

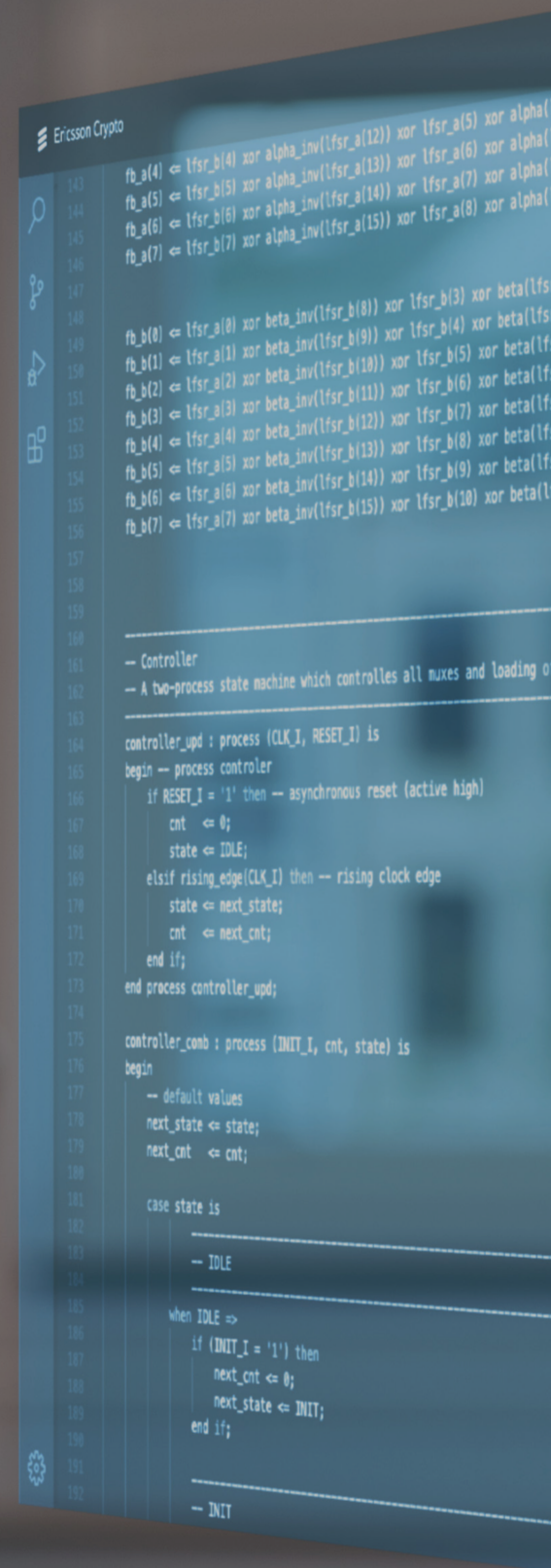
The dematerialized office

A vision of the internet of senses in the 2030 future workplace



October 2020

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This report explores the future workplace, where senses such as touch, taste and smell are part of digital communications.

Methodology

This report aims to extend our insight of the internet of senses, a vision originating with Ericsson Research, where not only sight and sound but also other sensorial experiences, such as touch, taste, smell and sensations of hot or cold, are part of digital communications.

In December 2019, Ericsson Consumer & IndustryLab published the 10 Hot Consumer Trends 2030: The Internet of Senses. We now follow up with a study focusing on enterprise use, also looking at what business professionals expect to happen by the year 2030.

The quantitative results in the report are based on a July 2020 online survey of 7,842 white collar workers in Australia, Brazil, China, Mexico, India, Japan, KSA, Russia, South Africa, South Korea, Qatar, Sweden, Turkey, UAE, the UK and the US. The sample consists of at least 500 respondents (250 managers and 250 non-managers) per country (except Qatar with 263 respondents), aged 18–69. They are either regular users of augmented reality (AR), virtual reality (VR) or virtual assistants, or plan to use these technologies in the future.

Correspondingly, they represent only around 133 million of the roughly 300 million white collar workers living in the countries surveyed. However, we believe their early adopter profile makes them important when exploring the changing nature of office work 10 years into the future.

For comparison, a matched subsample from the 10 Hot Consumer Trends 2030: The Internet of Senses study, consisting of 2,999 white collar employees surveyed in October 2019, has also been used.

About Consumer & IndustryLab

Ericsson Consumer & IndustryLab delivers world-class research and insights for innovation and sustainable business development. We explore the future of consumers, industries and sustainable society in regard to connectivity, by using scientific methods to provide unique insights on markets, industries and consumer trends.

Our knowledge is gained in global consumer and industry research programs, including collaborations with renowned industry organizations and world-leading universities. Our research programs cover interviews with over 100,000 individuals each year, in more than 40 countries, statistically representing the views of 1.1 billion people.

All reports can be found at:
www.ericsson.com/industrylib

Working in a dematerialized office

Imagine a virtual workplace that automatically changes depending on what you need to do. It might give you a big display when you are retouching a video, or a haptic keyboard and thesaurus for writing a report.

Imagine that by 2030 it has become commonplace to have a lifestyle involving working and socializing totally in virtual realms without ever physically leaving home.

As recently as last year, this seemed like a far-fetched futuristic fantasy. But truth is stranger than fiction. In early 2020, the Covid-19 pandemic struck in full force and the idea of working and socializing from home was no longer a theoretical proposition. To the contrary, for many of the world's office workers, it was suddenly the new reality.

This 'new normal' involves long workdays in front of a laptop in video meetings with colleagues and business relations. The internet has become a working lifeline, and it has functioned surprisingly well; by and large, professional activity has continued and the job has been done. For many, the internet saved the day, and as a result, online activity has grown quite significantly on a global scale.

Yet, many realize that one thing is sorely missing – the technology to make up for the presence and immersion of the physical world. Spending your whole day in front of a flat screen with flat sound doesn't even come close to the real experience of a face-to-face business meeting. For a digital meeting to be as interactive as the real thing, communications technology would need to take a big leap forward.

And it would involve much more than better video meetings. It would have to enable the experience of collaborating in the same room with colleagues – which is a reason why interest in AR/VR technology has grown rapidly over the last six months. But even that would only be going half the way. During isolation people everywhere are rediscovering the importance of the smells and the flavors and the sheer physicality of the locations they normally frequent and do business in. In fact, the pandemic has created a tipping point for what white collar workers expect of the future digital office.

