



# Digitalization and its impact on workplaces

Key results of a seven country survey

Prof. Dr. Anna Schneider

Trier University of Applied Sciences, Trier (Germany)

19 September 2023

Picture Markus Spiske from unsplash



# Executive Summary

This report presents novel data on digitalization and its impact on the workplace. It draws on a survey of more than 13,000 workers in seven countries (China, France, Germany, Greece, Italy, the UK, and the US) and uses a new approach to assess digitalization and digital skills.

Digitalization is clearly making waves in China, **with the average reliance on digital tools and, in particular, the internet among Chinese firms registering ~7% higher than in any of the other six countries surveyed.** The impact of workplace digitalization in China is also clearly visible based on the job profiles found in Chinese firms. In highly digitalized firms, workers use a wider variety of skills more frequently than in less digitalized work environments. In addition, highly digitalized environments are often marked with a higher degree of freedom to make individual decisions about work-related tasks, which is linked with a higher need for individual problem solving skills. Similar patterns emerge in Europe and the US, but they are far less pronounced.

For the US, the survey points to a virtuous cycle consisting of young, digitally savvy talent seizing fast track career opportunities in highly digitalized firms then driving further use of digital tools within these firms. **Digital skills also feature among the very top skills for the US's mid-to-late twenties age group, but not in Europe or China's.** On the other hand, the US sees a much stronger decrease of digital skills relative to all other skills in older age groups. The same tendency is also true in Europe and China, but on a smaller scale.

New forms of human-computer interaction (HCI) are becoming increasingly possible as touchscreens, large language models, and augmented/virtual reality come into maturity. However, **in Germany and the UK, more than half of all HCI happens on hard keyboards, even in the most digitalized workplaces. In all surveyed countries, the use of advanced and virtual interfaces in the workplace lags noticeably behind private use** and respondents consistently expected this gap to widen in the next five years. **Individuals are clearly more ready to embrace new interfaces than the firms they work at, as they tend to be very confident in their ability to operate touch-centric, voice, and gesture interfaces, regardless of how digitalized their workplace is.**

Workplace digitalization also seems to have an impact on the management culture of a firm. **Respondents in highly digitalized firms attribute more thoughtfulness to their managers, which, in turn, appears to improve their acceptance of management authority and decisions.** These results align with our insights on changes in job profiles. More individual freedom to make decisions, more variety of tasks and skills required, and a higher need for individual problem solving all shape the interactions between employees and managers in highly digitalized workplaces. **A high level of workplace digitalization also seems to stimulate knowledge exchange within the workplace by more than 20% compared to firms with a lower level of digitalization.**

# How digital is your firm, your sector, and your country?

## Introduction

How do you determine the level of digitalization of a specific firm, sector, or country? There is no shortage of indices trying to pin this information down, and each has its own merits and faults. However, they seem to universally share the same source when it comes to expert appraisals of digitalization.

Our approach sharply differs from most existing methods as it draws on the first hand experiences of a large sample of more than 13,000 workers<sup>1</sup> in seven countries.<sup>2</sup> This approach allows us to move away from the idea that identifying the level of digitalization of a specific firm is a goal in and of itself. Instead, this approach creates a starting point for understanding the impact of digitalization on workers, their work environments, and the jobs they perform.

The index presented here builds on nine easy-to-answer questions about the relevance of the internet across business model building blocks. A similar questionnaire administered to experts demonstrated its ability to provide a reliable snapshot of the digitalization level of a firm.<sup>3</sup>

## Why is measuring digitalization levels challenging?

*Digitalization is more than just technology.* Implementing a certain technology does not necessarily mean that it is being used to its full potential. With technologies like artificial intelligence (AI) or cloud computing, we also find that digital technology slowly affects processes. Consequently, our approach does not focus on individual digital technologies, but instead emphasizes the effect of digitalization on processes within a firm.

*Digitalization is a moving target. It evolves continuously.* Yesterday's cutting edge technologies and services are easily overtaken by the next more capable, powerful, and efficient generation. This report is not affected by this typical challenge because it only presents a snapshot of digitalization and focuses on its impact rather than emphasizing specific characteristics.

*Digitalization is never complete.* Due to its continuously evolving nature, it is virtually impossible that any firm or country to reach a final state of complete digitalization. The approach taken in this report accounts for this as it situates measured digitalization within the perceived low and high points of digital technologies and services respondents see in their own lives.



