

Achieve operational
excellence through planning
and scheduling optimization



How optimized plans and schedules can dramatically increase business value in service, manufacturing, and asset-intensive industries

Planning and scheduling have always been complex functions, but today they are more complex and business-critical than ever. Optimizing a schedule can mean the difference between operating profit and loss. This paper examines the scheduling challenges faced by organizations in the service sector, manufacturing, and asset-intensive industries, explains how to overcome them, and quantifies the impressive business benefits of optimized schedules.



1. Business challenges and value drivers

Business trends

We are experiencing an exceptionally volatile business environment. Energy prices are rising and decarbonization has become a priority. The Great Resignation is among the causes of labor shortages in many industries, along with an aging workforce. Geopolitical events are creating an uncertain future.

Within this environment, the performance bar keeps rising. Companies of all kinds are trying to meet ever-higher customer expectations. They are contending with competitive pressures from more agile new entrants and volatile supply chains. Speed of execution and reducing time to market have become critical to competitiveness.

At the same time, technological advances and the accelerating pace of digitalization, while bringing many benefits, are also complicating matters. Greater complexity in supply chains, business processes, products, operational assets and service requirements are all making it harder to achieve operational excellence.

The servitization of products, while adding value, changes the business model and adds business risk. Products and assets are getting more complicated and connected. Servicing

and maintaining them is getting more critical to customer experience, operational processes and business performance. And the sheer number of connected assets, like industrial IoT sensors, distributed energy resources (DERs), and electric vehicles, is growing at an exponential rate.

Imperatives

To mitigate these trends and seize the business opportunities which they present, organizations are working hard to increase speed and reduce complexity. Management effort is laser focused on maximizing productivity and operational efficiency. It remains critically important to deliver a great customer experience while ensuring safety and compliance.

All organizations have their own Moment of Service™ where they delight their customers with tangible value, empower their people, and

leverage their assets to maximum effect. To deliver value at this crucial point, they have to get the right person with the right skills, the right parts and equipment, to the right place at the right time. And that's where planning and scheduling come in.

Introducing planning and scheduling

In this unpredictable world of higher expectations and greater complexity, there is less margin for error. But there is one key driver of value where great improvements can still be made: planning and scheduling.

This often-underestimated business activity can make or break operating margin. The gap between an ordinary plan or schedule and an optimized one can mean the difference between operating profit and loss. Organizations that want to achieve operational efficiency, customer satisfaction, and competitive business performance need to focus on planning and optimizing their schedules.



2. The critical role of planning and scheduling

What is planning and scheduling?

Planning is about what needs to be done and how.

Organizations of different kinds need to plan and schedule different tasks. Examples include product service calls, engineer visits for installation or repair, asset maintenance tasks (whether reactive or proactive), manufacturing production, and safety and compliance inspections. The discipline covers an enormous variety of tasks.

To schedule anything, you need a resource (which could be a person, a part, or piece of equipment) and an activity (which might be some maintenance task or shop order operation). A schedule then determines which resource is allocated to carry out what activity and its expected start and finish times.

Why is scheduling important?

Scheduling enables an organization to address all sorts of day-to-day challenges like meeting deadlines and SLAs. But beyond its obvious operational necessity, it also fulfills a more strategic role.

It empowers an organization to maximize the utilization of in-house staff, reduce the need for overtime and contract workers, and so contain labor costs. It also allows the organization to plan the capacity of resources (including machines, equipment, staff, spare parts and raw materials) it will need in the future. And it can be involved in identifying revenue-development opportunities such as formulating premium customer service packages.

Scheduling has become more complex

Scheduling has always been a complex activity, but in today's real-time world, with more factors to consider and a faster rate of change, it's become more complex than ever. As you add more factors to a scheduling problem, the number of possible solutions grows factorially – that's worse than exponentially.

Even for a small team of five engineers performing 70 activities a day, there are googol possibilities (that's a 1 followed by 100 zeros). Most service, manufacturing, and asset-intensive organizations have many, many more possibilities than this with more resources, dependencies, constraints and activities than our simple example.



From a practical point of view, the factors which planners and schedulers have to juggle include:

- Technicians who have different skills, experience and certifications
- Staff that work in shifts and need breaks, are available some days and not others, and have a certain capacity of jobs per day
- Jobs requiring tools, equipment, vehicles, parts, and consumables, all of which have to be coordinated
- Compliance with regulations about when jobs have to be done, how they are performed and who can perform them
- Prerequisites: other tasks that have to be done before this task can commence.

Even seemingly simple issues like travel can be more complex than they seem. Scheduling has to take into account the cost and time of travel versus the value of the visit. SLAs may change according to day of week or time of day. Cubic, for example, the company which supplies and maintains London Underground ticket barriers, has a 60-minute SLA.

A journey may incur planning penalties if, for example, it involves a driver exceeding a number of hours per day or going beyond a certain distance from home. All this is in addition to the more obvious issues of finding the shortest route, the availability of parking at the site, traffic jams, and unexpected delays.

Schedules often have to be changed at short notice if a resource is running late, for example. The schedule might need to reallocate a job to another suitably skilled technician who can reach the site in time to hit the SLA, provided incremental travel cost does not exceed visit value.