Realistic immersion means going beyond video and sound, beyond AR and VR; it also means digitally communicating touch, taste, smell and the feeling of heat or cold. At Ericsson Research, our vision is that a decade from now, advanced technology and 5G networks could enable such a full internet of senses.

Office work will not go back to the way it was before the pandemic. Instead, employees will spend more time working digitally and, for this reason, drive the need for future technologies on a scale and at a pace that was unimaginable only a year ago. Rather than just letting us pull up a virtual computer screen in thin air, the experience could become all-inclusive, covering coffee breaks, social experiences and a digital commute.

With increasing digitalization of both work and team building, and correspondingly more time spent working from home, the overall carbon footprint could potentially be reduced as well.

Go ahead, enter the dematerialized office!



"The pandemic has created a tipping point for what white collar workers expect of the future digital office."

There has been a dramatic rise in interest in AR/VR technology in the last six months, but how far could this go by 2030?

Key findings

>50%

01

The dematerialized office may be a reality by 2030. Not only do half of respondents want a digital workstation allowing full-sense presence at work from anywhere, but close to 6 in 10 also want full-sense virtual warehouses both for buying from suppliers and for selling to customers.

02

The pandemic has become a digital tipping point. Nearly 6 in 10 foresee a permanent increase in online meetings with customers, suppliers and colleagues – and need tools that better support remote interaction.

6 in 10

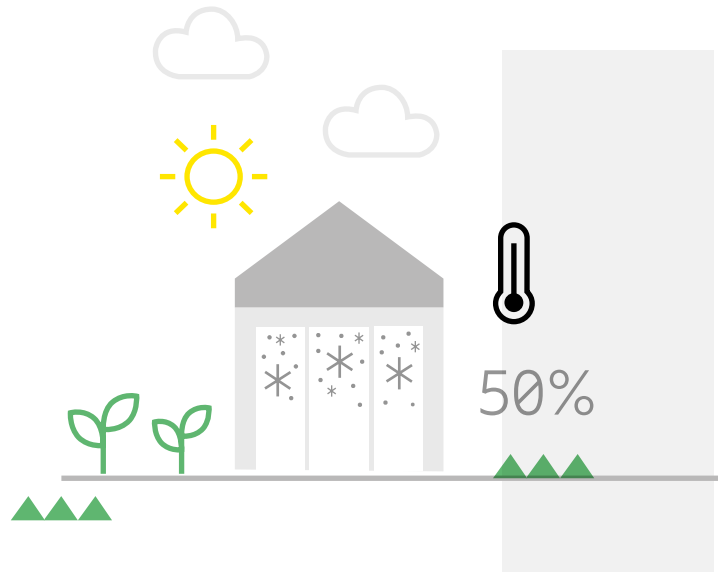
03

Dematerialization of the office will be driven by efficiency gains and sales, but the environment is also expected to benefit. As many as 77 percent indicate that an internet of senses for business use would make companies more sustainable.

77%

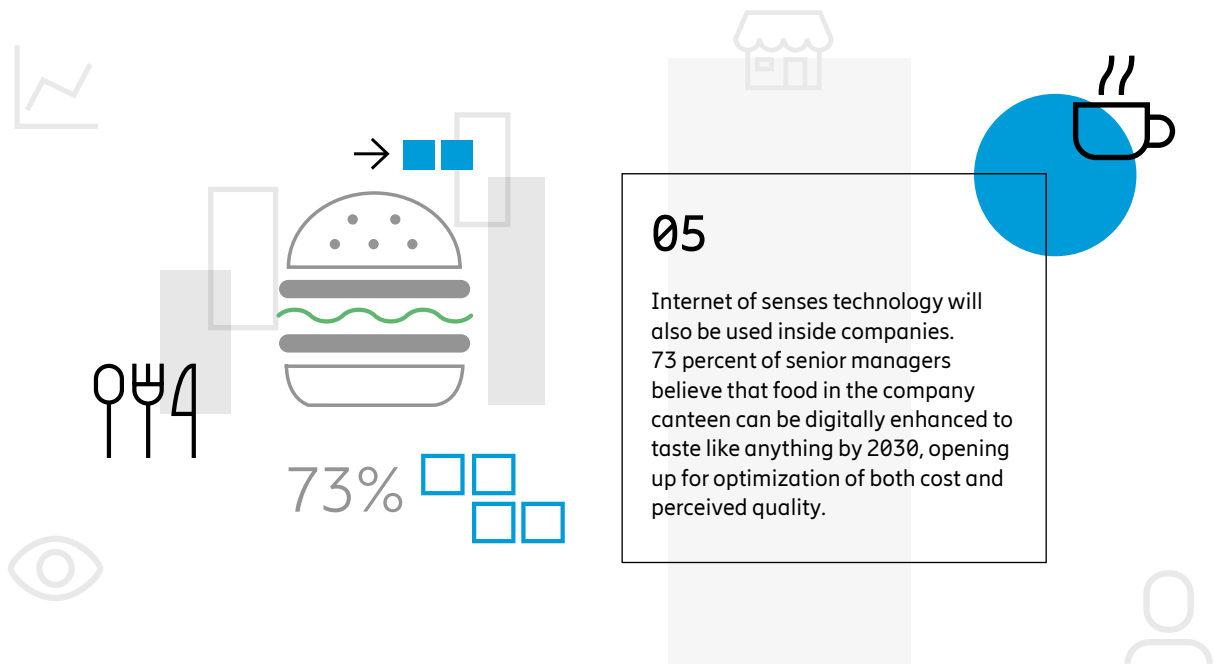
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The internet of senses will most likely be used for marketing and sales, with 59 percent saying that spatial video and 50 percent saying digital temperature will be used to more immersively engage customers by 2030.



