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## GRIPS / PRISMA

# Excellent data jugglers – with augmented work

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## Specialist article

# Excellent data jugglers – with augmented work

**Work 4.0 is taking place in a working environment with intelligent information and services. These are introducing the possibility of digital work assistants and digital work accelerators that are calibrated to the specific capabilities of the worker they are helping. The future effects of Work 4.0 are the subject of highly controversial discussion – in particular the question of which jobs will decline or cease to exist as a result of automation and, in return, which new jobs will be introduced.**

## Rethinking the concept of "work"

It is interesting to note that there is another core question regarding digitization which has been addressed very little: How can people and machines mutually support one another using digital processes in such a way that reconciles their respective strengths and weaknesses while creating a high-performance work cycle? This is sometimes known as "augmentation" or "augmented work", but "digitally assisted working" is a more meaningful expression.

Tom Davenport and Julia Kirby have researched the augmentation approach in real-life applications and written an in-depth analysis of it in their book [1]. They give numerous examples of how humans and intelligent machines are working together and achieving considerably better results and continuous improvements together than they are able to separately.

This allows work to maintain its role as the director and catalyst for sustainable economic development; it does not degenerate to become a "gap-filler" for anything that a machine cannot (yet) do. Human jobs will become the last and most important mile in digitization, and a decisive factor in the long-term success of digitization projects. This means that digitization, combined with demographic trends, presents an entirely new set of requirements.

## "It's all about flexibility" – project not routine

The number of routine jobs is falling dramatically with Work 4.0. According to research conducted by McKinsey, two thirds of all highly digitized companies anticipate that the organization of workflows will become more project-based than function-oriented [2]. The risk of a job becoming automated, maintains The Economist, depends primarily on whether or not the job comprises routine work [3].

A recent study conducted by PricewaterhouseCoopers (PwC) comes to the same conclusion: To a large extent, jobs with a high risk of automation consist of physically demanding or routinely repetitive tasks, e.g. filling in forms or simple problem-solving. Careers that demand social skills or education will be less affected by automation [4].

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**Learning on the job – working as learning**

Fewer routine tasks also means that employees must be continuously acquiring and learning new skills. Learning will play an ever more significant part in employability – an article by the BBC about the effects of automation comes to the following conclusion: Employees will therefore be in a constant state of requiring new expertise and will not be able to depend on one set of acquired skills that will be rendered partially superfluous by automation at some point anyway [5].

**Know-how – AI is hardly a replacement for experience**

Practical knowledge sharing and on-the-job training are not new ideas; they have always been lived out by experienced experts and seasoned industry veterans. As the baby boomer generation reaches retirement age, however, the number of such persons available is falling – and it is becoming increasingly harder to fill the vacancies they leave behind with qualified specialists. Automation is now making it possible to train workers with less experience and help them perform complicated tasks confidently and without making mistakes.

## Digital assistance – new concepts of work as a basis

If the content of work is undergoing constant change, workers are continuously required to learn to do new jobs and specialist knowledge is growing scarce, Work 4.0 can only be successful with the help of highly efficient digital assistance. In other words, support and instruction that is effective and adapted to suit individual employees is not just possible with digitization – it is required as a matter of urgency.

Digital assistance is certain to raise productivity, increase employer satisfaction and reduce errors. For the product-based Work 4.0, this means that assistance is based on experience, is configured for each individual case, employs appropriate media, relieves employees of routine jobs and is based on the context in hand. Viewed individually, these attributes are defined as follows:

▲ Experience-based

Support must be adapted depending on the employee's experience.

▲ Individually configured

Instructions must take into account the unique configuration of the system or the individual product in question.

▲ Media-appropriate

Information must be offered in the medium that is best suited for the task in hand, e.g. 3D models for processes that are hard to visualize spatially; animations for complex work steps; voice assistance for jobs requiring both hands and constant visual attention; augmented reality for less experienced employees and virtual reality for training courses and work preparation.

▲ Unburdening

Assistance services must relieve employees of routine jobs, e.g. service planning, time and cost calculations, stock checks, diagnostics strategies and log keeping.

