkaufsregalen ausgelegt. Die Überwachung der Qualität sowie die Aussortierung der schlechten Ware erfolgt mehrmals täglich in manueller Tätigkeit durch die Mitarbeiter.
Mit unserer Lösung von Software und Sensortechnik bieten wir die automatische Erkennung von Obst und Gemüse mit ungenügender Qualität an. Aufwendige Arbeitsschritte können damit reduziert oder eingespart werden. Bei einer definierten Abweichung vom erwarteten Qualitätsstandard generiert das System eine Meldung, die direkt auf dem Handlesegerät des Mitarbeiters angezeigt wird. Nach Entgegennahme der Meldung wird er/sie zum entsprechenden Regal geführt, um die Ware auszusortieren. Durch den integrierten Prozess mit NFC Technologie wird sichergestellt, dass die erforderliche Tätigkeit nachweislich ausgeführt wurde. Als zusätzlichen Mehrwert können damit einfach Auffälligkeiten oder Häufungen dargestellt werden, was unseren Kunden weiter Zeit einspart bei der Analyse und Einleitung notwendiger Massnahmen oder Optimierung der Lieferkette.

Key words
Automatische Erkennung, Klassifizierung, Integrierter Workflow, Sensoren

1. Welche Herausforderung lösen wir?

Kleinhändler und auch grosse Retailstores müssen mit der gleichen Challenge kämpfen: das Koordinieren von täglichen Durchgängen um verfaultes Obst und Gemüse auszusortieren. Diese Tätigkeit nimmt viel Zeit in Anspruch und ist sehr Resourcen-intensiv, wie unsere Field-Research herausgestellt hat. Dieser Prozess konnte bis heute nicht automatisiert werden. Mit Smartshelf werden Mitarbeiter über Körbe direkt benachrichtigt, die Fäulnis ausweisen und aussortieren werden müssen.

Von dem Service werden in erster Linie die Filialleiter, aber auch die normalen Mitarbeiter profitieren. Die Leiter müssen nicht mehr die Durchläufe manuell koordinieren und die Mitarbeiter können die händische Arbeit minimieren. Nur noch die wirklich mangelhaften Körbe müssen aussortiert werden.



Bei den Gain-Creators kann man zwei Punkte erwähnen:
1.) die Filialleiter können mit dem Service die Ware im Regal ansprechender präsentieren
2.) die Aussortierung von mangelhafter Ware erfolgt durch genaue Lokalisierung effizienter
Als Pain-Relievers konnten wir fünf Punkte identifizieren:
1.) die Mitarbeiter-Ressourcen können effizienter eingesetzt werden
2.) die Reklamationen durch Kunden können minimiert und die Kundenzufriedenheit gesteigert werden
3.) der Schimmelübergriff auf frische Ware wird eingedämmt
4.) Qualitätsüberwachung/-prüfung wird erleichtert
5.) Food-Waste wird gesamtheitlich minimiert.

2. Mit welchem datengetriebenen Service-Ansatz lösen wir die Herausforderung?

Wir, «Smartshelf», rüsten konventionelle Obst- und Gemüse-Regale mit Sensoren aus. Die erzeugten Sensordaten werden benutz, um traditionelle menschliche Aufgaben automatisch zu delegieren. Damit entlasten wir unseren Kunden. Diese Aufgaben werden zusätzlich automatisch überwacht, was die Arbeit von unseren Kunden zusätzlich vereinfacht.

Abbildung 1: Storyboard

Unser Service erkennt aus den erzeugten Daten die Präsenz von verfaulten oder qualitativ minderwertigen Produkten im Regal und löst automatisch via Push-Nachricht auf dem Handheld einen Kontrollgang aus. Der Mitarbeiter lokalisiert die Position mittels NFC und bestätigt die Aussortierung nach Abschluss der Arbeit auf dem Handheld
(siehe Abbildung 2).

Abbildung 2: Ausschnitt Prototyp

3. Wie sieht unser Service-System aus?

Anhand des in Abschnitt 2 gezeigten Storyboards und Präsentation unseres ersten Entwurfs der Applikation mittels Marvelapp (Abbildung 2), konnten die direkten Interaktionen unseres Kunden gezeigt werden. Der Grossteil unseres Service läuft aber im Hintergrund ab, hinter der sogenannten «Back of Stage Interactions»-Linie. Mittels Service Blueprint kann ein Überblick über den Prozess gegeben werden, siehe Abbildung 3.

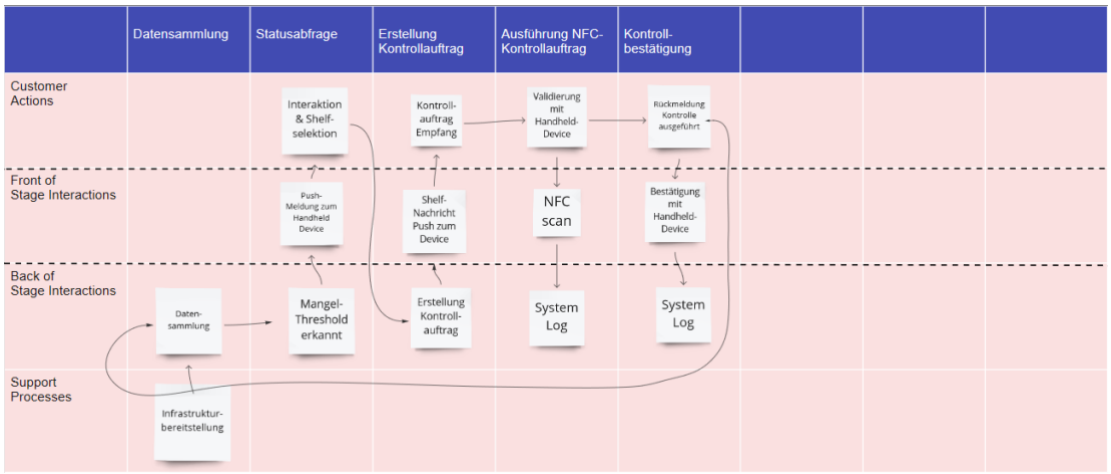


Abbildung 3: Service Blueprint

Gesammelt werden lediglich Daten über das Produkt, sprich das Obst und Gemüse. Auch wenn der Mitarbeiter mit seinem Gerät den Start und das Abschliessen der Arbeit (Aussortierung des Gemüses/Früchte) mittels NFC-Scan bestätigen muss, sollen auf Seiten SmartShelf AG keine Kunden/Mitarbeiterdaten erfasst und ausgewertet werden. Da die Integration der SmarShelf-Software auch in bestehende Systeme möglich ist, kann jedoch nicht ausgeschlossen werden, dass diese Auswertung nicht doch über das Hauptsystem erfolgen kann. Zum Schutz der Mitarbeiter und des Arbeitsklimas wird dies daher nicht empfohlen. Somit liegt der Wert für den Filialleiter nicht in der Überwachung seiner Mitarbeiter, sondern in der Effizienzsteigerung der internen Abläufe. Durch die genaue Erkennung von auftretender Fäulnis und die Benachrichtigung an die Mitarbeiter, können Kontrollgänge genauer und effizienter geplant werden, was Zeit- und Aufwandsersparnisse mit sich bringen. Dies Entlasten wiederum den Mitarbeiter selbst.

Was bei jeder Installation beachtet werden muss ist zum einen die Aufgabenzuweisung und wie das Team intern aufgestellt ist. Je nach Filiale und Anzahl Mitarbeiter muss gegeben falls beim Eintreffen der Mitteilung auf dem Handheld eine Zuweisung oder Annahme des Mitarbeiters erfolgen, um Leerläufe und Missverständnisse zu vermeiden.
Auf der technischen Seite bedarf es einer «Learning-Curve» des Detection-Algorithms. Da jede Filiale anders aufgebaut ist und somit über andere Einflussfaktoren verfügt, muss sich das System erst einpendeln, was kurz nach Installation zu möglichen Falschmeldungen führen kann. Diese Falschmeldungen werden Systemintern bearbeitet, da es sich im Kern um ein Lernendes System handelt. Detektionen werden immer mit einer Wahrscheinlichkeit angegeben, die der Kunde jedoch nicht sieht und nur für das System sichtbar ist. Bei Häufung solcher Fehlinterpretationen kann Smartshelf mittels Feature-Engineering nachhelfen.

