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# MANAGING AND MONITORING MOBILE SERVICE WORKERS VIA SMARTPHONE APP

**A case study on worker monitoring, algorithmic management and software for "field service management"**

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# Managing and Monitoring Mobile Service Workers via Smartphone App

A case study on worker monitoring, algorithmic management and software for "field service management"
Cracked Labs, July 2024.

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# Summary

Mobile service workers, whether they are technicians, homecare workers or cleaning personnel, are increasingly being managed and monitored through smartphone apps. Data that was previously unavailable to employers is now being recorded and evaluated. As these apps give workers instructions about which client to visit next, how to get there and which tasks to perform at the client site, they become algorithmic managers. In the background, powerful software systems for "field service management" help employers organize, coordinate and schedule client visits, work orders and tasks. They promise to optimize, streamline and automate task allocation and help dispatchers and managers supervise workers, monitor their location, assess work performance and identify undesired behavior.

**This case study explores** how employers can use software and smartphone apps to manage and monitor mobile service workers. It focuses on the potential implications for employees in Europe and makes two contributions. First, it summarizes survey-based research on how employers actually use these technologies and how workers are affected. Second, it examines software that is available on the market. To illustrate wider practices, it investigates Microsoft software for "field service management", which is part of the company's comprehensive "Dynamics 365" system. The investigation aims to identify, examine and document data practices that affect workers, based on a detailed analysis of technical documentation and other publicly available sources.

**Microsoft's "field service management" system** provides extensive functionality for algorithmic management, performance control and behavioral monitoring:

- Via mobile app, workers receive instructions about work orders, client destinations, travel routes and a list of predefined tasks to be performed at client sites. The required arrival times and expected durations of work orders and tasks serve as target times. Workers confirm via app when they travel to clients, complete tasks or take breaks. Tasks can include sub-tasks with step-by-step instructions. Consequently, the app **structures, directs and micromanages work**, aligning it with rigidly defined processes. As it constantly reminds workers of time constraints and deviations, it includes implicit mechanisms for performance and behavior control.
- Employers can utilize **behavioral monitoring and performance control** to supervise and pressure workers. Dispatchers can see their real-time location and travel routes on a map. They can monitor the current degree of completion of work orders and tasks. For completed work, they can see how much time a worker actually spent on it in relation to the target time. The system can remind both dispatchers and workers of cost limits associated with the time spent on work orders. To keep contractually agreed response times low, it can show a timer to dispatchers that counts the minutes and seconds that have elapsed since the creation of a work order.
- New work orders can result from client inquiries or machines sending error codes, or they are automatically generated on a recurring basis, for example, based on service agreements. Organizations can define **standardized work orders** that include specific service tasks, instructions and estimated durations. The specified durations serve as target times and are used to distribute and schedule actual work orders to workers.
- The system can **automatically schedule and dispatch** work orders, and, as such, automatically assign tasks to workers. It can generate schedules for all workers for entire days or calculate a new schedule every 30 minutes. To match work orders to workers, it considers workers' availability, location, predicted travel times and **skill profiles**. Automated scheduling is based on customizable **optimization goals.** The "maximize productivity" goal leads to schedules with minimized travel and idle times. The system can optionally create schedules that require workers to travel to or from client sites outside their working hours. Besides fully automated scheduling, it can also semi-automatically recommend workers for particular work orders.

- Microsoft offers to **predict how long it will take to complete** particular work based on past data on work activities and "AI" models. It outlines possible reasons for deviations between predicted and previously specified durations by suggesting, for example, that a particular client, region, weekday, task or worker will likely increase the time required to carry out the work. As such, it may **accuse workers** of being slower than expected. This functionality can help dispatchers "enhance their team's performance", according to Microsoft.
- The system is designed to **rate and rank workers** according to a wide range of performance and behavior metrics over the previous year, including by the number of completed work orders, the time spent on them in relation to target times and the time spent travelling, on break and in an "idle" state, i.e. without an assignment. Managers can identify undesirable behavior by evaluating how often workers missed the target time or arrived late to a client. They can assess workers by how much revenue they generate and by how satisfied the customers are with their work, based on surveys sent to clients after work was completed. Group-level metrics, for example, on the average time spent completing certain types of work in relation to targets, can also create pressure to speed up work. Employers can use Microsoft's "Power BI" system to create almost any type of report.
- While **GPS location tracking** is optional, many features rely on it. Microsoft recommends recording a worker's location every "60 to 300 seconds". Clients can be offered access to the current location of the scheduled worker and their estimated arrival time. The system systematically **exposes personal data on worker behavior** to employers, who can, for example, view records about workers' exact whereabouts over time. It provides access to enriched location records that indicate, based on **geofencing**, at which time workers have entered or exited certain client sites or other areas. The system also provides records about **remote assistance calls,** including their start and end times, and summarizes how much time each worker spent on those calls.
- Despite concerns about the reliability of "generative AI", Microsoft has rushed to put its **CoPilot** technology into many products, including field service management. CoPilot promises to summarize information, create draft work orders based on customer emails and draft email replies. While Microsoft advertises it as a means to accelerate work, dispatchers are told to review "AI-generated content" because it can be "incorrect".
- The system can be integrated with Microsoft 365 and other Microsoft software. Dispatchers and workers can handle work orders directly from within **Outlook** and **Teams**, turning them into task management systems.

Employers can customize Microsoft's field service technology and use it in more or less problematic ways. Some intrusive pre-built reports are not available for German customers. Employers can add custom workflows to manage and monitor different types of mobile work. Microsoft's **Home Health** system extends its field service technology with functionality specific to homecare. A brief investigation of field service technology offered by the major German vendor SAP shows that its system also offers intrusive performance monitoring functionality.

**Implications for workers.** The review of survey-based research on the practical use of field service technology in Austria, Norway, the UK and the US shows that these systems can have significant negative implications for workers. Digital task documentation in the name of billing, quality management or workload balancing can quickly evolve into far-reaching algorithmic management via app. Task direction and monitoring via smartphone app generally leads to increased surveillance and digital control at work. Employers may intentionally misuse the data for purposes other than it was originally collected, including for making negative decisions about workers. Standardized processes, rigid performance targets and automated scheduling can accelerate and intensify work and undermine work discretion. Knowledge that once resided with workers now increasingly lies within technical systems.

This case study is part of the ongoing project "Surveillance and Digital Control at Work" (2023-2024), led by Cracked Labs, which explores how companies use personal data on workers in Europe.

# 1. Introduction

Mobile service workers, whether they are field technicians, homecare workers or cleaning personnel, do not work at a single location, such as an office or a factory. Instead, they regularly visit client sites or otherwise perform work at constantly changing locations. Mobile workers are increasingly managed and monitored through smartphone apps that provide instructions about the tasks to perform at client sites and that capture data on their work activities, movements and other behaviors. In the background, powerful software systems help employers to plan, organize, coordinate, standardize, optimize and streamline their work. These systems help dispatchers and service managers automate task allocation, rate and rank workers by assessing how much time they spend on tasks and identify undesirable behavior. They offer extensive functionality for algorithmic management and worker monitoring.

**This case study explores** how employers can use software and smartphone apps to manage and monitor mobile service workers. It focuses on the potential implications for employees in Europe and makes two contributions. First, it summarizes research on how employers actually use these technologies and how workers are affected. It reviews survey-based studies that address different sectors and countries, including Austria, Norway and the UK. Second, it examines software that is available on the market. To illustrate wider practices, it investigates software provided by the enterprise software giant Microsoft. Its software for "field service management" helps employers manage and monitor mobile work via app. The system can be used to manage different types of mobile service work ranging from technical maintenance to healthcare. In addition, the study briefly examines similar software provided by SAP. The investigation aims to identify, examine and document data practices that affect workers, based on an analysis of publicly available corporate sources such as technical documentation and promotional materials.

## 1.1 Overview

- **Section 2** reviews survey-based studies about the practical use of technologies that manage mobile service workers through smartphone apps, with a focus on implications for workers. It summarizes an interview-based case study on technical maintenance work in Austria and a Norwegian study based on interviews with software vendors and worker representatives in different sectors including electrical installation, cleaning, security and healthcare. Furthermore, it presents research about homecare work in the US and UK.
- **Section 3** gives a brief overview of smartphone apps for workers and software systems for mobile service work. It introduces systems for "field service management" and the software vendors who provide it.
- **Section 4** investigates in detail how Microsoft's software for "field service management" processes personal data on mobile workers and how it can be used to automate management, monitor workers, streamline work and maximize productivity. It documents how the system can help employers micromanage granular tasks via smartphone app, put workers under constant pressure, assess their performance and identify undesirable behavior. In addition to automated route planning, work order scheduling and task allocation, it examines AI-based predictions of travel and work times, location tracking and intrusive reporting functionality. The investigation also addresses how the system can be integrated with Microsoft's broader cloud-based software offerings including Dynamics 365, Microsoft 365, Outlook and Teams. Furthermore, it explores how Microsoft has rushed to integrate its unreliable "CoPilot" technology based on "generative AI" into enterprise applications in ways that can seriously affect workers.
- **Section 5** briefly examines similar technology offered by the major German enterprise software vendor SAP.
- **Section 6** summarizes the findings and reflects on potential implications for employees.

## 1.2 Context, scope and limitations

This case study is part of a series of case studies on systems that process data at the workplace, which are, in turn, part of the **ongoing project**, "Surveillance and Digital Control at Work",[1] led by Cracked Labs. The project aims to explore how companies use personal data on and against workers in Europe, together with AlgorithmWatch, Jeremias Prassl (Oxford), UNI Europa and GPA, funded by the Austrian Arbeiterkammer.

The case studies build on **previous research** on the topic (Christl, 2021). They aim to document technologies and data practices by reviewing existing literature and by **examining technologies and software systems** that are available on the market based on publicly accessible vendor information. This includes software documentation and marketing materials, which might be ambiguous and incomplete. Every effort has been made to accurately interpret these corporate sources, but we cannot accept any liability in the case of eventual errors. Where the case studies rely on the examination of corporate sources, it remains largely unclear how employers actually implement, customize and use the functionality provided by these systems.

The findings of the case studies will be incorporated into the **main report** of the ongoing project, which will draw further conclusions from the findings.

# 2. Worker monitoring and algorithmic management in mobile service work

This section summarizes research about the practical use of technologies that manage and monitor mobile service workers through smartphone apps in Austria, Norway, UK and US. It reviews survey-based studies that focus on the implications for employees – from technical services to cleaning to homecare.

## 2.1 How the smartphone changed technical maintenance work in Austria

In the course of an earlier project led by the author of this study, Hans Christian Voigt (p. 13, 2021) carried out interviews with worker representatives from two Austrian companies, both of which are part of global groups involved in installing, maintaining and repairing technical facilities located in buildings and other client sites. The resulting case study shows how the introduction of the smartphone has fundamentally changed everyday work carried out by Austrian technical maintenance workers, who visit client sites regularly as well as whenever an incident report is filed (Christl, 2021, p. 137). This subsection summarizes the findings of this German-language case study.

When the two companies first introduced basic cell phones decades ago, mobile maintenance workers still had fixed responsibilities for certain client sites and a high degree of discretion over how they performed their work. When the employers started sending instructions to workers via short text messages (SMS), workers could answer with basic status codes that indicated their acceptance, rejection or completion of a maintenance job. The head office still did not have any ability to verify their status or location. Workers had to visit the office only once a month.

Today, around 15 years after Apple introduced the iPhone (Markoff, 2007), all workers' movements across client sites, the maintenance tasks they perform and their duration are documented via a smartphone app. A digital map

[1] https://crackedlabs.org/en/data-at-work

in the head office shows in real time who is working on what. While workers are free to decide whether to activate GPS location tracking or not, the system always knows where they are, even without GPS tracking, because workers have to enter information into the app whenever they arrive at a client site, work on billable tasks or leave a site. In addition, workers began to receive increasingly precise instructions via smartphone app about which maintenance tasks to perform at a particular facility. One company recently introduced a system that uses "artificial intelligence" to determine maintenance tasks based on sensor data recorded at client facilities. Client companies who operate the facilities increasingly want to manage and control maintenance workers employed at outsourced maintenance contractors as if they were their own employees. For this purpose, one Austrian maintenance contractor now offers real-time access to data on the work performed and on the workers who perform it, as an extra service package. As such, worker data and digital control of workers have become products sold by the maintenance contractor.

