Business Information Systems - Part 2

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November 23, 2023

Contents

1 Exam Schedules and Evaluations

Students in group two should attend the lecture, while students in group one should study the subject and the lecture slides for the exam. Group two students will be evaluated in class, while group one students will have an exam based on the material covered in the lecture. Some students from group one have asked about the midterm exam for BIS two, and the answer is yes, there will be a midterm exam. The date for the final exam can be found on the course schedule on the WEB platform, and it will only cover the material from BIS two. The midterm exam for BIS one has already taken place, and there will be a separate midterm exam for BIS two. During official exam dates, excluding midterms, both BIS one and BIS two exams are usually scheduled at different times. However, starting from September, when there are fewer students, the exams are held simultaneously in the same room. In June and July, BIS one is typically conducted first, followed by BIS two after an hour. I will inform you of the specific instructions via email when the time comes.

2 Workforce Management Lecture

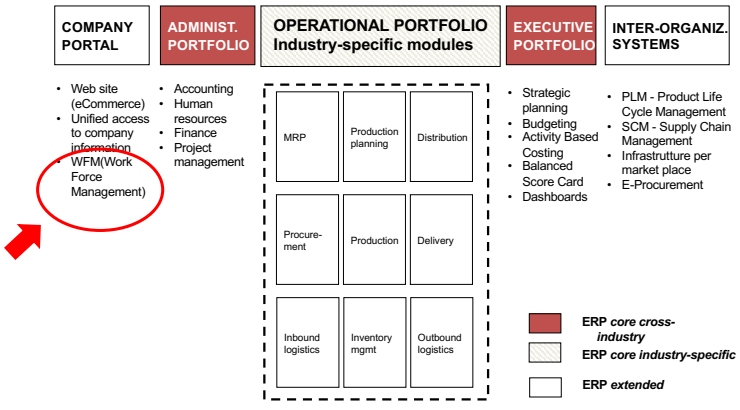
Agenda

- Functionalities and technology architecture of WFM
- Case study: OTIS elevators
- Case study: Utility company

2.1 Extended ERP and Workforce Management

Now, let's move on to the topic of workforce management. Extended ERP is the focus here. Extended ERP aims to integrate all information flows and processes involving not only internal actors like employees but also external players such as clients and partners of the company. This comprehensive approach ensures efficient interactions between the company and its stakeholders.

Functional architecture of ERP systems: overview



2.2 Client Relationships and Transaction Models

Workforce management is closely tied to the relationship between a company and its clients, particularly during the post-sale phase. This relationship is governed by a transaction model, which we discussed in the context of transaction theory. It's important to note that there are various types of transactions, depending on the nature of the goods or services involved. However, all transactions ideally consist of four phases, with the final phase being post-settlement or post-sale services. Workforce management focuses on these post-sale services and the ongoing relationship between the company and the client.

2.3 Post-Sale Services and WFM in Manufacturing

When discussing workforce management, it is often in the context of the manufacturing industry. In this industry, companies produce physical products that are installed at the customer's location. Examples of these installations include elevators, household appliances like washing machines and dishwashers, as well as appliances for electricity or gas. The focus of workforce management in this context is on maintaining these installations.

Once a customer has purchased an appliance, they may encounter issues that require maintenance. The manufacturer is responsible for addressing these maintenance requests. Typically, the customer has already paid for the appliance, so the transaction has been completed. However, additional services are needed to resolve any issues with the product. To provide these services, the company must send specialized employees to the customer's location.