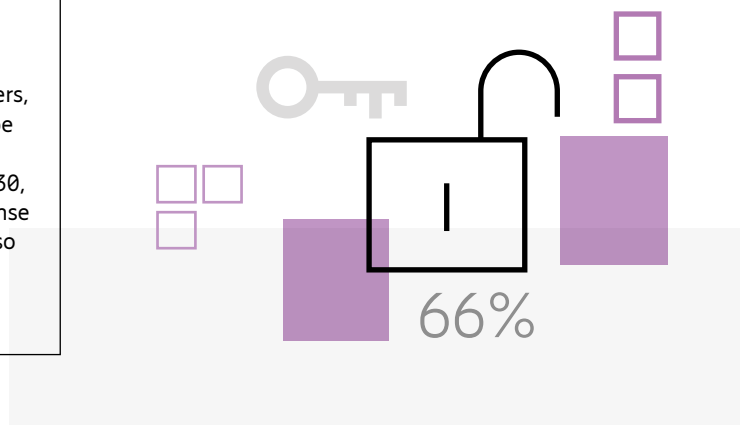
05

Internet of senses technology will also be used inside companies. 73 percent of senior managers believe that food in the company canteen can be digitally enhanced to taste like anything by 2030, opening up for optimization of both cost and perceived quality.



06

Security and privacy are key barriers, and privacy in particular is set to be a critical challenge going forward. While 66 percent think that by 2030, technology will enable them to sense when a colleague is upset, that also means their employer will know when they themselves are upset.



The internet of senses goes to work

Working digitally today means emails, digital reports, and connecting from home via online platforms. But a decade from now, digital work life is bound to be fundamentally different.

By 2030, your laptop may have been replaced by a digital workstation that allows for full virtual presence anywhere. That would mean that not only do your colleagues appear and sound totally real, but you could also use anything in the room, and everything would feel real to the touch and smell right. During a remote coffee break, someone might have brought a chocolate cake in that you could even smell and taste.

Interest in a fully immersive office experience, where all sensory experiences are completely digitally interactive, is primarily driven by those who already use AR/VR on at least a weekly basis. The fact that 58 percent of them are interested in a full-sense digital office is probably due to their current experiences, which give them an idea of what could be possible going forward.

Even so, although it is quite below the average interest level of 52 percent, as many as 40 percent of those who neither use AR/VR today nor plan to use it in the future, are already interested in such a virtual office environment. While the current generation of AR/VR is perceived by many as not being attractive, this might change once the technology has matured and is more convenient to use.

Extra pay if you stay – at home

The full-sense digital home office will also get a boost, if and when companies direct the funds that currently go into maintaining physical offices towards improving employees' home office setups. And here we see less of a difference between users and non-users of AR/VR: 62 percent of weekly AR/VR users want to have a work agreement where they never go to the office, and instead receive a tax-free home office reimbursement of up to USD 1,000/month, compared to as many as 57 percent of those who are currently rejecting AR/VR technology.



A fully immersive digital experience might involve all of the senses.

Virtual interaction with clients and colleagues

While having a digital office may be a basic requirement a decade from now, work is about so much more. Specifically, it involves interactions with suppliers, customers, and not least with other colleagues.

Full-sense sales environments

Providing immersive full-sense sales environments that allow for completely natural-feeling interaction with prospective buyers will be crucial. Your company's products could be sold in a virtual shopping mall where customers handle them as if they were real. This includes feeling surface textures and smelling items, which interested 61 percent of current AR/VR users. In this scenario, edible products could even be tasted digitally, which might explain the high average interest level of 56 percent.

Virtual supplies

Sourcing supplies is equally interesting to 61 percent of AR/VR users, with the total respondent base trailing behind just slightly at 57 percent interested. In this case, your company's suppliers would display their offerings in a virtual warehouse, and you could interactively try out all functions digitally, as well as judge quality of materials, sense the weight and feel surface textures.

Dematerialized team building

Team building with colleagues might be even more important if you do not meet physically anymore. Hence, 55 percent of AR/VR users and 49 percent of all respondents would, for example, like to go with their colleagues on a digital team-building trip to the ancient Roman city of Pompeii, walk its streets, taste ancient street food and experience a traditional bath. Imagine that Vesuvius suddenly erupted, the plumes of volcanic ash showering the city and the scorching heat as the city becomes engulfed in lava. It would certainly be something to talk about around the virtual water cooler later.

And although only 30 percent of those who do not plan to use AR/VR are interested in playing immersive virtual football during work breaks, those who are into AR/VR are much more positive, driving up the interest to 48 percent of all respondents.

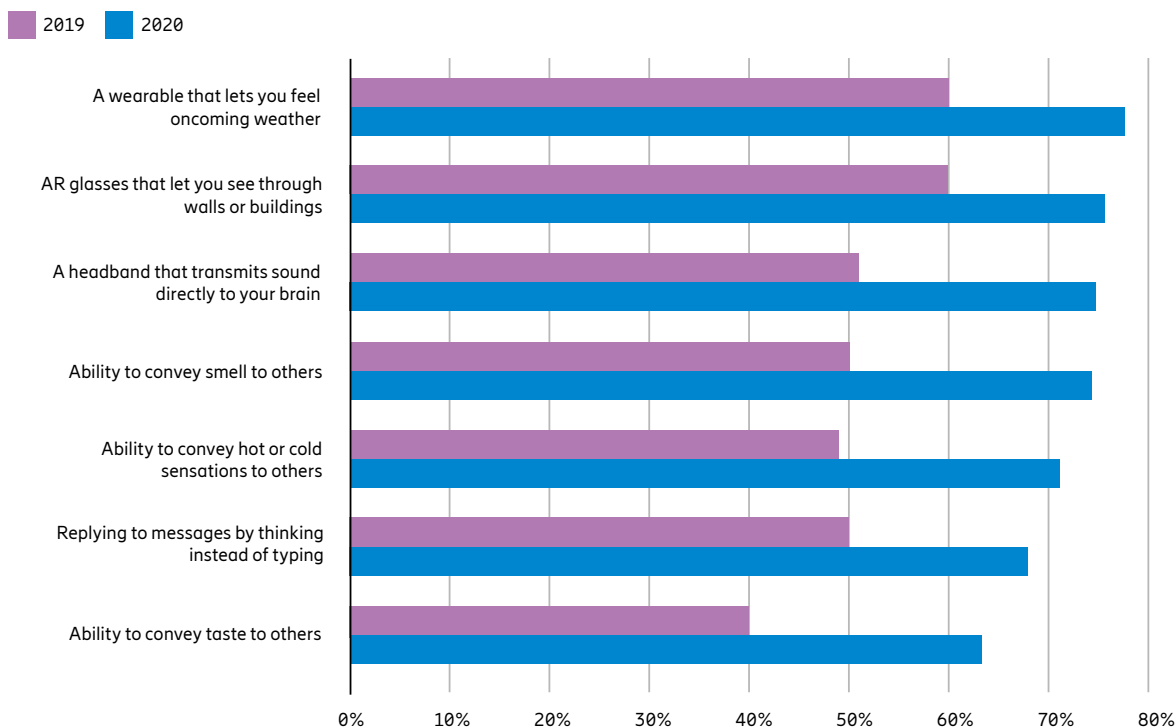


You might physically sense a remote colleague, and whisper in their ear while others are talking.