According to the interviews, this transformation has had the following effects on workers:

- **Reduction of work discretion, autonomy and sense of purpose** due to increasingly specific instructions down to individual tasks. Workers perceive a form of "digital rigidity" that allows little room for deviation. Older employees used to consider themselves to be "experts" with extensive knowledge about "their" facilities and the time required for each task. This knowledge now lies within the technical systems. The systems' complexity and ongoing updates render these systems opaque, hinder participation and create feelings of discomfort and powerlessness in workers.
- **Acceleration and intensification of work**, as the time available for individual tasks has been drastically reduced over the years.
- **Comprehensive monitoring of performance and behavior.** The smartphone has significantly intensified digital surveillance and control at work. In meetings with workers, managers began to discuss the time required for maintenance tasks down to minutes or even seconds. Managers, who have to reach their own KPI targets, pressure workers to save time when performing tasks or to eliminate steps that are deemed unnecessary according to the technical system.
- **Challenges for worker participation and co-determination.** Because of its technical complexity, the Austrian works councils[2] had to involve technical experts to negotiate an agreement about the use of these systems. In one company, the works council has an agreement about the use of the mobile app system but not about the underlying SAP system. Constant software updates occur without consulting with the works council.

## 2.2 Evidence from a Norwegian study on technical services, cleaning, security and mobile homecare

Tranvik and Bråten (2017) examined the use of mobile devices for data collection and digital control of workers in several industries and sectors in Norway including electrical installation, road maintenance, cleaning, security and mobile homecare. Their qualitative study is based on interviews with field technology vendors and with worker representatives in 52 private companies and public organizations. These organizations also provided the study authors with internal documents such as email communications concerning alleged data misuse. Field technology entails the use of mobile devices that capture work-related data on field workers, including information on their location, the work activities they perform and the time they spend completing them. This data is made available to

[2] Austrian works councils have co-determination rights over the introduction and use of systems for worker control, see e.g. Abraha (2022)

supervisors, dispatchers and other managers. The authors identified three main areas of application for field technology:

- **Labor management.** Employers used field technology to remotely direct workers based on real-time data from mobile devices and vehicles, which served to centralize decision-making and streamline the prioritization, scheduling, assignment and dispatching of work. In electrical installation, for example, dispatchers made these decisions based on information about workers' qualification and experience, their capacity, current location and progress of job execution, the latter of which involved evaluating status information entered by workers such as "job started" and "job completed". Managers had access to performance metrics about individual workers, such as the average time spent on jobs and compared it with overall averages or previously defined targets.
- **Documentation.** Field technology was also used to demonstrate that work was performed according to contractual agreements, invoiced services, legal obligations or safety requirements. Data about work activities was captured via mobile devices, for example, to ensure that security guards took their routes and checked all required facilities or to verify attendance and the timing of jobs for cleaning personnel. Security guards and cleaning personnel sometimes had to scan a barcode or an RFID tag with their mobile device to demonstrate their physical attendance at certain sites. For homecare workers, the recorded data served to prove that workers assisted their clients with cleaning, cooking or personal hygiene according to the number of minutes allotted in the employer's contract with local authorities. In road maintenance, data automatically generated during, for instance, the salting of icy roads or the use of snowplows (when, where and by whom), was also used for documentation purposes. Digital documentation served as evidence when managers or customers suspected that work had not been done as desired and to correct deviations. This was considered specifically important for work that left no clearly visible or physical evidence of its completion (documenting "the invisible"). Sometimes, this also involved disclosing data about the activities of workers to customers.
- **Inspection.** While the boundaries between what the authors of the study refer to as "documentation" and "inspection" appear to be blurry, the latter refers to the further evaluation of information about work activities. This includes inspecting the "quality" of work, but also assessing workers' performance and behavior. In electrical installation, managers had access to performance metrics about individual workers, such as the average time spent completing jobs, and compared it with overall averages or previously defined targets. This was utilized for quality management and for performance-based pay in the form of bonus schemes. Constantly recorded data on the use of vehicles, including their location, arrivals, departures and "idle" statuses, could be compared to, for instance, data on the time spent per job that was manually entered by field workers. Work-related data captured by mobile devices was also used to inspect the routes and activities of security guards. For cleaning personnel, similarly collected data has been used to inspect their performance at the individual level and compare it to targets for the number of minutes spent per job, as defined in customer contracts. In mobile homecare, the data was primarily used to identify systematic deviations between the actual durations of client visits and contractually defined targets. Some cleaning companies even experimented with evaluating the number of steps taken by workers and comparing it to previously defined targets per building and room.

While the study was published in 2017, the interviews with worker representatives were conducted back in 2011 and 2012, around five years after Apple had introduced the smartphone (Markoff, 2007). Nevertheless, the interviews revealed a wide range of potential and actual implications for workers:

- **Surveillance, criticism and resistance.** While practices varied across different industries and sectors, many workers saw field technology as a surveillance tool. Its deployment and use was often met with criticism and

sometimes resistance from employees. Controversial questions included the overall necessity of field technology, the types of data collected and the purposes it is used for. Worker representatives assumed that managers could utilize the data as they saw fit since no effective technical or organizational barriers would prevent them from doing so. Workers often would not even know how the data was used.

- **Systematic data misuse.** In the 52 companies and organizations that participated in the study, the number of reported cases concerning alleged misuse of data for purposes other than the purpose it was originally collected for was "relatively high". This often involved managers utilizing the data for "negative decisions" about individual employees, ranging from formal warnings to terminations. In electric installation, data that was originally not collected for monitoring purposes was utilized to assess attendance, punctuality, response times and the time spent on particular jobs in relation to performance targets. Managers even asked employees about issues unrelated to work, such as why they did not spend the night at their home address. Security guards were given formal warnings when the data alleged they had not completed their rounds as expected.
- **Work intensification.** Many worker representatives, especially in cleaning and homecare, were concerned about field technology leading to increased workloads and greater physical strain due to tougher performance targets or increased control of time spent travelling and with clients.
- **Centralized control and reduction of work discretion.** The authors of the study argue that rather than trusting field workers to schedule and perform work at their own discretion, field technology based on real-time data from mobile devices centralizes control about the scheduling and performance of work.
- **Outsourcing of public services and worker monitoring.** According to the study, the outsourcing of public services often contractually required private companies to provide more detailed accounts of how individual employees perform their work.
- **Positive effects for employees?** In some cases, worker representatives stated that the data helped employees dispute accusations of sloppy or improper work. In other cases, they assumed that employers were wary of the data because it could help workers to prove that they actually worked more hours than they were paid.
- **Increased power imbalance at work.** The authors conclude that field technology strengthened the employers' ability to organize, direct and control work. Data about field workers that was previously unavailable to managers was now being recorded and evaluated. Control over information was unevenly distributed. Surveillance and control were increasingly "individualized" and workers were increasingly treated as "risk factors".

## 2.3 Electronic monitoring of homecare workers in the US and UK

A number of studies examined the use of mobile devices to manage and monitor homecare workers. In the US, many states require homecare workers to record data about client visits, including about arrivals, departures, locations and types of services provided, via smartphone app (Metcalf, 2018). The "electronic visit verification" (EVV) system was introduced in the US to prevent fraud in billing care services to the Medicare public health insurance program. Alexandra Mateescu (2021) found, in her comprehensive study based on interviews, that the system "made workers' jobs more difficult by placing a greater emphasis on policing compliance than providing care". Care workers "struggled to make their work visible to digital systems; slight missteps in compliance often led to delayed or lost wages". It also negatively affected service recipients, as everyday activities were flagged as "exceptions". Both service recipients and workers "spoke of feeling criminalized, viewing EVV as an extension of broader legacies of government surveillance over people of color, and poor, disabled, and older adults".

An interview-based study of similar systems in the UK focuses on the implications of strictly allocated service times and tasks for homecare workers. Moore and Hayes (2017) found that local authorities increasingly required care

providers to implement electronic monitoring in order to get paid, and authorities could even access data about homecare workers, their location and the services they provide to clients. Because of the rigid way that authorities and care providers define billable labor time, workers had to absorb the risks involved with the fluctuating and unexpected demands of service recipients. As a result, workers were systematically penalized by performing unpaid labor and perceived electronic monitoring as "undermining their autonomy and discretion in what is contingent and unpredictable work".

# 3. Smartphone apps for workers and software for "field service management"

This section gives a brief overview of smartphone apps for workers and software systems that aim to manage and monitor mobile service work.

## 3.1 From tracking time and attendance to managing work via app

The smartphone and other networked mobile devices have certainly changed a lot in our personal lives, in society and, unsurprisingly, also at work (Ojala and Pyöriä, 2018). These devices increasingly shape how work is being done in the digital age (Bader and Kaiser, 2017). Many enterprise software vendors provide mobile apps for workers that serve different purposes, ranging from communication and collaboration to the organization and management of specific workflows (Stieglitz et al., 2015). Several vendors provide mobile apps for time and attendance tracking, the submission of time-off requests, shift scheduling and other functionality that is typically considered part of human resource management. This includes, for instance, mobile apps from large HR software systems such as SAP SuccessFactors[3] and UKG (Ultimate Kronos Group).[4] Smaller vendors provide software for specific industries and sectors, which often go beyond HR functionality. The German vendor M-SOFT, for example, offers a mobile app that provides time and attendance tracking for different industries from plumbing and construction to retail,[5] while also supporting the management, documentation and billing of work orders and tasks via the app.[6]

As soon as a mobile app for workers tracks not only the time spent at work but also the time spent completing particular work activities, for example, in the name of documentation and billing, an app for time and attendance management quickly turns into a system that monitors activities and behaviors at work.

## 3.2 Software for mobile service work and "field service management"

While some mobile apps for workers are also used by employees who always work at a particular location, such as an office, a factory or at home, other apps are specifically targeted at workers who regularly visit client sites or otherwise perform work at constantly changing locations. Systems that organize and manage mobile work in the "field" are often referred to as systems for "field service management" or FSM (Pretterhofer and Mezhuyev, 2021). They typically consist of a mobile app for workers and a comprehensive, cloud-based software system that provides functionality for planning, organizing, coordinating, managing and monitoring client visits, work orders and tasks.

[3] https://help.sap.com/docs/SAP_SUCCESSFACTORS_MOBILE/c3cbc8ddf8ef421d81d4b71a6f88a7a3/9ec6c201d4b6469caf7605c34f3364f0.html [28.8.2023]
[4] https://www.ukg.com/sites/default/files/2022-07/UKG-Ready-Mobile-Product-Profile_CV0183-USv9.pdf [28.8.2023]
[5] https://www.msoft.de/software/zeiterfassung.html, https://www.msoft.de/branchen/handel.html [28.8.2023]
[6] https://www.msoft.de/software/mobile-auftragsbearbeitung.html, https://www.msoft.de/software/auftragsabwicklung-handwerk.html [28.8.2023]

Major FSM vendors include enterprise software giants such as Microsoft, Oracle, SAP and Salesforce and other vendors that focus on service management, such as IFS (Sweden), Nomadia (France), OverIT (Italia), Praxedo (France), ServiceMax (US), ServiceNow (US).[7]

Many FSM systems focus on technical installation, repair and maintenance services in different industries, including in manufacturing, equipment operation, construction, facility management, utilities, oil and gas, automotive and telecommunications. Several systems also address other sectors such as insurance, auditing, retail and healthcare. Microsoft's software for field service management, which is examined in detail in section 4, can be extended with extra functionality for specific sectors like mobile healthcare, retail and manufacturing. Dozens of other vendors offer software that builds on Microsoft's FSM platform.[8] Vendors that provide FSM systems that specifically or additionally address mobile healthcare work include, for example, Serviceware (Germany),[9] Fastleansmart (Germany),[10] Civica (UK)[11] and Birdie (UK).[12] WorkWave, a US company with offices in Italy and the UK, is an example of an FSM vendor that focuses on cleaning, security guarding, plumbing, landscaping and pest control.[13]

[7] Gartner (2022): Magic Quadrant for Field Service Management. Gartner, 24.10.2022
[8] Ibid.
[9] https://serviceware-se.com/company/locations [28.8.2023]
[10] https://fastleansmart.com/en/blog/real-time-scheduling-field-home-healthcare/, https://fastleansmart.com/en/company [28.8.2023]
[11] https://www.civica.com/en-gb/product-pages/care-management-software/, https://www.civica.com/en-gb/about-us/office-locations/ [28.8.2023]
[12] https://www.birdie.care/ [28.8.2023]
[13] https://www.workwave.com/, https://www.workwave.com/company/ [28.8.2023]

# 4. Microsoft software for field service management

The enterprise software giant Microsoft offers a comprehensive system that helps employers to plan, organize, coordinate, manage and monitor work performed at client sites by mobile workers, who receive information about travel destinations, work orders and granular service tasks via a smartphone app.