The Course of the Year 2020

We had four very interesting cases lined up here. Without wanting to prioritize the cases, they are put into a sequence here:

There were two cases with a focus on optimizing the life of professional or private users while a material stream of logistics was involved:

- Automatic medical implant ordering for hospitals
- Smart Emergency Supplies

And there were two cases with a focus on immaterial handling of processes and facilitating the job of professionals with their customers:

- GiZ - Gebäude im Zentrum
- Smart Selling

Automatic medical implant ordering for hospitals

Andreas Dünki
Dominik Jenni
Reto Järmann
Stéphanie Bartels
Stephan Geuter

Abstract

Most hospitals in Switzerland issue purchase orders for implants only after an implant has been used in surgery, delaying cash flow for manufacturers. Furthermore, orders are still made by fax or other manual procedures. Our company offers implant manufacturers a solution that enables their implants with IoT-capabilities together with a service that automates the ordering process and automatically manages stock at hospitals. This will completely eliminate manual ordering tasks for hospitals and implant manufacturers can deliver their products quickly, accurately and in standardized manner. In addition, we will use the consumption data from the hospitals to create predictive models to power our new service. Our offer allows implant delivery before the need is recognized by hospitals. Our service frees-up capital by optimizing hospital stock and thus increasing cost efficiency. Lastly, implant manufacturers can automate order processes, and gain better insights about their current implant stock with our new service.

Key words
Order processes; IoT; hospital logistics; medical implants; healthcare

1. Which Challenge Do We Solve?

Hospital logistics consider in particular the material flow from the supplier to the patient. A reactive ordering process has established itself in many relationships between implant suppliers and hospitals. After an implant has been consumed in the surgery room the medical staff sticks the product labels on a paper consumption report and sends it to the implant manufacturer. After receiving the consumption report, the implant manufacturer's back-office prepares the replacement products, replenishes hospital stock on site, and invoices for consumed implants.

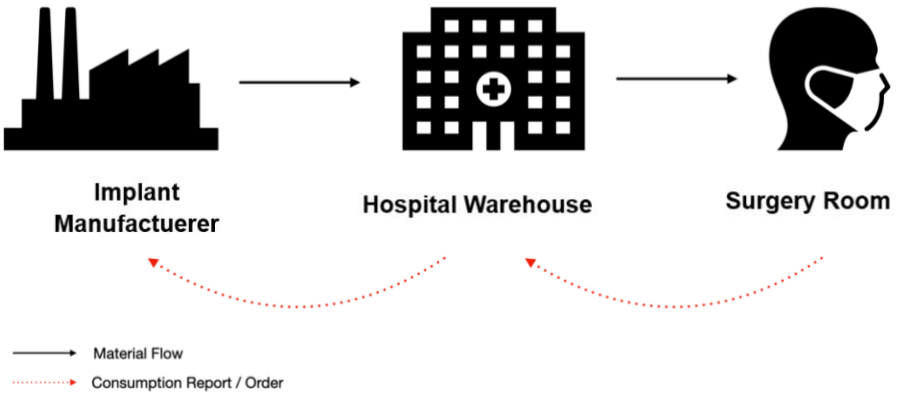


Figure 1. Current flow of implants, information, and purchase orders

The main challenges for the hospital employees are mistakes in the heat of moment in the surgery room. Sometimes product labels go missing or are listed twice on the consumption report. This is leading to incorrect bookings, inconsistent inventory counts, and disputes over invoices.

"Unreadable reports, increased error rates and manual entry of the orders into the system"

The implant manufacturer receives the consumption reports from hospitals in many different formats. The negative consequences for the back-office employees on the supplier's side are unreadable reports, subsequently increased error rates and the manual entry of the orders into the system. Fast delivery times are crucial for customer satisfaction, cost efficiency and patient safety. Furthermore, most suppliers maintain device stocks in the hospital that is still owned by themselves thereby blocking capital.

Lastly, the manufacturer's overview about stock in hospitals is unreliable so that regular inventory counts on-site needs to be performed. These cost time and resources and generate large organizational efforts. Stock inventory checks need to be done by the implant manufacturer under supervision of a hospital employee.

"Inaccurate forecasts, lots of tied-up capital and expiry of sterile products"

In other departments of the implant manufacturer employees struggle with high storage costs of implants, due to inaccurate forecasts. Expensive sterile implants tie-up a lot of capital, furthermore, after the expiry date the remaining stock has to be disposed.

In conclusion, both sides will strongly benefit from a simplified, standardized and faster communication. The supplier would like to receive a purchase order quickly so they can replenish stock in hospitals. On-site stock at hospitals can be optimized using modern machine learning algorithms to free-up manufacturer's capital as much as possible. Hospitals want immediate and complete transparency on delivery dates, so they can better plan surgeries.

There are existing approaches on both sides of this business relationship. Our solution addresses the implant manufacturer where we focused on the biggest pains and gains mentioned above. For the hospital staff the new ordering process much faster and easier. Although, both sides benefit from the new service, we believe that business innovation should be driven together with dynamic medical manufacturers.

2. By which Data-Driven Service Approach Do We Solve the Challenge?

We call ourselves ImpStock and offer a service to benefit implant manufacturers and hospitals. Our customers (implant manufacturers) store their products in the hospital in our intelligent IoT-storage system. The Smart Medical Cabinet SMC2000 (SMC) automatically and independently registers implant consumption on the hospital side and sends these data via our service to the manufacturers for invoicing and re-stoking.

Figure 2. Drawing of our Smart Medical Cabinet Prototype

"Increased production planning reliability as well as reduced storage costs and waste"

We leverage consumption data, accident statistics and weather data and build a prediction model to forecast the future consumption of implants in hospitals. Thereby, we enable manufacturers to increase production planning reliability, reduce storage costs and the waste of expired sterile implants.

"Increased customer satisfaction and competitiveness"

Thanks to our AI powered service, implant manufacturers achieve better availability of implants in hospitals as before, while needing less implants. For the medical staff, the workflow improves as well. They can remove the implants from the storage as usual without thinking about subsequent

Figure 3. Storybook visualizing the process steps with the new service for an exemplary hospital in the Swiss mountains.

paperwork. Both measures increase the satisfaction of the end customer (the hospital) and thus the competitiveness of the implant manufacturer.

3. What Does Our Target Service System Look Like?

Our ecosystem consists of data suppliers, delivery companies and hospitals. Thanks to our ecosystem and our fully integrated service platform, we can transfer implants from one hospital to another if this is faster than the delivery from the supplier.

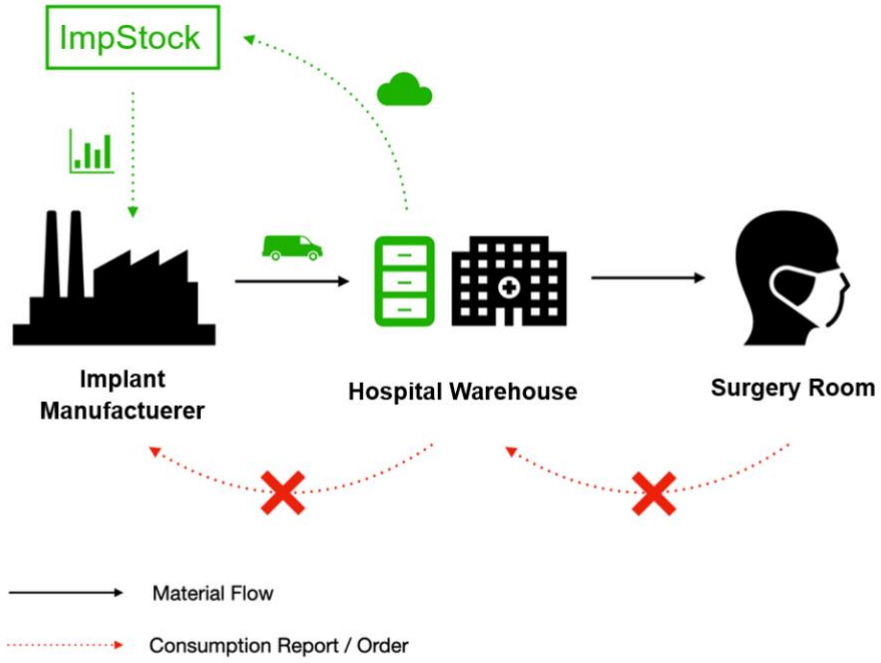


Figure 4. Flow of implants, information, and purchase orders with our new service.

The backstage within our service blueprint consists of an implant management system and the prediction model (Figure 5). These two systems trigger orders to the implant manufacturer (front stage) which is either an interface to their Enterprise-Resource-Planning system or a web portal. Furthermore, the web portal also gives status information about stock in the different hospitals, supplies in delivery, and projected consumption. After preparing the order, an independent logistics service delivers implants to our Smart Medical Cabinets in the hospitals.

The key component of our new service offering is the Smart Medical Cabinet – it maps implant usage in hospitals to a comprehensive implant management system. Implant manufacturers gain an accurate

view into their stock located at hospitals. The biggest pain reduction and gains are on the manufacturer side whom we will charge a commission for our services.

In addition, the data collected during implant transactions allows us to continuously improve our predictive capabilities. As with other smart, data-based services, our predictions and services get better and better the more SMC are installed at hospitals. The improved service in turn benefits of course our offering, but also our customers on both sides.

In order to build a successful service, critical assumptions need to be verified. The most critical assumption underlying the service concerns the value proposition.

WE BELIEVE THAT:

We can reduce storage cost with our service.