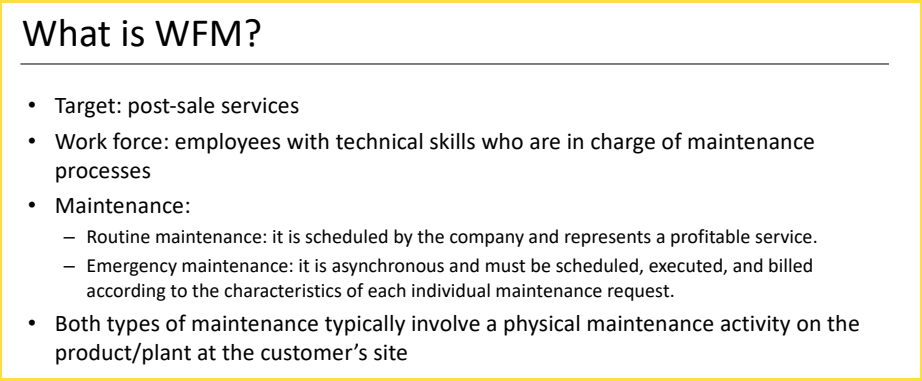
2.4 Maintenance Challenges and Costs

For example, let's say your elevator is broken. In this scenario, someone from the company needs to come to your building to fix it. However, having a workforce that needs to travel to different locations comes with a significant cost for the company. It would be much more cost-effective if the client could bring the appliance to the company for repairs.

To illustrate this, let's consider the example of a broken cell phone. When your cell phone breaks, you don't have someone come to your place to fix it. Instead, you go to a shop that specializes in cell phone repairs. You might go to a shop in Chinatown, for example, where they provide excellent service. You drop off your phone, go about your day, and then return to pick it up once it's fixed. This process requires you to invest your time in physically going to the shop, which can be a significant amount of time. However, you are not charged for the traveling costs.

In contrast, when a company needs to send a workforce to your home to fix a broken appliance, it becomes more complex. The company has to consider the costs associated with sending their workforce to your location, including travel expenses and the time required for travel. These costs are eventually factored into the price of the service, which you, as the client, will have to pay. Unlike when you take your cell phone to a shop, where you are not charged for traveling costs, the company needs to include these costs in their service fees. Additionally, the company must ensure that they send the right skilled workers to address the specific issue you are facing.

2.5 Emergency vs. Routine Maintenance



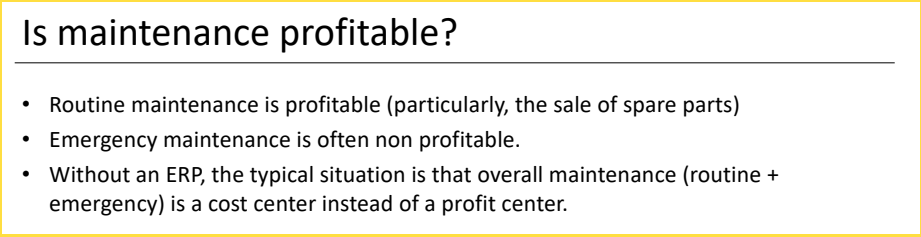
And so, when it comes to fixing appliances like elevators, the team responsible for the repairs needs to have the necessary skills and competencies. Unlike other appliances that can be taken to the company for repairs, elevators need to be fixed on-site, which often requires multiple visits. The first visit is to assess the problem, and subsequent visits are made with the appropriate team and materials to fix the issue. This process is complex and involves managing response times, which is crucial for customer satisfaction and safety.

In the case of elevators, response time is particularly important because a malfunctioning elevator can pose a safety risk, especially if someone is trapped inside. For example, if a patient in a hospital is being transferred between departments and the elevator gets stuck, it becomes a matter of urgency to rescue them. The level of service provided in these situations is not only important for customer satisfaction but also for ensuring safety. Incidents where people are trapped in elevators and their lives are at risk are rare but significant. Therefore, the level of service and efficiency in handling emergencies is crucial.

Maintenance plays a vital role in assessing the quality of service provided by a company. When an appliance breaks down, it is an opportunity for the company to demonstrate its commitment to customer satisfaction. If the company

efficiently handles the maintenance process, customers are more likely to remain loyal. Studies have shown that satisfied customers who receive efficient maintenance services are more likely to continue purchasing products from the same company. Acquiring new customers is challenging, so maintaining the loyalty of existing customers is essential for long-term competitiveness.