## Our approach

Large-scale survey of employees reporting their experience with digitalization

## Typical approaches



Count digital tools and services used



Observe how "digital" companies present themselves



Survey internal experts

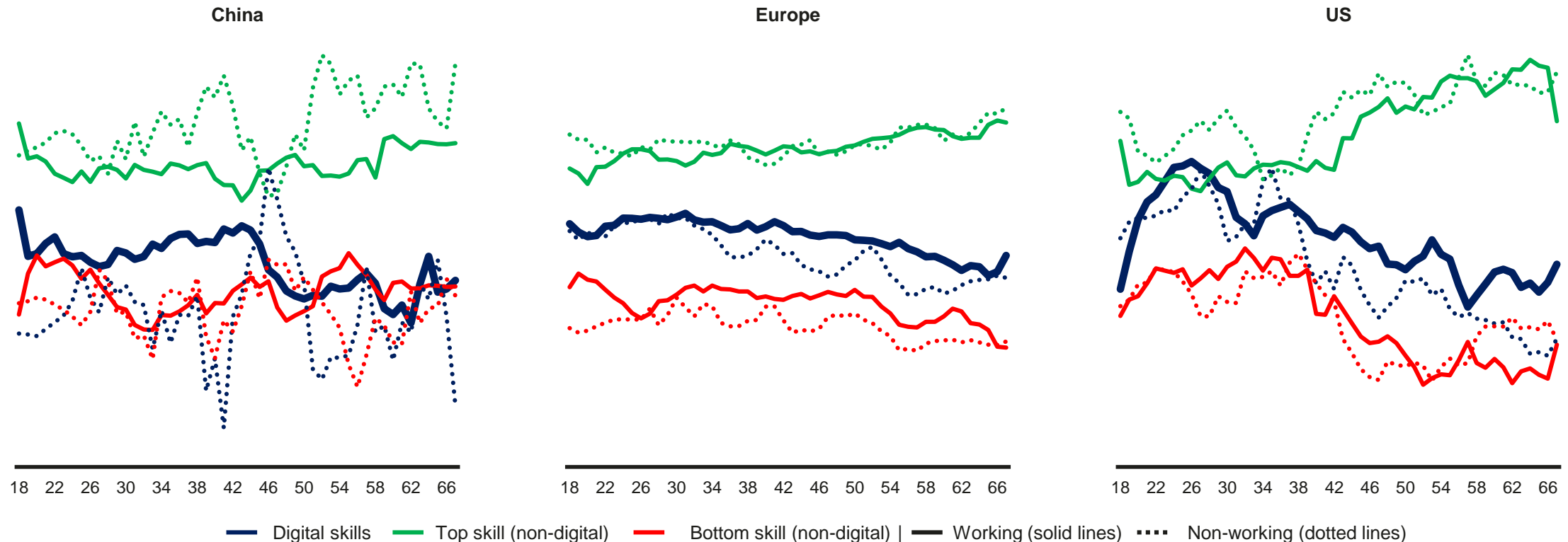


Collect external expert opinions

# Digital upskilling needs to account for regional differences

It is well known that a digitally skilled workforce is one of the preconditions for industrial digitalization. Specifically where digital upskilling will be most effective, however, is still relatively unclear. We found that in the US, people in their mid-to-late twenties consider digital skills among their very top skills, while they notably do not within the same age cohort in Europe and China. However, the US sees a much stronger decrease of digital skills relative to all other skills as the age of respondents increased. This trend is also found in Europe and China, but it is not quite as pronounced. Another important finding was the difference in digital skills between employed and unemployed people. In Europe, similar levels of digital skills were found in both employed and unemployed youth. Almost all other age groups and in every region, however saw unemployed respondents rank their digital skills lower than employed respondents. This gap is particularly large for people in their 30s in China. In Europe and the US, the gap tends to widen with age after people turn 40. Companies will need to provide upskilling for their employees, to meet their own digital talent requirements. However, they will also need policymakers to develop targeted interventions to close the gaps between unemployed and employed people if they hope to take advantage of the full talent market.

