



The Eight Commandments to digitising your shop floor workforce

Table of contents

Introduction	4
1. Bring the consumer's reality into the realm of industry	5
2. Select the right challenges	6
3. Place your workforce at the centre	8
4. Weigh your options smartly	11
5. Let the voice of your workforce lead you through your transformation	17
6. Select the most promising operational area to start your journey	19
Thinking beyond the usual suspects	23
7. Connecting your workforce is the means to an end: unlocking the data	24
8. A small step for your workforce can be a big step in your digital transformation	26
Conclusion	28

Introduction

The Eight Commandments to digitising your shop floor workforce bundles insights, examples and lessons learned from PwC's experience in digital transformation in an operations and supply chain environment into eight practical 'commandments'. Operations, production, and supply chain leaders can apply this knowledge to digitising and connecting their workforce through wearable technologies.

COOs, operations managers and production leaders often struggle to successfully connect their workforce with processes, tools and support on the shop floor. This can be a result of lack of knowledge about the latest technologies or providers, failure to focus on the worker experience, or neglecting to incorporate the wearable implementation into the larger digital journey and vision.

While the first smartphones hit the shelves 28 years ago, many manufacturers are only now starting to realise the enormous benefits of connecting their workforce with smart technologies in an operational context. Connectivity has since moved far beyond the use of mobile phones alone, with the emergence of a host of new technologies like augmented reality (AR) and virtual reality (VR).

By interacting with a digital environment in a realistic way, quality compliance, production and logistic efficiency can be increased, as can the self-learning and training opportunities that enable the workforce to adapt to their changing environment.

Are your people ready
to adopt new technologies
and change their way
of working?

1

Bring the consumer's reality into the realm of industry



The enormous impact of mobile devices on our daily lives is undeniable. The number of mobile phone users is expected to surpass the five billion mark, over half of which are smartphone users. It doesn't stop there. The wearable device market is also flourishing, as the number of wearables worldwide is expected to increase from 325 million in 2016 to over 1.1 billion in 2022¹.

Though smart devices are mainly used by consumers, another opportunity for these technologies lies in operations, on the shop floor. Whereas consumers can track a pizza delivery from the oven to their front door,

some production managers still don't know when their next bulk shipment of raw materials will arrive. Our industries are changing at an ever increasing pace and technological developments are countless, but when it comes to the industrial environment, we prefer to stick to what we know: paper. Deskless workers, representing 2.7 billion people worldwide², don't use any technology in their daily activities.

¹ <https://www.statista.com/statistics/487291/global-connected-wearable-devices/>

² <https://venturebeat.com/2018/09/08/the-deskless-workforce-a-massive-opportunity-for-entrepreneurs/>



2

Select the right challenges

Your workforce is facing new challenges, from increased machinery and product complexity to changing safety regulations and circumstances. It's crucial to consider these challenges and select the most important ones to address or overcome during your digital transformation.

Industrial leaders indicate the lack of digital talent, digital culture and adequate training as the main challenges companies are currently facing.³

As the need for digitally skilled people increases, so does the need for companies to invest in training programmes for digital concepts and capabilities, and in finding new ways to attract talent. Your 'workforce of the future' will work with state-of-the-art technology, so the required skill set will shift accordingly.

Creativity, adaptability, problem solving, leadership and innovation top the list⁴ of preferred skills for both blue- and white-collar jobs. Lifelong learning is crucial, but the workforce has proven to be ambitious: a recent study shows that 74% is ready to learn new skills or completely retrain in order to remain employable in the future.³

³ Industry 4.0: Hype or reality – PwC 2017

⁴ Workforce of the future – PwC 2018

Figure 1

Operational workers are confronted with numerous challenges



This shift towards a digital workforce doesn't happen overnight. Whether they're employed in production, logistics, maintenance, quality or warehousing, operational workers are confronted with numerous challenges, some of which are shown in figure (1). It's crucial to define focus areas and key challenges that will serve as starting points for this transformation. When it

comes to adapting the way people work, change and cultural factors are crucial considerations for success. Only when these are addressed can the first use cases occur with enthusiasm, momentum and engagement, and promote eagerness among your workforce for the next stages of your digital journey.