What is optimization?

Given the number of possibilities in a schedule of any reasonable size, it is impractical, even with the fastest computers, to check every possible combination. Instead, advanced scheduling uses a technique called optimization, which is an iterative process of trying to find improvements to an existing schedule.

Optimization takes an existing schedule and makes some changes to see if they improve it. Factors like travel cost and value of visit can all be weighted. An overall score is calculated for the new schedule, and if it's better than the old one, it becomes the new best schedule. If an external factor changes, like a resource running late, then the objective is to incorporate the necessary changes into the schedule with the minimum disruption and reduction in the overall score.

Then optimization repeats the process, continuously looking for ways to get a better overall schedule. This is what's called always-on optimization.

Where do optimized schedules matter?

Scheduling is critically important in three key sectors:

Service industries

In the retail aftermarket sector, activities requiring scheduling may include fixing a boiler or replacing a windshield. For a utility, it may be installing a consumer smart meter, or inspecting a sub-station. In property and facilities management, it might be cleaning or replenishment. All these are activities central to the organization's mission and purpose.

In field service, resources are mobile and have to travel between jobs. Here planning and scheduling affect customer experience, adherence to SLAs and the avoidance of penalties. It will be a priority to reduce travel time, cost, and emissions, and the company will want to maximize first-time fix rates by allocating the right person with the right skills, parts and equipment to each activity.

Asset-intensive industries

Asset-intensive industries include mills and mining, oil and gas, power generation, transmission and distribution, water and wastewater, and telecommunications. In this sector, assets tend to be static, and the business priority is about maximizing asset yield by minimizing downtime and maximizing utilization, as well as using skilled resources as efficiently as possible.

Scheduling is key to optimizing maintenance activity, for example by performing preventive maintenance at the same time as corrective maintenance. Scheduling is also key in enabling an asset-intensive organization to move from reactive to proactive maintenance.

Planning and scheduling always was difficult – now it's getting even more challenging. For example, the number of sensors used on pipelines and transmission lines is growing with the increased use of IoT devices. Operations managers, maintenance leads, and health and safety officials rely on sensors across distribution networks to monitor, manage and maintain infrastructure and ensure the safety of workers and the public.



Manufacturing

In industries like automotive, chemicals, food and beverage, high-tech, industrial, and life sciences, scheduling affects both production operations and asset maintenance.

In terms of production planning, the days of infinite loading are over and manufacturers now need to operate to a realistic production schedule. Doing so tends to improve customer service levels due to higher fulfilment and on-time delivery rates. It also enables them to spot and analyze potential problems, like supply shortages, while there is still time to take corrective action.

Production plants also need to optimize the use of available resources, including machinery, tools, people, and raw materials in order to maximize production throughput, minimize setup time, reduce wastage and avoid bottlenecks. Optimizing resource utilization also helps them reduce lead times, inventory levels, and work-in-progress time in production.

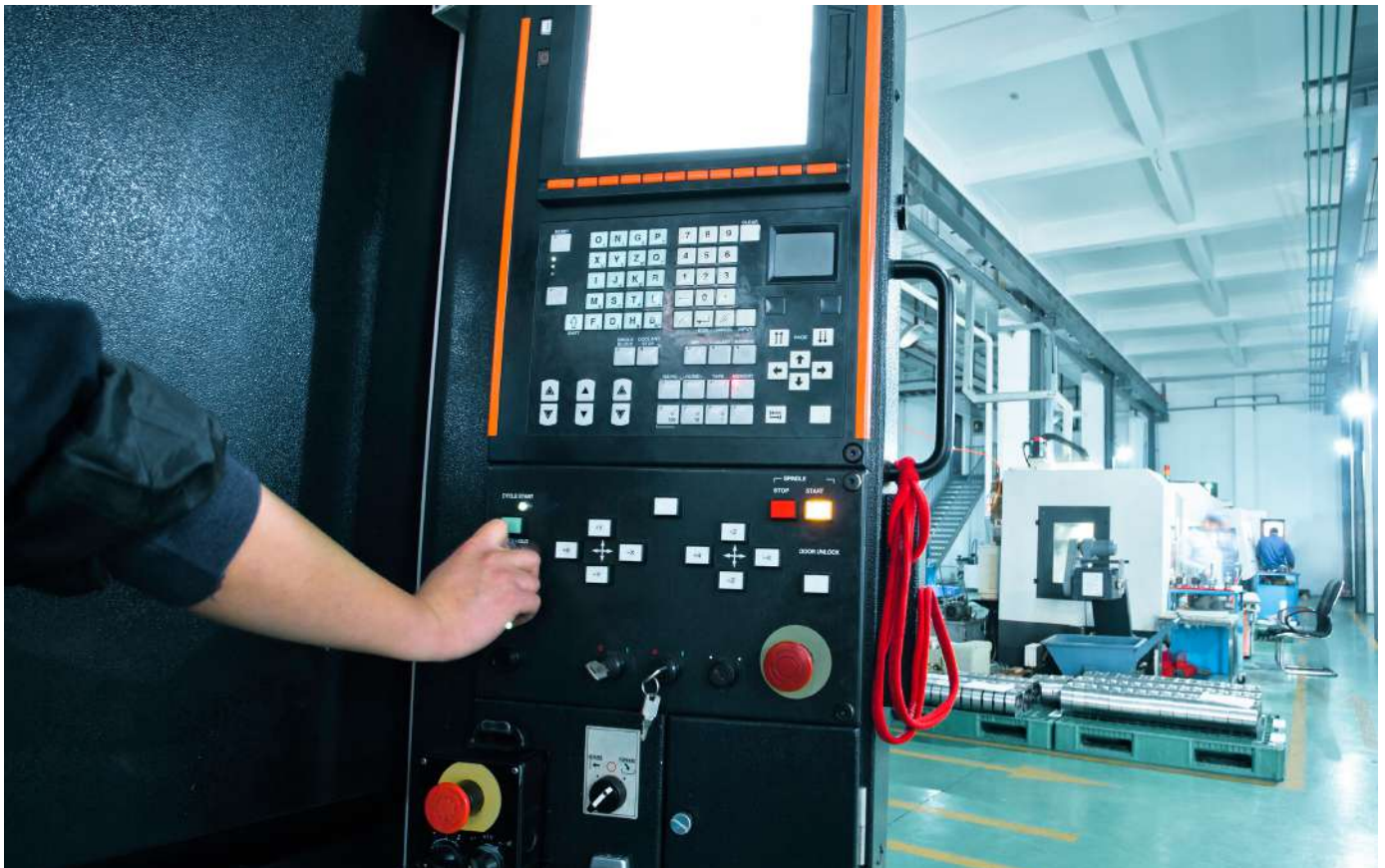
Schedule optimization can be used, for example, to schedule the work of a paint machine, timing jobs of the same color to be done together,