## Self-reported digital-skills level compared to respondents' top and bottom skills (all countries)

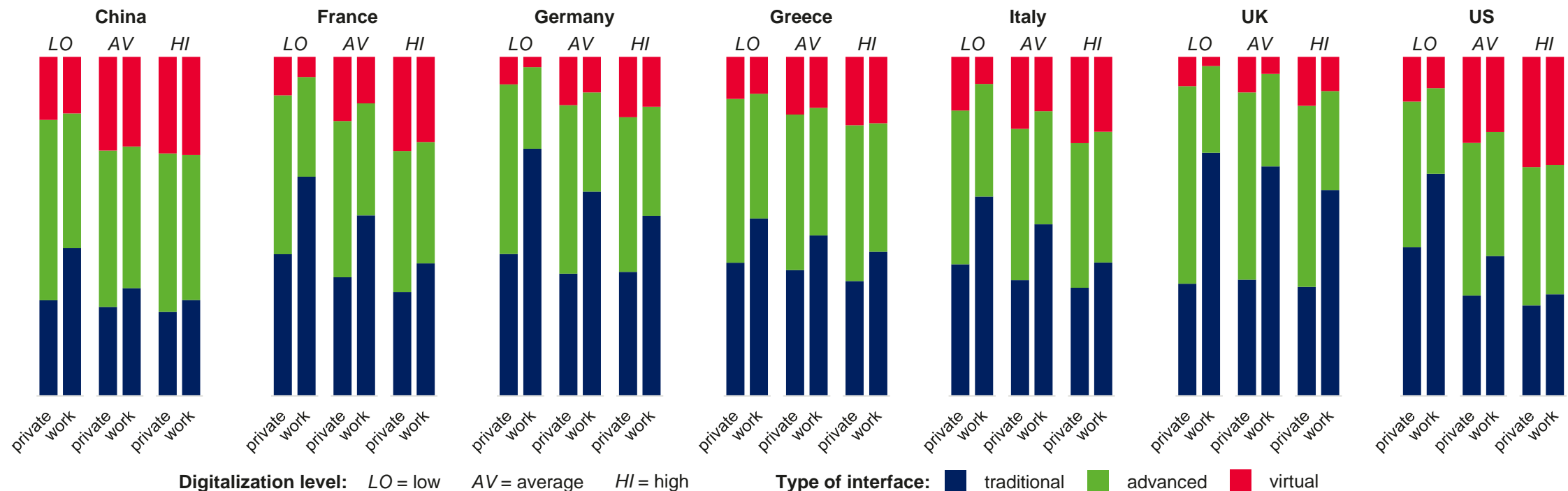


Source: Survey (n=19,363). Notes: Respondents were asked to rank eight sets of skills from top (what they are best at) to bottom (their weakest set of skills). The charts show the (moving) average (reversed) rank of their digital skills and their top and bottom non-digital skills on the same scale applied to all three charts. The skillsets covered were (1) digital, (2) vocational, (3) social, (4) literacy, (5) technical, (6) intellectual, (7) communication, and (8) physical. Skillsets were presented in a randomized order for respondents to rank. Respondents' age was capped at 67 years for this chart. Moving average for age +/- 2 years. Europe includes France, Germany, Greece, Italy, and the UK.

# Employees use more advanced, virtual interfaces at home than at work, even in the most digitalized firms

The way we interact with computers is changing rapidly. Chat interfaces enabled by AI and the gesture controls used by car cockpits and smart phones are ushering in a new age of human computer interaction (HCI). When we looked at the average time spent by consumers using traditional (hard button), advanced (touch-centric), and virtual (voice and gesture control) interfaces, we found that even the most digital firms have not yet found ways to integrate such new interfaces into the workplace to the same extent they have made their way into our private lives. China and the US are leading the transition from traditional to advanced and virtual interfaces used in the workplace. This change is important since it will influence how they define digital skills. The low and no code environments of the future may lend themselves more naturally to workers with superior communication and literacy skills. Future-proofing business and digital policies will require considering how this likely shift will effect how we teach and evaluate digital skills.

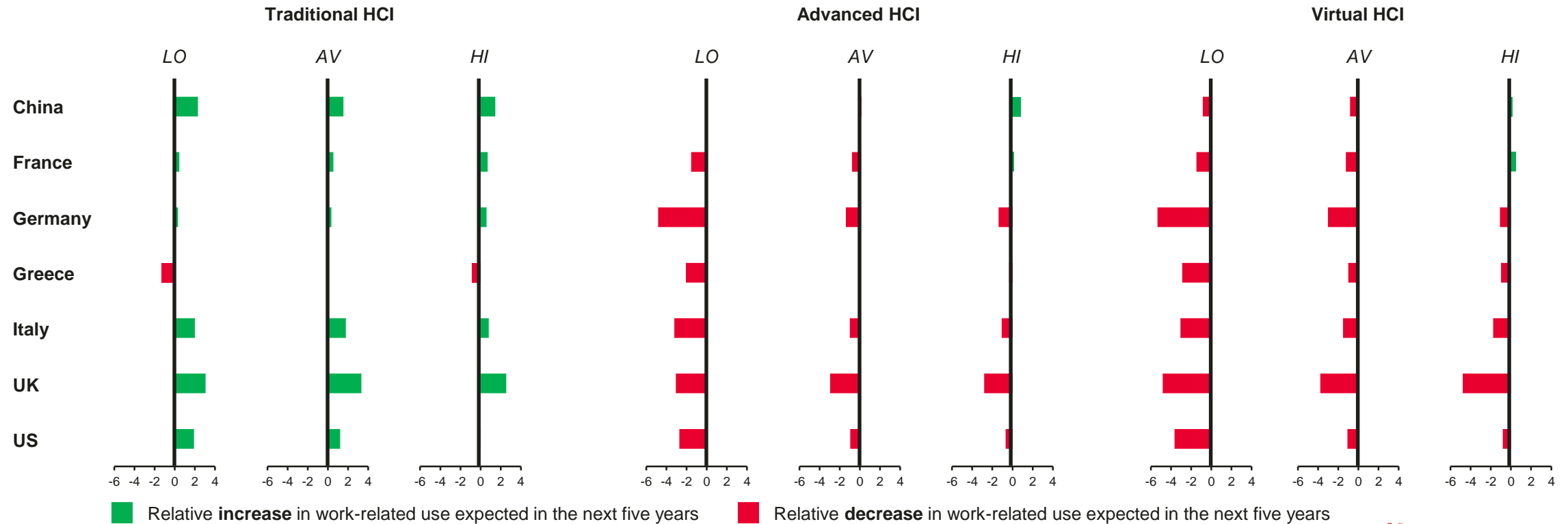
**Average share (%) of traditional (buttons), advanced (touch-centric), and virtual (voice & gesture) interfaces in work and private environments across levels of workplace digitalization**