3

Place your workforce at the centre

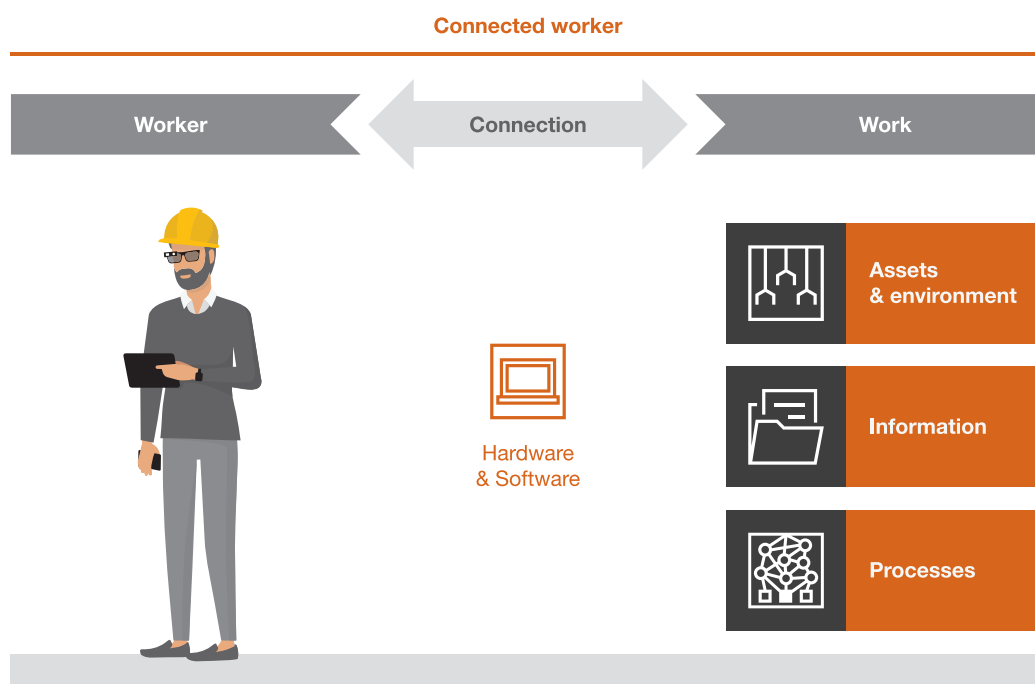


According to a recent PwC Industry 4.0 study, industrial leaders see the biggest potential for digitisation on the shop floor. Companies need to think about how they can connect their workers with the equipment, information and processes they handle on a daily basis: there are various wearable devices and software options available on the market that can help do just that.

For example, if you give an operator a wearable with applications that contain digital and dynamic versions of their work instructions, they'd have access to all relevant processes and thus be able to complete the task at hand faster and more effectively. However, this connection is not limited to processes, as illustrated in figure (2).

There's a growing number of resources available that enable companies to connect their workforce with the assets and environment in which they operate. These provide workers with internal information from internal sources such as asset, ERP, and other data, as well as external sources. The increasing generation of data, and therefore information, by new assets and technologies will only further increase the opportunity and urgency to connect your workforce with these sources of information.

Figure 2 Types of connectivity



We've established three predominant levels of connectivity, as illustrated in figure 3.

First, connecting your workforce by location alone already presents many opportunities for safety and quality assurance. For example, the location information of an operator can allow or prohibit them to access specific areas or execute certain tasks. In case of a hazardous situation or emergency in an industrial environment, all internal employees and contractors can be traced and evacuated.

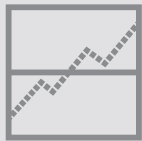
Including additional static information in the connection, such as real-time performance data, manuals and routes, supports the workforce in its tasks and assures better compliance with safety, quality and operational procedures. For example, providing the operator with a machine's oil temperature may help them make a better and faster decision on specific preventive maintenance needs.

When the static information is extended to dynamic information and interaction, the operator is supported in an even more elaborate way. For example, they can be steered to execute certain tasks based on data input, measurements and circumstantial information, similar to a dynamic decision tree. Another example would be remote engineering support via communication by data exchange, call, or video.

Connecting your workforce with these various sources and utilising one or more connectivity levels across different applications can have a significant impact on your company's overall performance. Industry leaders like GE⁵, Boeing⁶ and AGCO⁷ report breakthrough performance improvements with, for example, digital instructions and inspections leveraging mobile and wearable technology:



reduction in inspection time, with elimination of paperwork and manual uploads



improvement in productivity



reduced waste



learning curve reduction for new hires

Figure 3 Three levels of connectivity

Connectivity levels

	1. Locate	The connection is purely based on the location of the employee to perform access control, security checks, tracking etc.
	2. Inform	Static real-time information like performance data, manuals, routes etc. can be consulted by the worker during the job
	3. Interact	Dynamic information depending on the worker's situation and environment provides tailored support (e.g. remote support)

5 https://www.ge.com/digital/sites/default/files/download_assets/datasheet_ge-workflow-ds-gfa1950e.V1.pdf

6 <https://www.boeing.com/features/2018/01/augmented-reality-01-18.page>

7 <https://news.agcocorp.com/topics/agco-innovations-in-manufacturing-with-glass>