Microsoft's "Field Service" software[14] provides extensive functionality for **algorithmic management and worker monitoring**. It is part of "Dynamics 365", a cloud-based enterprise system for customer relationship management (CRM) and enterprise resource planning (ERP).[15] According to Microsoft, the system can be used to manage very different types of work including technical maintenance and repair services, on-site risk surveying by insurers, in-home healthcare services, landscaping and cleaning.[16] In addition to managing work performed at client sites, it can also be used to manage "frontline" workers within an organization who do not visit clients.[17] The system also includes functionality for communication, time and location tracking, billing and for managing information about customers, equipment and required materials. Most important, it helps employers manage and automate the scheduling and dispatching of workers, work orders and service tasks.[18]

Microsoft often refers to workers as "resources".[19] According to the company, the system helps organizations "maximize service efficiency" by "streamlining all aspects of managing a mobile workforce"[20], "reduce travel time", "increase efficiency and standardize processes"[21] and "boost" worker "productivity",[22] for example, by "fitting more appointments into working hours" and by "allowing dispatchers to manage more resources".[23]

## 4.1 Managing and monitoring mobile work

### 4.1.1 Managing workers via smartphone app

Figure 1 shows a number of screenshots from Microsoft's **mobile app for field service workers**,[24] in this case addressing technical maintenance work. As the first screen illustrates, the employee who uses the app sees a queue of work orders assigned to them, which includes information about the respective client, the desired arrival time and the estimated duration of the visit, i.e., a form of performance target. For example, a work order named "standard inspection", scheduled for 8 AM at a particular client site, is planned to take 2 hours and 6 minutes. Another work order concerning "fire safety system maintenance" is estimated to take 2 hours and 39 minutes. The app also reminds the worker that the next work order is scheduled "in two hours" from now. Like in many workflow management systems,[25] status codes play an important role. When driving to a client site, the worker is required to set their status

[14] https://dynamics.microsoft.com/en-us/field-service/overview/, https://learn.microsoft.com/en-us/dynamics365/field-service/overview [23.8.2023]
[15] See e.g. Luszczak, A. (2019): What is Microsoft Dynamics 365/AX? In: Using Microsoft Dynamics 365 for Finance and Operations. Springer Vieweg, Wiesbaden. DOI: 10.1007/978-3-658-24107-0_1
[16] https://learn.microsoft.com/en-us/dynamics365/field-service/overview, https://customers.microsoft.com/en-us/story/1610771099870479631-santam-insurance-dynamics-365-finance-en-south-africa, https://dynamics.microsoft.com/en-us/field-service/field-service-management-software/ [23.8.2023]
[17] https://learn.microsoft.com/en-us/dynamics365/field-service/frontline-worker-set-up [23.8.2023]
[18] https://learn.microsoft.com/en-us/dynamics365/field-service/overview [23.8.2023]
[19] https://learn.microsoft.com/en-us/dynamics365/field-service/set-up-bookable-resource-categories [30.5.2024]
[20] https://dynamics.microsoft.com/en-us/field-service/field-service-management-software/ [30.5.2024]
[21] https://learn.microsoft.com/en-us/dynamics365/field-service/overview [30.5.2024]
[22] https://learn.microsoft.com/en-us/dynamics365/release-plan/2024wave1/service/dynamics365-field-service/empower-frontline-workers [30.5.2024]
[23] https://learn.microsoft.com/en-us/dynamics365/field-service/rso-overview [30.5.2024]
[24] See also: https://learn.microsoft.com/en-us/dynamics365/field-service/mobile-power-app-overview [23.8.2023]
[25] See e.g. Christl (2023)

to “traveling”, which automatically changes the status of the corresponding work order from “scheduled” to “in progress”.[26] The system then shows a map and travel directions to the client site (figure 1, second screen).

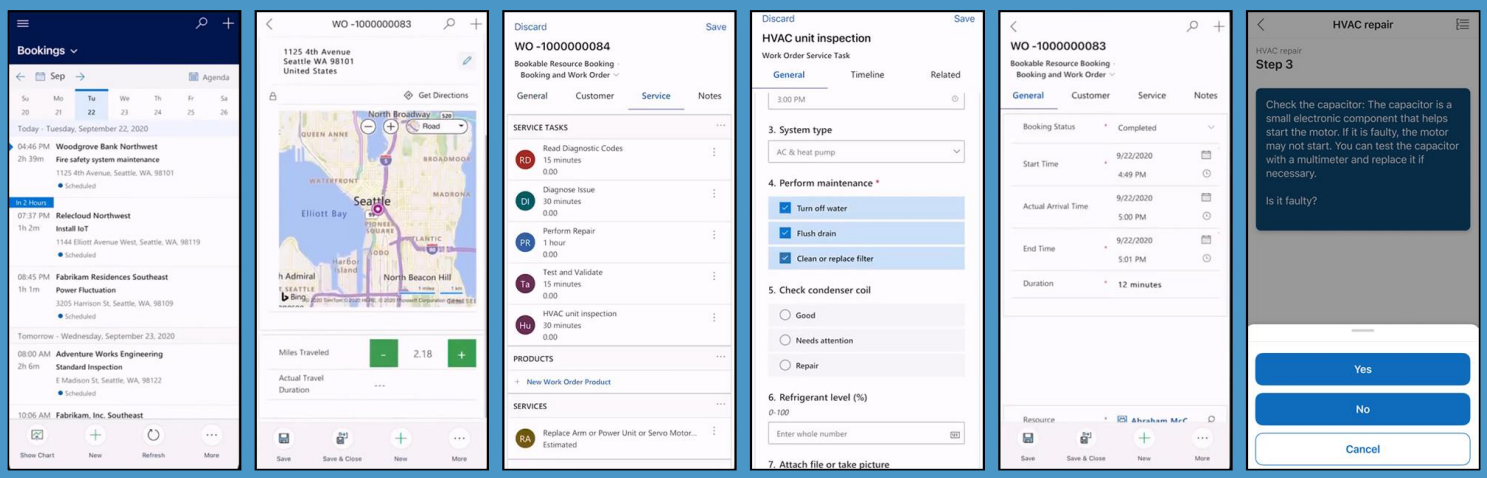


**Figure 1: Smartphone app to manage field service work (Microsoft)[27]**

When arriving at the client site, the app shows a sequence of granular “service tasks” to the worker, once again including time estimations (figure 1, third screen). The worker in this example is expected to initially perform the tasks “read diagnostic codes” and “diagnose issue”, which are estimated to take 15 and 30 minutes, respectively. After completing the “perform repair” task, which is planned to take one hour, the work order requires the worker to perform two more tasks. The system can display the exact time spent on each task after its completion.[28] As figure 1 (fourth screen) shows, one task requires the worker to complete a digital form by sequentially performing certain subtasks, answering questions and uploading a photo (figure 1, fourth screen). As such, service tasks can contain even more granular subtasks. Microsoft refers to these digital forms as “inspections”,[29] which can, for example, address safety protocols, serve documentation purposes or generally guide workers through the process. As the last screen in figure 1 shows, a newer version of the mobile app also offers interactive guides that provide step-by-step instructions and can include multimedia content.[30]

After checking all service tasks as done,[31] the worker sets the status of the entire work order to “completed”.[32] The app then displays the actual time spent on the work order (figure 1, fifth screen). It also displays the actual arrival time in contrast to the expected arrival time. Workers may have to enter information about products, spare parts and

[26] https://learn.microsoft.com/en-us/dynamics365/field-service/work-order-status-booking-status [23.8.2023]

[27] Figures © Microsoft. The figures serve as basis for the discussion of the corporate practices examined in this study. Sources: video "Module 6: Dynamics 365 Field Service mobile app (Microsoft Power Platform)", 1.10.2020, min 1:32 and 2:06: https://www.youtube.com/watch?v=tcDt_vJ5csI; video "Module 8: Inspections", 21.10.2020, min 5:19 and 5:39: https://www.youtube.com/watch?v=aDfwIP7rT-U; video "Module 6: Dynamics 365 Field Service mobile app (Microsoft Power Platform)", 1.10.2020, min 3:59: https://www.youtube.com/watch?v=tcDt_vJ5csI [22.8.2023]

[28] min 4:07: https://www.youtube.com/watch?v=lblmqd7qFwg [22.8.2023]

[29] https://learn.microsoft.com/en-us/dynamics365/field-service/inspections [23.8.2023]

[30] https://learn.microsoft.com/en-us/dynamics365/field-service/mixed-reality-guides-integration, https://learn.microsoft.com/en-us/dynamics365/mixed-reality/guides/overview [23.8.2023]

[31] https://learn.microsoft.com/en-us/dynamics365/field-service/get-work-done-mobile-app?tabs=vCurrent; video min 4:07: https://www.youtube.com/watch?v=lblmqd7qFwg [23.8.2023]

[32] https://learn.microsoft.com/en-us/dynamics365/field-service/work-order-status-booking-status [23.8.2023]

other required resources[33] and capture the client's signature.[34] Employers can send notifications to workers' smartphones to notify them of new work orders and other duties.[35] To take a break, workers have to set their status in the app to "on break".[36] Overall, the app is clearly designed to align work with strictly defined processes and constantly remind workers of requirements and time constraints. Depending on how the system is set up by an employer, the provided functionality can turn the app into an algorithmic micromanager for field services work.

### 4.1.2 Work order monitoring and control

Information about work orders recorded in the mobile app can be accessed by **dispatchers and other managers** in different ways. Figure 2 (top right) illustrates how a dispatcher can monitor in real time a work order with an estimated duration of 1 hour and 55 minutes that is still in progress.[37] In this example, the employee has already spent 40 minutes on the work order and completed three out of five tasks.

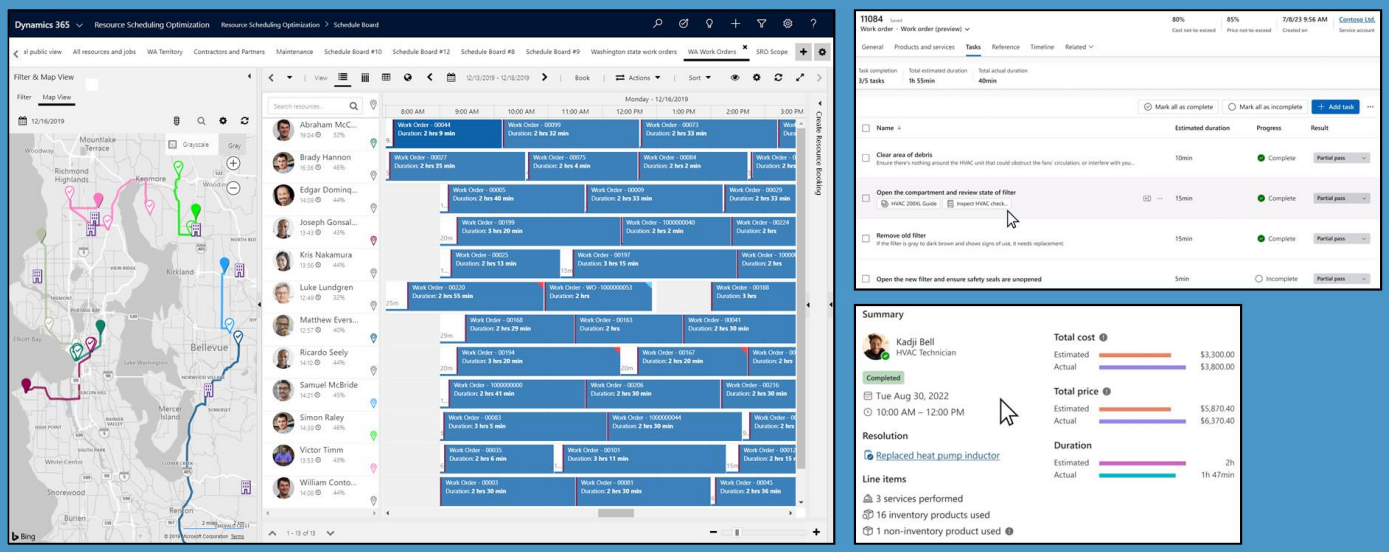


**Figure 2: Schedule board, location tracking and worker monitoring (Microsoft)[38]**

Figure 2 (right bottom) shows the summary of a completed work order, which involved performing three "services" and "using" a number of "products". In addition to information about estimated and actual costs and prices, the summary indicates that the worker actually spent only 1 hour and 47 minutes rather than the estimated 2 hours on this work order. Figure 3 (top left) shows similar functionality in an older software version, displaying information about a work order with four service tasks, including their planned duration and degree of completion in real time.

Dispatchers also see an "SLA timer" that counts the minutes and seconds that have elapsed since the creation of the work order (figure 3, bottom left). This helps to comply with contractually agreed response times[39] but also puts

[33] https://learn.microsoft.com/en-us/dynamics365/field-service/inventory-purchasing-returns-overview [23.8.2023]
[34] https://learn.microsoft.com/en-us/dynamics365/field-service/get-work-done-mobile-app?tabs=vCurrent [23.8.2023]
[35] https://learn.microsoft.com/en-us/dynamics365/field-service/mobile-power-app-push-notifications [23.8.2023]
[36] https://learn.microsoft.com/en-us/dynamics365/field-service/work-order-status-booking-status [23.8.2023]
[37] Microsoft refers to it as a "preview feature": https://learn.microsoft.com/en-us/dynamics365/field-service/work-order-recap [23.8.2023]
[38] Figures © Microsoft. The figures serve as basis for the discussion of the corporate practices examined in this study. Sources: https://learn.microsoft.com/en-us/dynamics365/field-service/rso-overview; video "Microsoft Dynamics 365 Field Service / Work Order Management", min 1:28 and 0:44: https://learn.microsoft.com/en-us/dynamics365/field-service/work-order-recap [22.8.2023]
[39] https://learn.microsoft.com/en-us/dynamics365/field-service/sla-work-orders [23.8.2023]

dispatchers under pressure. The system can automatically track the time workers spend on the different tasks associated with a work order based on the timestamps of the recorded status codes (e.g. “in progress”, “completed”). Optionally, it can be configured to expect time entries that are entered manually by workers.[40] To track estimated and actual costs associated with a work order, employers can enter hourly rates and other payroll information.[41]

### 4.1.3 Work order schedules and location tracking

Figure 2 (left) shows the **schedule board**, which allows dispatchers to schedule work orders to field workers and see a timetable of all scheduled work orders on a given day for each worker, including a map that displays their routes and current locations.[42] While the system would already know where workers are currently located because they constantly enter information about when they arrive at and leave particular client sites in the mobile app, it can also use GPS location tracking, as detailed in section 4.4.