# Private use of advanced and virtual interfaces will continue to outpace their use in the workplace

Overall, respondents expect the use of traditional interfaces to increase in their workplaces compared to their private use of digital devices. Interestingly, they also expect the advanced and virtual interfaces to be used less in their workplace compared to in their daily lives. This would result in workplaces falling even further behind private use of these new technologies. According to our data, firms with low digitalization level in Germany are expected to fall behind the most when it comes to advanced and virtual interfaces in the next five years, and respondents in the UK think they will see a continuation of the focus on traditional interfaces in the workplace across all levels of digitalization. However, respondents in highly digitalized firms generally expect less differences between future workplace and private use.

Expected relative increase of interface use in the next five years (use at work versus private use – within subject) across countries and digitalization levels in %



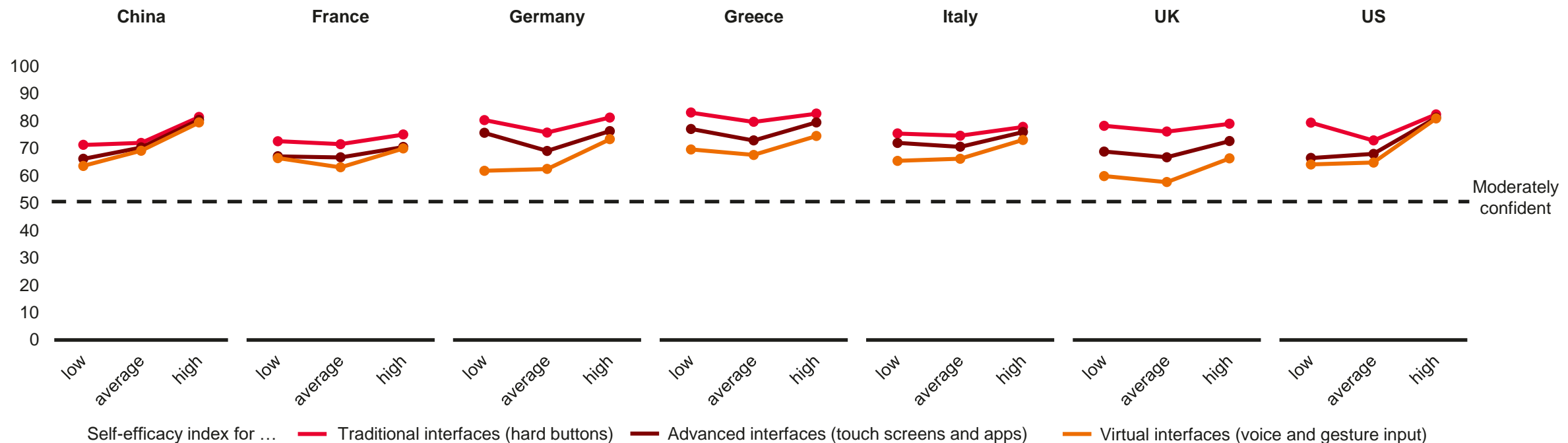
6 Source: Survey (n=13,147). Notes: Working respondents were asked to rate their expectation for decreases or increases in the use of each human-computer-interface (hard buttons, touchscreens, apps for remote control, voice assistants, and gesture controls) at their workplace and in the private use separately. The scores shown here represent the relative change respondents expected in the their workplace use compared to private use expectations. The same scales and question formats were use for work and private use expectations.



# Individual confidence in new interfaces is largely independent from workplace digitalization

Private use of advanced and virtual interfaces is almost identical no matter the level digitalization of the respondent's workplace (see page 7). In line with this finding, our results suggest that the individual confidence in advanced and virtual interfaces does not significantly differ between firms with low, average, and high levels of digitalization. It appears that private use of digital technologies plays a more significant role for individual digital poise than is commonly reflected in the public debate. These results also indicate that a migration to new interfaces is feasible even for companies that currently have a relatively low level of digitalization. This means that emerging tools featuring large language models (LLMs), augmented reality, and robotic process automation can usher in a new era of human computer interaction (HCI) leveling the playing field and redefining digital skills.