4

Weigh your options

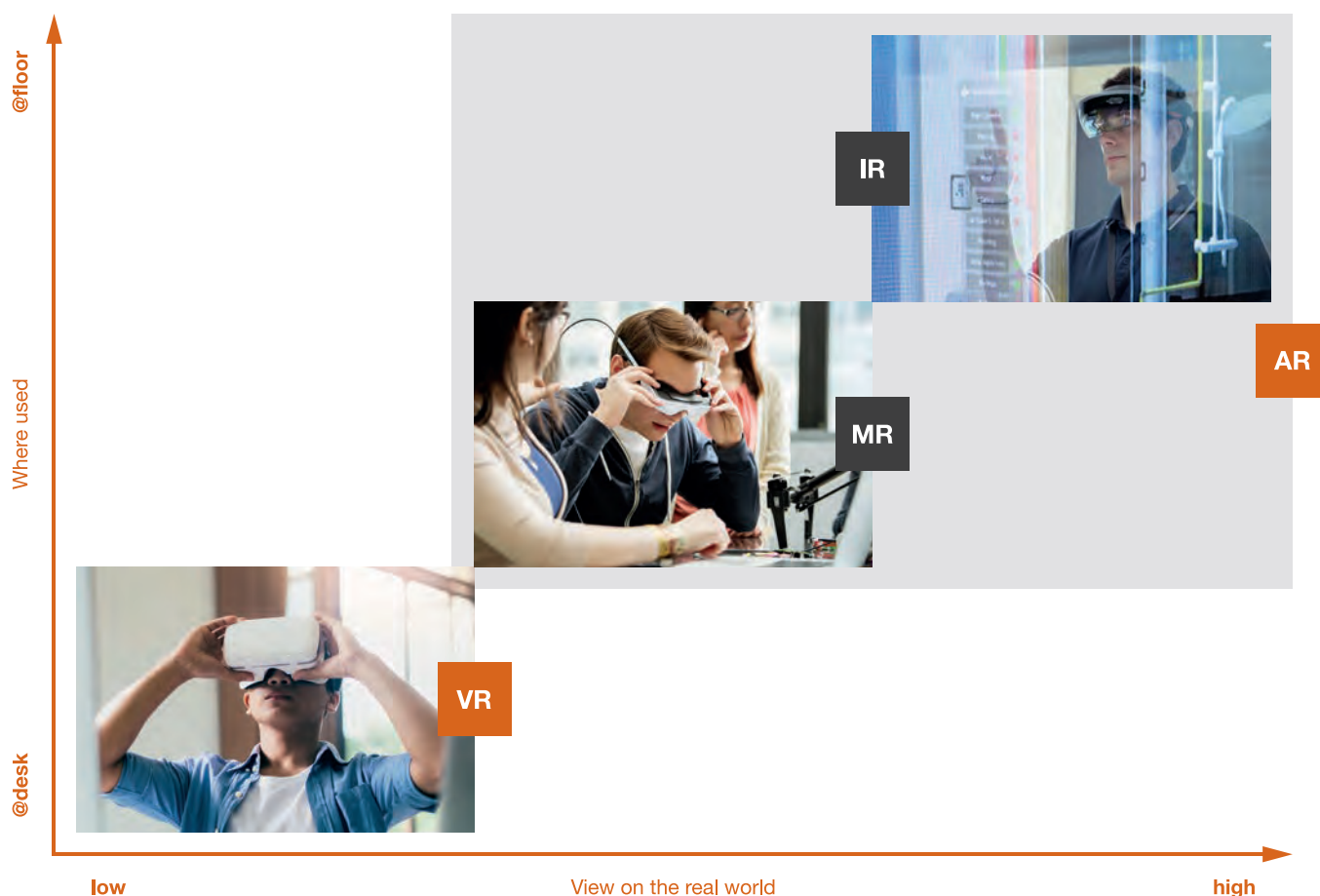
smartly

There are many possibilities using AR and VR, depending on the degree of reality augmentation you require and the mobility of the workforce. Do you want to project information on top of human vision, or create a virtual world? Is your workforce mobile on the floor, or in a fixed location such as at a desk or in a training room? You need to consider the specific environment and application when choosing the optimal type of reality and associated hardware.

AR and VR are currently hot topics in digital operations. To illustrate the two technologies, we use a graphic representation with two axes: reality and mobility, as shown below in figure (4). Specifically, four levels of augmentation can be distinguished on the wide spectrum between regular and virtual reality:

Figure 4

On the wide spectrum between regular and virtual reality, four levels of augmentation can be distinguished



Source: Proceedix

1

Clear or regular reality: this is what we perceive without any digital support. We see the world as it is, with our own eyes.

2

Augmented reality (AR) can be split into two levels:

a. Informed reality (IR) adds some information to the user's field of view. Like the rearview mirror in your car, the information is readily available when you need it, but it also allows you to focus on the reality in front of you.

b. Mixed reality (MR) overlays reality with additional information. This layer is often added to your complete field of view. You can't 'look away' from the added information.



Smartwatch giving directions



3D interior design apps, for example IKEA



Notifications on your tablet



Pokémon GO

3

Virtual reality (VR): this level fully submerges you in a completely virtual world. A classic example is a VR roller coaster, where people fall off their chairs when the roller coaster suddenly takes a sharp corner.

The application, environment and company maturity should be carefully considered to select the right type of reality, also having a direct impact on the hardware and software requirements.



Woman experiencing VR

Smart eyewear: a (surprisingly) mature technology









By connecting your workforce, you can empower, interact with and support your people to make better decisions and increase efficiency. Like selecting the right software for the application(s) in mind, you have to think ahead and choose the right technology and provider for your company's specific activities and requirements. There's a wide variety of smart technology available on today's market, like phones, tablets and smart watches. Smart glasses are increasingly available, and bring their own extra features and advantages.

When it comes to efficiency, which is the main driver for adopting wearable technologies according to half of respondents in PwC's study [The Wearable Life 2.0](#)⁸, phones, tablets and smart watches have a common drawback: they're not entirely hands-free. To operate them, you need to have at least one hand free. Smart glasses, on the other hand, offer exactly that: they have comparable functionalities to smartphones or tablets,

while providing totally hands-free functionality. Using a hand-held device like a tablet will inevitably decrease productivity by creating downtime, because workers need to stop their activity to consult the device in their hands. A comparison of wearable devices can be found below in figure (5).