### 4.1.4 Standardized work orders, service tasks and skill profiles

Work orders can either result from “incidents”, such as a customer inquiry or a machine sending an error code, or they can be automatically generated on a recurring basis, for example, based on service agreements that promise customers daily or monthly inspections.[43]

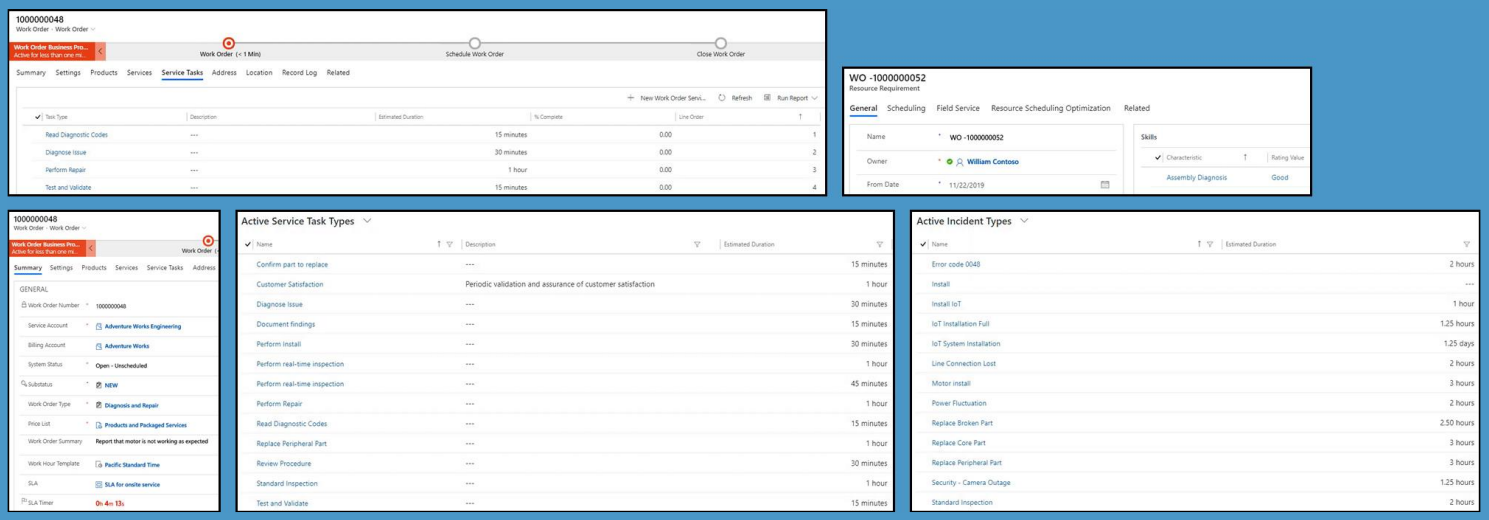


**Figure 3: Skill profile, performance targets for tasks and other management views (Microsoft)[44]**

As figure 3 (bottom right) shows, organizations can configure lists of possible incidents (e.g. “error code 0048”, “power fluctuation”, “replace broken part” or “standard inspection”), which represent “templates” for work orders.[45]

[40] https://learn.microsoft.com/en-us/dynamics365/field-service/booking-timestamps, https://learn.microsoft.com/en-us/dynamics365/field-service/configure-default-settings, https://learn.microsoft.com/en-us/dynamics365/field-service/field-service-time-entry [23.8.2023]

[41] https://learn.microsoft.com/en-us/dynamics365/field-service/set-up-bookable-resources, https://learn.microsoft.com/en-us/dynamics365/field-service/set-up-resource-pay-types [23.8.2023]

[42] https://learn.microsoft.com/en-us/dynamics365/field-service/configure-schedule-board [23.8.2023]

[43] https://learn.microsoft.com/en-us/dynamics365/field-service/field-service-architecture, https://learn.microsoft.com/en-us/dynamics365/field-service/set-up-customer-agreements [23.8.2023]

[44] Figures © Microsoft. The figures serve as basis for the discussion of the corporate practices examined in this study. Source: video "Module 3: Work Orders", 5.12.2019, min 2:48, 19:42, 2:11, 6:30 and 9:23: https://www.youtube.com/watch?v=lblmqd7qFwg [22.8.2023]

[45] https://learn.microsoft.com/en-us/dynamics365/field-service/configure-incident-types [23.8.2023]

These **standardized work orders** can be linked to particular service tasks (e.g. "diagnose issue", "document findings", "perform install", "perform repair" or "test and validate"), as illustrated in figure 3 (bottom center). For each service task, an "estimated duration" can be specified,[46] for example, 30 minutes to diagnose an issue, one hour to perform a repair or 15 minutes to "test and validate" the outcome. The specified durations serve as target times for the completion of a task. The sum[47] of the target times for all tasks linked to a standardized work order is later used to distribute and schedule actual work orders to field workers, who Microsoft typically refers to as "resources".[48]

Standardized work orders can be linked to "resource requirements", which describe the "characteristics" and "skills" of a worker that are deemed necessary to perform the corresponding work.[49] A work order can, for example, require fluency in a certain language or "good" skills in "assembly diagnosis", as illustrated in figure 3 (top right). For this purpose, employers have to maintain **skill profiles about workers**, which consist of lists of skills and ratings.[50]

In addition, the system can calculate estimated and actual costs for work orders,[51] as illustrated in figure 2 (bottom right). Organizations can define "not-to-exceed" limits for the cost associated with a particular work order. These "not-to-exceed" values can be shown to both managers and mobile workers, who can optionally receive a warning when workers get close to the cost limit during the completion of a work order.[52] As managers and mobile workers will aim to keep the cost (based on time spent on the work order) within the limit, this represents another mechanism for performance control.

### 4.1.5 Automating and optimizing work order scheduling

Microsoft provides a wide range of mechanisms that help organizations schedule work orders and assign them to workers. The company's "universal resource scheduling" system matches work orders with certain characteristics to available workers with certain characteristics.[53] The matching process considers, on the one hand, information about a work order's location, desired starting time, estimated duration and required skills. On the other hand, it involves information about workers, including their working hours, break times, skill profile, current assignments and location.[54] It makes estimations about travel times[55] and can also consider the characteristics and availability of other "resources" such as equipment.[56] In addition to manual scheduling, dispatchers or service managers can use the "schedule assistant", a **semi-automated** mechanism that recommends them a list of matching workers for a work order but leaves the decision to them.[57]

They can also use Microsoft's **fully automated** system for "resource scheduling optimization", which automatically schedules work orders for entire days for all available workers.[58] Automated work order scheduling can occur once

[46] https://learn.microsoft.com/en-us/dynamics365/field-service/set-up-service-task-types [23.8.2023]
[47] https://learn.microsoft.com/en-us/dynamics365/field-service/configure-incident-types [23.8.2023]
[48] https://learn.microsoft.com/en-us/dynamics365/field-service/set-up-bookable-resources [23.8.2023]
[49] https://learn.microsoft.com/en-us/dynamics365/field-service/configure-incident-types, https://learn.microsoft.com/en-us/dynamics365/field-service/set-up-bookable-resources, https://learn.microsoft.com/en-us/dynamics365/field-service/set-up-characteristics [23.8.2023]
[50] Ibid.
[51] See section 4.1.2
[52] https://learn.microsoft.com/en-us/dynamics365/field-service/work-order-not-to-exceed [23.8.2023]
[53] https://learn.microsoft.com/en-us/dynamics365/field-service/universal-resource-scheduling-for-field-service [24.8.2023]
[54] https://learn.microsoft.com/en-us/dynamics365/field-service/universal-resource-scheduling-for-field-service, https://learn.microsoft.com/en-us/dynamics365/field-service/schedule-assistant, https://learn.microsoft.com/en-us/dynamics365/field-service/set-up-bookable-resources, https://learn.microsoft.com/en-us/dynamics365/field-service/schedule-with-travel-time [24.8.2023]
[55] https://learn.microsoft.com/en-us/dynamics365/field-service/schedule-with-travel-time [24.8.2023]
[56] https://learn.microsoft.com/en-us/dynamics365/field-service/set-up-bookable-resources [24.8.2023]
[57] https://learn.microsoft.com/en-us/dynamics365/field-service/schedule-assistant [24.8.2023]
[58] https://learn.microsoft.com/en-us/dynamics365/field-service/rso-overview [24.8.2023]

a day or even every 30 minutes.[59] Automated decisions about which work order to assign to which worker at which time are based on "**optimization goals**", which consist of scheduling "constraints" and "objectives":[60]

**Constraints** represent conditions that must be met to assign a work order to a worker, such as available time windows and required skills. When the "schedule within working hours" constraint is activated, both working and travel times must lie within the employees' working hours. When employers remove this constraint, the system schedules work orders in a way that can require workers to travel to or from a client site outside their working hours. **Optimization objectives** determine how the system assigns work orders to workers who meet the defined constraints. Typically, the system aims to maximize working time, minimize travel time and maximize skill matching. Employers can choose multiple objectives and rank them by relevance. This can include objectives such as scheduling a work order "as soon as possible", prioritizing "high priority" work orders or choosing "preferred resources" first.[61]

**Maximizing productivity.** Microsoft's software documentation prominently shows an example "optimization goal" that is named "maximize productivity".[62] Employers can customize the system based on the predefined constraints and objectives offered by Microsoft. Figure 2 (left) illustrates the result of automated work order scheduling. Many work orders shown in this example schedule are assigned in a way that minimizes idle time.

### 4.1.6 Predicting travel times and work durations

Microsoft's work order scheduling system can predict travel times based on historical traffic information from Microsoft Bing.[63] It also offers to **predict future work durations** based on past data. This system is "powered by artificial intelligence models" and "learn[s] from historical booking completion times", according to the company. While it is referred to as a "public preview feature", employers can activate it in the settings.[64]

| Booking id | Allocated duration | Predicted duration | Difference | Confidence | Prediction factors |
|---|---|---|---|---|---|
| RR_1980 | 7h 30m | 8h 50m | +1h 20m ▼ | 59% | • [Blue Yonder Airlines] increases duration by about 64m<br>• [Bob Kozak] increases duration by about 13m<br>• [Spokane County] increases duration by about 6m<br>• [Maintenance] decreases duration by about 4m<br>• [Line Connection Lost] decreases duration by about 2m |
| RR_1335 | 4h 30m | 4h 50m | +20m ▼ | 69% | • [Fabrikam Robotics] increases duration by about 43m<br>• [Jennifer Rivas] decreases duration by about 27m<br>• [Kitsap County] increases duration by about 7m<br>• [Unit Overheating] decreases duration by about 6m<br>• [Friday] increases duration by about 3m<br>• [Priority 4] decreases duration by about 2m |
| RR_1708 | 7h | 7h 35m | +35m ▼ | 72% | • [Northwind Traders] increases duration by about 70m<br>• [Eva Dawson] decreases duration by about 51m<br>• [Skagit County] increases duration by about 10m<br>• [Replace Core Part] increases duration by about 10m<br>• [09:00 AM] decreases duration by about 6m<br>• [Priority 4] increases duration by about 5m<br>• [Friday] decreases duration by about 3m<br>• [Maintenance] decreases duration by about 2m |

Incident type metrics

| Incident type | Jobs completed | Est. duration | Avg. duration | Difference | Proficiency score | Proficiency factors |
|---|---|---|---|---|---|---|
| Standard Inspection | 135 | 8h | 8h 10m | +10m ▼ | 51 | • Increased by about 33 in 3 of 7 days of the week<br>• Decreased by about 21 in 4 of 7 days of the week<br>• Decreased by about 51 in 3 of 7 territories<br>• Increased by about 45 in 4 of 7 territories<br>• Increased by about 49 in 4 of 12 customers<br>• Decreased by about 51 in 8 of 12 customers |
| Replace Broken Part | 84 | 2h | 2h 5m | +5m ▼ | 35 | • Decreased by about 32 in 3 of 7 days of the week<br>• Increased by about 25 in 4 of 7 days of the week<br>• Decreased by about 35 in 2 of 5 territories<br>• Increased by about 46 in 3 of 5 territories<br>• Increased by about 65 in 3 of 8 customers<br>• Decreased by about 35 in 5 of 8 customers |

**Figure 4: Aggregate metrics, predicting work duration and singling out workers (Microsoft)[65]**

Figure 4 (left) shows a list of upcoming work orders. For each work order, the table in this example report displays the time it will take to complete the job according to the duration previously determined by the dispatcher or manager ("allocated duration") and the duration predicted by the system based on historical data ("predicted duration").