reducing the unproductive time the asset spends in clean-down and set-up mode.

Heads of manufacturing constantly strive to attain greater production cost control and hence more consistent profit margins. Optimizing planning and scheduling can give them increased control over production change costs through better visibility of potential problems.

Scheduling is also critical in the role of inspecting and maintaining production line equipment and plants. Timing these activities smartly minimizes downtime and its adverse operational and commercial impacts. It helps ensure continuous production, allowing the organization to operate to just-in-time or just-in-case inventory management principles.

The combination of optimal production and maintenance schedules allows the manufacturer to deliver to customers on spec and on time, ensure customer satisfaction and avoid contract penalties. Importantly, the scheduling of inspections and timely maintenance also helps to ensure worker safety and company compliance with regulations.



3. Business and operational challenges by sector

Ordinary, unoptimized planning and scheduling can cause a catalogue of unwanted business challenges for any business:

- Higher than necessary planning and scheduling costs and a high ratio of dispatchers to technicians
- Operational inefficiencies, below-average asset utilization, under-par technician/engineer productivity
- Excessive unplanned downtime, interruptions to production, and low operating margins
- Customer dissatisfaction, missed SLAs and penalties, low net promoter scores
- Service outages resulting in damage to brand reputation
- Unacceptable safety and compliance risk
- Unnecessary travel, high fuel costs and CO₂ emissions, and failure to meet decarbonization targets.



Operational challenges in service industries

Scheduling jobs is becoming more demanding. Products are getting more complex, containing more parts and being connected to the internet; and customers are more demanding, requiring stricter SLAs and faster response times.

Delivering reliable, consistent service (whether break-fix, maintenance, or installation) is more of a challenge than ever – and that's before you factor in supply chain issues and the difficulty of recruiting and retaining field technicians post-pandemic.

Sub-optimal scheduling in the service sector can result in:

- Difficulty meeting target first-time-fix rates
- Low field technician utilization
- Incomplete jobs requiring a return visit (e.g. if a technician with the wrong skills was assigned to a job)
- Customer dissatisfaction
- Unnecessary travel with unwanted fuel costs and emissions
- Difficulty moving from reactive break-fix to proactive, preventive maintenance.

In a mobile service organization, for example, it can be a huge challenge just getting the right parts to the right place at the right time. Often a technician will need more than one part to do a job, and if they only have two out of three parts, they can't complete it. Parts get upgraded, and the engineer needs to have the right version of the part, especially where compliance is involved.

A job will usually also require consumables, like cleaning fluid or oil, which are not generally considered parts, but nonetheless need to be replenished in a timely manner depending on how many jobs have been done. To overcome the challenge, an organization may have to engage in dynamic restocking from a depot, another van, a locker, or direct from the supplier. Some organizations even restock engineers' vans outside their homes overnight.

Operational challenges in manufacturing industries

Creating an optimized manufacturing schedule with finite resources is incredibly challenging when dealing with ever-changing variables such as raw materials, staff schedules and asset availability. For some manufacturers, customer demand can change by the hour, necessitating same-day planning. Just creating an optimized plan up front can be tricky, let alone adjusting it when something goes wrong, such as a machine going down or a shipment of materials being delayed.