What started with the consumer-oriented Google Glass has, like other wearables for consumers, become a new industrial market offering with a unique potential. This is why smart glasses are considered the next big thing in industrial environments. Although the technology's already considered mature, the real breakthrough is yet to come. The first smart glasses were designed for consumers, but didn't enjoy the success that Google had hoped, largely due to battery life issues and other physical restrictions. Now, Google has acknowledged the potential for the technology in the industry by launching a smart glass 'enterprise edition'⁹. In the meantime, other companies have also released their versions of industrial smart glasses.

Figure 5 Comparison of wearable devices across the three connectivity levels

		 Smart clothes (shoes, jackets etc.)	 Fitness band	 Smart watch	 Smartphone or tablet	 Smart eyewear
 1. Locate	Track and trace	X	X	X	X	X
	Internet browser access			X	X	X
 2. Inform	Video and image streaming		X	X	X	X
	Notifications and alerts	X	X	X	X	X
	3D visualisation					X
	QR and barcode scanning				X	X
 3. Interact	Text input			With voice	X	With voice
	Voice control		X	X	X	X
	Video and image capture				X	X
	Hands-free work	X				X

⁸ The Wearable Life 2.0 – Connected living in a wearable world (PwC Study 2016)

⁹ <https://www.google.com/glass/start/>




In the world of smart glasses, different types exist, each with their own characteristics, pros, cons and relevant applications, as presented in the table below. In comparison with software, smart glasses selection is rather straightforward, given your company's activities and corresponding requirements.

Table 1

Comparison of three types of smart glasses

FOV: Field of View

Source: Proceedix

	Informed Reality	Mixed Reality	Virtual Reality
		 *	 **
Technical & functional specifications			
Battery life	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●
Weight	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●
Comfort	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●
Computing power	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●
Immersion	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●
Price	< €2,000	€2,000 – €4,000	< €1,000
Pros & cons			
Pros	Information snacking is 20% of complexity and power & 80% of today's use cases	Complete FOV overlay with an information layer, no longer requiring the effort of the user to 'look away' to obtain the information	Complete immersion – there are no limitations to what can be seen and experienced
Cons	The user needs to 'look away' to see the added information layer	Risk of running into objects, because attention is moved towards the added information layer	Limited mobility – no connection anymore with reality
Relevant applications			
Remote support	Camera, audio & screen to provide information ++	Less relevant, higher level of immersion +	Not relevant, fully immersed in virtual world ×
Information snacking	Screen in corner of FOV ++	Constant projection layer, more info pushing +	Not relevant, fully immersed in virtual world ×
Information with depth view (e.g. assembly)	Screen in corner of FOV +	Complex on-the-job visualisation possible ++	Not relevant, fully immersed in virtual world ×
Training	Screen in corner of FOV +	Complex on-the-job visualisation is possible ++	Classroom training in virtual world ++
Design & development	Screen in corner of FOV ×	Combination of reality and virtual models is possible +	Virtual models can identify problems before actual development ++
Hardware providers			
Vendors (examples)	Realwear, Iristick, Google Glass, Vuzix	Microsoft – HoloLens, Magic Leap 1	Oculus, Zeiss, HTC Vive

*) Microsoft HoloLens
Source: www.windowcentral.com

**) HTC Vive
Source: www.wearablesmagazine.nl

Legend:



Not relevant



Moderate impact



Strength



Signify use case

High-intensity discharge (HID) lamps have been around for more than 100 years, used both commercially and in homes. While largely replaced by more modern light-emitting sources in private properties, they're still widely employed in commercial spaces by owners looking to reduce operational expenses and optimise their investment in infrastructure.

With HID lamps its main product, Signify in Turnhout has unsurprisingly seen its business shrink over the last few years. Despite this, it continues to invest.

To help Signify achieve its ambitions, it's working with five other parties (namely Iristick, Luxexcel, OMC, Proceedix and PwC) to explore what Industry 4.0 could mean for the plant. In particular, the use of smart glasses for inspections on the shop floor, making the process voice-activated and entirely handsfree. The results of the project could have far-reaching implications not just for Signify, but for manufacturing firms around the world.

You can read more about the case here:



<https://www.pwc.be/en/news-publications/client-case-studies/innovating-with-industry-4-0-for-signify.html>



5

Let the voice of your workforce lead you through your transformation

To guide your workers through the digital transformation process successfully, it's important to involve them from the very beginning. First, you need to learn how your workers operate within their environment before you consider a new and better solution. This approach enables you not only to define a connected worker strategy and choose the right innovative technologies, but also to imagine the future of your connected workers.

Getting out into the field to talk with and observe your operators performing real tasks on the work floor is the most powerful and valuable way to define the challenges and pain points that need to be addressed. It's amazing what you can learn by spending time on the floor. Field research and user observations enable you to understand the possibilities, but also the limitations of implementing certain technologies and helping you decide which digital solutions will fit into and actually add value to a specific working environment. That way, you'll be able to define in detail which technologies are best suited to your people's specific needs, improve the quality and efficiency of their work and the ease with which they perform their daily tasks.

To illustrate how to successfully implement a connected worker strategy, take the PwC real case of a large global firm specialised in agricultural products and environmental protection agents. The firm wanted to

establish itself as a global leader in digital operations in production, and asked us to help with its digital transformation. To kick off the process, we began by digitising crucial steps in the maintenance process.

A new connected reality

Implementing a connected worker strategy is a powerful component in a digital transformation process. By easily connecting your workers to their colleagues and giving them the correct information at the right time in the easiest possible way, you can make operational processes more efficient and productive than ever. Only by systematically involving your workers throughout the whole transformation process is it possible to implement real and valuable solutions on the work floor. Solutions that are easily accepted by your workers will ultimately become the new and natural ways of working.