The pandemic has become a digital tipping point

The priorities and needs of employees have shifted since the global outbreak of Covid-19, leading to a higher interest in engaging with all senses online.

Fast-forward to the internet of senses: a jump in what respondents think is likely to be available by 2030



Base 2020: 5511 white collar workers in Australia, Brazil, China, Mexico, India, Japan, Russia, South Africa, Sweden, UK, US

Base 2019: 2999 white collar workers in major cities in Australia, Brazil, China, Mexico, India, Japan, Russia, South Africa, Sweden, UK, US

Not only is the interest significantly higher for the already mentioned full-sense digital workstation and digital shopping mall, but as many as 54 percent want the ability to turn their office or cubicle into a virtual palace complete with full sensory effects, compared to the 44 percent in our 2019 study who were interested in a similar makeover of their personal space.

In addition, there is a jump of 16 to 24 percentage points in the belief that a long range of sensory interaction services will be available by 2030.

Although we are slightly comparing apples and oranges here, as the 2019 data refers to leisure activities and the 2020 data refers to work, the overall increased interest in an internet of senses is nevertheless quite striking.

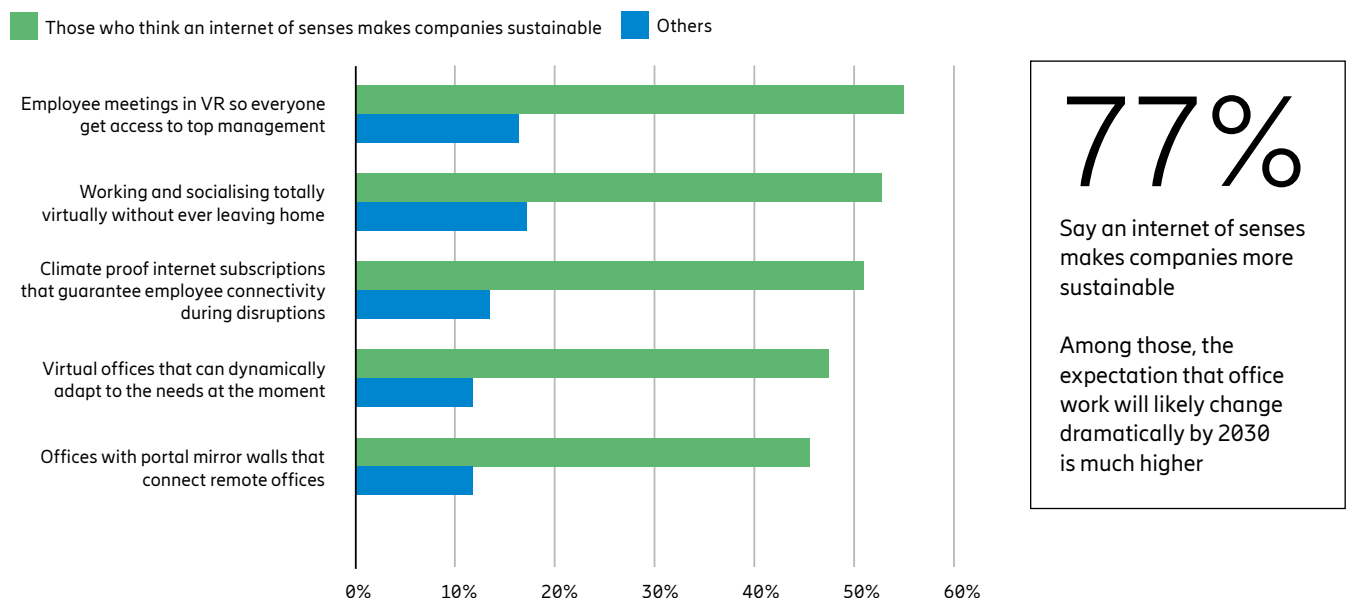
One reason for this fast-forward to the future effect is most definitely the Covid-19 pandemic. With nearly 6 in 10 believing that it will lead to an increase in online meetings with customers, as well as with suppliers, and finally with colleagues, there is a need for tools that better support remote interaction.

After having spent the better part of a year bent over a work laptop at home, constantly engaged in video meetings, and facing challenges with disturbances in their home environments, many employees have probably realized that while connectivity is more important than ever before, digital meetings need to evolve before they become as good as the real thing. The pandemic has in fact created a digital tipping point.

The sustainable dematerialized office

Dematerializing work life means less need for office space and less time spent commuting.

Work-life scenarios rated likely to happen by 2030



Base: 7842 white collar workers in Australia, Brazil, China, Mexico, India, Japan, KSA, Russia, South Africa, South Korea, Qatar, Sweden, Turkey, UAE, UK, US

For white collar workers, increased efficiency and better online sales are the key business drivers, followed by more realistic remote working opportunities and more effective advertising. The climate is only selected by 23 percent as an adoption driver for the internet of senses in business use, giving it an overall fifth place in the ranking. While this may mean that we should not expect companies to self-regulate when it comes to the environment, there are nevertheless substantial positive side effects with digitalization in this respect.

As many as 77 percent indicate that an internet of senses for business use would make companies more sustainable. Among those, the expectation that office work will likely dramatically digitalize by 2030 is also much higher than among the 23 percent who do not see any sustainability merits with the internet of senses.

We might think of this as the dematerialization of the office – something that will not only lead to a drastically diminished need for costly office space but will also save employees both commuting time and cost.

Having a dematerialized office obviously does not mean that physical places will cease to exist.

Instead, it offers the opportunity for employees not to be disadvantaged in their work, regardless of where they are – at home, in a community workspace, or in the traditional office. Regardless of location, they will have an all-inclusive work experience that extends to fully participating in coffee breaks, workshops, team building activities and everything else that a normal workday entails.