Being able to replan quickly to produce the best possible schedule based on the latest data is unbelievably complex and time-consuming if you have to collect and analyze all the data manually or have a scheduling application that isn't AI-powered. Without an optimized production schedule, manufacturers face challenges such as:

- Low asset utilization at plant, line, and equipment level
- Low employee productivity
- Burdensome planning and administration
- Reduced production throughput due to inefficiencies and bottlenecks
- Wastage of materials, agents/catalysts, water, energy, and time
- Having to hold excessive inventory as a buffer, tying up operating capital
- Adverse customer experience – orders may be late, incomplete, or not on spec.

In manufacturing, minimizing downtime (both planned and unplanned) makes a huge difference to the productivity of a production line.

Supposing you have an urgent corrective maintenance task that requires obstructive work, i.e. taking a section of the line out of operation, it makes sense to cluster any upcoming preventive maintenance tasks that would also require obstructive work and do them at the same time. One period of downtime, even a slightly longer one, is often better than two because of the time and cost involved in safely shutting down and restarting the line.

Operational challenges in asset-intensive industries

In asset-intensive organizations, it's a constant challenge to balance uptime and maintenance. Maintenance and operations teams are responsible for planning and scheduling inspection and maintenance jobs on highly complex assets. Organizing what needs to be done, when, by whom, and with what parts and equipment, to thousands of assets, is a massively complex function that can have a huge impact on operations, cost, safety, compliance, and customer experience.

The scheduling challenges in this diverse sector include:

- The growing number and complexity of assets, make planning and scheduling more problematic than ever
- The need to balance uptime and maintenance: over-maintaining costs more than necessary while under-maintaining incurs the cost and revenue impact of unplanned downtime due to machine failure
- The huge impact of downtime, in terms of operational continuity, cost, customer experience, and brand reputation
- Organizations understandably want to move away from scheduled maintenance to condition-based maintenance, but this further complicates the task of scheduling because you don't know as far in advance what work will be required or when
- Complexity is compounded by the need to factor in how business-critical the asset is and the safety and compliance implications of its failure.

A typical refinery, power station or electricity grid might easily have several hundred inspection and maintenance tasks a day being carried out by a hundred engineers with different skills. There will be a fixed number of trucks, pieces of equipment, and tools available, and a finite inventory of spare parts. The complexity of this challenge quickly multiplies into millions of possible combinations.

Factor-in business criticality, safety and compliance regulations, and the scheduling task becomes so complex that it can only be performed effectively not just by software, but by automated, AI-powered software. However, planners and schedulers still need to be able to understand the basis on which the software recommends a given schedule, so they can validate it and make manual alterations if necessary.

4. How to optimize planning and scheduling

There are many aspects to consider when adopting planning and scheduling optimization in your organization.

Cultural change

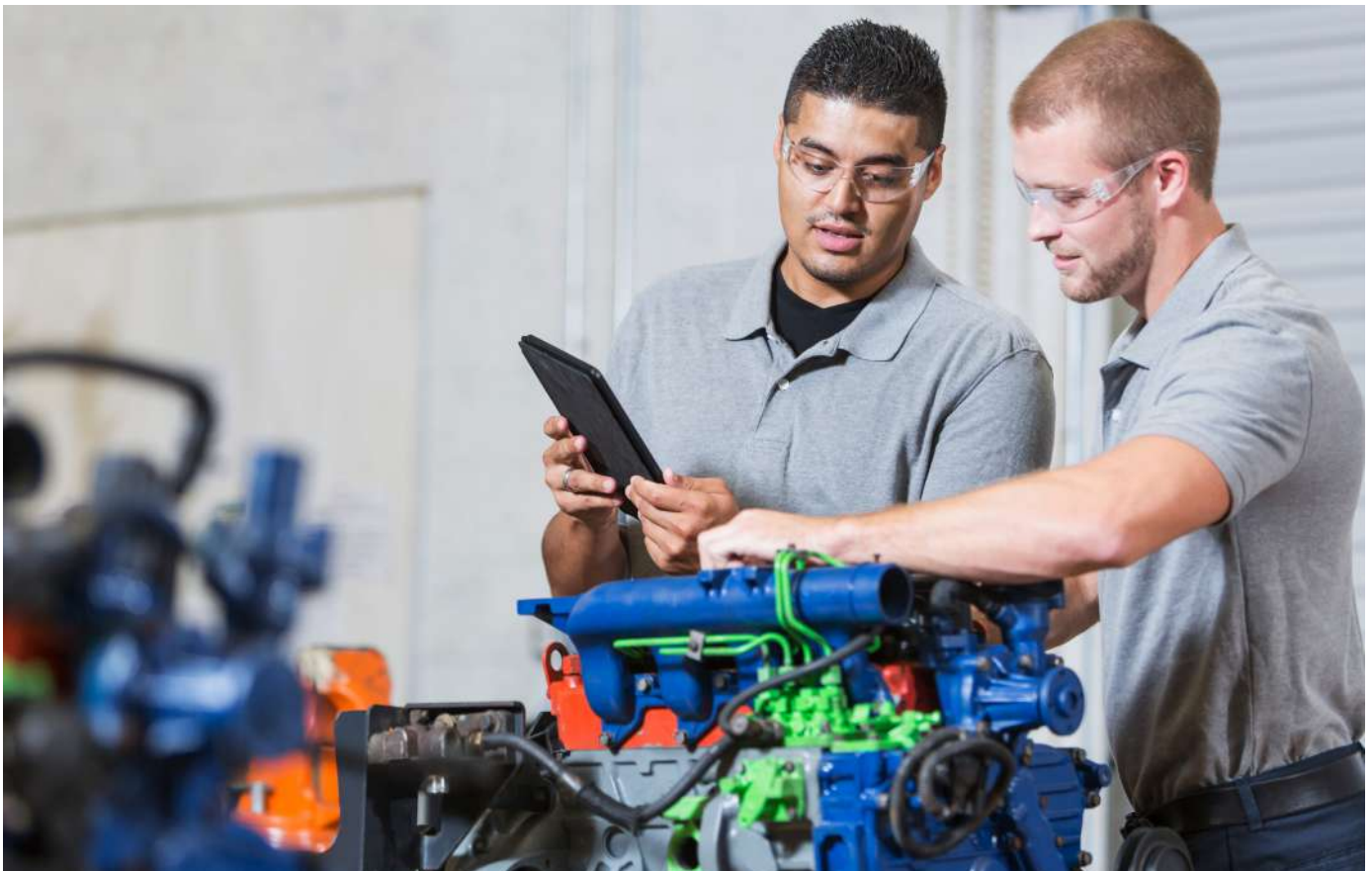
Don't underestimate the cultural impact of moving from manual to automatic scheduling. The role of planners and dispatchers changes – they no longer need to perform their traditional role of scheduling the jobs. Instead, they monitor and manage exceptions. This frees up dispatchers to take on a more strategic role, looking at future possible scenarios such as the organization's ability to take on new contracts with existing resources.