Elevators are a prime example of the importance of maintenance because they are long-lasting investments. Instead of replacing a broken elevator, it is more cost-effective to repair it. Therefore, maintenance becomes even more critical for elevators. However, maintenance requests can be divided into two types: routine maintenance and emergency maintenance. Routine maintenance, such as changing the oil in a car engine, can be planned and scheduled in advance. It is preventive maintenance that helps avoid breakdowns and can be optimized for efficiency. On the other hand, emergency maintenance is unpredictable and requires immediate attention.



Routine maintenance is relatively easy to manage and profitable for companies. It can be planned ahead of time, and the effort required is known in advance. This type of maintenance is designed to be straightforward and can be performed without specialized expertise or spare parts. It is a predictable demand that allows companies to allocate resources efficiently. In contrast, emergency maintenance is unpredictable and requires a reactive response.

In summary, the composition of the workforce and their competencies are crucial for fixing appliances like elevators. Response time is essential for customer satisfaction and safety, especially in emergency situations. Maintenance is an opportunity for companies to demonstrate their commitment to customer service and build loyalty. Routine maintenance can be planned and optimized, while emergency maintenance requires immediate attention. By understanding the different types of maintenance and their importance, companies can ensure long-term competitiveness and customer satisfaction.

2.6 Customer Service and Maintenance Requests

In the case of sudden problems that require management, the typical scenario involves a client calling the company to report the issue. This asynchronous communication requires a synchronous response from the company to handle the

problem efficiently. However, this type of demand is difficult to forecast, leading to challenges in planning and efficiency. Emergency maintenance, especially if it involves safety, must be prioritized regardless of location. This means that companies must be prepared to serve clients in remote areas, even if it is less convenient or profitable.

Outsourcing maintenance?

- Why non proprietary maintenance services?
  - The sale of spare parts can be used as an economic lever. If price is high, non-original spare parts are available on the market.
  - The physical distribution of customers gives an edge to local maintenance services.
  - In general, smaller companies are more flexible and can accommodate maintenance with greater efficiency.
- In some cases, companies partner with non proprietary maintenance services to outsource maintenance.
- Outsourcing maintenance can be risky:
  - Non-effective maintenance has a negative impact on the company's brand equity.
  - Legal issues/liability for inefficient emergency management.
  - No cross-selling.

For manufacturing companies, the transaction with the customer typically ends with the payment, and there is no ongoing contract or relationship. This can lead some clients, especially businesses, to seek maintenance services from other providers instead of the manufacturer. This is often driven by the perception that independent maintenance services are cheaper than going to the manufacturer. Smaller maintenance services tend to focus on profitable areas with high concentrations of potential issues, while leaving less profitable areas to the manufacturer. As a result, manufacturers are left with the more challenging and less profitable emergency maintenance tasks.

Why is maintenance costly?

- Customers (and the workforce) are physically distributed over a (possibly) large geographical region.
- Visits are costly.
- Maintenance activities can involve different skills. The optimization of teams, schedule, and visits is not an easy task.
- A maintenance request is often generic and multiple visits are needed to specify customers' needs.
- Spare parts may or may not be available, especially for emergency maintenance.
- SLA can be tight. If human life is involved, companies must oversize their workforce (e.g. elevators).

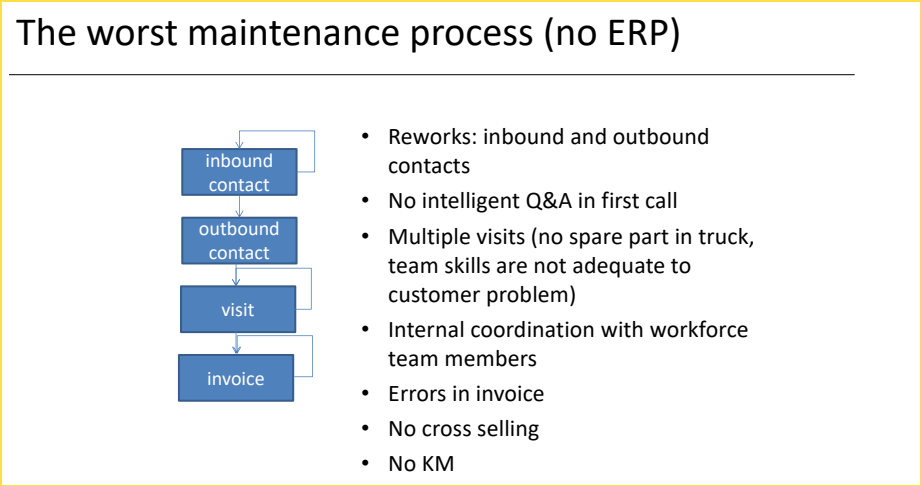
Emergency maintenance is generally not profitable, especially when it re-