[59] Ibid.
[60] https://learn.microsoft.com/en-us/dynamics365/field-service/rso-optimization-goal [24.8.2023]
[61] Ibid.
[62] Ibid.
[63] https://learn.microsoft.com/en-us/dynamics365/field-service/rso-predictive-travel [24.8.2023]
[64] https://learn.microsoft.com/en-us/dynamics365/field-service/analytics-predictive-work-duration#resource-duration [24.8.2023]
[65] Figures © Microsoft. The figures serve as basis for the discussion of the corporate practices examined in this study. Source: https://learn.microsoft.com/en-us/dynamics365/field-service/analytics-predictive-work-duration [22.8.2023]

In addition, it displays a number that indicates the likelihood that the actual duration will be close to the predicted duration ("confidence") and a list of factors that contributed to the prediction ("prediction factors").

In this example, completing the first work order is predicted to take 8 hours and 50 minutes, which is significantly longer than the 7 hours and 30 minutes previously determined by a manager and allocated in the scheduling system. The "prediction factors" column provides possible reasons for this prediction. It suggests that completing the work order might take 64 minutes longer than planned because of the customer, "Blue Yonder Airlines". While it might take 6 minutes longer than planned because it occurs in a particular region, it might take 4 minutes shorter than planned because it is a "maintenance" work order. Not least, it may take 13 minutes longer than planned because it is assigned to a worker named "Bob Kozak". However, the confidence in the prediction is only 59%.

While disclosing the contributing factors and the confidence may increase the transparency and explainability of such a prediction, it is remarkable that the report **singles out individual workers**. While the system predicts that completing the first work order in figure 4 will take 13 minutes longer because of Bob Kozak, it suggests that other work orders will take shorter than planned because of workers named "Jennifer Rivas" and "Eva Dawson". A single prediction about Bob Kozak increasing the planned work duration for a particular work order does not necessarily represent a general pattern. Nevertheless, this functionality can be considered a form of performance monitoring. Microsoft emphasizes in the documentation that its "predictive work duration" system is "not intended for use in making, and should not be used to make, decisions that affect the employment of an employee or group of employees, including compensation, rewards, seniority, or other rights or entitlements". It is, however, "intended to help dispatchers or admins enhance their team's performance and improve customer satisfaction".[66]

### 4.1.7 Built-in reports, singling out workers and performance monitoring

Microsoft offers a range of built-in **analysis and reporting functionality** for its field service management system.

Figure 4 (right) shows a report that displays performance metrics about different types of work orders. In this example, the completion of 135 "standard inspection" work orders in a certain period of time took, on average, 10 minutes more than previously estimated. Although these metrics are not displayed for individual workers, the report can certainly lead to discussions about work order durations between managers, dispatchers and workers.

Figure 5 (left) shows a section of the "resource and utilization" report[67] that displays a variety of metrics. According to the documentation and the example screenshot, the report can display aggregate metrics across all workers, but can also be filtered by "bookable resource", which suggests that all the metrics are also available for individual workers.[68] Figure 5 (top right) shows a section of the "work order summary" report, which can also be filtered by "resource" (according to the documentation) or "technician" (according to the screenshot).[69] This suggests that Microsoft provides the following performance metrics both at the aggregate level and for individual employees:

- Number of completed work orders, number of open work orders[70]

[66] Ibid.
[67] https://learn.microsoft.com/en-us/dynamics365/field-service/resource-utilization-report [24.8.2023]
[68] Ibid.
[69] https://learn.microsoft.com/en-us/dynamics365/field-service/work-order-summary-report [24.8.2023]
[70] Ibid.

- "Broken promise (%)" (percentage of work orders that were not completed within the time promised to the client)[71]
- Average work time per day, average travel time per day, total miles traveled, average miles traveled per day[72]
- Utilization rate (percentage of work and travel time in relation to total available/paid work hours)[73]
- Work, travel, break and "idle" time per month[74]
- Late arrival rate (percentage of work orders "where the technician arrived late")[75]
- Average customer satisfaction rate (CSAT)[76]

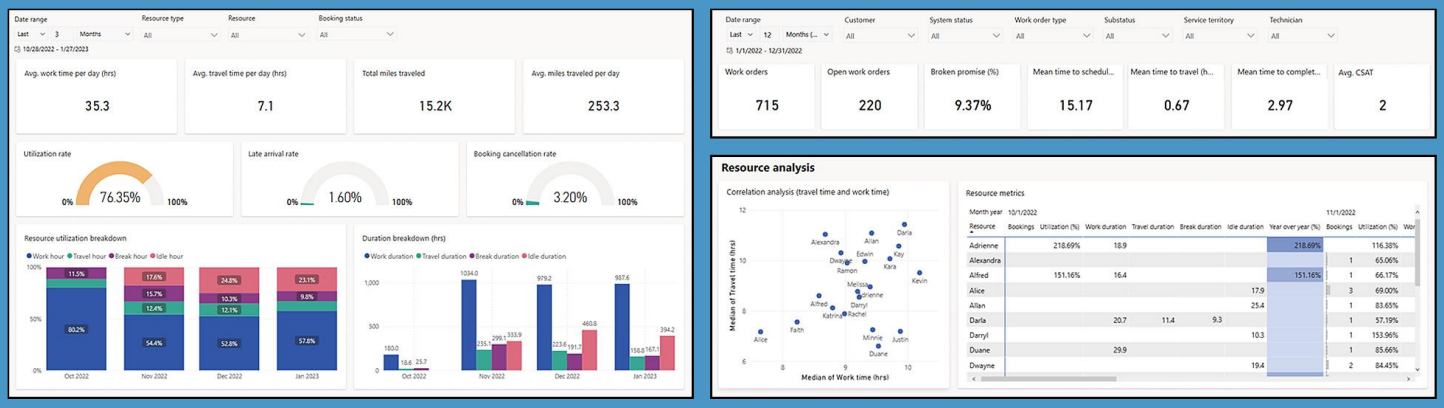


**Figure 5: Reporting, singling out individual workers and performance monitoring[77]**

The "customer satisfaction rate" can be based on surveys sent to customers after the completion of work orders.[78] The "late arrival rate" can be considered a metric that can be used for disciplinary purposes. As figure 5 (top right) indicates, the reports can display information about work activities up to 12 months in the past. Another section of the "resource and utilization" report[79] displays individual-level metrics without the need to apply a filter. As shown in figure 5 (bottom right), it displays several metrics for named workers including their break and idle times. As the table can be sorted by any column, it can serve as a ranking. Figure 5 (bottom right) shows a "correlation analysis" that places named workers on a two-dimensional chart according to their work and travel times. Whereas "Justin" spent a large amount of time completing work orders and only a little time travelling, "Alexandra" spent much more time travelling and much less time completing work orders.

The reports described in this section show that Microsoft's system for field service management provides extensive functionality for **individual-level performance monitoring**. Interestingly, Microsoft states that its pre-built reports are available in almost every region of the world including in Europe, but not in Germany.[80]

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[71] Ibid.
[72] https://learn.microsoft.com/en-us/dynamics365/field-service/resource-utilization-report [24.8.2023]
[73] Ibid.
[74] Ibid.
[75] Ibid.
[76] https://learn.microsoft.com/en-us/dynamics365/field-service/work-order-summary-report [24.8.2023]
[77] Figures © Microsoft. The figures serve as basis for the discussion of the corporate practices examined in this study. Sources: https://learn.microsoft.com/en-us/dynamics365/field-service/resource-utilization-report, https://learn.microsoft.com/en-us/dynamics365/field-service/work-order-summary-report, https://learn.microsoft.com/en-us/dynamics365/field-service/resource-utilization-report [22.8.2023]
[78] https://learn.microsoft.com/en-us/dynamics365/field-service/work-order-surveys [24.8.2023]
[79] https://learn.microsoft.com/en-us/dynamics365/field-service/resource-utilization-report [24.8.2023]
[80] https://learn.microsoft.com/en-us/dynamics365/field-service/reports [24.8.2023]

### 4.1.8 Singling out workers and performance monitoring via "Power BI"

Intrusive reports about field service workers and their activities are not restricted to the built-in reporting functionality. Microsoft allows employers to access and analyze almost any data recorded by its cloud-based systems, for example, via its enterprise analytics software **Power BI**.[81] Figure 6 (left) shows a Power BI report for Microsoft's field service management system from a demonstration video presented by a Microsoft representative.[82] It displays rankings of named workers by the number of completed work orders and by revenue generated. The table at the bottom of the screen contains a list of all work orders including their status, duration and assigned worker.


**Figure 6: Singling out workers and performance monitoring with "Power BI" (Microsoft/JourneyTEAM)[83]**

Figure 6 (right) shows a section of another Power BI report provided by a third-party company.[84] It displays a comparison between the estimated and the actual average time named workers spent completing work orders. Put differently, it shows performance metrics for individual workers in relation to performance targets. These reports are just two examples. Employers and third-party companies can use Microsoft Power BI to create almost any type of report based on personal data about field workers.

## 4.2 Dynamics 365 and integrations with Microsoft 365, Teams and Outlook

Microsoft provides a range of integrations with its other software systems. As its field service management technology is part of Microsoft Dynamics 365, it can be integrated with almost any other functionality available in **Dynamics 365**,[85] such as for customer relationship management (CRM),[86] supply chain management (SCM)[87] and

[81] https://powerbi.microsoft.com/ [24.8.2023]
[82] https://www.youtube.com/watch?v=U8X7sP3D9yk [24.8.2023]
[83] Figures © Microsoft/JourneyTEAM. The figures serve as basis for the discussion of the corporate practices examined in this study. Sources: video "Power BI Solution Template for Dynamics 365 Field Service", 19.8.2017, min 1:05: https://www.youtube.com/watch?v=U8X7sP3D9yk; video "JourneyTEAM Power BI Analytic Solution | Dynamics 365 for Field Service", 20.6.2017, min 2:06: https://www.youtube.com/watch?v=LcVOR0aOa64 [22.8.2023]
[84] https://www.youtube.com/watch?v=LcVOR0aOa64 [24.8.2023]
[85] https://learn.microsoft.com/en-us/dynamics365/ [25.8.2023]
[86] https://dynamics.microsoft.com/en-us/customer-service/overview/ [25.8.2023]
[87] https://learn.microsoft.com/en-us/dynamics365/field-service/supply-chain-field-service-integration [25.8.2023]

human resource management (HRM).[88] Several modules are actually used across field service management and other applications in Dynamics 365. Microsoft uses the work order **scheduling system** described in section 4.1.5 across Dynamics 365 software for field service management, customer relationship management and project management.[89] The **interactive guides** that provide field workers with step-by-step instructions, as described in section 4.1.1, are part of a separate Dynamics 365 product.[90] Field service workers can also use the **remote assistance** module in Dynamics 365 to make calls to experts for help with their work at the client site.[91]

Of course, the field service management system can be integrated with **Microsoft 365** and its applications, such as Teams, Outlook and "Viva Connections".[92] Both field service workers and managers can handle work orders directly from within **Teams and Outlook**.[93] Figure 7 (left) shows a chat in Microsoft Teams that is linked to a particular work order as seen by a dispatcher (figure 7, top) and a field service worker (figure 7, bottom).