People don't always trust decisions made by computers – think of individuals disagreeing with vehicle route navigation. Planners, schedulers and dispatchers need the ability to interrogate decisions made by automated software – so they can learn to trust them, override them if necessary, and help train the algorithm to make better recommendations in future.

Expertise

As with anything, it's a good idea to consult with specialists. Planning and scheduling consultants abound, but it's best to use ones who also understand the wider picture and appreciate how the discipline fits in with supply chain, manufacturing and operational control systems, HR, safety, and compliance.

It's important to work with people who know your industry in depth. Oil and gas companies want to work with scheduling experts who are familiar with the safety regulations in their industry. Telecommunications operators need their scheduling advisors to understand the importance of customer satisfaction in a market where customer switching is easy. And the production manager in a bottling plant doesn't want to have to explain to their scheduling team the financial impact of an hour of downtime on the line.



Technology adoption

If organizations want to improve the effectiveness of their planning and scheduling function, they also have to embrace advanced techniques, such as:

- **AI-driven clustering.** Clustering involves breaking the schedule up into manageable chunks, e.g. according to geography or time. AI-driven clustering does this automatically, continuously tweaking the parameters to generate clusters of different shapes and sizes to see which ones work best.
- **Optimal shared recurring schedules.** Suppose there is lots of maintenance work that needs to be done monthly. This technique determines the best day of the month to perform the work, minimizing travel time and distributing the work across the workforce.
- **Flexible roster planning.** This ensures the organization has the right resources on a shift, based on predicted requirements, by division or area, and by skills and roles.
- **What-if scenario planning.** This technique uses simulation algorithms to test alternative scenarios based on the core schedule. It uses an AI algorithm on top of the core scheduling algorithm, to adjust certain criteria such as how many resources of a certain skill level would be required to meet an increase in SLA.



What to look for in a software solution

There is a lot of planning and scheduling software available. Here is a checklist of 10 key questions to ask during your vendor selection process:

1. Has your solution got AI that does continuous optimization of the schedule, repeatedly looking for possible improvements?
2. Does it offer the ability to choose how to use the scheduling engine, i.e. dynamically (for short-term volatile environments with frequent changes) or statically (for more stable environments) – and does it have the ability for users to manually adjust the incentive score attributed to an activity?
3. Can it do predictive analytics - using asset condition data to predict when preventive maintenance will be needed?
4. Can you use it to perform data driven planning and forecasting for more objective and strategic decision making?
5. Can the planning and scheduling technology be deployed across different business functions to benefit your whole organization?
6. Is it future-proof – meaning not only is it adaptable and scalable, but also does it come from an innovative company that will keep on improving it?
7. Is it truly scalable to deal with scheduling tens of thousands of resources, and the ability to do this in real time?
8. Does it support scheduling based on value to your business and meeting your KPIs, like factoring in cost-to-deliver or whether a customer is a priority customer?
9. Has the software solution been proven to deliver value in your industry?
10. Is planning and scheduling optimization part of a single end-to-end solution including Enterprise Resource Planning (ERP), Enterprise Asset Management (EAM) and Field Service Management (FSM)?

5. Business benefits of optimized scheduling

With the right advice, techniques, and software, it's possible for the chief operating officer and their team to ensure the efficient running of the business to meet targets and deliver customer satisfaction. In particular, they can:

- Improve operating margin and cash flow
- Improve customer satisfaction
- Maximize asset utilization and employee productivity
- Ensure worker safety and regulatory compliance.