Self-efficacy index for operating traditional, advanced, and virtual human computer interfaces by digitalization level of the work environment

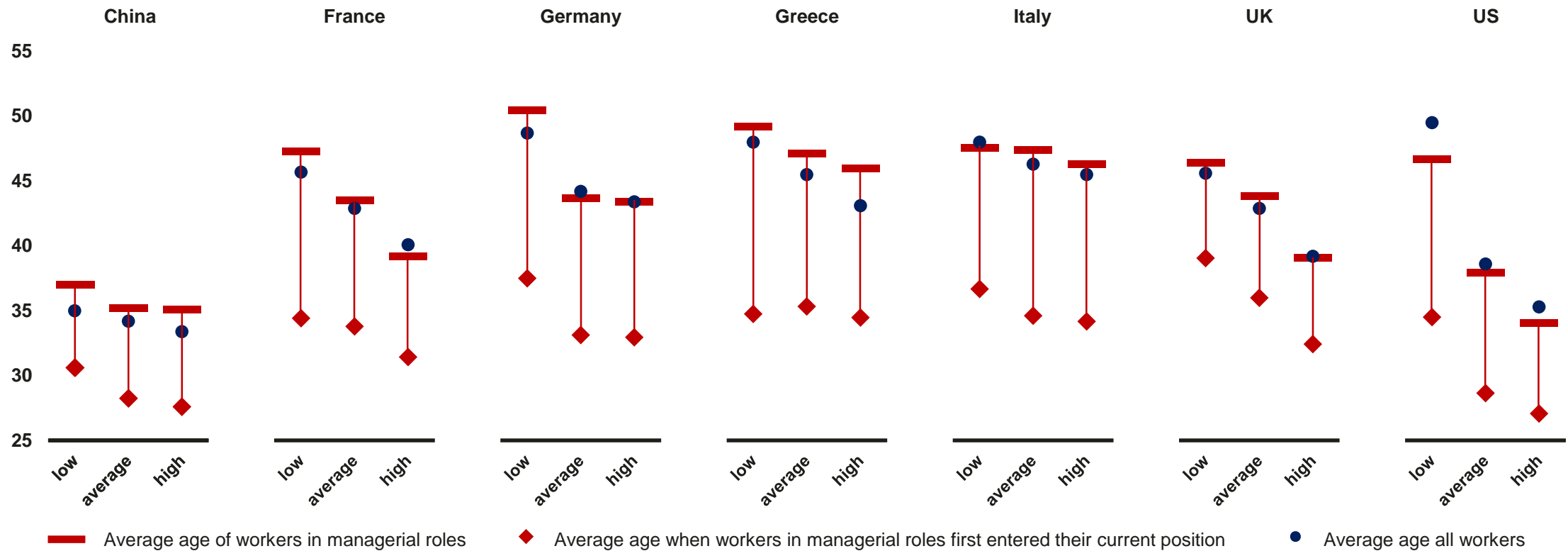


Sources: Survey (between n=4,870 and n=11,826 depending on the interface – users only). Notes: Digitalization of the company was measured on a nine item scale (Cronbach alpha >.9 for all countries) built from the Osterwalder and Pigneur (2010) business model canvas. The groups for low, average, and high digitalization were developed for each country individually based on a triadic split of the data using +/- one standard deviation from the mean as the cut-off. Scales were developed based on the recommendations by Bandura, A. (2006). Guide for constructing self-efficacy scales. Self-efficacy beliefs of adolescents, 5(1), 307-337. The scales captured the same five items for each interface representing increasingly difficult operations. The Cronbach alpha scores for the scales were all >.8 for all countries. The index ranged from Min=0 to Max=100.

# Managers in digital firms are younger and started earlier

Firms with a high level of digitalization consistently have younger workers than those with lower levels of digitalization.<sup>1</sup> Except for Greece and Italy, employees in highly digitalized firms also take on managerial roles at an earlier age than in other firms. This pattern is particularly pronounced in the UK and the US.<sup>2</sup> As digital skills are higher with younger workers, these results indicate that there is a virtuous cycle for highly digitalized firms where young, more digitally savvy managers drive digitalization forward. The data also implies that ambitious graduates should choose more digitalized firms over less digital ones if they want to fast track their career to become managers. This may give digitalized firms an additional edge in the competition for the best young talent.

Average age of workers in managerial roles and the average age when they first entered their current position across digitalization levels and countries<sup>3</sup>



Source: Survey (n=13,147; 5,081 in managerial roles) Notes: 1 Tukey HSD tests revealed at least one statistically significant difference for average age of all workers in the expected direction ( $p < .05$ ) in each country. In France, Greece, the UK and the US all contrast were statistically significant. 2 Tukey HSD tests revealed at least one statistically significant difference for average age when workers entered their current position in the expected direction ( $p < .05$ ) in all countries except Greece and Italy. In the UK and the US all contrast were statistically significant. 3 Digitalization of the company was measured on a nine item scale (Cronbach alpha  $> .9$  for all countries) built from the Osterwalder and Pigneur (2010) business model canvas. The groups for low, average, and high digitalization were developed for each country individually based on a triadic split of the data using +/- one standard deviation from the mean as the cut-off.