Step 1: Challenge the experience

As a first step, we went on site to observe the field technicians in their working environment. We combined these observations with interviews with different stakeholders in the entire process, from technician to plant manager to director.

On the basis of our field research and the input from interviews, we were able to conclude that the communication between planners and maintenance workers, including the large amount of paperwork and permits, was the biggest issue in the overall maintenance process. In order to address this issue, we implemented a connected worker strategy to connect the maintenance workers back to their colleagues and the information they need.

Step 3: Enact the experience

Based on a validated prototype development started, but even then technicians were involved and invited for user tests every week, so that we could continue to improve the solution. Involving workers in the process, giving them time to wrap up to the idea of change in their work and time to voice their concerns got them ready for the real implementation of the new digital maintenance application, which largely affects the maintenance workers' daily lives, how they do their job, and even their mindset while being at work.

Step 5: Embrace the experience

A successful digital transformation hinges on an organization's ability to embrace change. When change is being embedded and instantiated successfully in the organisation, people will start wondering how they managed before and will become real promoters of the new connected way of working. But even then, there is always room for further enhancement. That is why it is important to collect valuable insights and measure the usage metrics.

Fed by real data from the field and supported by information and decision-making processes that elevate and resolve issues, you can then make the adjustments necessary to maintain momentum and drive results. The important thing here is to create a process for continuous improvement by gathering data and input from workers, stakeholders and leaders, analysing these data and learn from it, make adjustments where needed and repeat.

Step 2: Reimagine the experience

During a Design Thinking Week, a five-day step-by-step ideation and co-creation process, we brought together different people across the firm to ideate and brainstorm on a concrete solution. Leveraging on technology the maintenance workers already know and use, we designed a prototype of a digital maintenance application that links the technician with the needed information to resolve pressing issues and that collects feedback from the worker for future enhancements.

Prototyping a solution, be it a single feature change or an entire new enterprise system, is an effective way to validate (or dismiss) a solution. Prototypes are low-risk, low-cost, low-energy, and have an impressively high impact. Involving the users in testing and commenting on prototypes has the added bonus of improving the chances of adoption on release.

Step 4: Activate the experience

Once the solution is developed, it's ready to be launched and used in the field. Because of the fact that your workers have been involved in the process from the beginning, the change process will go a lot easier.

As a result, you will have more time to train and support your operators in the new connected way of working. A well-focused training program teaches about the direct and indirect changes of the new way of working and leads to a mastery of relevant skills, which will ultimately reduce frustrations and drive adoption. Consequently, your workers will embrace the implementation of the new digital features more easily into their daily work routine. And once you have launched the application successfully in one plant, you are ready to ramp up and bring it to other sites.



6

Select the most promising
operational area

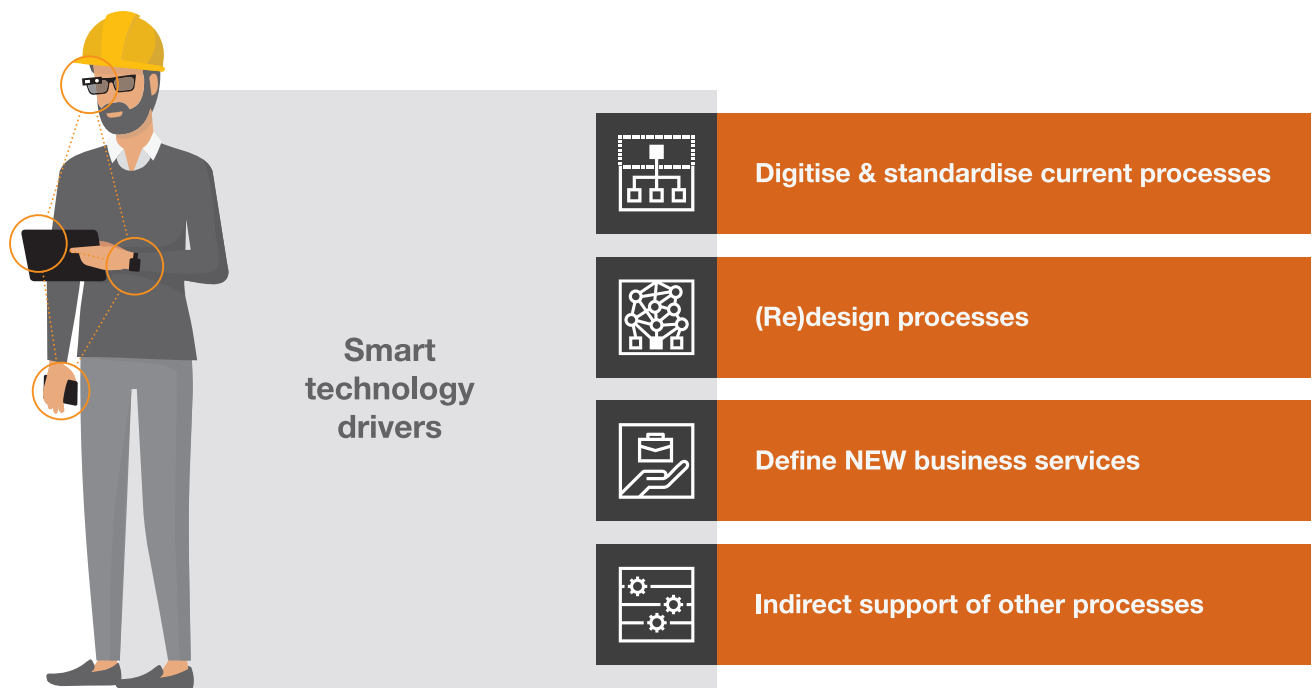
to start your journey

Connecting your workers with the use of smart wearables offers a wide range of opportunities. However, more often than not, it also requires specific software and customisation for both workers and your organisation. Therefore, it's important to assess the impact of the changes on the area of operations you're considering, and ensure the correct funneling and selection procedures are in place.