WE'LL TEST IT WITH:

Building a scenario using historical data from Implant manufacturers. To be able to use the data we will convince three manufacturers to sign an LOI.

AND MEASURE IT WITH:

Inventory turnover rate for specific implants in hospitals.

WE ARE RIGHT IF:

Our scenario shows that the inventory turnover rate can be improved by 30%.

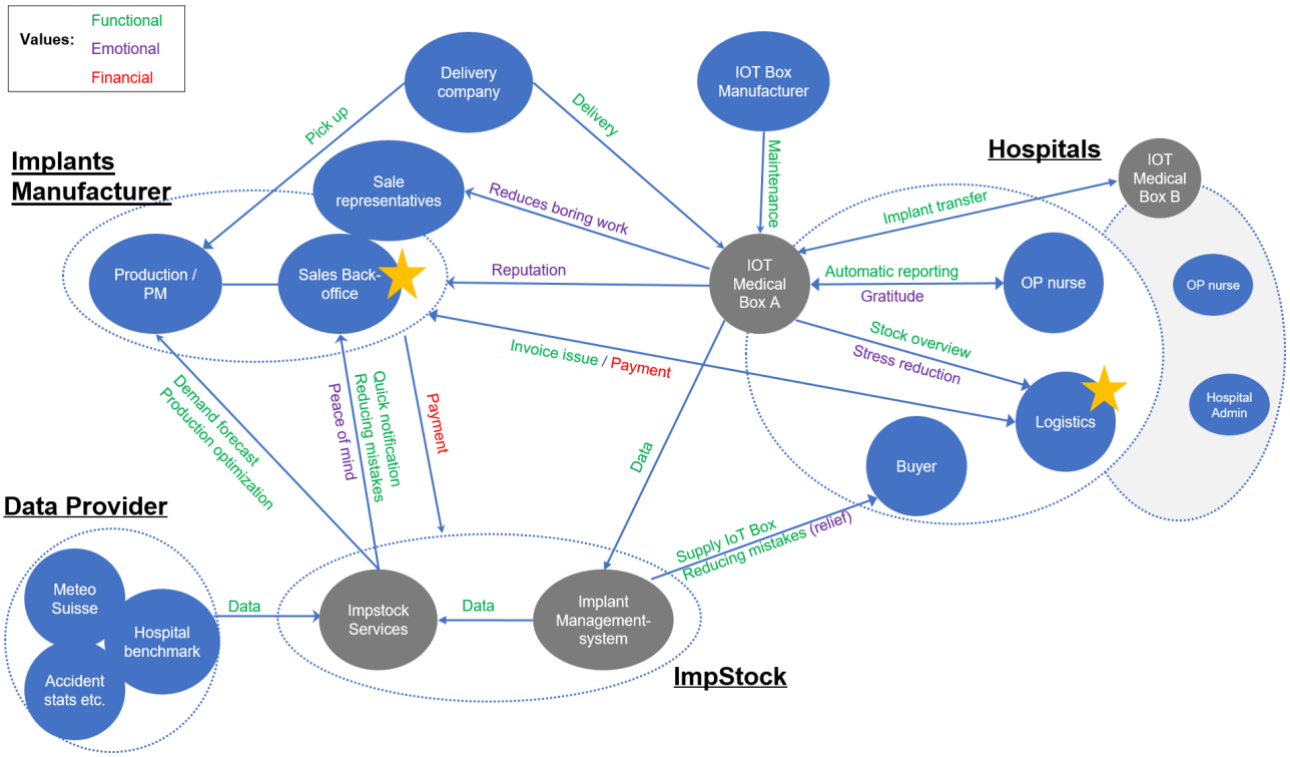


Figure 5. Service Ecosystem for ImpStock automated implant ordering process.

4. Acknowledgement

During the development phase of our project, many people helped us to get insights into the ordering process of implants. Many of them also challenged our ideas and gave us advice, which helped us and improved our service. We sincerely thank all interviewees, gest-speakers, fellow students and our Professor Dr. Jürg Meierhofer for their invaluable support.

Smart Emergency Supplies

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Marc Kistler
Heidi Steiger

Abstract

Emergency supply can become an important survival factor. It does not only consist of food, but also of various other products such as gas cookers, flashlights, batteries, toilet paper etc. Households should stock sufficient supplies at home to be prepared for a period of emergency. According to surveys, up to one third of households in Switzerland do not have sufficient emergency supplies for one week.
However, when food is thrown away every day and millions of liters of water are used to produce it, households need help to slow down and control this waste. A smart service is proposed to support households and make it much simpler to order, stock and manage emergency supplies at home. Initially, the service proposes products according to a households' individual tastes and preferences in the right amounts.
A virtual shopping cart is generated, and selected supplies are ordered and delivered through third-party retailers with home delivery service. Consequently, the service keeps track of the amount and composition of the emergency supplies, including expiry dates. It proposes recipes for regular consumption and turnover of goods, and reminds the household to re-stock on a regular basis.

Key words
Emergency supplies, food management, food logistics, food waste, smart ordering

1. Which Challenge Do We Solve?

Use Case

During the Corona crisis in 2020 many households started panic-buying supplies such as food, toilet paper and soap in order to be prepared for a potentially longer period without access to retail shops. Within a few days, retailers were sold out of certain goods.
Switzerland authorities recommend storing a sufficient amount of supplies at home to be able to survive at least one week without having access to a shop.[8] A study by Agroscope in 2018 found that between one fourth and one third of households do not meet this requirement.[9]
Storage of supplies at home requires regular use and turnover of goods in order to avoid waste. This can be a quite significant logistical challenge for households. The authors of this paper see an opportunity to support them. They propose a smart service to support households in the different stages of this task, from selecting the right products and amounts for their emergency supplies to providing recipes for meal planning such that the supplies can be regularly used and re-stocked. The purchase of the supplies will leverage existing retailers offering home delivery service.

Beneficiaries

The main beneficiary of this service are private households. They are supported to have the right range and amounts of supplies for an emergency situation. The service leverages information about individual preferences and therefore is customized for each household's needs.
Beneficiaries of the service are furthermore retailers with home delivery service, who will benefit from higher revenues and improved capacity utilization. Furthermore, they might be better protected from "shop runs" similar to those observed during the Corona crisis in early 2020.

Jobs, pains, and gains of the beneficiary

Jobs	○ select the right range and amounts of emergency supplies to be able to satisfy the basic needs of the household in case of an emergency ○ regularly replace and re-stock supplies to ensure that they are unexpired and edible
Gains	○ being prepared for an emergency ○ having the right amounts and choice of supplies ○ healthy food in line with the household members' individual taste and preferences (right amount of calories per person per day)
Pains	○ needs to get informed what is required for emergency supplies ○ keeping track of expiry dates ○ risk of food waste if not regularly consumed ○ lack of ideas what to cook

[8] https://www.bwl.admin.ch/bwl/en/home/themen/notvorrat.html
[9] A. Zimmermann, G. Prescia (2018), Notvorrat: aktuelle Situation und Einflusskriterien, Agroscope, https://www.bwl.admin.ch/dam/bwl/de/dokumente/Dokumentation/publikationen/studie_notvorrat_agroscope.pdf.download.pdf/71_AS_Lebensmittel_Zimmermann_Notvorrat_D.pdf

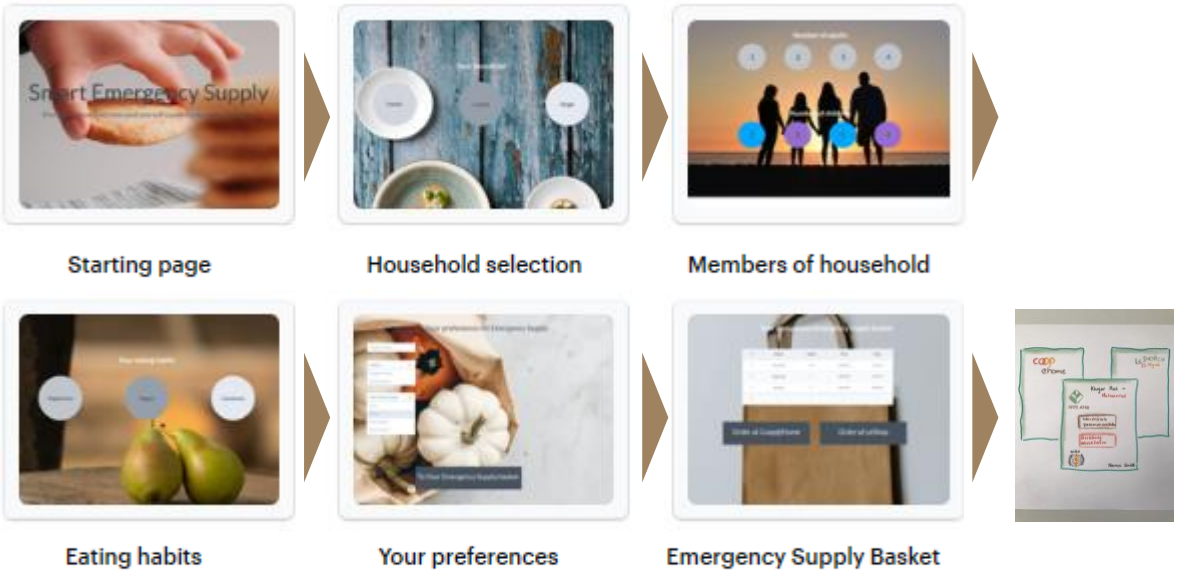
2. By which Data-Driven Service Approach Do We Solve the Challenge?