quires sending a workforce to the customer's location. Maintenance activities can be costly due to the geographical distribution of customers, the expense of visits, and the difficulty of finding employees who are skilled at problem-solving. Employees who excel at fixing appliances may even leave to start their own maintenance services, becoming competitors to the manufacturer. Additionally, handling maintenance requests can be challenging, as customers often express their frustration and anger without providing essential information about the appliance and its model.

Overall, routine maintenance is typically more profitable than emergency maintenance. However, the nature of emergency maintenance, with its generic and often emotionally charged requests, makes it more difficult to manage efficiently.

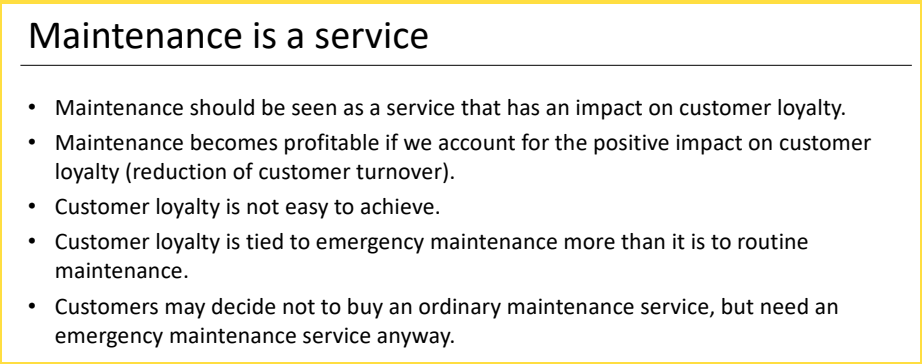
2.7 Optimizing the Maintenance Process

To optimize the maintenance process, it is important for customers to provide essential information about the appliance, such as its location and details. However, many customers are not aware of this and may struggle to accurately describe the problem. This is where the call center operators play a crucial role in asking the right questions to gather the necessary information. Unfortunately, level one call center operators often lack the skills to ask precise questions, which can lead to inefficiencies in the process.



To address this issue, it is important for organizations to ensure that the call center operators have access to an enterprise resource planning (ERP) system. This system can help them set up appointments and share the workforce's agenda, ensuring that the right resources are available when needed. Additionally, having spare parts readily available is essential to avoid delays in the

maintenance process. However, tight service level agreements (SLAs) can pose challenges, as the workforce needs to be adequately sized to handle peak calls, which can increase costs.



It is common for maintenance to be seen as a non-profitable and challenging process. However, it is crucial to change this mindset and view maintenance as a service that can help build customer loyalty. Outsourcing maintenance may seem like a good solution, but it can have negative repercussions on brand equity if issues arise. Therefore, organizations should carefully consider the level of service provided by maintenance service providers before outsourcing.