▲ Context-specific

Digital assistants must take into account the context, e.g. the work objective (Does the job involve service, maintenance or troubleshooting work?), the application profile of the product (How has the product been used? How will the product be used?), the current condition of the product as determined by condition monitoring, and the product history, taken from its service and maintenance history.

Today, these requirements can only be met consistently by means of a semantic information management concept [6]. Such a concept forms the basis upon which efficient assistance services can be made available within a realistic budget – these services are known as "smart content" services.

## Smart content services – practical solutions

Smart content services are a new technological concept developed to make Work 4.0 more productive by supporting it intelligently with digitization measures. This support is based on both content and data.
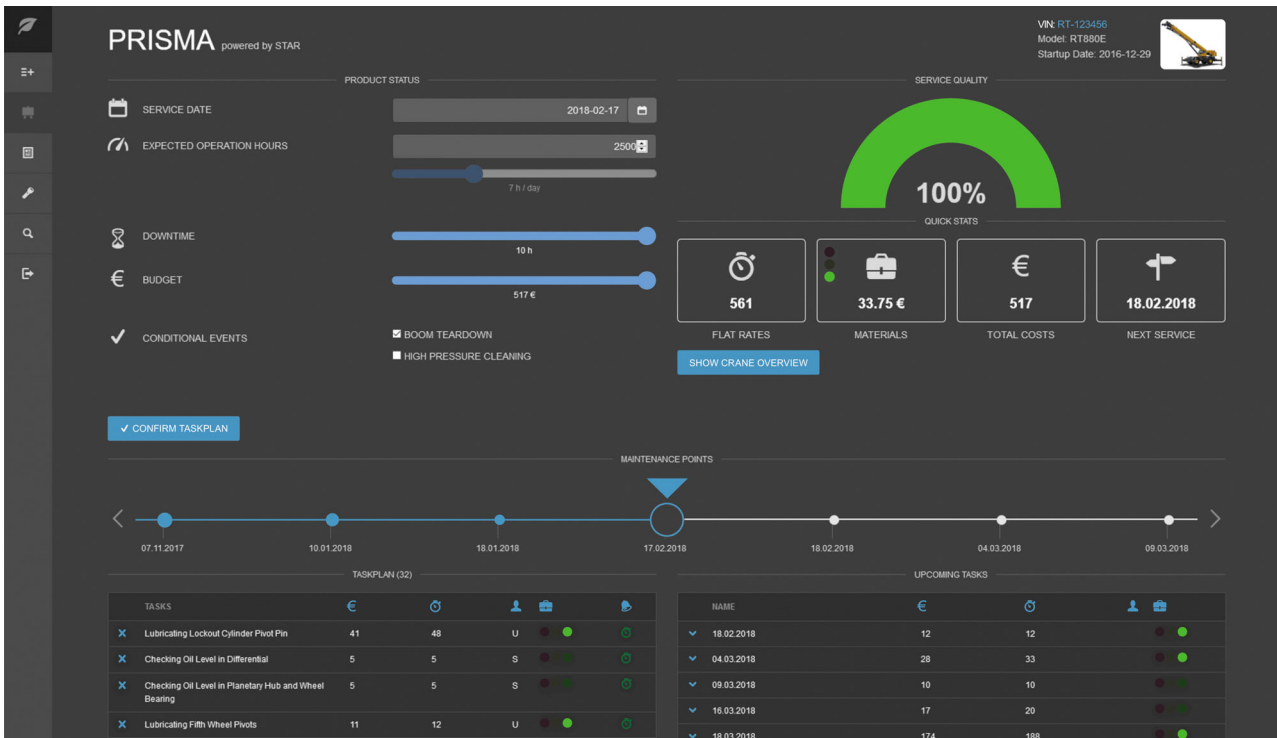
Smart content services for intelligent service planning

At the heart of smart content services are semantic information models which present content (e.g. work descriptions, diagnostics networks, rules) such that it can not only be reworked into instructions for people but also interpreted by digital processes. This type of intelligent content is currently known as a knowledge graph or semantic graph by most high-tech companies [6]. Smart content services are developed for specific applications and made available for work assistance.