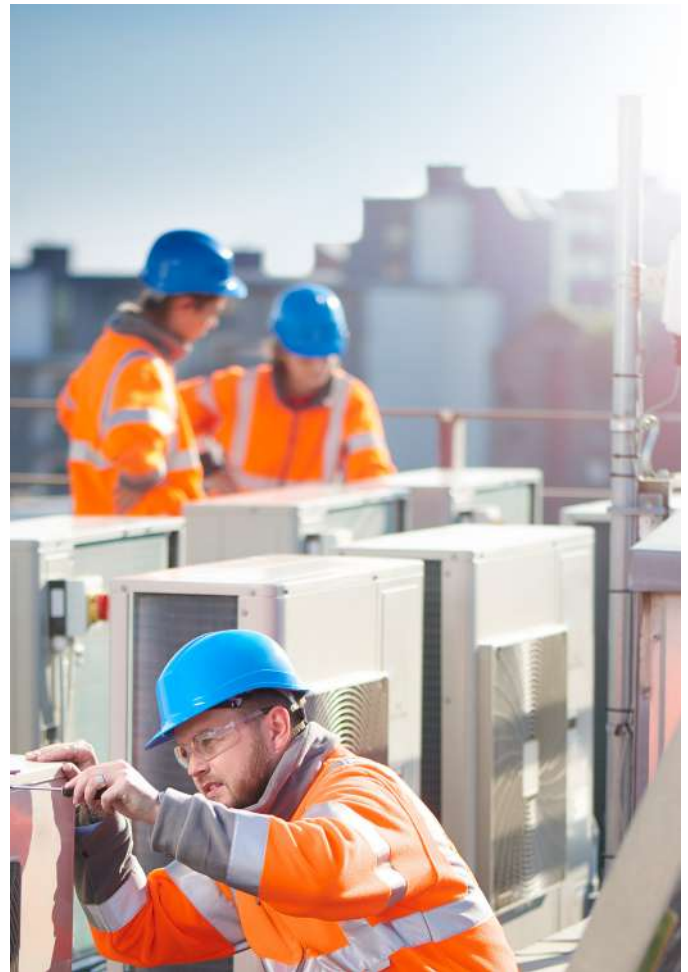
Other senior leaders benefit too:

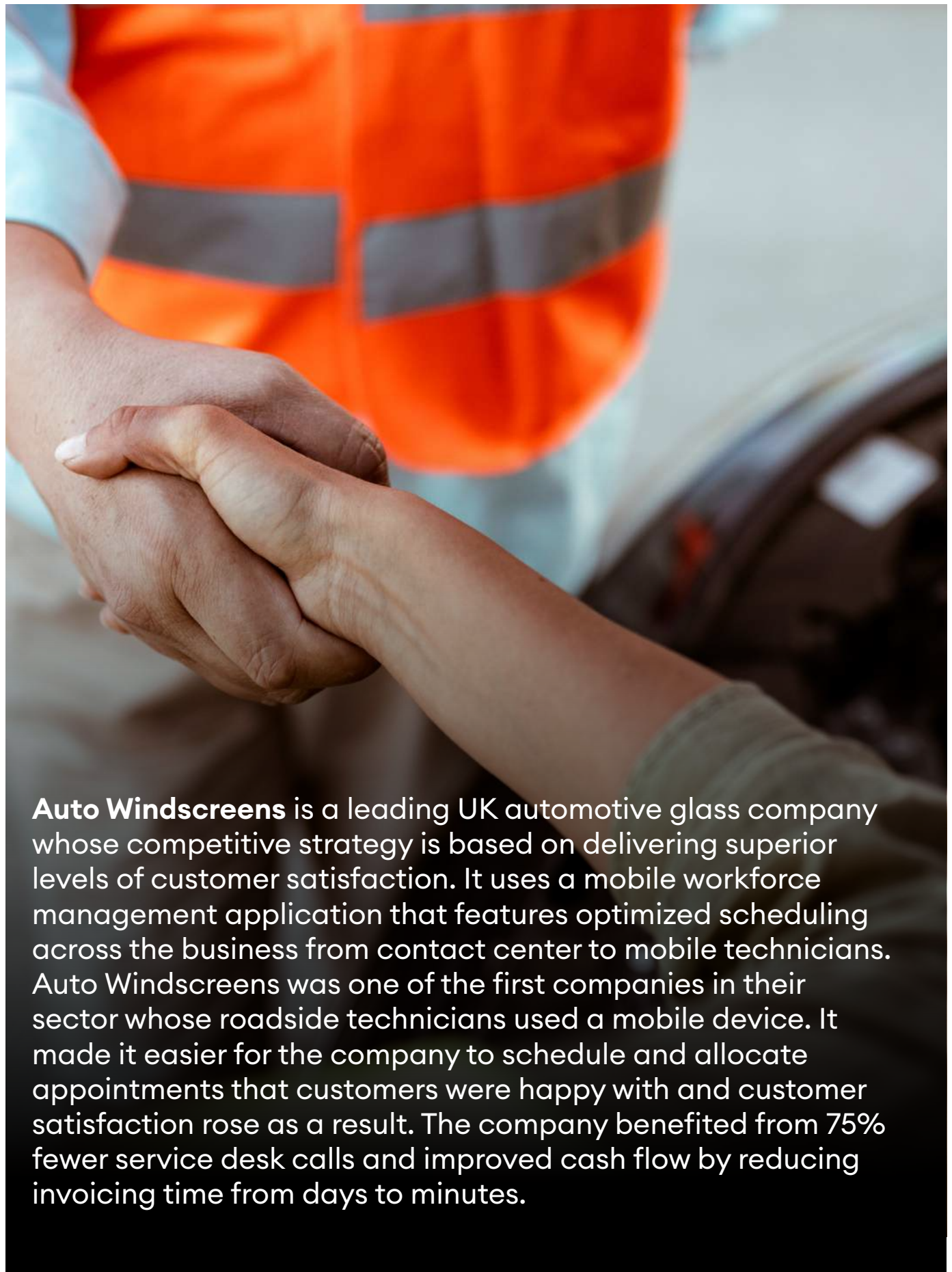
- The Head of HR can be more confident of always meeting worker safety requirements both on-site and in the field
- Service leaders will find it easier to meet customer satisfaction levels
- Asset owners and maintenance leaders can reduce asset downtime and maximize their assets' life.
- The CFO will see improvements in return on assets, operating margin ratio, and output per employee.