# Jobs in digitalized workplaces require more skills, independence, and problem solving

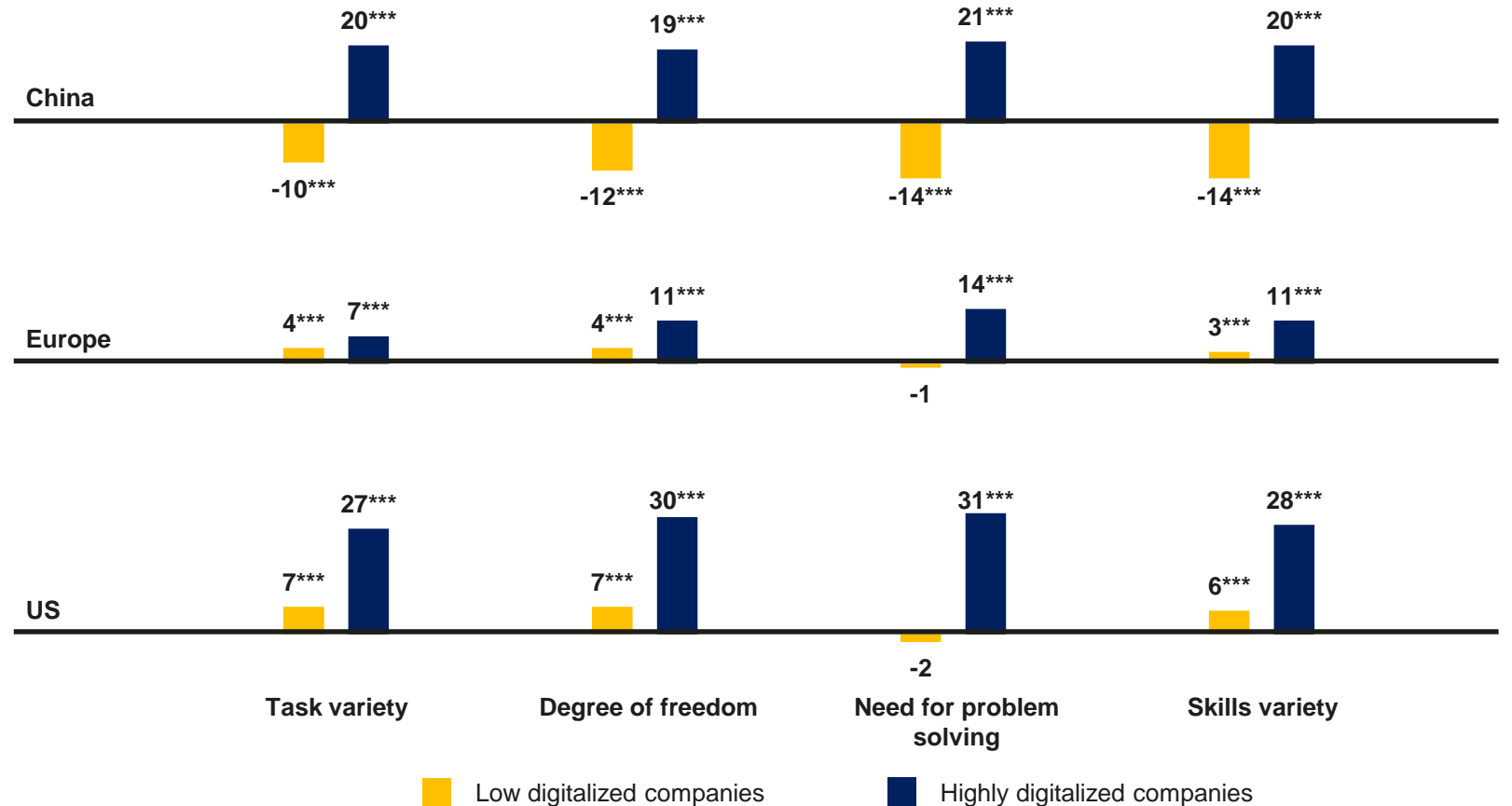
Getting a job in digitalized workplaces and then performing well in that job requires workers to be adaptable. Our results suggest that they have to be able to deal with a larger variety of tasks during a typical day at work than workers in less digital environments. Jobs in highly digitalized workplaces also require a wider variety of skills to be used frequently than less digital work environments.

Furthermore, the survey shows that a higher degree of freedom in individual decisions provided goes hand-in-hand with a stronger need for problem solving skills of the individual.

The general pattern of these differences in job requirements holds across China, Europe, and the US. However, the differences in job requirements across low, average, and high levels digitalized workplaces are most obvious in China. This matches the general business environment which at the low end of digitalization is still dominated by production facilities featuring straightforward job profiles with a high share of repetitive tasks.