Areas of operation can be categorised as one of the following four functionalities, which can serve as starting point for the brainstorming phase:

Figure 6

Four functionalities to categorize different connected worker applications



1. Digitise and standardise current processes

An efficiency increase in current processes can be established through digitisation. **Shift handover**, where operators have to fill in lengthy documents during or after their shifts, is a good example. This task is often done quickly and inaccurately because it's not perceived as adding much value. This can lead to having to redo the task and other inefficiencies. In this case, digitisation can certainly help save time: by logging information and KPIs digitally on a wearable device during the shift, double work is avoided since people no longer have to fill in documents at the end of their shifts.

2. (Re)design processes

Similarly, we can increase the effectiveness of industrial processes by redefining them. Training is a good example of this. Currently, training sessions are often quite theoretical and classroom- and/or paper-based. **Training** is largely generic, yet the specific training needs of individuals can differ greatly. AR and VR technologies offer a wide range of tailored training possibilities. While AR enables more on-the-job training and guidance, VR is mostly classroom-based, where trainees are fully immersed in a virtual training world. Offering employees a digital environment designed to train them in potential job processes and challenges before encountering them in the real world can save businesses a significant amount of time and money, certainly in environments with high turnover or with a great deal of non-recurring tasks.

3. Define new business services

As technology finds its way into the current way of working and becomes part of the standard operating equipment, new business possibilities arise. With smart glasses, for example, users can call, read and browse hands-free, and are able to view exactly what an individual in another location sees. This technology will very likely disrupt support services. The possibilities offered by smart glasses will enable **remote support** to guide operators through support actions, rather than going onsite themselves. The impact on the service business can be groundbreaking, as the number of physical interventions from support experts can be dramatically reduced. Service centers could be centralised, while being able to tackle issues across the globe and save valuable time.

4. Indirect support of other processes

In this last driver, we identify opportunities which weren't specific goals from the start, but become a possibility through the implementation of the other drivers. The abundance of data being captured is a crucial enabler

for these kinds of drivers. We can, for example, think of online database consulting or **improved safety measures**. When operators and assets located throughout the shop floor can be tracked, collisions can be avoided and escape routes can be indicated and adapted to the location of the user.

The software landscape is so vast that it's difficult to compare across products due to the extremely high level of potential customisation. To enable all four of the functionalities above, companies need to think strategically about partnership choices and consider the following software aspects:

- Enterprise-wide system vs. local information sharing
- Multiple vs. specific functionality
- Customised vs. off-the-shelf
- Make vs. buy

It's important to have a clear idea of the requirements and objectives of your application, as various functionalities will have to be covered by your organisation's capabilities, software specifications and hardware devices.





Thinking beyond the usual suspects

Companies often consider ‘connected worker’ initiatives to apply to a specific operations area. However, it’s strongly advised to consider the full range of operations and beyond. The scope shouldn’t be limited to manufacturing and maintenance, but should also include logistics: consider smart wearables for digitising procedures and switching to smart paperless warehouses.

By connecting order pickers, team leads and others can monitor real-time performance, enabling them to proactively deal with potential problems or bottlenecks in day-to-day warehouse operations. It enables them to gather a great deal of data on daily activities, and in turn use that data to gain insights that can be applied to further robotics and automation initiatives.

Picking remains a heavy paper-based process where operators use printed pick lists and pick the products as they’re ordered on the page, without dynamically optimising routes and minimising walking distance. A first step in digitising this process is to install scanners, although this still requires the picker to drop the scanner and pick list for heavy items. Therefore, the use of smart glasses within picking has recently increased, given its hands-free functionalities. Smart glasses enable companies to avoid the waste of extra handling, and can dynamically optimise the route and/or order of picking. Furthermore, the visual inspection and laser of smart glasses can guide the picker to an exact location and make sure the correct item is picked, resulting in improved quality. Smart devices in picking thus increase speed, efficiency and quality. This has

a big impact on customer service and satisfaction, as delivery errors and downtime on downstream activities such as assembly are reduced.

Gathering activity data not only helps identify waste and improve warehouse routes, layout, and task interleaving, it can also help improve the picker’s safety by predicting and avoiding collisions between pickers and/or forklift drivers, for example. Note that to create and/or improve a safe environment in the long term, the ergonomics of certain smart glasses and other smart devices should always be carefully investigated. In this respect, smart glasses have improved tremendously in recent years by enabling a custom-adjusted viewing angle of the projection screen (for example).

In summary, equipping your warehouse operators with smart devices results in increased speed, efficiency, and quality of activities. Tracking devices such as smart watches enable us to communicate in a hands-free way, and track and optimise picking locations and routes. Adding a camera functionality through the use of phones, tablets or smart glasses improves efficiency and quality to an even greater extent, but also requires a higher investment in terms of cost and change management.