Service industries

Heads of service and heads of field service are empowered to hit SLAs, reduce dependency on external labor, reduce fuel costs and emissions, and increase dispatcher capacity. Optimization makes it easier to manage intra-day changes to schedules, and with automated scheduling, dispatchers can concentrate on managing exceptions and planning for the future.

By optimizing the utilization of technicians, resources, and parts, chief service officers can improve the profitability of service operations, increase service revenues, reduce service costs, maximize service margin, and uphold customer satisfaction.





Auto Windscreens is a leading UK automotive glass company whose competitive strategy is based on delivering superior levels of customer satisfaction. It uses a mobile workforce management application that features optimized scheduling across the business from contact center to mobile technicians. Auto Windscreens was one of the first companies in their sector whose roadside technicians used a mobile device. It made it easier for the company to schedule and allocate appointments that customers were happy with and customer satisfaction rose as a result. The company benefited from 75% fewer service desk calls and improved cash flow by reducing invoicing time from days to minutes.

Manufacturing industries

Heads of manufacturing, plant, production, and operations in manufacturing organizations can maximize continuous uninterrupted production, and increase plant or line throughput. They can improve control over production costs and reduce unnecessary wastage, cut the amount of disruption and machine downtime (both planned and unplanned), increase right-first-time-through rate, and hit customer SLAs.

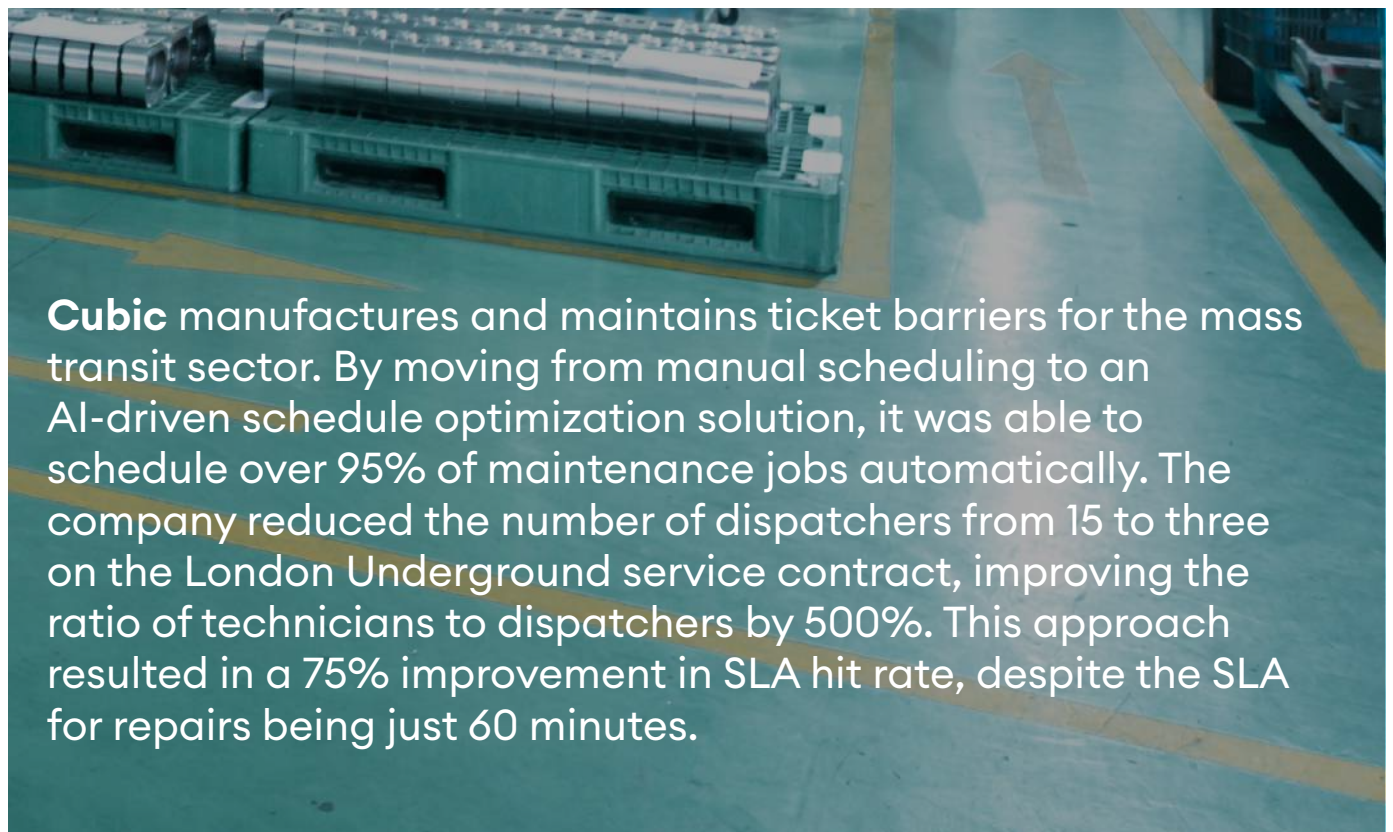
Heads of maintenance and engineering can optimize the planning and scheduling of maintenance while remaining agile, optimize maintenance costs versus asset output, avoid under- or over-maintaining assets, and so ensure availability, performance, safety, and compliance cost-effectively. They can spot and analyze potential problems while there is still time to take corrective action, and support the company's transition from scheduled to predictive maintenance.