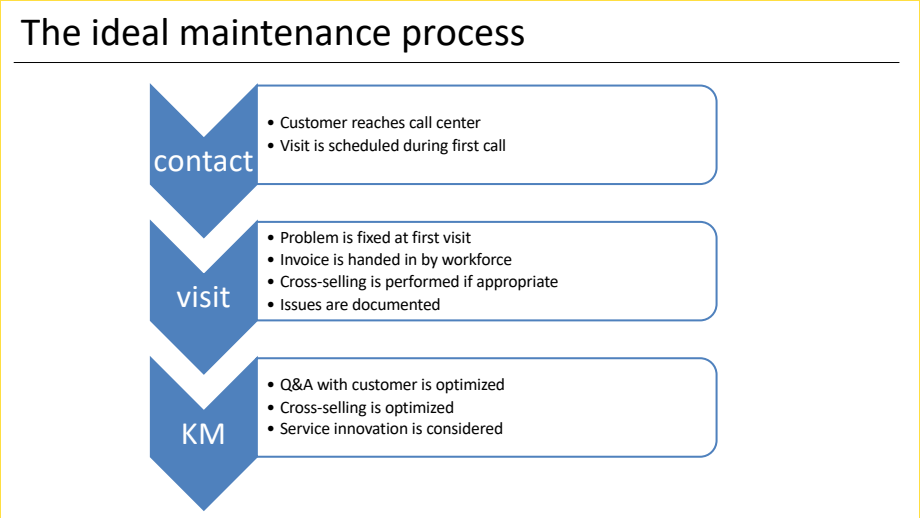
The worst possible maintenance process is one where the customer provides limited information about the issue, leading to multiple visits and coordination challenges within the workforce. This not only inconveniences the customer but also increases costs. Additionally, missed opportunities for cross-selling[1] can occur during maintenance interventions. This is the perfect time to offer maintenance subscriptions or additional services to customers.

To optimize the maintenance process, it is crucial for call center operators to ask the right questions and gather accurate information from customers. This will help streamline the process, reduce costs, and improve customer satisfaction.

2.8 Knowledge Management and Business Intelligence

To ensure efficient maintenance processes, it is important to have an intelligent Q&A system in place. This system allows the maintenance workforce to diagnose problems accurately and quickly. By diagnosing the problem, the necessary spare parts can be prepared in advance. The ERP system can be used to check

[1] Cross-selling is a sales strategy where a company encourages customers to purchase additional products or services related to their initial purchase. The goal of cross-selling is to increase the average transaction value and maximize revenue from each customer. This strategy involves suggesting complementary or supplementary items that go hand-in-hand with the customer's original purchase, thereby enhancing their overall experience and meeting more of their needs.



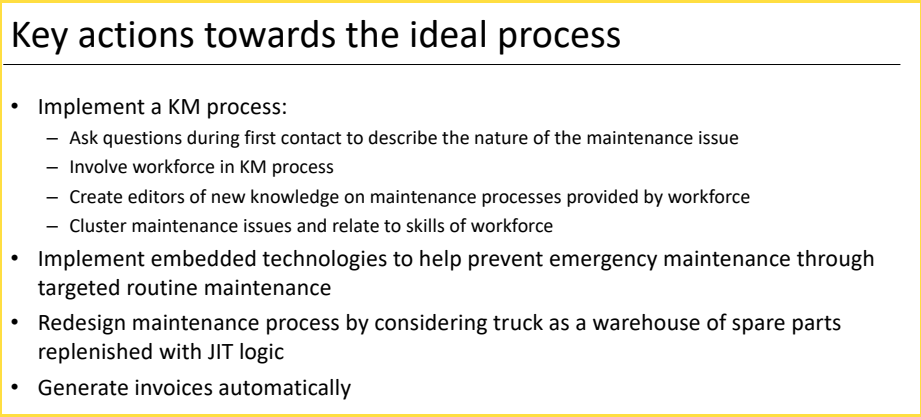
if the spare parts are available in the physical warehouse and ensure they are loaded onto the truck. This way, the technician can make an appointment at the right time and avoid any delays.

Invoicing is another crucial aspect of the maintenance process. It is essential to make the customer aware of why they are spending money and provide a breakdown of the costs, including the price of the spare parts. By doing this, the customer can understand the value they are receiving for their investment. It is recommended to print the invoice as soon as possible, preferably during the discussion with the customer, to ensure accuracy and transparency.

Training the workforce to handle the administrative part of the job is necessary. Although technicians may not enjoy administrative tasks, it is important to equip them with the skills to handle invoicing and other administrative responsibilities. This can be facilitated by using a simple application that tracks materials used during maintenance services and simplifies the invoicing process.

Implementing knowledge management is crucial for an intelligent Q&A system. By analyzing past maintenance interventions and building diagnostic intelligence, the system can ask the right questions and provide accurate solutions. Additionally, appliances equipped with sensors can self-diagnose and provide error codes, making the Q&A process even more efficient.