Organizations can use Microsoft's "Power Pages" to let **customers and subcontractors** access data from the field service management system.[94] Customers can book appointments, view information about work orders associated with them and track the location of dispatched workers.[95] Microsoft refers to the latter feature as "track my technician".[96] Organizations can also distribute work to subcontractors rather than to their own employees. They can have multiple subcontractors who compete with each other. To decide about which subcontractor gets the opportunity to carry out the work, the system uses "ranking metrics" including the average time the subcontractor took to respond.[97]

## 4.3 Creating and summarizing work orders with Microsoft's "Copilot" AI system

Since the release of OpenAI's ChatGPT in November 2022,[98] the buzz around "generative AI" appears to know no bounds.[99] Microsoft, whose cumulative investment in OpenAI has reportedly risen to $13 billion,[100] has rushed to integrate these technologies across many products, including its enterprise software systems,[101] despite many concerns about their lack of maturity and reliability (see, e.g., Bender et al., 2021). Introduced in March 2023,[102] Microsoft's **Copilot** system is now also part of its field service management system.[103]

Figure 7 (center left) shows how the Copilot system automatically creates a work order from an email with a customer request, based on an integration with Microsoft Outlook.[104] For this purpose, the system parses the contents

[88] See e.g. https://www.youtube.com/watch?v=BDdx1cVhgiI [25.8.2023]
[89] https://learn.microsoft.com/en-us/dynamics365/common-scheduler/schedule-anything-with-universal-resource-scheduling [25.8.2023]
[90] https://learn.microsoft.com/en-us/dynamics365/mixed-reality/guides/ [25.8.2023]
[91] https://learn.microsoft.com/en-us/dynamics365/field-service/remote-assist-hololens [25.8.2023]
[92] https://learn.microsoft.com/en-us/dynamics365/field-service/flw-overview [25.8.2023]
[93] Ibid.
[94] https://learn.microsoft.com/en-us/power-pages/templates/dynamics-365-apps/integrate-field-service [5.6.2024]
[95] https://learn.microsoft.com/en-us/dynamics365/field-service/customer-portal-overview [5.6.2024]
[96] https://learn.microsoft.com/en-us/dynamics365/field-service/customer-portal-technician-tracking [5.6.2024]
[97] https://learn.microsoft.com/en-us/power-pages/templates/dynamics-365-apps/integrate-field-service [5.6.2024]
[98] https://www.forbes.com/sites/bernardmarr/2023/05/19/a-short-history-of-chatgpt-how-we-got-to-where-we-are-today/
[99] See e.g.: https://www.gartner.com/en/newsroom/press-releases/2023-08-16-gartner-places-generative-ai-on-the-peak-of-inflated-expectations-on-the-2023-hype-cycle-for-emerging-technologies
[100] https://www.nytimes.com/2023/01/23/business/microsoft-chatgpt-artificial-intelligence.html
[101] https://www.theregister.com/2023/06/16/microsoft_copilot_ai_erp/
[102] https://blogs.microsoft.com/blog/2023/03/16/introducing-microsoft-365-copilot-your-copilot-for-work/ [25.8.2023]
[103] https://cloudblogs.microsoft.com/dynamics365/bdm/2023/08/09/introducing-copilot-in-dynamics-365-field-service-helping-your-frontline-deliver-exceptional-service-with-next-generation-ai/ [25.8.2023]
[104] https://learn.microsoft.com/en-us/dynamics365/field-service/flw-outlook [25.8.2023]

of the email conversation and populates fields in a work order form, including the type of incident, its priority, the promised time window and a paragraph that promises to summarize the issue.[105] In a box positioned far away from the "save" button, the dispatcher is told to "review the work order before saving to ensure all AI-generated content is accurate, complete and appropriate". Next to the summary, the phrase "AI-generated content may be incorrect" is displayed.

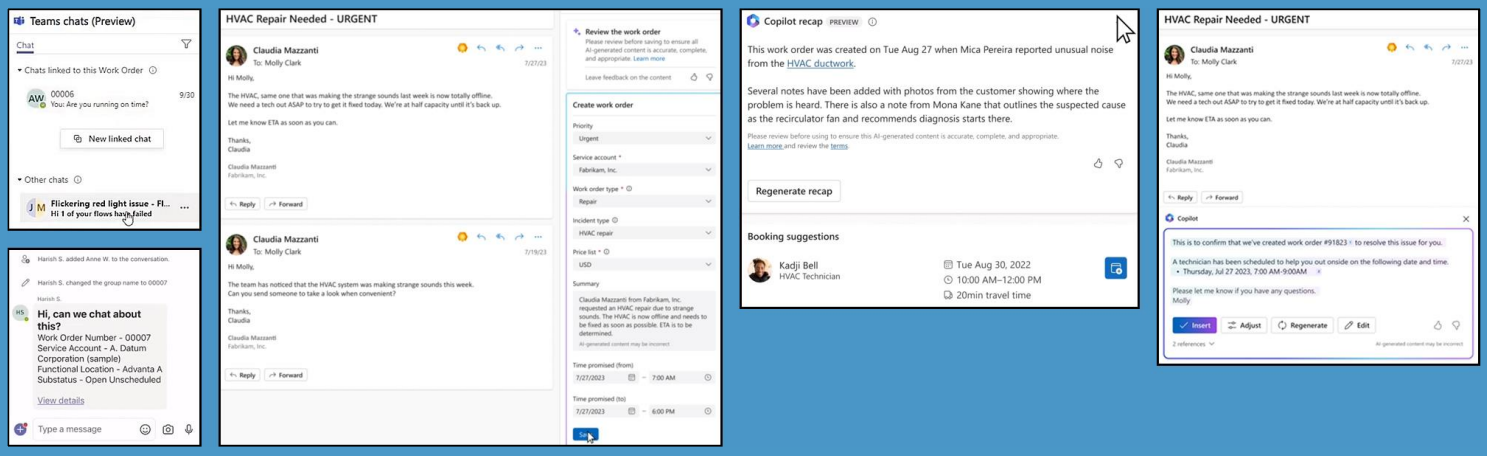


**Figure 7: Field service management, Teams, Outlook and the AI system "Copilot" (Microsoft)[106]**

In addition, the system promises to summarize all information about a work order available in the field service management system. As shown in figure 7 (center right), the "Copilot recap" provides a brief history of the work order from its initial creation to the subsequent addition of several "notes". The dispatcher can then schedule the work order by assigning it to the worker recommended by the system. Microsoft tells dispatchers they should review the generated summary before "using" it and provides a button to "regenerate" a new version of it. After the work order was scheduled, the system offers to automatically draft an email reply to the customer, as illustrated in figure 7 (right). Once again, dispatchers are told in the fine print that "AI-generated content may be incorrect".

It is unrealistic to expect that dispatchers spend much time reviewing the generated summaries or even regenerate them and review them again, especially as Microsoft advertises the product as a means to "streamline" work and "speed time to resolution".[107]

## 4.4 Behavioral monitoring via location tracking and "geofencing"

While Microsoft's field service technology can probably be used without constantly tracking the geolocation of field workers via their smartphones, several features rely on it.[108] In addition to utilizing geolocation data for travel

[105] https://learn.microsoft.com/en-us/dynamics365/field-service/faqs-wo-flw-copilot

[106] Figures © Microsoft. The figures serve as basis for the discussion of the corporate practices examined in this study. Sources: video "Collaborate throughout the work order lifecycle with Microsoft Teams", 25.10.2021, min 3:14 and 5:53: https://www.youtube.com/watch?v=m3-FZH-Nqr0; video 'Optimise service operations', min 0:05 and 0:18: https://dynamics.microsoft.com/en-gb/field-service/overview/; video "Microsoft Dynamics 365 Field Service. Work Order Management", min 0:34: https://learn.microsoft.com/en-us/dynamics365/field-service/work-order-recap [22.8.2023]

[107] https://cloudblogs.microsoft.com/dynamics365/bdm/2023/08/09/introducing-copilot-in-dynamics-365-field-service-helping-your-frontline-deliver-exceptional-service-with-next-generation-ai/ [25.8.2023]

[108] See e.g. https://learn.microsoft.com/en-us/dynamics365/field-service/schedule-with-travel-time [24.8.2023]

time calculation and automated work order scheduling, Microsoft provides access to **location audit records**, which represent a full list of the whereabouts of workers over time.[109]

As shown in figure 8 (left), this report can display the exact geographic coordinates of a particular worker on a particular day. In this example, it shows where an employee has been at 1:08, 1:17, 1:19, 1:20, 1:24 and 1:25.

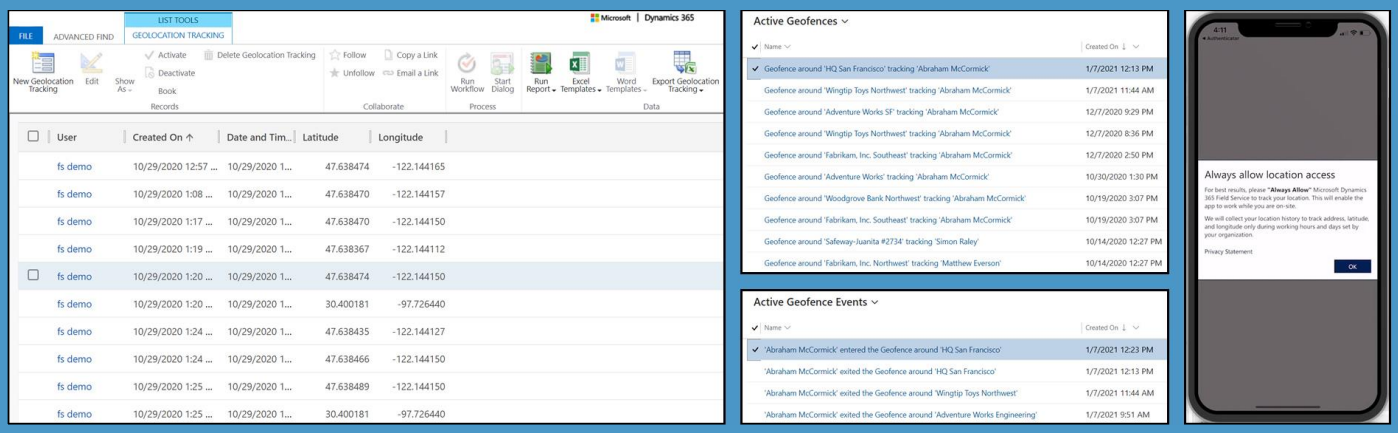


**Figure 8: Location tracking, geofencing, notification "always allow location access" (Microsoft)[110]**

Employers can configure how frequently the system records the workers' GPS geolocation. Microsoft recommends recording it every "60 to 300 seconds" based on their "business needs".[111] In August 2023, Microsoft stated that location tracking is "enabled by default for all new Field Service environments".[112] As Microsoft has since then removed this statement from its software documentation,[113] it is not clear whether it is still enabled by default. In any case, workers may have to "allow" access to location data on their smartphones. Figure 8 (right) shows an example notification that asks users to "always allow" Microsoft to track their location, which "will enable the app to work".

In addition, employers can create so-called **geofences**,[114] which are virtual perimeters around geographic areas, such as certain client offices or factory sites. Subsequently, the system will detect workers exiting or entering these areas.[115] Figure 8 (center top) shows a list of active geofences for particular workers. Microsoft provides access to records that indicate at which time workers have entered or exited such geofenced areas, as shown in figure 8 (center bottom). Another justification for the collection of real-time location data lies in the provision of the data to clients, who can be offered access to the current location of the scheduled worker and their estimated arrival time.[116]

[109] https://learn.microsoft.com/en-us/dynamics365/field-service/mobile-powerapp-location-auditing [24.8.2023]

[110] Figures © Microsoft. The figures serve as basis for the discussion of the corporate practices examined in this study. Sources: https://learn.microsoft.com/en-us/dynamics365/field-service/mobile-powerapp-location-auditing, https://learn.microsoft.com/en-us/dynamics365/field-service/mobile-powerapp-geofence, video "Field Service mobile app: Location auditing", min 2:56: https://learn.microsoft.com/en-us/dynamics365/field-service/mobile-powerapp-location-auditing [22.8.2023]

[111] Ibid.

[112] https://learn.microsoft.com/en-us/dynamics365/field-service/mobile-powerapp-location-auditing [24.8.2023]

[113] https://learn.microsoft.com/en-us/dynamics365/field-service/mobile-powerapp-location-auditing [30.5.2024]

[114] See e.g. https://en.wikipedia.org/wiki/Geo-fence

[115] https://learn.microsoft.com/en-us/dynamics365/field-service/mobile-powerapp-geofence [24.8.2023]

[116] https://learn.microsoft.com/en-us/dynamics365/field-service/customer-portal-technician-tracking [24.8.2023]

## 4.5 Behavioral monitoring via call tracking

Microsoft's field service management system and other Microsoft software collects comprehensive personal data about work activities and behaviors of employees. As sections 4.1.7 and 4.1.8 show, Microsoft allows employers to access almost all data recorded by its cloud-based systems. This section addresses another example of how Microsoft systematically exposes data via intrusive pre-built reports.