As more developed economies, Europe and the US show less substantial differences between jobs in firms with low and average digitalization. The relatively greater uptick across all job profile indicators in the US compared to Europe is another indication of a general higher degree of digitalization in the US than in Europe.

Change of perceived job characteristics in % (index 0 = average digitalization level)



Source: Survey (n=13,147). Notes: Digitalization of the company was measured on a nine item scale (Cronbach alpha >.9 for all countries) built from the Osterwalder and Pigneur (2010) business model canvas. The groups for low, average, and high digitalization were developed for each country individually based on a triadic split of the data using +/- one standard deviation from the mean as the cut-off. The scales for measuring the individual indicators were taken from: Morgeson, F. P., & Humphrey, S. E. (2006). The Work

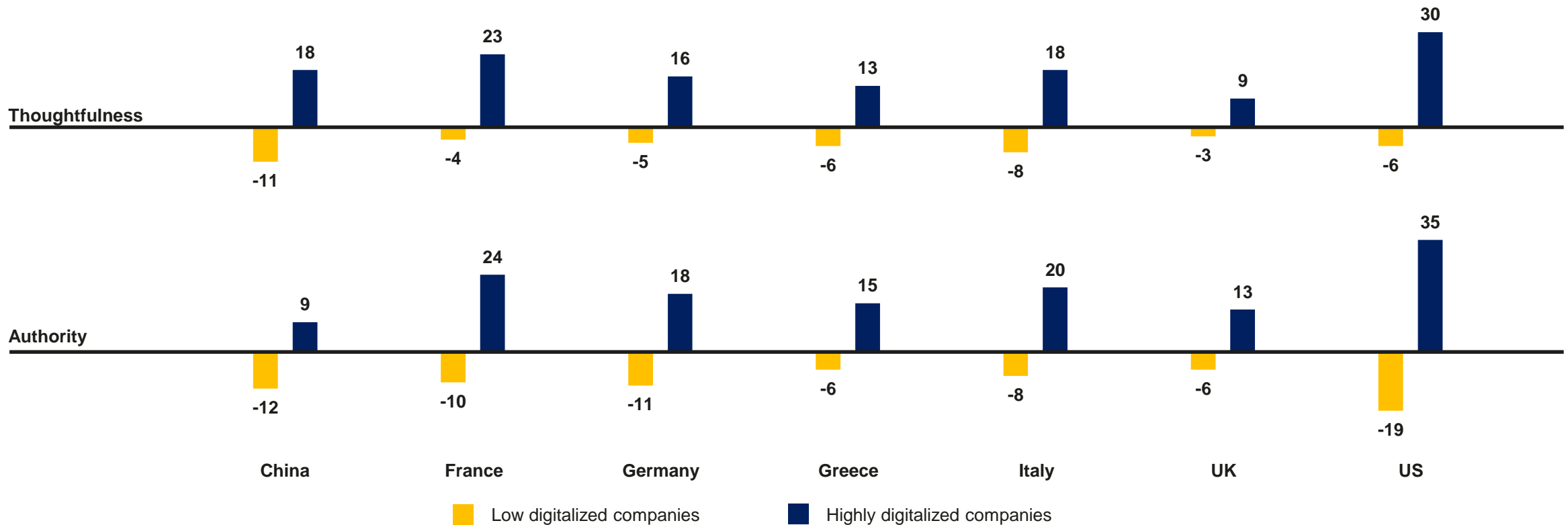
g Design Questionnaire (WDQ): developing and validating a comprehensive measure for assessing job design and the nature of work. Journal of applied psychology, 91(6), 1321. Wilcoxon pairwise tests (\*p<.1; \*\*p<.05; \*\*\*p<.01) were used to establish the statistical significance of differences between the different levels of digitalization in China, Europe, and the US. Notably, all other possible contrasts were also statistically significant (at least p=.05) except from high digitalization to low digitalization in Europe on task variety. Europe includes France, Germany, Greece, Italy, and the UK.



# Digital firms benefit from more effective management cultures

The survey data suggests that workplace digitalization impacts the management culture of a firm. Respondents in highly digitalized firms attributed more thoughtfulness to their managers. This also appears to improve their acceptance of management authority and decisions. These results align with the insights on changes in job profiles reported on the preceding page. More individual freedom to make decisions, more variety of tasks and skills required, and a higher need for individual problem solving all shape the interactions between employees and managers in highly digitalized workplaces.