Furthermore, by analyzing data from maintenance services, companies can gain valuable insights into common issues with different appliance models. This information can be used to improve product design and solve recurring problems. However, it is important to note that using knowledge management to intentionally shorten the lifespan of appliances for profit is unethical and should not be practiced.



In summary, the key actions to achieve an ideal maintenance process include implementing knowledge management, using an intelligent Q&A system, training the workforce in administrative tasks, and analyzing data for continuous improvement.

2.9 Case Studies

2.9.1 OTIS Elevators Example

Knowledge management is essential for analyzing data and understanding maintenance issues. By collaborating with the maintenance team and Research and Development (R&D) team, you can identify and fix problems before they become emergencies. This not only helps avoid costly interventions but also allows for the transformation of emergency maintenance into routine profitable maintenance. By analyzing information on maintenance interventions and working with R&D, you can discover the most common and recurring issues and implement preventive maintenance to avoid emergencies. This knowledge can be kept confidential and used to offer a competitive service in the market.

A case study that exemplifies these issues is the OTIS Elevator company. They faced the challenge of unprofitable maintenance services due to competition. Competitors focused on the easiest and most profitable interventions in urban areas, leaving OTIS Elevator with elevators in remote areas that lacked maintenance subscriptions and routine maintenance. This resulted in numerous emergency calls. Additionally, OTIS Elevator mismanaged interventions and faced payment issues from clients. While a small percentage of unpaid interventions can be managed, if it grows, it becomes a problem as it affects the profitability of the maintenance processes.

To address these challenges, OTIS Elevator decided to change their main-

OTIS elevators: the starting point

- OTIS is a global leading company in its sector
- It has not outsourced maintenance, as it has been always perceived as key to the brand
- Maintenance is:
  - Challenging, since safety is involved
  - Interesting since the life of the product is particularly long and demand is a steady variable
- The strategy of OTIS is to sell the maintenance contract together with the product to get as many subscriptions as possible before competitors come in

OTIS elevators: the management issue

- They experienced a decrease in market share (maintenance market)
- The decrease was faster in urban areas where smaller competitors provided maintenance services at a lower price.
- Urban areas are the most profitable areas for maintenance services and decreasing price would significantly reduce profitability.
- OTIS applied higher prices also due to high internal costs, therefore lowering prices to a competitive level would make OTIS maintenance processes non profitable.

tenance processes and implement knowledge management. This involved conducting proper business intelligence analysis and data analytics to uncover the root causes of issues and their relationships. By working with data scientists and R&D, they established routine maintenance interventions that reduced the need for emergency interventions. They also leveraged their ability to diagnose issues before they occur and offered highly competitive prices for their maintenance services.

By understanding the issues and their causes, OTIS Elevator was able to proactively replace parts after three years, resulting in cost savings for customers and the ability to offer maintenance interventions at a discounted price compared to the market. Through this process, they invested in customer relationships and subscription maintenance services, reducing the need for emergency maintenance by 30 percent and becoming more competitive in terms of pricing. This demonstrates the benefits of industrializing processes by standardizing and making them more efficient.

By utilizing knowledge management and business intelligence, OTIS Elevator was able to act proactively and avoid problems. This approach not only improved their maintenance processes but also enhanced their overall service quality.

OTIS elevators: the solution

- They implemented KM
- They redesigned their maintenance processes
- Their goal was cost reduction, but they continued to sell their service as leading service as opposed to low cost solutions
- They implemented embedded technologies and reduced the need of emergency maintenance by over 30%.
- Their leveraged their position as large global company to provide a highly responsive call center service (OTISLINE commnication service).
- With mobile devices, the workforce has real time access to technical and administrative information

OTIS elevators: the solution

"Otis offers a variety of maintenance programs and building support systems to fit customers' needs and equipment types. We have standardized work practices around the world and can tailor a maintenance program specifically to the environment. Ultimately, **the right maintenance at the right time extends the life of the equipment and protects the owner's investment**."