**A glimpse into service planning**

The following application example demonstrates the concept of smart content services using an intelligent service planner for a crane that is based on the PRISMA solution from the STAR Group.

This case involves various different smart content services:

▲ Vehicle-specific data

Information specific to the vehicle, such as the chassis number, model designation and date of commissioning are displayed.

On the basis of this data, the data for the vehicle in question is called up in the background – this includes the service history and the vehicle config-

uration, which are required in order to provide the service information specific to the vehicle.

▲ Product status

Here the next service date is displayed along with the number of operating hours.

The expected service life can be updated manually at any time and incidents from condition monitoring are listed as well.

▲ Details of servicing

Here details are given about how long the suggested service will take and how much it will cost (broken down into time and material costs). A suggested date for the following service is also displayed.

These details of time and cost, as well as the time until the next service, are key variables for the customer when it comes to decision-making and optimization.

▲ Service timeline

The timeline displays past services and the date of the currently planned service, as well as other calculated intervals. The scope of the pending maintenance measures is also indicated.

▲ Overview of service work and materials

The user can also see which types of service work should be carried out – this includes their cost, the time required and any qualification they may need. In addition, a traffic light system indicates whether the required materials are available (green), can be delivered by the service date (amber) or still need to be ordered (red).

▲ Overview of future servicing

The dashboard displays further planned service dates that can be added manually to the current service date as applicable in order to outline maintenance works.

**Speeding up troubleshooting**

The second example application shows how smart content services can speed up diagnostics and troubleshooting, and even help experienced diagnostics specialists to make decisions. This example is also based on the PRISMA solution and the crane from before.

The solution reads out error messages directly from a tester or receives them via telemetry or a condition monitoring system. To start diagnostics, the technician selects an error message, such as fault P3045 ("Engine will not start") in the example below.

In "Custom diagnostics" mode, all possible causes of the fault are listed and supplemented by an indication of the minimum and maximum time it will take to check each individual cause and to carry out the entire diagnostics procedure.

This enables experienced specialist personnel to decide for themselves which order they want to check the possible causes in: The frequency of every possible cause is displayed for the individual vehicle (identified via its vehicle identification number) and across all models. The causes can also be sorted by the frequency with which they occur. The time of the last occurrence of that message on the vehicle is shown as well. A panel shows the checking steps and their potential results. Once a result is selected, the solution provides practical instructions on how to rectify the fault.