Highest ranked internet of senses technologies for business use

Spatial video tech is a given

Spatial video services expected by almost 9 in 10 to be in use by 2030

AR/VR educational software that can be used for everything from internal communications to demonstrations of the company's services/products.

Virtual meetings where everyone looks and can interact exactly like in a physical meeting.

AR/VR meetings that replicate your actual work environments and not just the faces of participants.

Digital sound tech continues to evolve

Advanced sound functions that more than 8 in 10 think will be used in 2030

Earphones that automatically and flawlessly translate between languages using the sound of your own voice. You can call anyone in the world in any language and sound just like yourself.

A headband that enables a hearing impaired person to work and interact perfectly by transmitting sounds directly to the brain.

A microphone that perfectly transforms the sound of your voice into someone else's voice. You could, for example, take on any voice when receiving a customer support call.

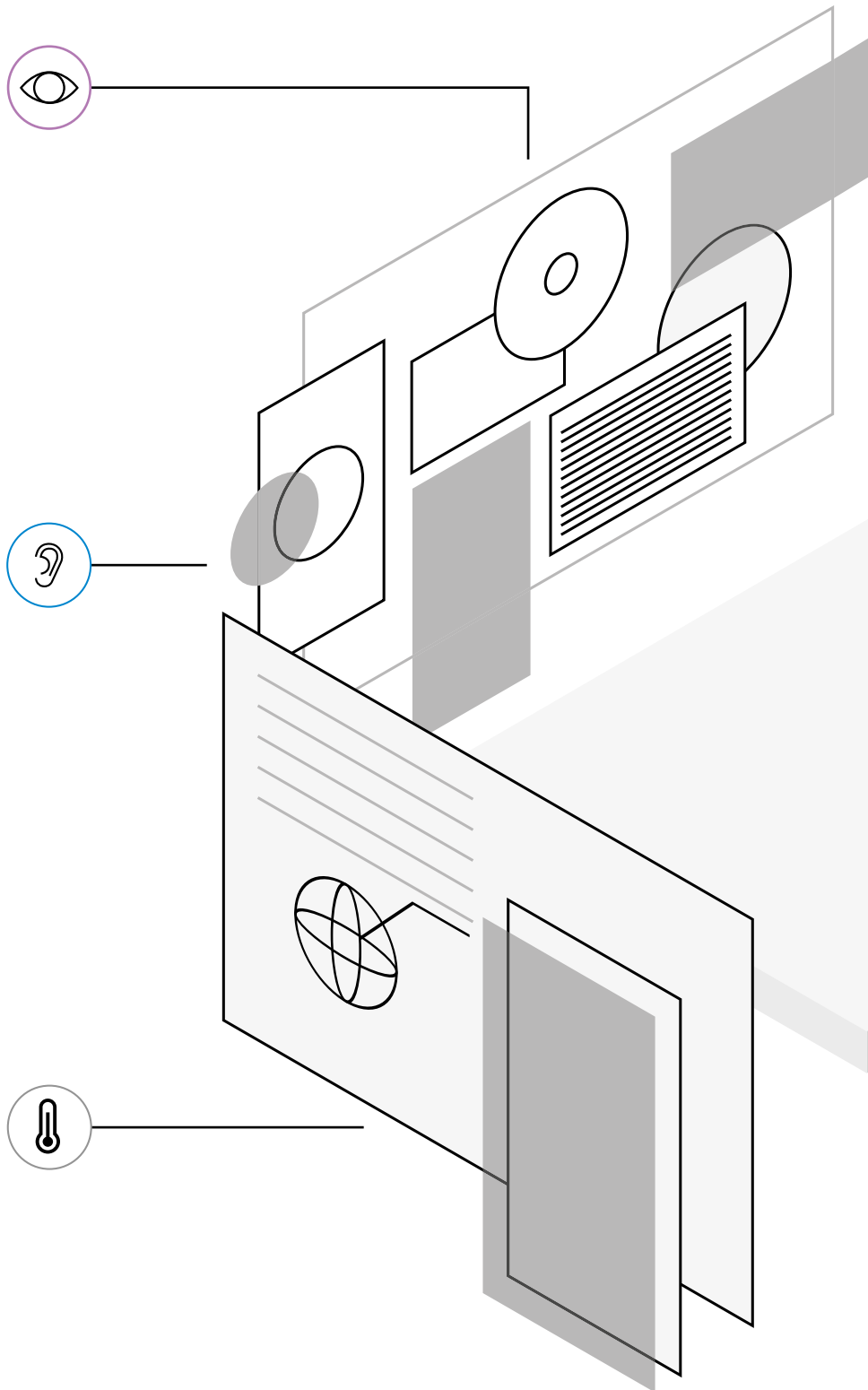
Chilling out at work

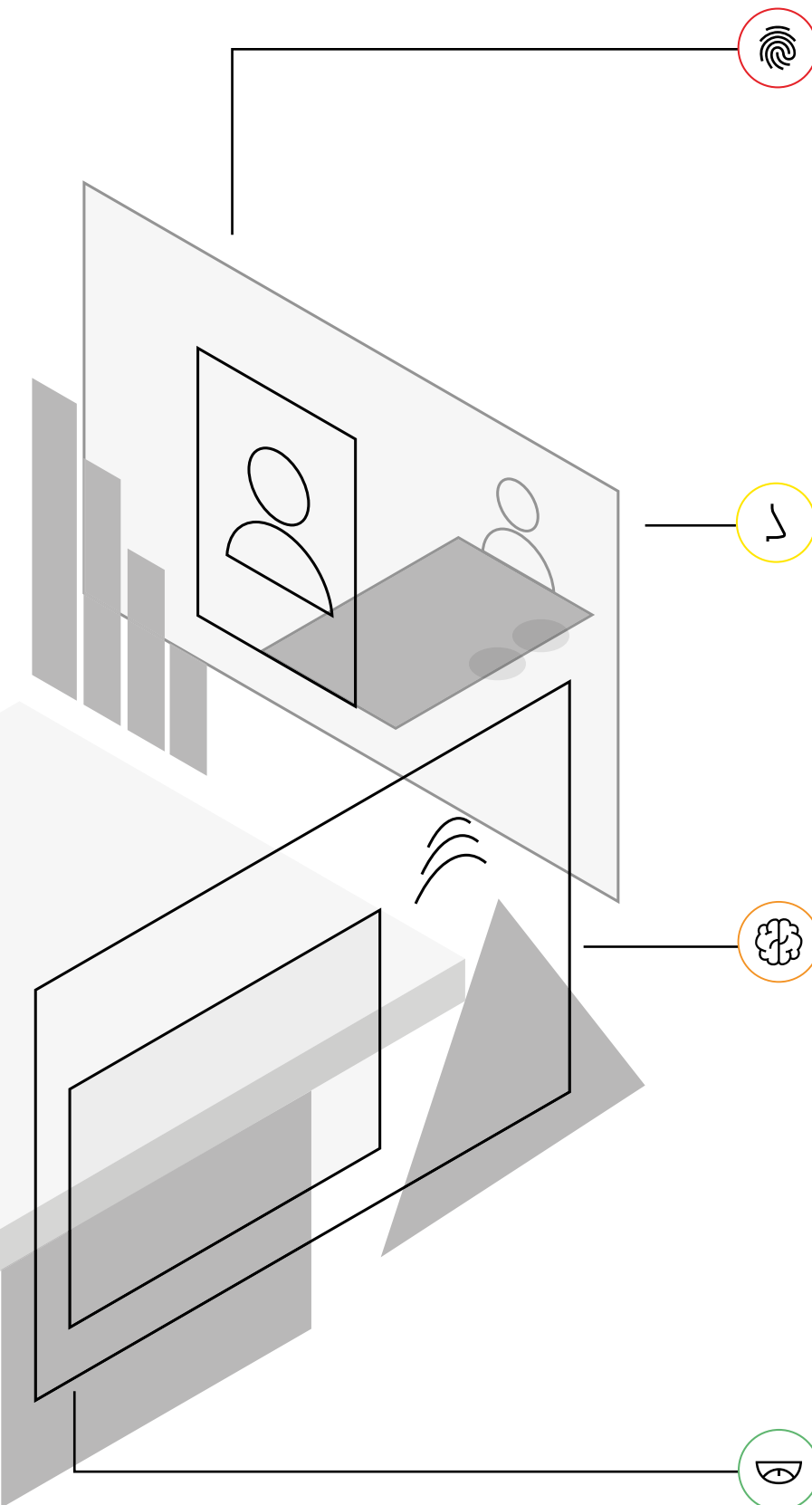
Digital temperature technologies that 8 in 10 expect by 2030

A wearable device that uses digital technology to make you feel cool even when it is very hot where you are, such as in an office or conference room.

An add-on to AR/VR glasses that lets you remotely experience the temperature in a warehouse or in a customer's premises.

A device that cools or heats your body to mimic an environment you visit digitally, such as an office abroad or a customer's premises.





Digital touch tech evolves

Tactile experiences that 8 in 10 believe will be available by 2030

Smartphone screens that give you the sensation of feeling the shape and texture of digital icons and buttons.

Earphones that convey the physical impact of machinery sounds when virtually visiting a production facility.

A wearable device that uses online weather forecasts so that you can feel the oncoming weather, such as the amount of wind or rain you are exposed to on your commute or on a customer visit.

Digital smell tech appears