The **remote assist** functionality allows field service workers to make calls to experts for help while performing work at the client site.[117] Figure 9 (left) illustrates how Microsoft displays a timeline of workers' conversations linked to a work order to dispatchers or service managers. In this example, the system displays metadata about a remote-assist phone call initiated by a particular worker that lasted 40 seconds. While workers can choose to either document a call in the timeline or not, Microsoft emphasizes that documenting calls is "important" for managers.[118]

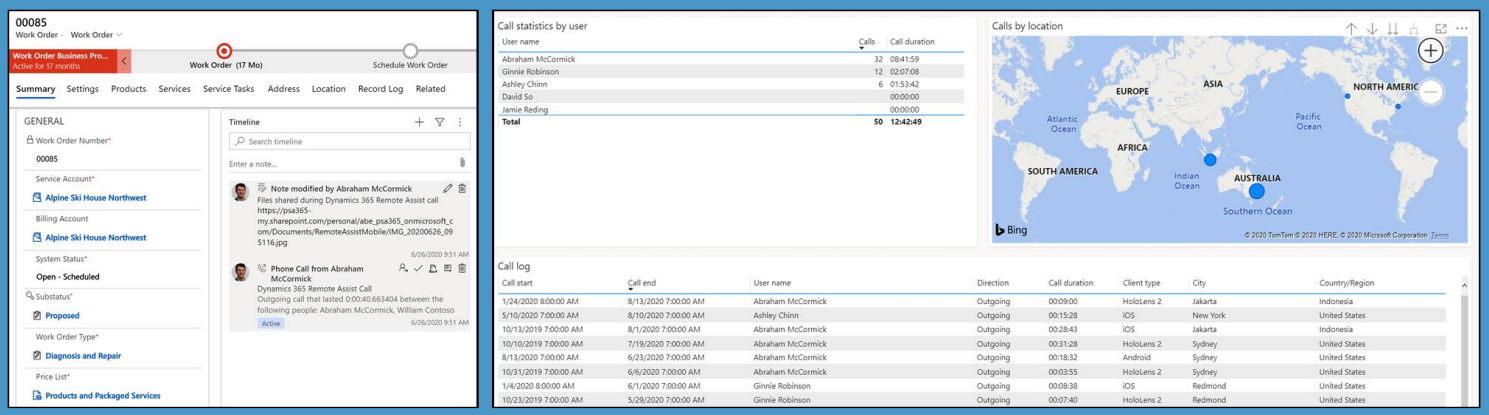


**Figure 9: Behavioral monitoring via call tracking (Microsoft)[119]**

In addition, Microsoft provides a pre-built report that offers access to a **detailed log of remote-assist calls**, including their start and end times, duration and information about which worker initiated the call, as shown in figure 9 (right). The report also contains a summary of how much time particular named workers spent on how many calls. Microsoft explains that the report is "intended to help supervisors and managers derive insights regarding operational efficiencies and usage of Dynamics 365 Remote Assist". The data is "retained for 24 months".[120]

## 4.6 Functionality for mobile homecare and other types of field work

Microsoft's field service management system can be customized and extended to manage and monitor different types of mobile work. Employers can add custom workflows, status codes, scheduling rules and app modules.[121]

**Monitoring and managing homecare workers.** Microsoft itself offers a product named "Home Health" that extends the field service management system with functionality specific to mobile homecare and integrates it with

[117] https://learn.microsoft.com/en-us/dynamics365/field-service/remote-assist-hololens [25.8.2023]
[118] Ibid.
[119] Figures © Microsoft. The figures serve as basis for the discussion of the corporate practices examined in this study. Sources: https://learn.microsoft.com/en-us/dynamics365/field-service/remote-assist-hololens, https://learn.microsoft.com/en-us/dynamics365/mixed-reality/remote-assist/calls-dashboard [22.8.2023]
[120] https://learn.microsoft.com/en-us/dynamics365/mixed-reality/remote-assist/calls-dashboard [25.8.2023]
[121] https://learn.microsoft.com/en-us/dynamics365/field-service/field-service-customizations [30.8.2023]

Microsoft's "Cloud for Healthcare".[122] The company's home health system provides all the functionality described in the previous sections. It uses the same mobile app and the same work order scheduling system, but adds some specific workflows, database attributes, labels and reports. Figure 10 (left and center) shows the mobile app for homecare workers displaying scheduled "home visits" and a list of "care plans" that can be completed, paused or canceled. Workers see detailed information about the patient's record, including clinical data and a list of "tasks that must be performed during the home visit".[123]

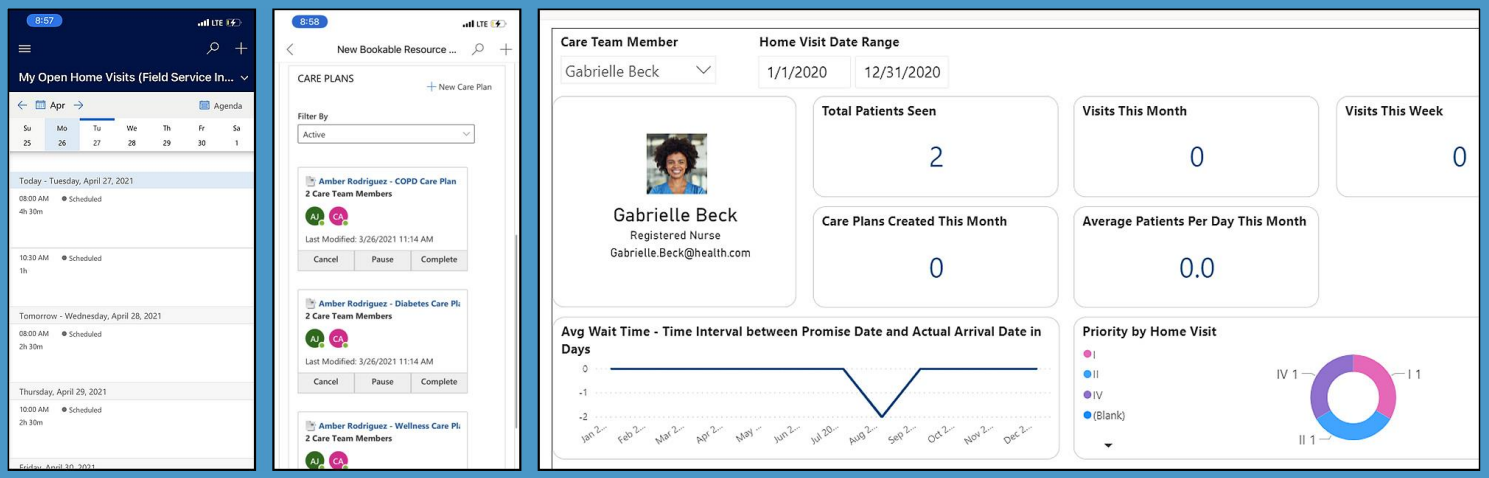


**Figure 10: Mobile app for homecare workers and individual-level report (Microsoft)[124]**

The system offers extra reports for homecare dispatchers and managers. For example, it provides a report that exposes metrics about homecare workers, including a chart that illustrates deviations between planned and actual arrival dates over the past 12 months, as shown in figure 10 (right). The documentation emphasizes that managers can create custom reports.[125]

## 5. SAP software for field service management

The German enterprise software vendor SAP also offers software for field service management that helps employers in different industries manage and monitor mobile workers via app. Similar to Microsoft's system, it provides automated work order and task scheduling.[126] Dispatchers can access a map that shows the real-time location, travel routes and work orders of mobile workers on a map, as shown in figure 11 (left).

SAP provides extensive **reporting functionality** on worker performance at the individual level. Figure 11 (right) shows a report on "technician performance" that ranks workers by the number of completed work orders ("service calls"), service tasks ("activities") and their duration. It lists the "top 5" workers and puts their performance metrics

[122] https://learn.microsoft.com/en-us/dynamics365/industry/healthcare/use-home-health [30.8.2023]
[123] Ibid.
[124] Figures © Microsoft. The figures serve as basis for the discussion of the corporate practices examined in this study. Sources: https://learn.microsoft.com/en-us/dynamics365/field-service/mobile-powerapp-location-auditing, https://learn.microsoft.com/en-us/dynamics365/field-service/mobile-powerapp-geofence, video "Field Service mobile app: Location auditing", min 2:56: https://learn.microsoft.com/en-us/dynamics365/field-service/mobile-powerapp-location-auditing [22.8.2023]
[125] https://learn.microsoft.com/en-us/dynamics365/industry/healthcare/use-home-health [30.8.2023]

[126] https://www.sap.com/products/scm/field-service-management/features.html [3.6.2024]

in relation to “average” numbers. The report also includes a section titled “performance of individual technician” that shows a chart with information on work activities over several months.

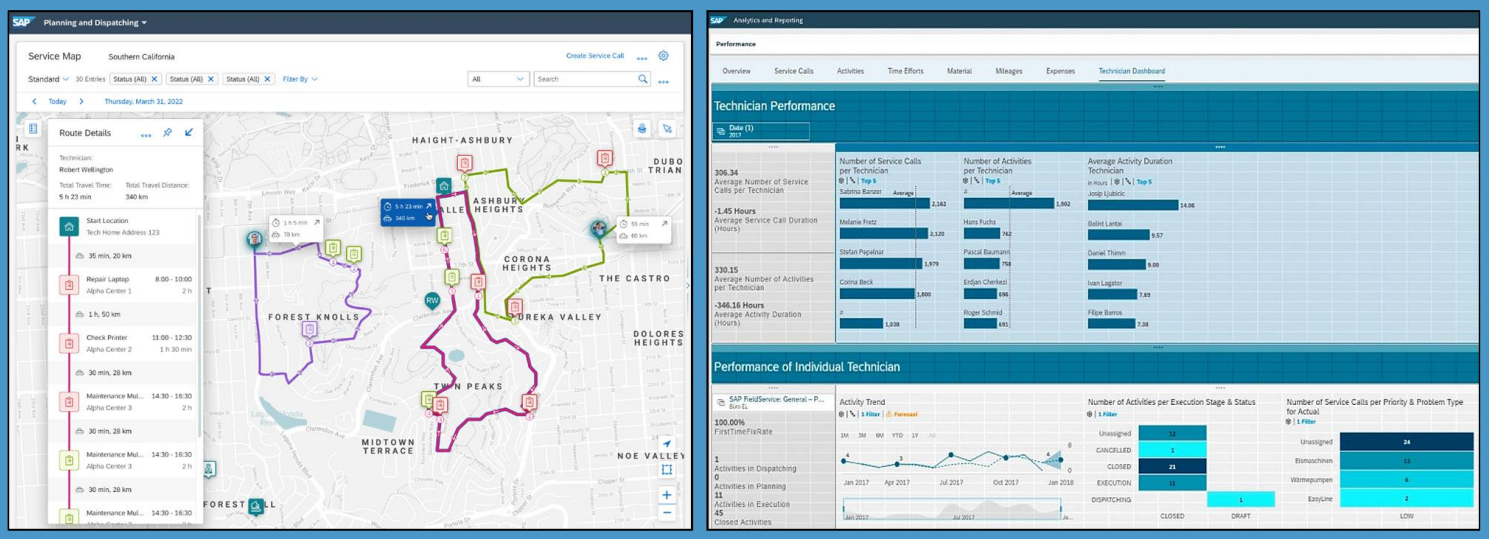


**Figure 11: Screens and reports from SAP’s field service management system (SAP/Ascarii)[127]**

[127] Figures © SAP, Ascarii. The figures serve as basis for the discussion of the corporate practices examined in this study. Sources: https://community.sap.com/t5/supply-chain-management-blogs-by-sap/digitized-field-service-management-deliver-maintenance-service-precision/ba-p/13557528, https://www.ascarii.com/sap-field-service-management [3.6.2024]

# 6. Summary of data practices and potential implications for employees

This section summarizes the findings of this case study and reflects on potential implications for employees.

The findings will be incorporated in the main report of the ongoing project "Surveillance and Digital Control at Work" (2023-2024), led by Cracked Labs, which aims to explore how companies use personal data on workers in Europe. The main report will draw further conclusions.

## 6.1 Managing and monitoring mobile workers with Microsoft software

As the investigation in section 4 shows, Microsoft's software for field service management provides extensive functionality for **algorithmic management, performance control and behavioral monitoring**. Employers can use it to manage mobile workers, whether they are field technicians, insurance representatives, homecare workers or cleaning personnel, in a highly automated way via smartphone app. The system aims to structure, standardize and streamline mobile work and helps dispatchers and service managers supervise, coordinate, direct and monitor workers who regularly visit client sites where they complete work orders by performing service tasks.

**Task direction and performance control via app.** Employees who use the mobile app see a list of work orders assigned to them, including information about the client, the desired arrival time and the expected duration of each visit. The app provides workers with map and navigation functionality. When arriving at the client site, it instructs them to perform a number of predefined service tasks, which can include information about their planned durations. The planned durations of work orders and service tasks can be considered time-based performance targets. Service tasks can include sub-tasks such as interactive forms and guides that provide step-by-step instructions.[128]

Mobile workers are constantly required to enter "status" information in the app, for example, when they start travelling to a client, arrive there, complete a work order or take a break. They may also be required to confirm the completion of each granular service task. The app can put additional pressure on workers by showing them information on the time they spent on each task, the time spent on a work order and their actual arrival time in contrast to the expected arrival time. Reminding workers of the expected arrival time for the next work order in the queue creates a sense of urgency. They may receive additional notifications about newly assigned work orders and other duties.[129] The app is clearly designed to align work with strictly defined processes. As it constantly reminds workers of time constraints and deviations, it includes mechanisms that can be considered implicit performance and behavior control directly embedded in the work process. The app structures, shapes and micromanages work based on feedback requirements such as providing status information and instructions about work orders and tasks.