Asset-intensive industries

Heads of planning and operations, heads of asset maintenance, and asset/portfolio directors will be able to balance asset uptime and maintenance needs and make sure the most important activities are prioritized in the plan. They'll improve mobile field workforce management, coordinating parts and skills, and operating SLA-aware scheduling. Planners will be able to focus on deviations, which will enhance their ability to comply with inspection and maintenance regulations.

Asset-intensive organizations which employ optimized planning and scheduling will benefit from:

- Better asset utilization
- Maximum asset availability
- Improved asset lifetime value
- Reduced unplanned downtime and operational disruption
- Higher first-time fix rates
- Highest possible technician productivity
- Reduced travel time, fuel costs, and CO₂ emissions.



Cubic manufactures and maintains ticket barriers for the mass transit sector. By moving from manual scheduling to an AI-driven schedule optimization solution, it was able to schedule over 95% of maintenance jobs automatically. The company reduced the number of dispatchers from 15 to three on the London Underground service contract, improving the ratio of technicians to dispatchers by 500%. This approach resulted in a 75% improvement in SLA hit rate, despite the SLA for repairs being just 60 minutes.

Smart Care is the largest independent organization in the US servicing and maintaining assets such as commercial kitchen equipment; heating, ventilation, and air conditioning (HVAC); and water filtration systems. With ambitious acquisition-based growth plans, the company needed insight into its many pools of disparate data in order to plan and resource its expansion. By using a suite of integrated enterprise resource management and field service management software that included an AI-powered planning and scheduling optimization engine, the company was able to analyze data on 0.5 million service events in a single platform automatically. Its using the resulting insight to predict future service requirements and formulate innovative service packages with guaranteed uptime commitments to differentiate themselves from their competitors.



6. The solution is within your reach

Over recent years, planning and scheduling has become more complex than ever, due to supply chain disruption, staff shortages and changing markets.

The planning and scheduling function needs to undergo a digital transformation of its own if it is to properly support the business in improving business processes, enabling innovation and delivering customer value.

Fortunately, truly optimized planning and scheduling has become possible. Proven AI-powered digital technologies are empowering planners and schedulers to deliver real business value:

- Optimizing service delivery costs while achieving SLAs in the service sector
- Increasing customer service levels and improving profit margins in manufacturing
- Maximizing asset lifetime value through preventive and regular maintenance in asset-intensive industries.

Is it time to optimize your planning and scheduling?

We're here to help. IFS offers real-time planning and scheduling optimization that is integral to IFS Cloud, our single-platform cloud enterprise software solution for companies around the world who manufacture and distribute goods, build and maintain assets, and manage service-focused operations.

IFS is recognized by key analysts including Gartner, Forrester, and IDC for our leadership in asset management, field service management and ERP solutions for manufacturing, service and asset-intensive industries.

To discover how planning and scheduling optimization can help you be your best in your Moment of Service™, get in touch at www.ifs.com/contact-us

About IFS

IFS develops and delivers cloud enterprise software for companies around the world who manufacture and distribute goods, build and maintain assets, and manage service-focused operations. Within our single platform, our industry specific products are innately connected to a single data model and use embedded digital innovation so that our customers can be their best when it really matters to their customers – at the Moment of Service™.

The industry expertise of our people and of our growing ecosystem, together with a commitment to deliver value at every single step, has made IFS a recognized leader and the most recommended supplier in our sector. Our global team of over 5,500 employees every day live our values of agility, trustworthiness and collaboration in how we support thousands of customers.

Learn more about how our enterprise software solutions can help your business today at ifs.com.

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