Technicians with little experience of diagnostics can use "Guided diagnostics": This specifies the optimum order for carrying out the checks, factoring in the probabilities of the causes and the time required to check them. If a cause is identified, the trigger is honed in on step by step until the appropriate remedial measure is found. The cause of the problem is then added to the fault frequency statistics so that the assistant "learns" with every job.
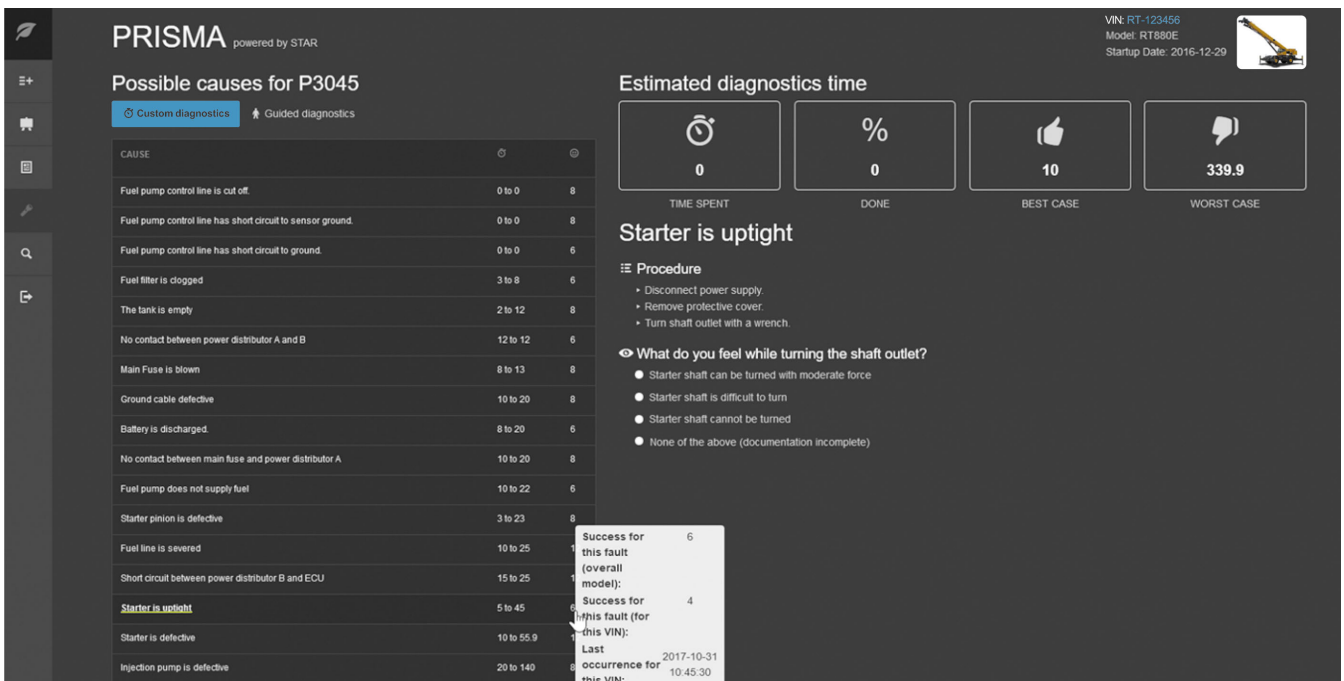


Smart content services for intelligent troubleshooting and diagnostics

### Relief from routine service work

In summary, the fact that smart content services make servicing work quicker and easier to plan and complete – and faults quicker and easier to pinpoint and rectify – is clear to see: Service employees are provided with individually configured service suggestions and the possible causes of a fault sorted according to frequency.

The assistance system recalculates and optimizes the service plan every time changes are made, while checks to ensure that all the tools and materials needed for the service are available are carried out automatically. The assistance system can generate guided troubleshooting too, whereby the minimum and maximum times taken to complete diagnostics are continuously updated on the basis of the progress made in the work.

This relieves service employees of these time-consuming routine jobs while eliminating sources of error (e.g. forgetting important service tasks or miscalculating the cause frequencies). Consequently, employees have time to attend to the customer's wishes more thoroughly and align the service/diagnostics with their requirements in terms of deadline, duration and costs.

## Digital coaching – on-site instruction

Smart content services not only facilitate planning but also assist technicians working in the field [6]. Digital assistance combined with augmented reality helps to rectify vehicle faults, for example, using features such as clear visualization of the position of an assembly or a part. Having the display on the object itself reduces error and speeds up work too.

This means that augmented reality representations can help untrained personnel to get to grips with unfamiliar products and learn on the job: Overall, instruction on the object produces a steep learning curve.

If technicians have their hands full or they cannot see the screen when working in the field, they also have the option to deploy voice assistants. PRISMA, for example, can read out the previous step or next step for navigation. Furthermore, it uses highlighting in the image or 3D model to show the current

position of a component and specifies which tools and materials are required. The user can read all technical data such as filling volumes, pressures, tightening torques and the time remaining, which helps to prevent exceeding the total time. If required, the assistance system can keep a log of all the measurements taken and additional observations made during service work.

## Situational information processing – attractive communication

Smart content services use animations, 3D representations, augmented/virtual reality (AR/VR) and voice assistants to enable an ease of instruction and degree of support that were previously unthinkable. Practical knowledge that has been hidden away in impractical manuals and unattractive pictorial instructions in the past can now be gained directly at the object in a situationally useful way.