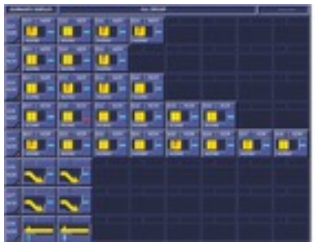
And then they implemented an industrialized process. The value proposition became subscribing to their maintenance service, which would result in a 30 percent reduction in emergency maintenance interventions and cost savings for customers. This would also improve the quality of their lives by minimizing the need to handle emergencies. By offering this service, they could shift the blame to competitors if any issues arose due to improper routine maintenance. In business contexts, people are willing to pay to avoid problems, making this a strong value proposition.

They successfully sold many maintenance services by investing in IoT and offering free sensors and diagnostic tools for old elevators. This allowed them to send the right technicians with the necessary spare parts at the right time. Ultimately, their solution extended the lifespan of the equipment and protected the owner's investment. They positioned maintenance as a service rather than a costly and unprofitable process.

OTIS elevators: the solution

Otis developed the REM (Remote Elevator Monitoring) system to optimize elevator performance and minimize elevator downtime. It is a **sophisticated interconnected system of sensors, monitors, circuits, hardware and software to collect, record, analyze and communicate data about elevator operations 24/7.** If the REM system detects a problem, it analyzes and diagnoses the cause and location, then makes the service call and helps an Otis mechanic identify the component causing the problem. Elevators are often back in service before owners or tenants even know there is a problem.

OTIS elevators: the solution



The Web-based EMS Panorama system enables building staff to monitor, control, report on and manage a full range of operation-critical functions from any computer with an Internet connection. Users can monitor the status of up to 30 groups of elevators, escalators and moving walkways, looking at a single building or an entire airport, college campus or medical center. Because the EMS Panorama system offers comprehensive, real-time data that shows building managers the full picture, they are able to respond quickly to passengers' needs and make informed decisions about equipment operations with greater certainty than ever before.

Their web-based system included remote monitoring capabilities, allowing them to proactively address issues before they occurred. They would contact customers to schedule maintenance visits, creating a high level of trust and customer satisfaction. This approach allowed them to charge premium prices, similar to a luxury hotel experience.

2.9.2 Utility Company and Smart Meters

Let's discuss the use of intelligent meters by utility companies. These meters provide real-time information on consumption, allowing for accurate billing without the need for manual readings. Instead of sending a workforce to check the meters, utility companies can position intelligent meters that provide consumption data in real time. This eliminates the need for manual readings and reduces costs.

OTIS elevators: final considerations

- It does not look as a low-cost maintenance service….
- ….it looks as a high-quality service that aims at customer loyalty.
- They have reduced internal costs by improving coordination.

WFM in a utility company (power supply)

- In utility companies, WFM is tightly related to back-office legacy functionalities:
  - Billing: it includes all accounting functionalities. Billing is usually periodical and includes the cost of maintenance (both routine and emergency)
  - Scheduling of workforce activities is usually one for both installations and maintenance.
- Maintenance is often requested by multiple customers (e.g. blackout)
- Maintenance and general inquiries go to the same call center

However, utility companies have not fully utilized the potential of the information provided by these meters. Currently, they mainly use the data for self-diagnosis and fixing any issues with the meters. While this is useful, it does not offer a compelling value proposition to customers. The meters themselves are simple and do not require frequent maintenance like elevators, so the potential for additional services is limited.

The value proposition of these meters is primarily focused on improving invoicing accuracy. However, utility companies are now reconsidering their approach due to sustainability concerns and the increasing cost of energy. They are exploring the idea of using renewable energy sources and optimizing energy consumption to reduce costs. This could potentially create a more compelling value proposition for customers.

In conclusion, while utility companies have not fully capitalized on the potential of intelligent meters, there is ongoing exploration of new value propositions. The example of the OTIS elevator remains a favorite case study, highlighting the importance of integrating maintenance into the overall service cycle.

Smart metering

- Remote access to energy consumption information (in real time)
- Alerts and alarms
- Self diagnosis
- Remote controls (on-off, limit to energy consumption, …)