**Standardized work orders and skill profiles.** A new work order, whether for technical maintenance or mobile homecare, can result from a client inquiry or a machine sending an error code, or the system can generate work orders automatically on a recurring basis, for example, based on service agreements that promise daily or monthly inspections. Organizations can configure standardized work orders that are linked to particular service tasks with specific instructions and estimated durations. The specified durations serve as target times for the completion of a

[128] See section 4.1.1
[129] Ibid.

task in the app. The sum of the target times for all tasks linked to a standardized work order is used to distribute and schedule actual work orders to mobile workers. The system can also maintain skill profiles about mobile workers, which consist of a list of skills and ratings.[130]

**Supervising, directing, scheduling and monitoring work.** Dispatchers have access to a "schedule board" that shows them the start times and durations of work orders currently assigned to workers on a given day. To assign a new work order they can manually choose an available worker and schedule it for a specific time. As described further below, the system also provides mechanisms for semi-automated and fully automated scheduling. Dispatchers can monitor in real-time how much time a worker already spent on an ongoing work order and the current degree of its completion, including granular information about which service tasks were already completed. This is a form of behavioral monitoring. They also see the current "status" of workers and a map that shows their real-time location and travel routes. The system tracks the location of workers either based on information they enter in the mobile app or based on GPS tracking. Even without GPS tracking, it knows when workers arrive at and leave client locations.[131]

For completed work orders, dispatchers see the actual duration as compared to the planned duration, which can be considered a form of performance monitoring. The system can display a timer to dispatchers that counts the minutes and seconds that have elapsed since the creation of a work order, which helps to comply with contractually agreed response times but also puts dispatchers under pressure. It can also calculate and display estimated and actual costs associated with each work order.[132] Organizations can define cost limits for particular work orders, which can be shown to both dispatchers and mobile workers, who can optionally receive a warning when they get close to the cost limit during the completion of a work order.[133] As the cost can be based on the time spent on the work order, dispatchers and mobile workers will aim to keep it within the limit, which represents another mechanism for performance control that is embedded in the work process.

**Automating and optimizing work order scheduling.** The system can semi-automatically assist dispatchers with scheduling by recommending them a list of available workers who match a work order. To match work orders with certain characteristics to workers with certain characteristics, it considers, on the one hand, information about a work order's location, desired starting time, estimated duration and required skills. On the other hand, it involves information about workers, including their working hours, break times, skill profile, current assignments and location. In addition, it predicts travel times based on historical traffic information. The system can also apply fully automated scheduling to assign work orders to all available workers for entire days.[134]

Automated decisions about which work order to assign to which worker for which time are based on "optimization" goals and objectives. Typically, the system will aim to "maximize productivity" based on minimizing travel and idle times, as presented in Microsoft's software documentation. Employers can choose multiple optimization objectives and rank them by relevance. This can include scheduling certain work orders as soon as possible or considering the match between required skills and a worker's skill profile more or less strictly.

[130] See section 4.1.4
[131] See sections 4.1.2 and 4.1.3
[132] Ibid.
[133] See section 4.1.4
[134] See section 4.1.5

As automated scheduling relies on estimated travel and work order durations, it can have many side effects. If the system creates streamlined schedules with minimized idle times between work orders and the specified durations for service tasks and work orders are inadequate, whether intentionally or not, the system can put workers under constant pressure to meet targets that cannot be met. Inaccurate travel time predictions can have similar effects. Optionally, employers can allow the system to schedule work orders in a way that may require workers to travel to or from a client site outside their working hours. Fully automated scheduling can occur, for example, once a day or every 30 minutes, the latter of which may lead to constant changes in work order assignments.[135]

**Predicting work durations based on past data and singling out workers.** Microsoft offers the ability to predict the future duration of work orders based on historical data and "AI" models. The system shows how the actual duration of certain work orders may deviate from the duration service managers have previously specified for this type of work order and lists possible reasons for the predicted deviations. It displays information about how a particular client, region, day of the week, service task or worker associated with a work order may increase or decrease the number of minutes required for completing it. The system processes extensive personal data on past employee activity and singles out named workers as the potential reason for work orders taking longer to complete than previously specified.[136]

Microsoft emphasizes that this functionality is "not intended for use in making, and should not be used to make, decisions that affect the employment of an employee or group of employees, including compensation, rewards, seniority, or other rights or entitlements". It is, however, "intended to help dispatchers or admins enhance their team's performance and improve customer satisfaction", and can be considered a form of performance monitoring. The system discloses information about the likelihood that a prediction is accurate. While this may increase the transparency and explainability of such a prediction, dispatchers may still make use of inaccurate predictions.[137]

**Performance and behavior monitoring at group and individual levels.** Microsoft's field service management system allows employers to access and analyze almost any available data on field service workers and their activities. In addition to built-in reports, which are available in almost every region of the world including in Europe (though they are not available in Germany), Microsoft's enterprise analytics software "Power BI" can be used to create custom reports. The built-in reports display performance metrics for both groups and individual workers over the past 12 months, including on the number of completed work orders, the time spent completing them, the time spent travelling, the time spent on break, and the time spent "idle", i.e. without any assignment. Managers can also access information about the rate of late arrivals and the rate of work orders that were not completed within the target time. Metrics on break times, late arrivals and missed target times address both work performance and behavior. They can potentially be used for disciplinary purposes. Based on surveys sent to customers after work orders were completed, the system can calculate the average "customer satisfaction rate" for work performed by particular employees, which represents a form of performance monitoring based on customer ratings.[138]

A "Power BI" report demonstrated by a Microsoft representative displays rankings of named workers by the number of completed work orders and by the revenue they generated. Another "Power BI" report from a third-party vendor

[135] Ibid.
[136] See section 4.1.6
[137] Ibid.
[138] See sections 4.1.7 and 4.1.8

displays information about the average time workers spent on completing work orders in relation to target times.[139]

The investigation in this case study shows that Microsoft's field service technology provides extensive functionality for performance and behavior monitoring at the individual level. It is designed to rate and rank mobile workers according to a wide range of metrics. Performance monitoring can affect employees even if employers abstain from individual-level metrics and only use group-level reports. Microsoft's built-in reports display, for example, information about the average time workers spent on completing certain types of work orders in relation to previously specified target times. While the analysis occurs at the group level, these numbers can certainly lead to discussions about work order durations between managers, dispatchers and workers and put pressure on them to reduce the time spent on work orders.[140]

As briefly examined in section 5, the field service management system provided by the German enterprise software giant SAP also offers intrusive reports that display performance metrics about workers at the individual level, including on the "top 5" workers ranked by the number of completed work orders, tasks and their durations.

**Integrations with other Microsoft software systems and customization.** Microsoft's field service management software is part of Dynamics 365, a comprehensive cloud-based software system that provides customer relationship management (CRM), enterprise resource planning (ERP), supply chain management (SCM) and human resource management (HRM). The field service management system can be integrated with almost any other functionality available in Dynamics 365 and Microsoft 365. Managers and mobile workers can handle work orders directly from within Outlook and Microsoft Teams. As such, Outlook and Teams can turn into task management systems. The "remote assist" module in Dynamics 365 allows mobile workers to make calls to higher-qualified experts for help while performing work at the client site.[141] Microsoft's field service management system can be customized and extended to manage and monitor different types of mobile work. Employers can add custom workflows, status codes and scheduling rules. Microsoft's "home health" software extends the field service management system with functionality specific to mobile homecare and integrates it with Microsoft's "Cloud for Healthcare" system.[142]

**Integration with Microsoft's AI system "CoPilot".** Despite many concerns about the lack of maturity and reliability of "generative AI", Microsoft has rushed to integrate its "CoPilot" technology into many products including its field service management system. It promises, for example, to summarize all available information about a particular work order. Dispatchers are told to "review" the summary before "using" it in order to "ensure AI-generated content is accurate, complete, and appropriate". CoPilot also offers to automatically create draft work orders based on the contents of emails with customer requests. Dispatchers are told that "AI-generated content may be incorrect" and should, once again, "review" the data before saving it. They can then schedule the work order by assigning it to a particular worker recommended by the system. After the work order was scheduled, the system offers to automatically draft an email reply to the customer. Once again, dispatchers are told in the fine print that "AI-generated content may be incorrect". It is unrealistic to expect that dispatchers spend much time reviewing the generated content, especially as Microsoft advertises CoPilot as a means to streamline and accelerate work.[143]

[139] Ibid.
[140] Ibid.
[141] See section 4.2
[142] See section 4.6
[143] See section 4.3

**Intrusive behavioral monitoring via location and call tracking.** While the system knows the current location of workers based on information entered in the app regarding when they arrived at and left a client, it also uses GPS location tracking. As of 2023, GPS location tracking was enabled by default and while it is not clear if this is still the case, several features rely on GPS location tracking. In addition to utilizing this information for travel time calculation and automated scheduling, clients can be offered access to the current location of the scheduled worker and their estimated arrival time. Employers can access "location audit records", which represent a full list of the whereabouts of workers over time. They can configure how frequently the system records workers' geolocation. Microsoft recommends recording it every "60 to 300 seconds". In addition, employers can create so-called "geofences", which are virtual perimeters around geographic areas, such as certain client offices or factory sites. Microsoft provides access to detailed records that indicate at which times workers have entered or exited such geofenced areas.[144]

Microsoft also provides access to detailed records about remote assistance calls carried out by mobile workers, including their start and end times, call duration and information about which worker initiated the call. The report also contains a summary of how much time particular workers spent on how many calls. It is "intended to help supervisors and managers derive insights regarding operational efficiencies and usage of Dynamics 365 Remote Assist", according to Microsoft. Remote assistance calls can become part of a work order's "timeline" that documents all information associated with it, and which lets dispatchers access information about past calls including their duration.[145]

**Taken together,** Microsoft's field service technology is designed to enable far-reaching algorithmic management and worker monitoring. Employers can use it to streamline mobile work, align it with rigid standardized processes and optimize workflows in order to maximize productivity and minimize idle time. Via smartphone app, they can direct and micromanage workers down to the level of granular tasks and put pressure on them by constantly reminding them of time targets and constraints. They can monitor data on work activities and tasks, rate and rank workers, assess their performance, identify undesired behavior and access intrusive pre-built and custom reports that systematically expose extensive personal data on workers.

## 6.2 Potential implications for mobile workers

The review of survey-based studies on the practical use of field service technology in section 2 shows that these systems can have significant negative implications for employees.

A study on **technical maintenance work in Austria**, which was part of an earlier project led by the author of this case study, found that task direction and monitoring via smartphone app led to increased surveillance and digital control at work. Based on the recorded data, managers now want to discuss the time required for tasks down to minutes or even seconds. The time available for individual tasks has been drastically reduced over the years. Field service technology has accelerated and intensified work. In addition, it has reduced work discretion and autonomy. The knowledge that once resided with workers, who considered themselves to be "experts" about the facilities they maintain, now lies within technical systems.[146]

[144] See section 4.4
[145] See section 4.5
[146] See section 2.1

**A comprehensive Norwegian study**, which examined the use of mobile devices to direct and monitor workers in electrical installation, road maintenance, cleaning, security and mobile homecare, found that many workers saw field technology as a surveillance tool. Controversial questions include the types of data collected and the purposes it is used for. Data about mobile workers that was previously unavailable to managers is now being recorded and evaluated. Several employers misused the data for purposes other than it was originally collected, including for negative decisions about workers, ranging from formal warnings to terminations. The data was also used to assess performance and behavior, including punctuality, response times and the time spent on particular jobs in relation to target times. Some employers used the data to reward and punish workers via performance-based pay. Worker representatives are concerned about increased workloads due to tougher performance targets and increased control of time spent travelling. Overall, the study argues that rather than trusting field workers to schedule and perform work at their own discretion, field technology based on real-time data from mobile devices centralizes control about the scheduling and performance of work. While field technology strengthens the employer's ability to organize, direct and manage work, control over information is unevenly distributed.[147]

A study of similar systems that focuses on the implications of strictly allocated tasks and service times for **homecare workers** in the UK found that workers had to absorb the risks involved with the fluctuating demands of service recipients. As a result, workers were systematically penalized by being required to perform unpaid labor, and they perceived electronic monitoring as "undermining their autonomy and discretion in what is contingent and unpredictable work". A study on homecare work in the US found that workers "struggled to make their work visible to digital systems; slight missteps in compliance often led to delayed or lost wages".[148]

## Microsoft statement

Microsoft provided the following statement on the case study:

*"Field service workers travel to multiple locations servicing different products every day. Dynamics 365 Field Service and its Copilot capabilities are designed to help field service workers schedule, plan and provide onsite maintenance and repairs in the right location, on time with the right information and workplace guides on their device to complete their jobs. Dynamics 365 Field Service does not use AI to recommend individual workers for specific jobs based on previous performance. Dynamics 365 Field Service was developed in accordance with our Responsible AI principles and data privacy statement. Customers are solely responsible for using Dynamics 365 Field Service in compliance with all applicable laws, including laws relating to accessing individual employee analytics and monitoring."*

[147] See section 2.2
[148] See section 2.3

# List of figures



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