Smells more than 7 in 10 say will be experienced digitally by 2030

Built in smell sensors at the office automatically alerting the facilities management that for example a specific waste basket needs emptying.

The ability to digitally convey the scent of food, clothes and even shoes for marketing purposes.

A service that enables you to digitally convey what you are smelling such as the fresh interior of a new car while demoing it online to customers.

Brain tech expands our senses

Thought-based interfaces that more than 7 in 10 think will be used 2030

A headband that enables a visually impaired person to work and interact perfectly by transmitting video directly to the brain.

When using augmented reality (AR) glasses, thinking "show info" displays a browser right before your eyes and you can search simply by thinking of what you are looking for.

Augmented reality (AR) glasses that show you information about colleagues, customers or other people, such as name or where you met before, just by thinking of the information you need.

Digital taste tech creates immersion

Flavors that more than 6 in 10 believe will be digitally tasted by 2030

The ability to digitally convey taste samples of sweets and other food for online marketing purposes.

The ability to add taste to pictures from company events, to better capture those memories.

Video conferencing software that allows you to experience the taste of the food on screen during a joint coffee break.

Internet of senses to drive sales

New sensory technologies open new avenues for companies to engage with customers.

Brain computer interfaces are predicted to be used in R&D departments more than anywhere else by 2030, with the IT and analytics departments also ranking highly.

Imagine that you just think about a support request you have at work in order for IT support to be aware of the issues and fix them before you know it. That would be a radical departure from the processes that are in place today.

But apart from brain computer interfaces, it is in fact the marketing & sales department that ranks highest for all other internet of senses technologies, ranging from 59 percent saying spatial video tech to 50 percent saying digital temperature tech will be used there by 2030.