The following table outlines the key elements of the value proposition of Smart Emergency Supplies and how these elements leverage data and analytics:

Value Proposition	**Leverage of data and analytics**
Composition of a customized shopping cart for emergency supplies *Values:* ○ Security (emotional value) ○ Being Prepared for an emergency (conditional value)	○ The customer answers several questions about her preferences and household characteristics (e.g. household size, budget, preference for certain brands, allergies, food habits…), which are stored as individual customer data ○ The service consequently proposes a virtual shopping basket with products from publicly available food databases, taking into account the household's preferences, the Federal Office for National Economic Supply (FONES) as well as WHO guidance for a balanced diet ○ The customer can change this list according to individual tastes and confirms the final choice
Online order with home delivery in collaboration with third-party retailers *Values:* ○ Convenience (functional value)	○ The electronic shopping basket is transferred to third-party retailers for ordering supplies ○ When executing the order, the online retailer sends back the expiry dates of the delivered goods, which then are stored by the service
Warehouse management: keep track of expiry dates, send reminders, re-stock supplies *Values:* ○ Avoid food waste (emotional, financial value)	○ The service constantly scans through every customer's products and expiry dates and suggests products with upcoming expiry for composition of meals
Customized recipe proposals *Values:* ○ Tasty and diversified meals (emotional value) ○ Good feedback from household members (social value)	○ Suggested goods are matched with recipe databases from external partners ○ Recipes are proposed to the customer based on the content of the client's emergency supplies

The service is targeted to learn over time what the client's preferences are in terms of products, frequency of consumption as well as recipes used.

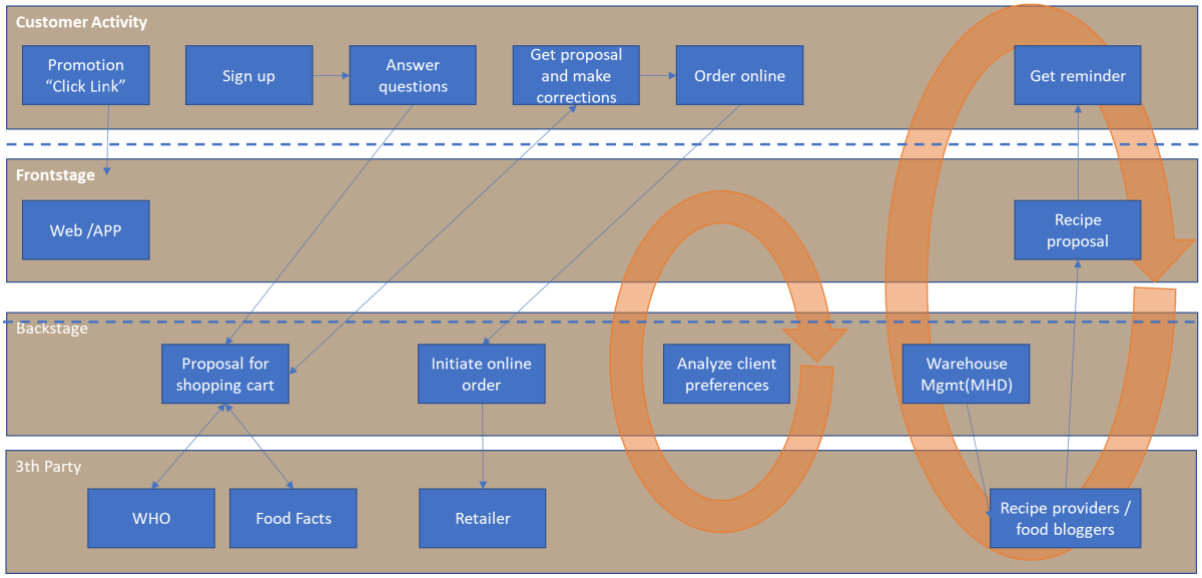
The initial interaction with the service is illustrated below in terms of a mock-up of a web page and flow for the initial Smart Emergency Supply Order:



3. What Does Our Target Service System Look Like?

Service Blueprint

The service blueprint visualizes the process steps of the service taking into account areas that are visible to the client as well as those that are running "backstage":



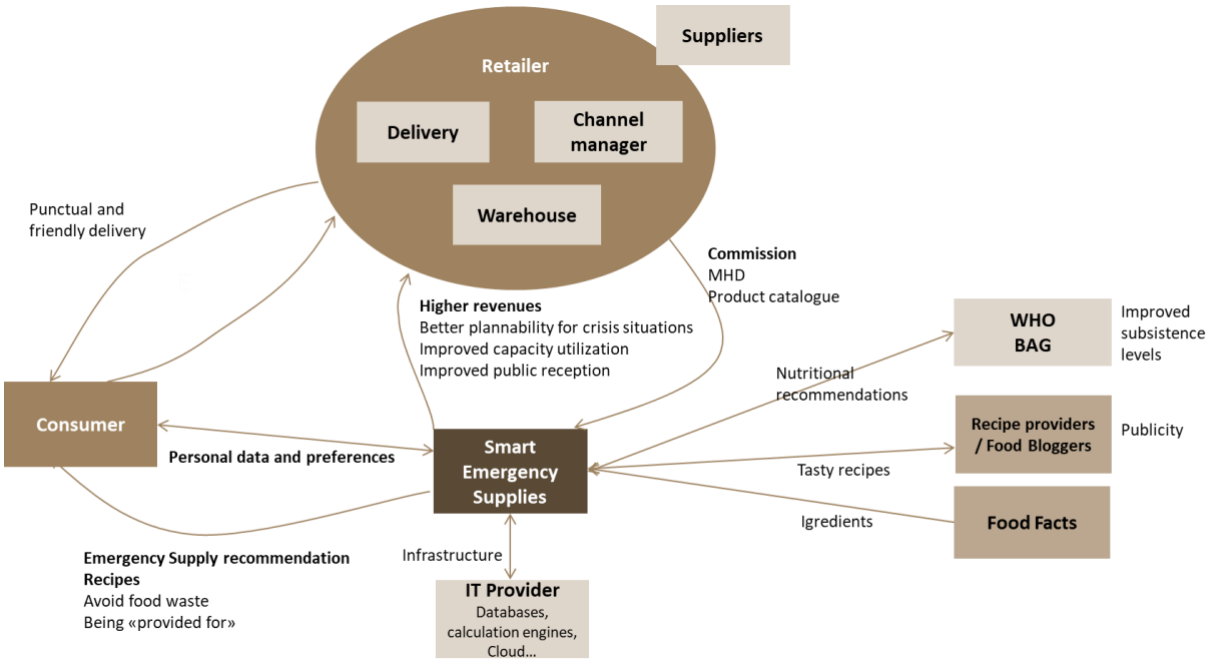
Data integration

Third-party providers are integrated into our service system as follows:

Food database ch.openfoodfacts.org	The database is openly accessible and can be fully downloaded or can be accessed via REST-API
Retailer	Interested Retailer has to provide API for accessing available products, basket, etc.
Expiration date	The expiration date is sent back from retailers once the order has been executed and is stored
Recipe databases	A household's list of products is used to query recipe databases for specific ingredients
Retailer Customer bonus system (Coop Supercard, Migros Cumuls)	Do improve our recommendation and services, private customer can voluntary give access to their *food shopping data (digital recipes/data)*

Value creation

The ecosystem and values created in the ecosystem are illustrated as follows:



Riskiest Hypotheses

Our two riskiest hypotheses are in relation to customer acquisition and revenue generation.

Hypothesis 1: Customer acquisition

We believe that we find enough people who are interested in having an emergency supply and a service supporting an personalized, intelligent compilation and a simple ordering process.
To verify that, we will start a survey in front of a retailer asking different questions in connection with our service to customers coming out of the store. We ask them to fill out a questionnaire with seven (7) specific questions (number of people who using the service, number of pets, special needs, special diets, possible diseases, personal preferences for branded articles and number of days they intend to stay self-sufficient) to classify the client and to put together a standard emergency supply. We measure the number of filled out questionnaires returned to us.