This means that even complex and new forms of work can be carried out safely and correctly. In addition, this type of knowledge communication makes learning much easier. Situational information processing also means, however, that assistants can be switched off once employees have become so proficient at a job that they can do it autonomously and confidently.

At this point, the teamwork between human and machine comes into play once again, in that it is not only people who can learn from machines, but also the other way round: If a technician knows of a better, more elegant solution than the assistant, they can record their improved variant as voice feedback or film it using a tablet or smart glasses.

This feedback is a valuable form of input for the development team, helping them to constantly enhance and optimize assistance with practical knowledge. Consequently, smart content services in the form of digital assistance offer a new and comprehensive concept for the final furlong of digitization.

## Summary

Digitally assisted working – or "augmented" working – is a people-friendly, innovative and realistic alternative to pessimistic assessments of digitization as a "job killer" and to the belief, driven by a bias towards technology, that many new jobs in digitization will emerge.

Digital assistance supports people without overstraining them or replacing them with premature automation alternatives. Augmentation means combining the strengths of man and machine in a creative way. This smart combination will help in successfully overcoming future challenges posed by the complex digital world of work and demographic development.

## Sources and literature

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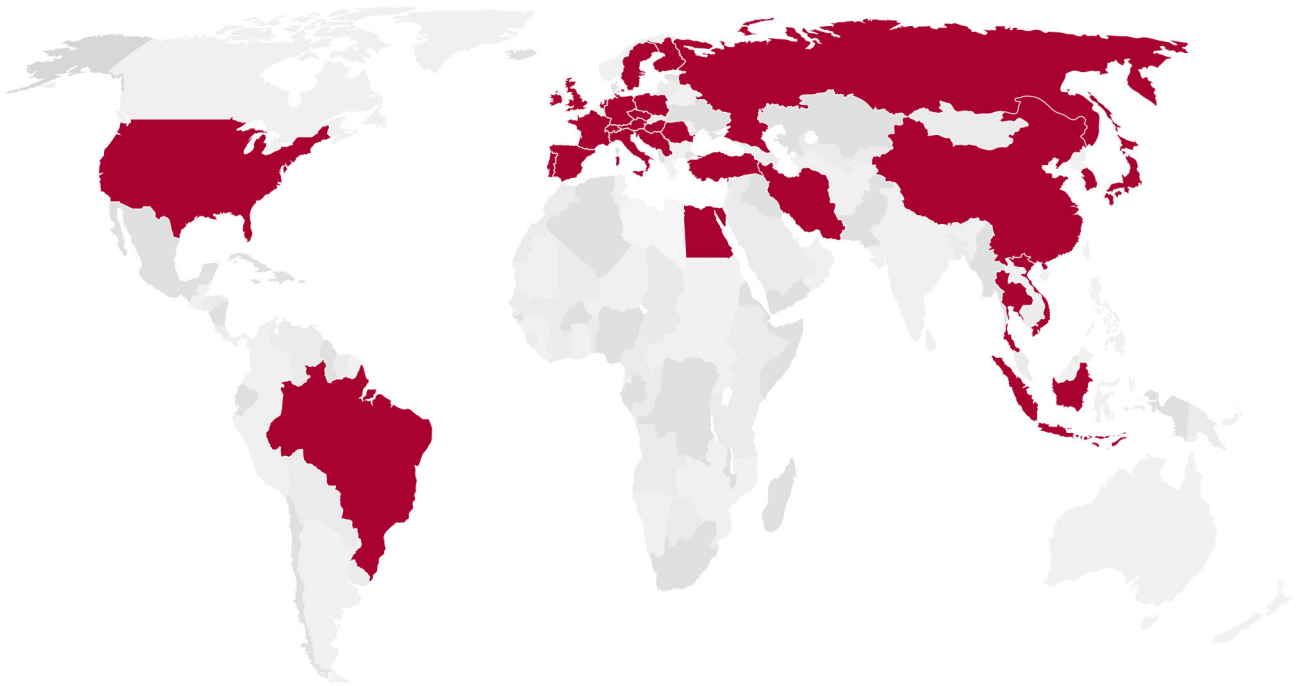
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