7

Connecting your workforce
is the means to an end:

unlocking the data

Smart devices need a lot of data input and connections, but at the same time they're tremendous generators of data. You should therefore consider your smart devices as important elements in the transition to a smart factory, where the data will be used for widespread analyses. You need to consider which data is available or required for other smart factory opportunities, and how this data can be used or generated going forward.

Smart devices aren't standalone solutions and should be integrated into the broader digital spectrum. The more tools, sensors, and technologies can interact and exchange data, the higher the efficiency gains and therefore return on investment. As with many technologies, data analytics is both an enabler as well as an incentive for achieving the full potential of smart devices.

Receiving input and data as enablers

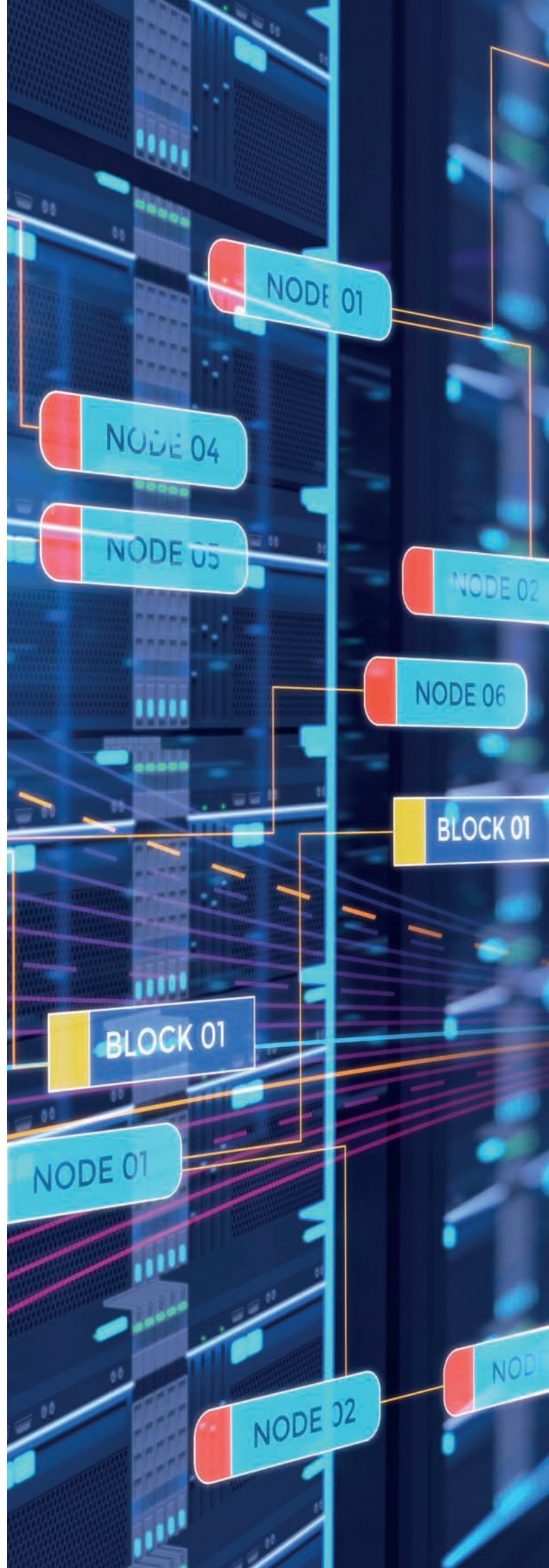
With the increasing availability of data from all types of sources, analytics platforms and dashboards are increasingly widespread and applied in domains such as commercial excellence, operations, logistics, energy and procurement. With smart glasses, the end user has hands-free access to these dashboards and their data insights.

The smart device user can also receive tasks to be completed, triggered by analytics platforms or enterprise systems. For example, **PwC's Factory Intelligence platform** combines different data sets captured by sensors to visualise performance and predict failures. Whenever a failure's predicted, a maintenance task is triggered and can be communicated, accompanied by a digital procedure, to the operator's smart device.

Generating data as an incentive

With the increasing use of analytics comes the need to connect and integrate as many data sources as possible. By using wearables as instruments during the execution of procedures, data registrations are not only stored digitally, but can also be fed into data analytics platforms. For example, equipment parameters such as oil temperature and pressure can be included in a broader analytics platform that helps predict maintenance needs.

Next to the capture of mainly numerical and text data by 'conventional' wearables, smart glasses increase the registration of image and video material. These data types will become increasingly valuable, given the development of machine learning technologies in the image recognition area and the increase in processing power on the smallest of devices.





8

A small step for your workforce

can be a big step

in your digital transformation

Smart devices can be used for a wide range of applications. However, they shouldn't be introduced as an isolated implementation, but launched as part of a bigger digital journey with the right vision, scope, communication and ecosystem of partners, suppliers, and customers. Often, industrial companies are overloaded with buzzwords and questions, and struggle to set up an effective and strategic digital transformation and ecosystem. PwC can help with your digital journey, using our proven 6-step approach:



Figure 7

PwC's 6-step approach to a successful digital journey

Envision

Traditionally, companies tend to think and work in silos, resulting in partial understanding and sub-utilisation of opportunities. Therefore, a **Business – eXperience – Technology** (BXT) approach can be highly beneficial, where Business and Technology viewpoints are combined with a hands-on eXperience perspective during short co-creation sessions. Cross-functional teams and stakeholders define business challenges while gaining technology insights, resulting in the identification of new opportunities through ideation and a clear view on the company's current digital maturity. With this input, management can create a holistic view on how digitisation can create value within the overall company vision, and establish clear targets and a digital roadmap for the short and long term. This holistic perspective should serve as a framework to structure tangible digitisation initiatives that tackle business needs.