We are right if at least 100 cards out of 500 are returned and confirm they want our service

Hypothesis 2: Revenue generation
We believe that an online retailer is willing to pay a commission for additional orders being placed through our service.
To verify that, we contact the responsible managers of online ordering at one of the retailers in Switzerland
We are right if the responsible manager promises verbally to be interested in our service

GiZ - Gebäude im Zentrum

With smart building data, GiZ create a consistent customer experience

Catherine Ammann
Fabian Uetz
Gennaro Montanino
Michael Hilti

Abstract

Digitization has touched almost all aspects of our life. This digital revolution requires to rethinking building engineering and automation. Currently, there is no unified and systematic option to store the available building data and often the data are stored on different platforms. The multitude of unstructured data is a challenge for the various stakeholders: data cannot be found, information on the building is not up-to-date or documents are located in a variety of different storage systems - the need for simplification is tremendously growing.

The aim of GiZ is to network and operationalise building data for building owners, and project managers.

GiZ places the building at the centre and creates connectivity between the different types of data. GiZ ensures smooth data processing and facilitate communication between project managers and their customers. GiZ creates a platform able to map data and information in a flexible and future-oriented manner. This increases the efficiency and effectiveness of project management, reduces costs and makes up-selling and cross-selling easier to achieve through automatic sales lead generation.

Key words
Internet of things (IoT), networking of building data, smart data, data storage, building life cycle, sales-lead generation, machine learning.

1. The building to the centre

Connected buildings, via Internet of Things help the owner to reduce operating costs, save energy, and increase the monitoring quality of the building.

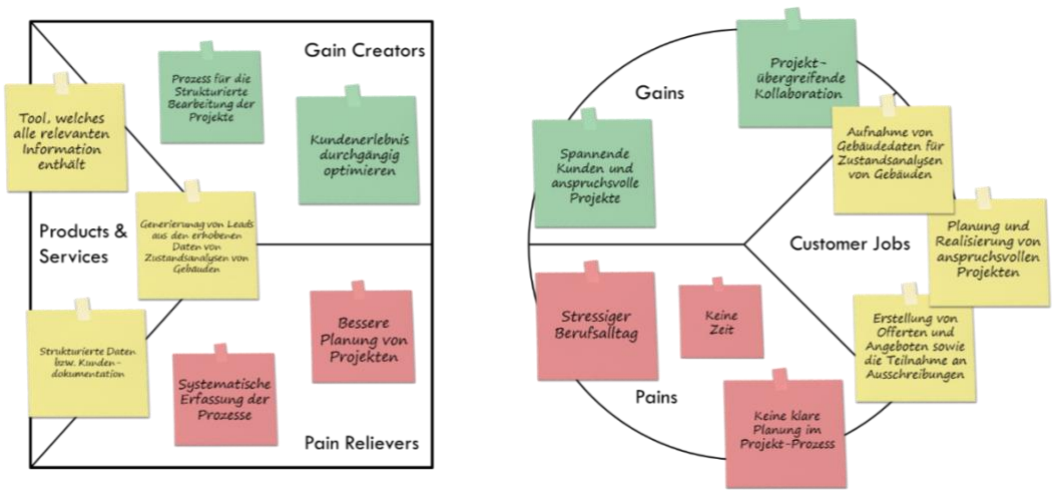
With a centralised platform, the collection and evaluation of building data becomes easy. Currently, such consistent processes are missing. The multitude of unstructured data available for a building is an immense challenge for the various stakeholders. The smart building data and operationalisation of this information for users - e.g. project managers – is the core of GiZ.

Currently, there is a lack of business incentives to manage the existing CRM system consistently and uniformly. As a result, relevant information about the customers or the building owner is missing: from wrong or missing addresses, to outdated or duplicated data, to inconsistent price calculations, discounts or hourly rates.

After the successful completion of the project, the customers are not consistently processed further, the motto "out of sight, out of mind" applies. The end-to-end customer experience and efficient and effective project management are often neglected and opportunities for up- and cross-selling are missed.

In order to align GiZ with the wishes and requirements of the target groups – here project managers - a value proposition canvas was created.

Figure 4: Value Proposition Canvas



Source: Own illustration

The relevant pains for the project manager before and during the completion of his tasks are:

- lack of planning security in the project process,
- stressful everyday work, and
- no time for anything.

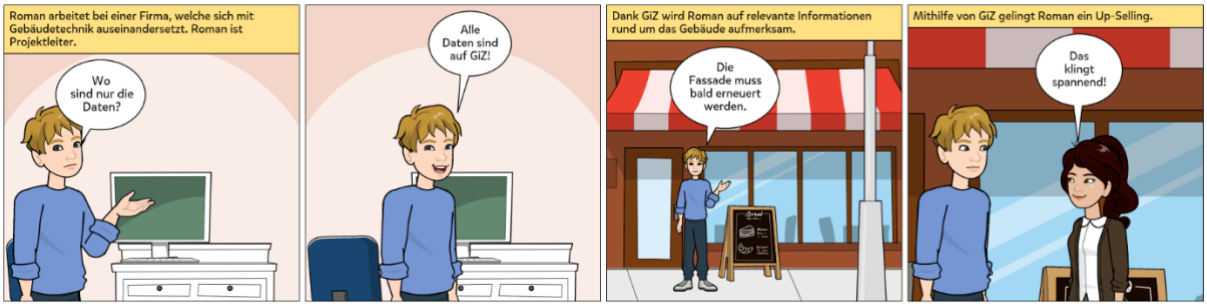
But there are not only pain but also pleasure points. The project manager achieves the following positive experiences and results when completing his tasks:

- cross-project collaboration, and
- exciting customers and challenging projects.

2. Data-driven decision-making in the building management industry

The aim of GiZ is primarily to create a long-term customer relationship over the entire life cycle of a property rather than a short-term project execution. However, this can only be achieved if the projects are carried out efficiently and effectively for the end customer, and the project manager can successfully support up- and cross-selling. GiZ connects and empowers the users to act competently and confidently towards the client. The story board visualises this value proposition.

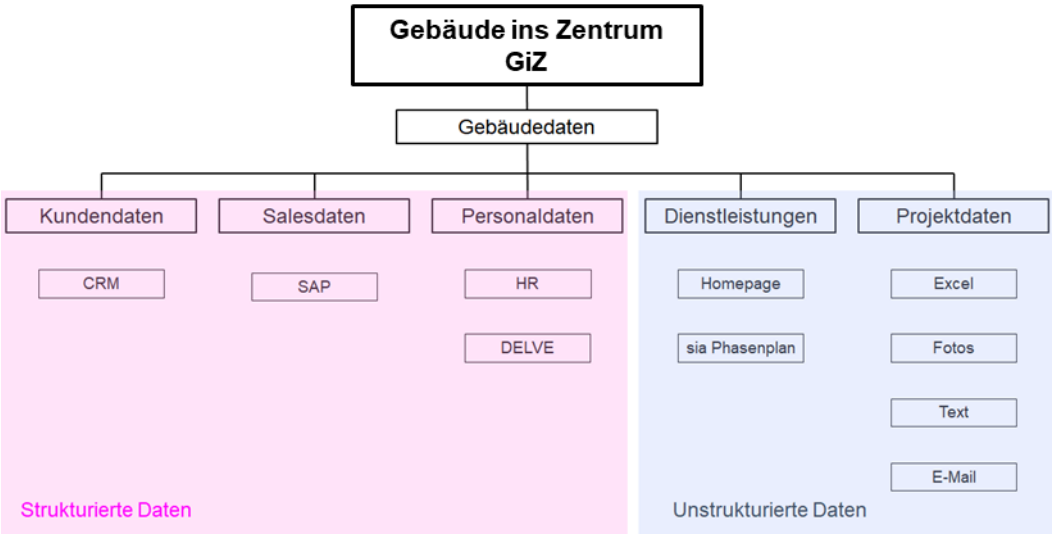
Figure 5: Story board



Source: Own illustration

GiZ aims at different data sources around building data, e.g. linking data from customers, sales, personnel, services, and projects:

Figure 6: Data sources



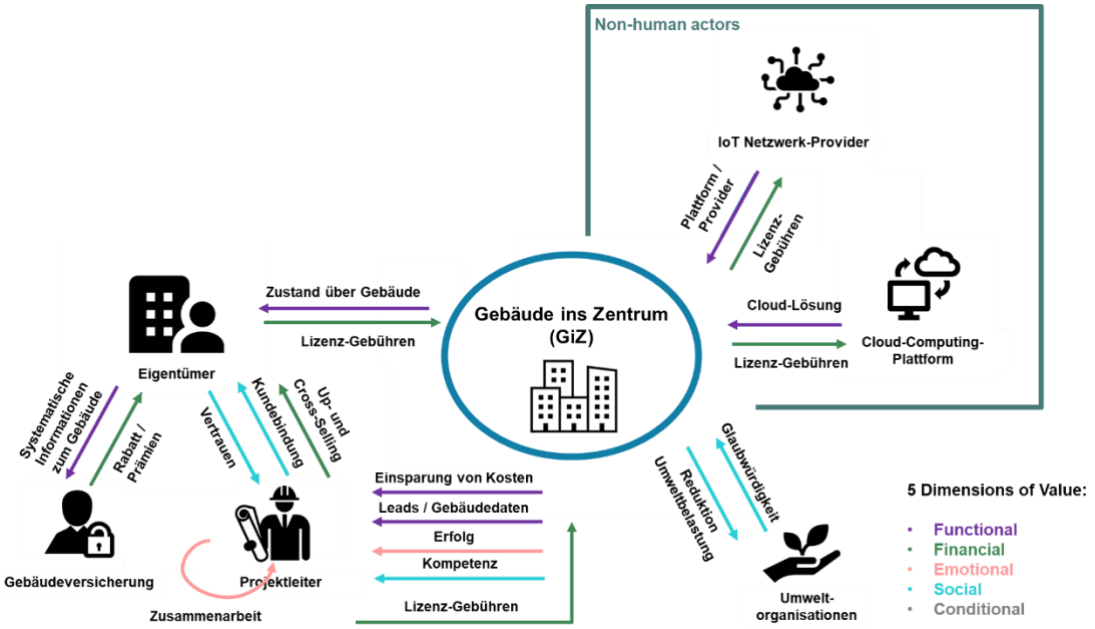
Source: Own illustration

3. Efficient and effective project management in building management industry

The more connected the world is, the more important thinking in networks becomes. GiZ builds networks for building data and thereby connects buildings, humans, and machines.

- Project manager:
- GiZ provides the project manager with all relevant information and data about the building – as well as emotional and social components (e.g. success and competence). In return, the project manager pays a license fee.
- Building owner:
- GiZ provides the owner with all relevant data and information about the building. In return, the owner pays a license fee.
- Non-human actors:
- The “Nun-human actors”, such as IoT network providers and cloud computing platforms, enable GiZ to create and connect the various databases, data sources and data systems. In return, GiZ pays licensing fees for the use of these platforms.

Figure 7: Ecosystem GiZ

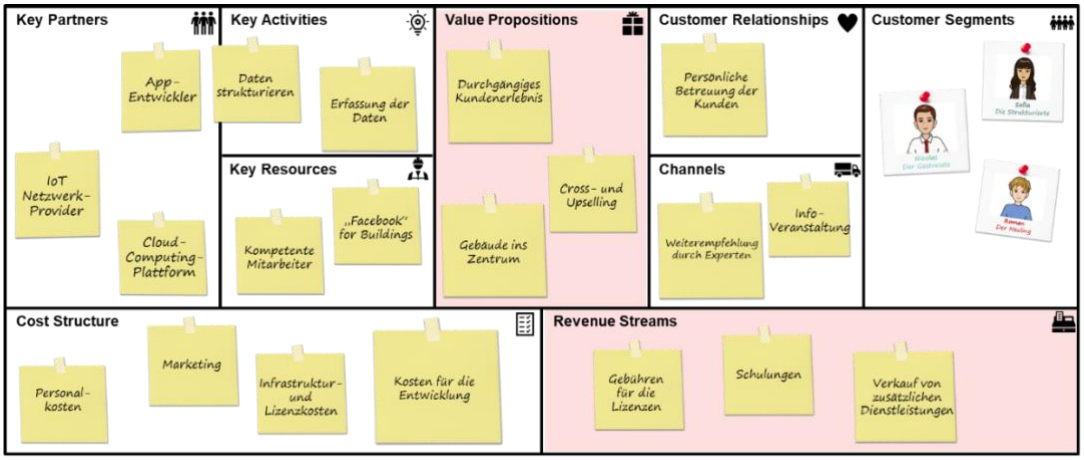


Source: Own illustration

In addition to the key elements, the Business Model Canvas also shows the critical hypotheses:

- Hypothesis 1: the customer is willing to spend CHF 40,000 to 50,000 annually for the service.
- Hypothesis 2: the project manager succeeds in selling the customer an additional service (up- or cross-selling) in one out of five cases.

Figure 8: Business Model Canvas



Source: Own illustration

Smart Selling

Ulrike Baldenweg
Tanja Weusthoff
Christoph Richard
Nicola Imelli
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Abstract

Contacting customers with product and service offers is daily business in many companies. Often the contact is not successful or may even annoy the person contacted, which is not beneficial for the motivation of the advisors and for the overall sales performance. Our service "Smart Selling" aims at improving the sales performance by providing better insights into the potential of end-customers based on the use of additional knowledge. On the top of existing systems, like for example AI systems which provide a scoring of customers' potential for a specific product, we collect inherent knowledge from the client advisors in a playful approach and use this together with additional information to improve the scoring. Doing this in a transparent way, we increase the acceptance by the advisors and keep them motivated.

Key words
Customer acquisition & retention, Explainable AI, Gamification, Knowledge management, Scoring

1. Which challenge do we solve?

This business case aims at improving the sales performance by means of optimal data usage and increased motivation. It can be applied to any industry; however, we initially concentrate on the banking industry.

Many banks already use artificial intelligence (AI) to support their sales process. Usually, client advisors get lists of clients generated by AI which suggest customers who are identified to having a high potential of buying specific products ("scorings"). However, client advisors often poorly accept these scorings because they do not understand how the scorings are generated. They also feel left out because their own knowledge of the customers was not taken into account. As a result, they are often unmotivated to contact the proposed customers, which affects the sales performance.

This is exactly where the service "Smart Selling" comes in: The service includes the knowledge customer advisors have about their clients. This knowledge is currently locked in their heads, in e-mails or notes. The inclusion of the knowledge can improve the quality of the customer potential estimation.
Furthermore, the involvement of client advisors' knowledge also increases their motivation. They better understand how the scorings have been generated, which makes them coherent in their eyes. Through a playful approach, "Smart Selling" additionally increases the motivation of customer advisors.
The main beneficiaries of the service are sales managers leading a team of client advisors. Their sales performance will increase as a result of better scorings and thanks to a higher motivation of their team.

The value proposition canvas (see fig. 1) provides an overview of the jobs, pains and gains of the sales manager. With our service, we mainly address the pain that data input is often seen as not useful and induces unwanted customer contacts, which leads to frustration of the client advisor. By including customer knowledge to the algorithm, we want to solve this problem. Another pain is the way the results from the algorithm are presented to the sales personnel: it is perceived as insufficient. This pain can be relieved by providing transparency through good representation and explanation of the results.

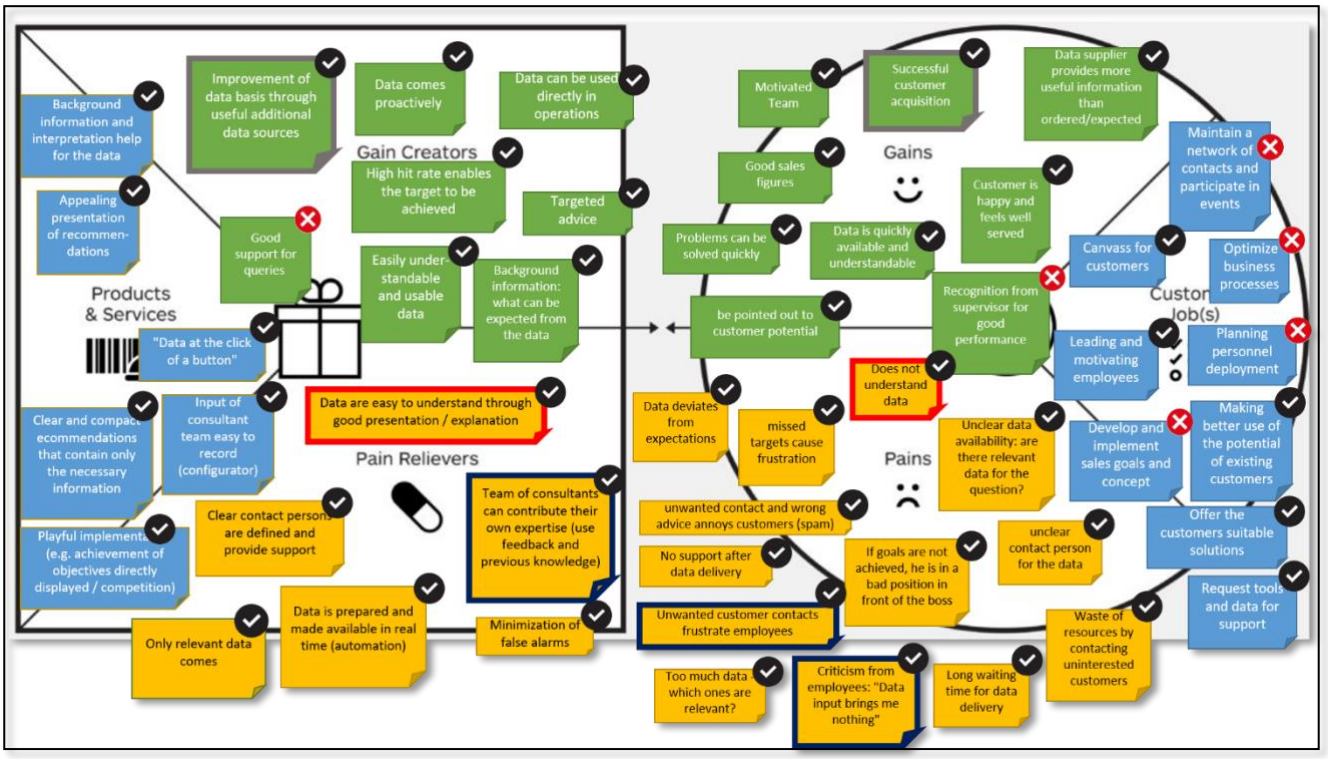


Fig. 1: Value proposition canvas

2. By which data-driven service approach do we solve the challenge?

To meet the recognized challenges, our service will deliver the following value propositions:

- Better customer target proposals through consideration of the existing knowledge of the client advisor about his customers;
- Increased motivation of the client advisors thanks to more involvement, gamification elements and a higher accuracy in terms of customer target proposals.