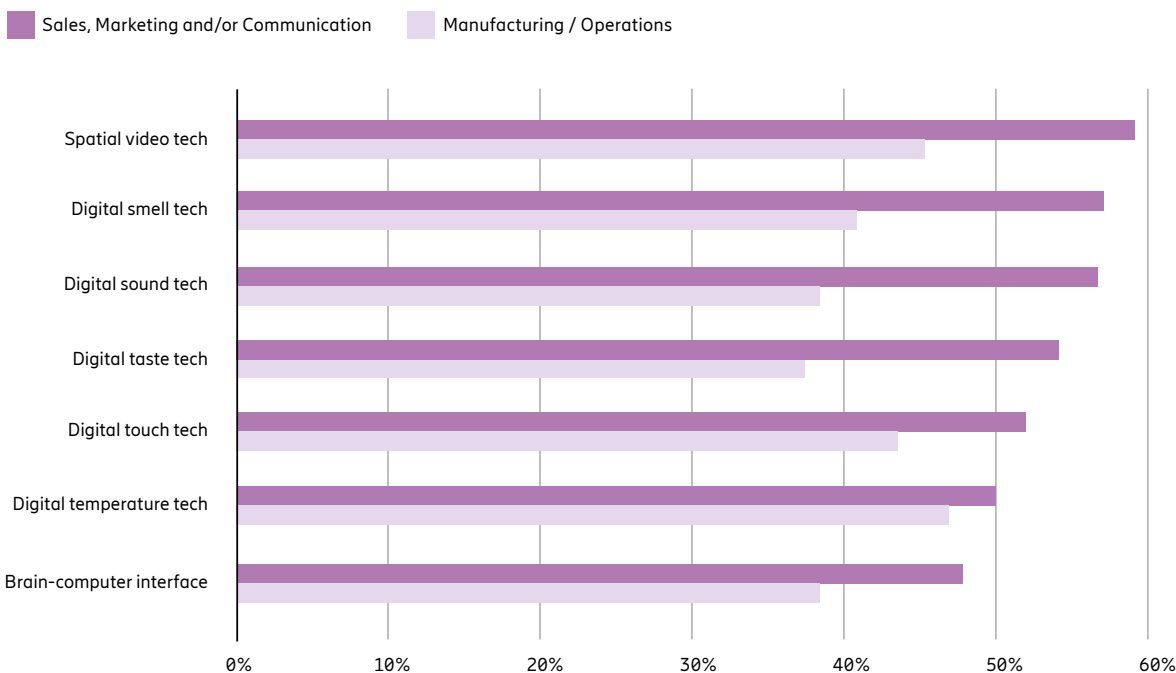
One reason is obviously that sales is of fundamental importance and ultimately drives all activities in companies. But a more intriguing perspective could be that respondents in this survey recognize that these technologies will also become popular among consumers in the same timeframe, thus opening new avenues for companies to interact with their customers.

The fact that manufacturing/operations ranks relatively high when it comes to digitalization of smell, taste and temperature probably also indicates a greater focus on consumer oriented products than on heavy industry applications, although being able to feel a bit cooler in a steel mill would still be very useful.

The IT sector in the driving seat

As for how respondents in different industrial sectors judge the coming decade in terms of internet of senses technologies, there is less variation, although, predictably, employees in IT companies have the highest belief that all of these technologies will be used by 2030.

Internet of senses tech rated likely to be used in different departments by 2030



Base: 7842 white collar workers in Australia, Brazil, China, Mexico, India, Japan, KSA, Russia, South Africa, South Korea, Qatar, Sweden, Turkey, UAE, UK, US

Sharing the stress of decision-making

Motivations to use internet of senses technologies differ between managers and white collars.

Do you often think that the company you work for always likes to use the latest cutting-edge technology as soon as it's available? If you do, you may be a senior manager, and if you don't you might not have a management position at all: 56 percent of senior managers in this study thought so, compared to only 18 percent of non-managers. However, most of that difference is accounted for by the 35 percent of non-managers who say that they use the latest technology after having evaluated what is best.

This difference between an overall management investment perspective and the slightly more reserved and user-oriented view by non-managers, also holds when it comes to applications of the internet of senses, with 83 percent of senior managers believing digital temperature tech will be used

in business by 2030 compared to 74 percent of non-managers; and 76 percent of senior managers even believing brain computer interfaces will be used, compared to a more sobering 60 percent of non-managers.

Decisions, decisions

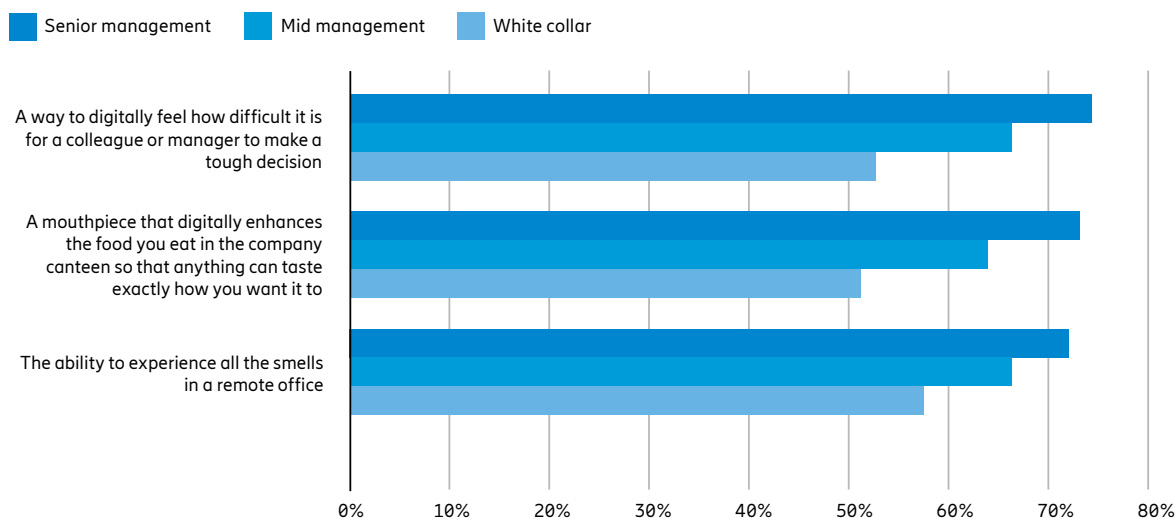
Managers may in fact be interested in using brain computer interfaces to share the burden of all the decisions they have to make as part of their job. For example, 74 percent of senior managers and 66 percent of middle managers believe that technology to digitally feel how difficult it is for a colleague to make a tough decision will be used in companies by 2030. If that kind of functionality was available, maybe some of the tougher decisions taken would indeed meet with greater sympathy. Furthermore, it seems that senior

managers may be unhappy with their business lunches, as 73 percent think a mouthpiece that digitally enhances the food in the canteen to taste like anything they want will be used a decade from now. However, a more likely perspective is that they see an opportunity to increase food quality and satisfaction among employees while simultaneously lowering food costs for the company.

73%

Senior managers think digitally enhancing the taste of canteen food will be possible.

Managers see higher likelihood that an internet of senses will be used by 2030



Base: 7842 white collar workers in Australia, Brazil, China, Mexico, India, Japan, KSA, Russia, South Africa, South Korea, Qatar, Sweden, Turkey, UAE, UK, US

Security and privacy are key barriers

Sensory technologies could open avenues for fraud and manipulation to multiply.

While cost was ranked as the main barrier for the adoption of internet of senses technologies for consumer use, IT security concerns come out as the main barrier for the internet of senses for business use.