Once the vision is established, leadership has a crucial role in enabling the workforce to live this digital transformation, shaping it by experimenting with digital tools and adapting to new ways of working. It's highly recommended to have a clear communication plan, a selection of digital pilot projects and digital leads and ambassadors at all levels across the organisation.

Act

As with every change and transformation, picking low-hanging fruit and showing tangible results and impact are key success factors. Therefore, it's important to start with small pilots and scale quickly in terms of digital applications. The connected worker is a pilot case that can be implemented at relatively low cost and effort. Tackle a specific improvement opportunity, such as increasing efficiency and quality compliance, by digitising a standard operating procedure. A recent PwC study on the perspective of start-ups and scale-ups in Belgium indicated that the majority of proof of concepts lasts for one to three months, costs between 10 and 30 thousand euros, and can have an enormous impact on digital transformation.¹⁰

After defining an overall digital vision and building a portfolio of value-based pilot cases, companies should prioritise time and resources for further rollout of implementation projects and add these to the digital roadmap with a clear timeline. Several aspects such as business case, strategy fit, technology readiness and availability, cultural change impact, IT/OT and resource and budget requirements should be considered during prioritisation. Notice that an agile mindset is recommended for the process of selecting pilots and adapting the strategy.

Sustain

Prior PwC studies revealed a lack of digital talent, culture and training as the most prominent concerns of industrial companies. Given people's central role in digital transformation, it's therefore recommended to map both current and required capabilities and define a strategy to address the gap. More importantly, a transformation isn't to be considered a one-time investment, but to create a culture where continuous learning, acquiring new skills, and applying creativity and innovation are encouraged. Enabling the connected workforce also clearly implies a new way of working and change in skill set for the operators. Therefore, mapping the capabilities upfront and preparing the required training, support and tools are key for a successful implementation and buy-in from the workforce.

It's a big challenge for many industrial companies to stay up-to-date on the technology landscape. At the same time, technology partners are constantly looking for validation and finetuning based on operator feedback during implementation. Therefore, it's in both parties' interests to create an ecosystem where knowledge is shared within a trusted relationship. This will allow companies to select the right technology in an efficient way, thereby boosting the business case and gaining traction from the workforce. Next to partnering with technology and software providers, it's also very important (and often underestimated) to partner with your traditional material suppliers and customers on developing and implementing digital initiatives to boost efficiency. Companies should therefore continuously invest in sustaining and growing their ecosystem, keeping it aligned with their overall digital strategy.²

¹⁰ Industry4.0: The perspective of start-ups and scale-ups in Belgium – PwC 2018

Conclusion

Your operators are facing numerous challenges, ranging from tightening safety regulations and aging equipment to increased product complexity. This requires continuously evolving knowledge and skills from their side, and therefore support is needed.

Support can be provided by connecting the workforce with their daily processes via manuals, digital procedures or human assistance by the 'You see what I see' principle. We distinguish three levels of connectivity ranging from the exchange of location, static real-time and dynamic information further used in decision trees and processes.

Diving deeper into visual assistance, we've distinguished different realities based on the proportion of reality augmentation and the mobility of the workforce. Certain objects or images (mixed reality) or information (informed reality) can be incorporated into the user's view. A totally virtual world for training and design purposes can also be created.

The main – yet often overlooked – differentiator for a successful implementation is the consideration and assessment of the workers' experience. It's therefore crucial to start on the shop floor and engage your workforce throughout the entire selection and design of applications.

The opportunities for applying digital procedures and assistance for your workforce are countless. However, it's dangerous to immediately dive into the most obvious application without having a broad brainstorming exercise followed by an impact and effort assessment and funnelling process. It may help to consider the four functional categories as outlined above, and involve enough people to cover all operational domains.

As with the selection of the right software and application, all available technologies should be assessed on their characteristics and differentiators for the one or more applications in mind. Therefore, it's recommended to consult the comparison tables of both wearable devices and the specific types of smart glasses during the exploration and selection process.

Connecting your workforce with procedures, systems, and each other will require and generate a significant amount of useful data. Therefore, it's important to define and install the right data platforms and actively investigate machine learning opportunities to gain additional efficiencies.

Finally, the connected worker should not be seen as a standalone solution, but should fit and be incorporated into the larger digital vision and journey your company pursues. In recent years, PwC has demonstrated both internally and externally that the **Business, eXperience, Technology** (BXT) methodology as part of a six-step approach is an essential ingredient for an effective, successful transformation.

The **Eight Commandments to digitising your shop floor workforce** is based on learnings and challenges we've encountered while helping clients with a wide variety of technological explorations and implementations. We've shared insights into the opportunities available to help you build your connected workforce, and this serves as a blueprint to get you started off right on the path to your digital transformation. But the real journey starts by gaining a deep understanding of the worker experience – right there on your shop floor.



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