These two elements finally lead to an increase of sales performance which is generating value for client advisors and their superiors which are highly focused on this key figure.

To offer the stated values we have to leverage data. The main data elements and how they help to provide our service can be found in the table below:

Data element	***How we use it***	***Which value does it support***
Structured and unstructured data (e.g. e-mail communication) in terms of knowledge about the customer, generated by the client advisor while interacting with the customer or explicitly asked about by our service	Our algorithm tries to extract features out of this data (e.g. with "text mining" methods) which then can be used to optimize customer target proposals.	Better proposals and increased motivation (both thanks to utilization of the client advisor's knowledge)
Data generated by the "target algorithm"	We want to present only transparent proposals, and therefore we calculate for each proposal the main features which	Increased motivation (thanks to transparency and

	have influenced the algorithmic decision (by using "explainable AI" methods) and present it to the client advisor	starting points for the client advisor)
External data (matched to customers & non-matched training data)	Publicly available data (e.g. published by the customer himself, e.g. LinkedIn Profile) could be used to extract knowledge about the customer (e.g. current job position or sector) to be more accurate in determining customer needs. Furthermore, anonymized customer behavior data could be used to train and optimize the scoring algorithm.	Better proposals
Sales performance data	Sales performance data can be used to monitor the client advisor's own performance and bring it into a team view. By using gamification elements (rewards, tips) this data can support the team to reach goals with more fun.	Increased motivation (thanks to team involvement and gamification)

To give a better feeling about our service working in practice we worked with a Storyboard and some mockups:

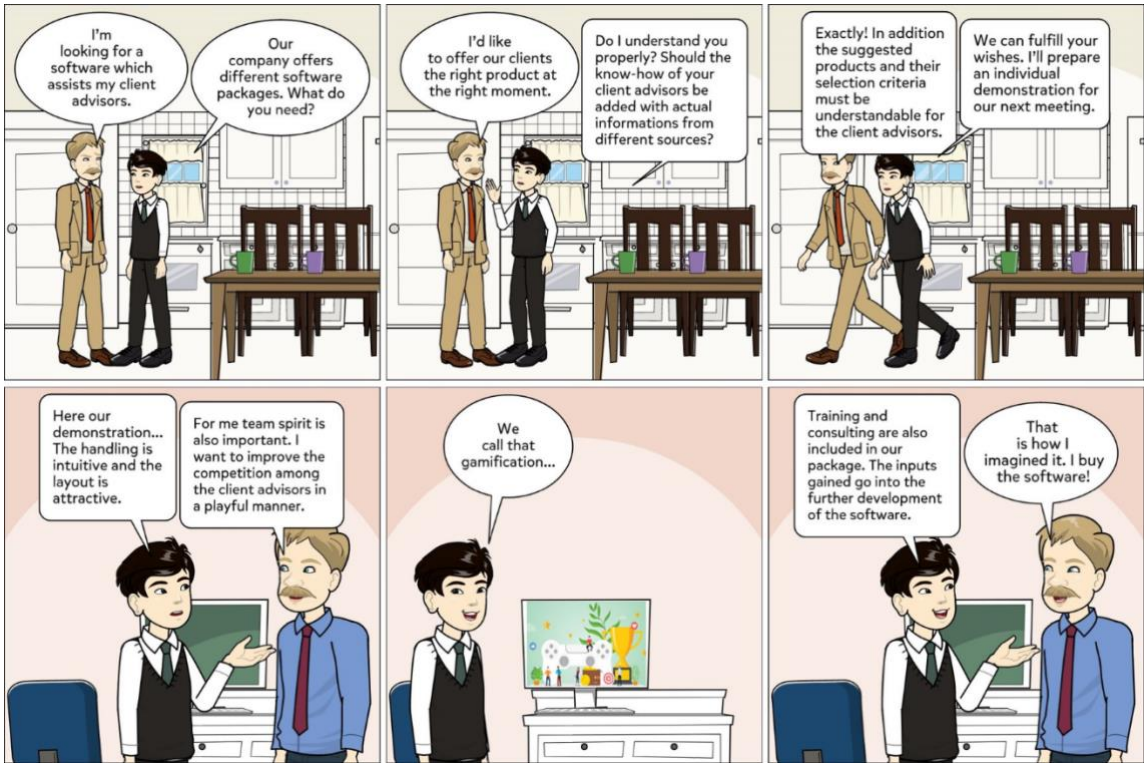


Fig. 2: Storyboard

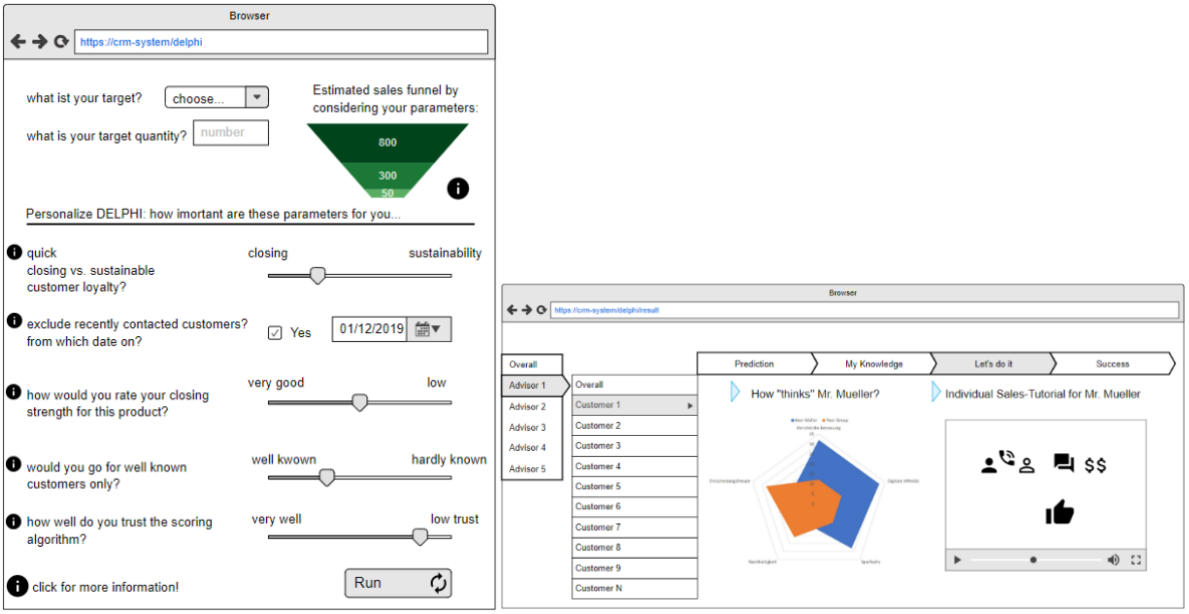


Fig. 3: Low-fidelity mockup

3. What does our target service system look like?

Our target service system can be visualized according to the following **service blueprint**, outlining key steps of the customer journey, our visible and backstage activities, as well as 3rd party service providers that will be needed. Since the value we propose to our customers becomes more tangible when having a closer look to the utilization phase, this phase is additionally shown separately.