These differences seem quite logical. Buying cutting edge technology for personal use often comes with a large upfront cost and a high depreciation rate, leading to low second-hand prices, whereas employing similar technology for business use would normally entail challenges with integrating it with existing equipment and company policies in a secure way. Still, investments rank third, so the costs for implementing new technology in companies should certainly not be ignored.

More interestingly, however, privacy is ranked as the second most important barrier both for consumer use in 2019 and for enterprise use in 2020.

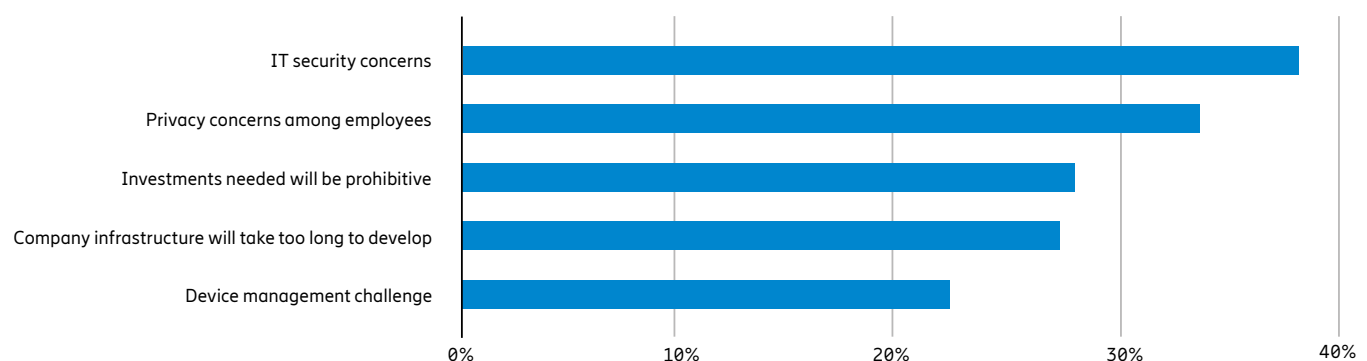
Once digital interaction moves beyond sound and vision to incorporate all our senses, and potentially also enables functionality such as thought control of devices, the avenues for fraud, manipulation and identity theft will grow exponentially. Although the challenges may be different in the consumer and enterprise markets, the underlying concerns relate very much to the basic experience of what it means to be a human being.

Interestingly, only 31 percent of senior managers chose privacy as a top barrier for adoption, compared to 37 percent among non-managers, indicating that privacy is perceived as less of a concern with new technology the higher up one sits in the company hierarchy.

Whereas costs were the main barrier reported by respondents for a consumer internet of senses, IT security concerns come out as the main barrier for enterprise of senses services.

Privacy remains a high concern and is ranked as the second most important barrier both for consumer and enterprise use of the internet of senses.

Highest ranked barriers to adoption of the internet of senses for business use



Base: 7842 white collar workers in Australia, Brazil, China, Mexico, India, Japan, KSA, Russia, South Africa, South Korea, Qatar, Sweden, Turkey, UAE, UK, US

The company that senses you

Privacy is increasingly set to become a critical challenge filled with paradoxes over the next decade.

As many as 53 percent of respondents are what we could call post-privacy employees. This means that on the one hand they believe face recognition will be everywhere and privacy will no longer exist, while on the other hand they think the use of employee data will be regulated so privacy concerns no longer exist. While this may initially seem a contradiction in terms, taken separately it is not so difficult to realize that people may agree to both of them. The challenge will be in finding a balance between these two extremes that allows for fast adoption of digital technology in the workplace, while also respecting the integrity of employees.

Overwhelmingly, post-privacy employees are also most positive to digital sense technology, with 93 percent wanting an internet of senses for business use in some form, compared to 65 percent among those who are not post-privacy oriented.

Having control means being controlled

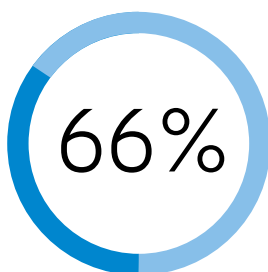
While a dematerialized office built on an internet of senses could provide many benefits, that same office could turn around and automate the way it watches you. It may be fun to sense when a colleague is upset, but it also means your employer knows when you are the one who is upset. Being able to write your monthly report by simply thinking about the key activities might save a lot of time, but then again your company might monitor other thoughts as well. Digitally sensing how someone is fretting over a decision might be nice. But, if it's you suffering from decision anxiety, wouldn't you mostly want to keep that to yourself?

Given that more than 6 in 10 of all post-privacy employees are concerned that new digital technology allows managers to control employees more, employees will only welcome these technologies if key privacy paradoxes are addressed from the start.

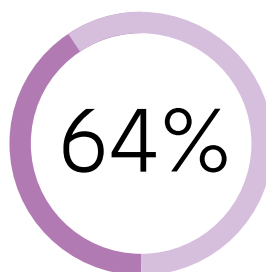
In a digital office environment where all human senses can be shared, there needs to be clear social norms. In addition, not only must sensory data formats be standardized for them to be communicated over networks; there need to be openly agreed upon and most likely legally regulated standards for how these data flows are treated, shared and stored.

This year's pandemic has changed the mindset of many companies and their employees, as it has brought forward the need for a new work environment with increasing online meetings with customers, suppliers and colleagues; as a result, the dematerialized office may well be here by 2030. In addition, an overwhelming majority of respondents indicate that an internet of senses for business use would make companies more environmentally sustainable. If privacy issues are solved, it may well be sustainable for employees to work in as well.

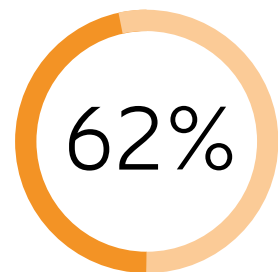
Digitally sensing thoughts and feelings rated likely to be used at work by 2030



A way to digitally sense when a colleague is nervous or upset



Write your monthly report by simply thinking about the key activities during the month



A way to digitally feel how difficult it is for a colleague or manager to make a tough decision

Ericsson enables communications service providers to capture the full value of connectivity. The company's portfolio spans Networks, Digital Services, Managed Services, and Emerging Business and is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's investments in innovation have delivered the benefits of telephony and mobile broadband to billions of people around the world. The Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.

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