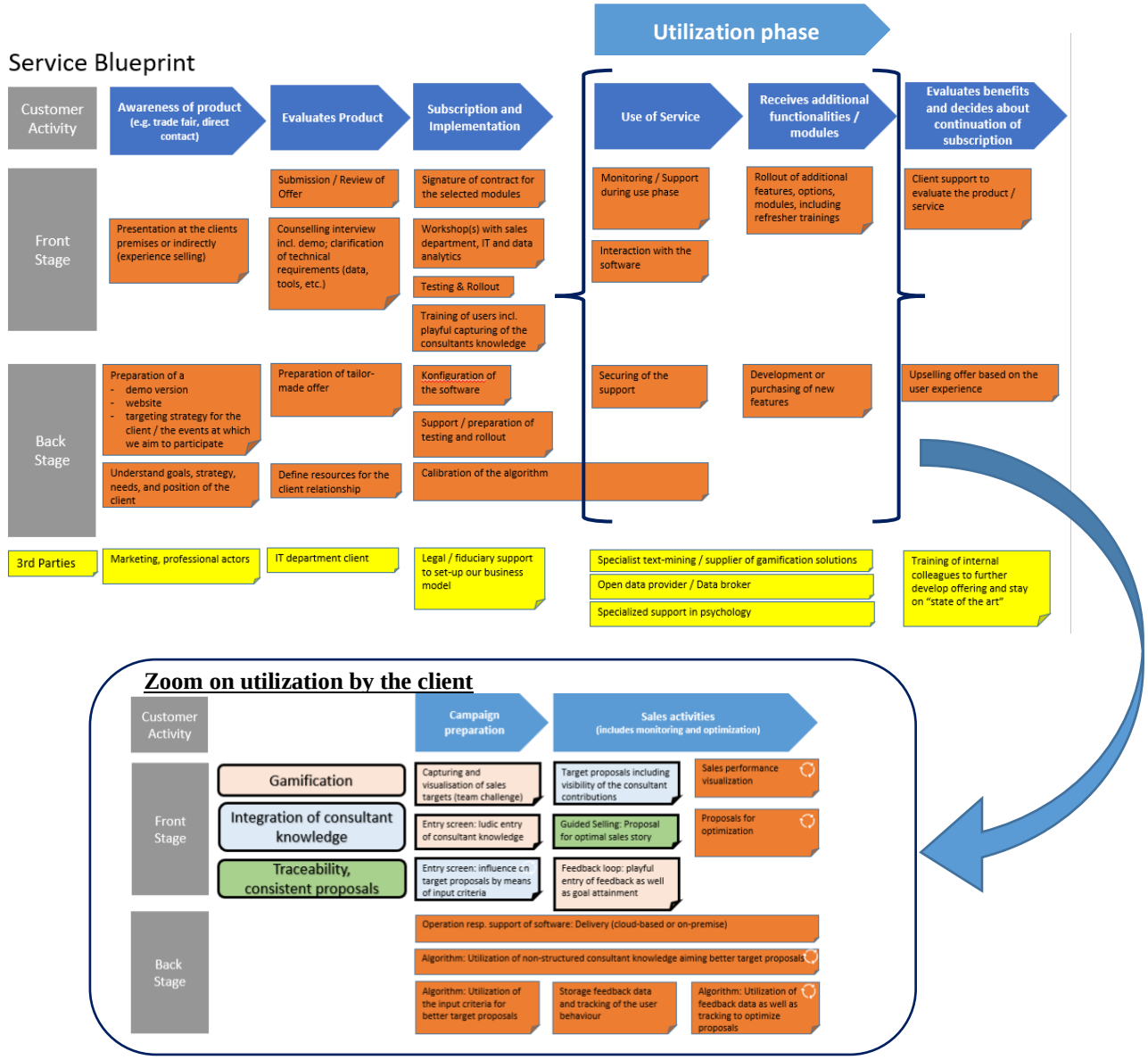


Fig. 4: Service Blueprint (incl. zoom)

In the service blueprint, external data providers are listed as 3rd parties. These could be open data sources, but also shared personal data sold by data brokers. The external data must be loaded into a consolidated analytics platform (e.g. data lake) and can then be used, together with the internal data, to train and/or to run the scoring algorithm. This loading and integration task can be managed through specialized interfaces (e.g. REST API) and data integration software.

This model creates value for the customer in the following manner:

- Enhancement of AI-based algorithm by human knowledge and experience. The job of sales consulting becomes more valuable and interesting since it leads to more positive client interactions and less frustration.
- Through guided selling: client advisors get good background information which allows them to propose the most appropriate product to their clients.
- Interactions with end-customers will be optimized, i.e. reduced to meaningful ones. There will be less end-customers who feel annoyed or disturbed.

- Gamification: higher "fun@work"-factor thanks to a graphically attractive interface to enter, retrieve, view data in relation to the sales campaign.
- Sales performance of any client advisor is visible to the team. This stimulates the competition among team members and supports them to reach goals in a playful manner.

As shown by our ecosystem (see fig. 5), the financial value for the service provider consists in the generation of subscription fees. But there is much more than that. For example, the development of our service gives us satisfaction as we support sales organizations in providing their consultants or sales personnel a much better work experience.

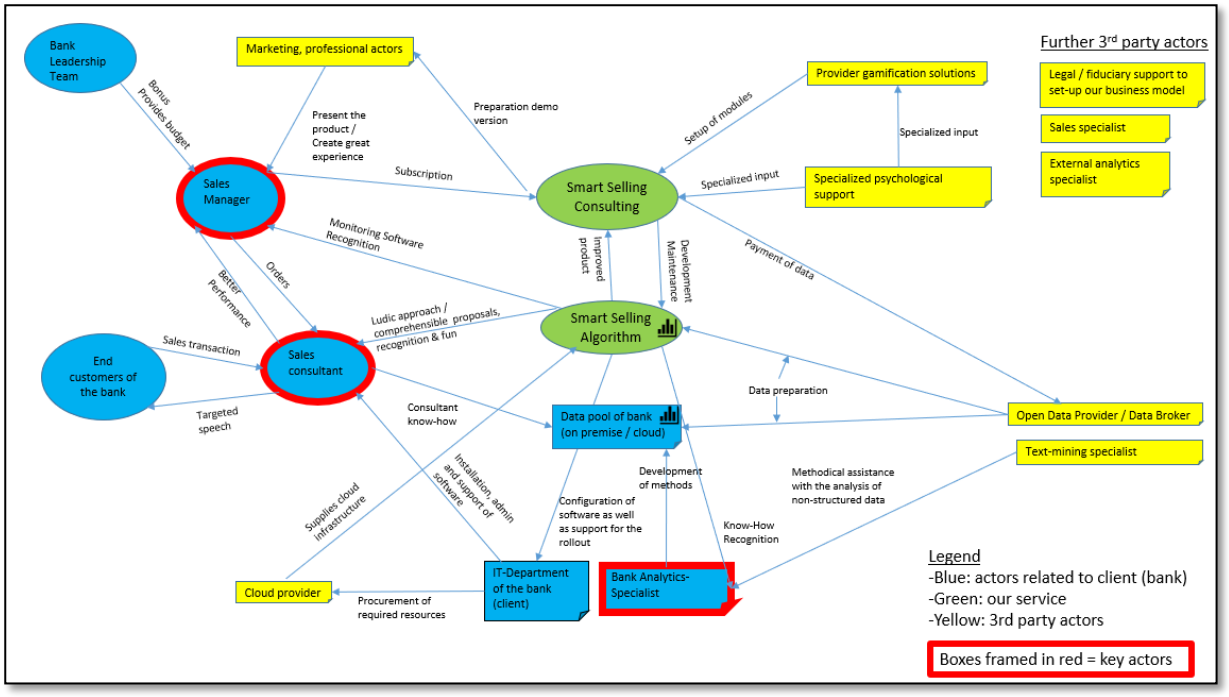
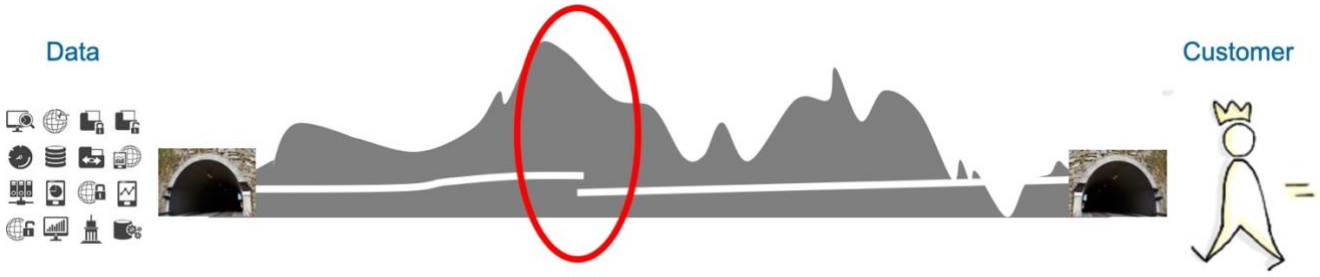


Fig. 5: Ecosystem

Our business case is based on several assumptions which need to be tested. The most important hypothesis assumes that sales consultants are most motivated when they can bring their own knowledge and experiences into the sales process. We test our assumption by giving to test consultants the opportunity to comment algorithm-generated scorings by describing how, where and when they bring in own knowledge. Simultaneously, their emotion curve and personal level of satisfaction is reported. We consider our hypothesis as correct if half of the consultants select a different order than the algorithm and if at least 50% of the test population attest this was a great experience for them.



Bridging the gap between data science and service design

Smart Service Engineering and Data Product Design

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