Change of perceived management culture indicators (index 0 = average digitalization level)

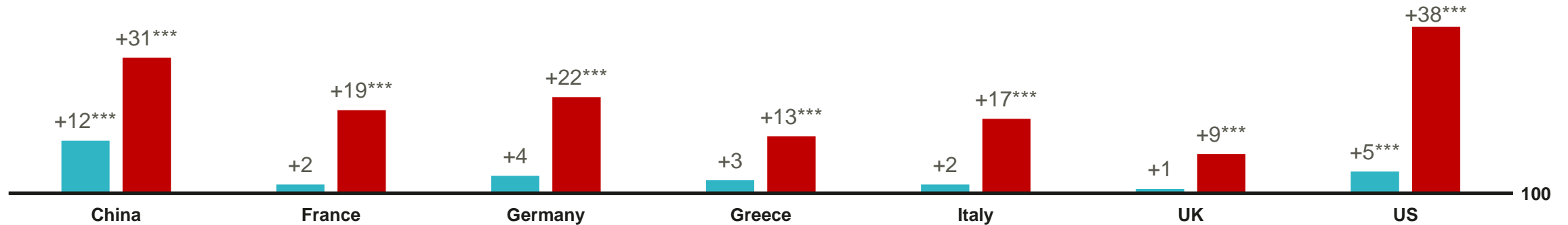


Source: Survey (n=13,147) Notes: Thoughtfulness and Authority represent indices based on multiple items, Cronbach alpha >.8 for all countries and both scales. Digitalization of the company was measured on a nine item scale (Cronbach alpha >.9 for all countries) built from the Osterwalder and Pigneur (2010) business model canvas. The groups for low, average, and high digitalization were developed for each country individually based on a triadic split of the data using +/- one standard deviation from the mean as the cut-off. For more information about the index methodology, see Notes: 1 Schiffer, M., & Arnold, R. (2011). Wirtschaft digitalisiert. Cologne and Berlin: IW Consult and Bitkom. and Arnold, R. et al. (2013). Wirtschaft digitalisiert. Welche Rolle spielt das Internet für die deutsche Industrie und Dienstleister? Cologne and Berlin: IW Consult and Bitkom. Except the differences from average to low digitalization levels in DE, FR, UK, and US (thoughtfulness) all differences across digitalization levels were statistically significant at least p<.05 using pairwise Wilcoxon tests.

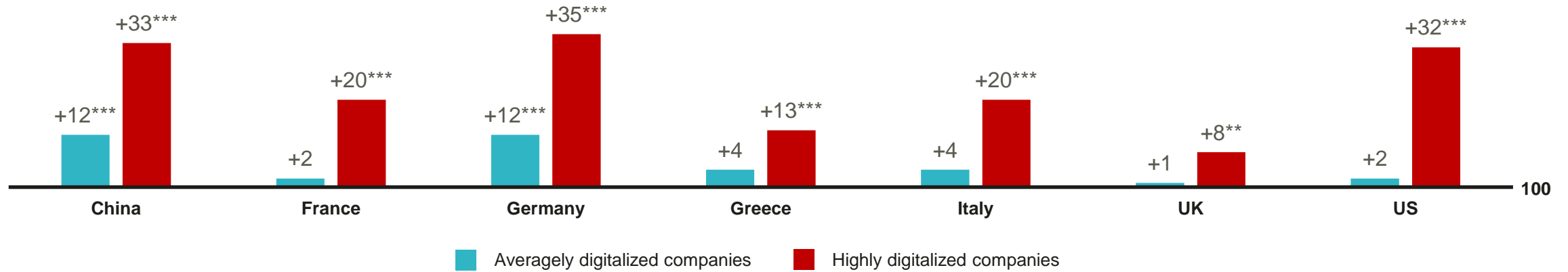
# Digitalization in the workplace boosts knowledge exchange

The survey clearly shows that in all seven countries, more digitalized companies benefit from more knowledge exchange. Both the receiving of knowledge and the giving of knowledge increase as companies become more digitalized. The most substantial boosts happen in environments with average to high levels of digitalization. This is yet another area where both policymakers and companies will need to take digitalization seriously and promote the use of digital technologies.

Index of 'receiving knowledge' in the workplace (low digitalized companies = 100)



Index of 'giving knowledge' in the workplace (low digitalized companies = 100)



Sources: Survey (n=12,112). Notes: Digitalization of the company was measured on a nine item scale (Cronbach alpha >.9 for all countries) built from the Osterwalder and Pigneur (2010) business model canvas. The groups for low, average, and high digitalization were developed for each country individually based on a triadic split of the data using +/- one standard deviation from the mean as the cut-off. Tukey HSD test p<.05\*\* and p<.01\*\*\*. The indices for "receiving knowledge" (Cronbach alpha >.8 for all countries) and "giving knowledge" (Cronbach alpha >.8 for all countries) were taken from four and three items scales from Fasbender, U., Gerpott, F. H., & Unger, D. (2021). Give and take? Knowledge exchange between older and younger employees as a function of generativity and development striving. Journal of Knowledge Management. This page was first published in: Schneider, A., & Arnold, R. (2022). Intergenerational collaboration and digitalization. Shenzhen: Huawei.

# Methodology

<b>Method:</b>	CAWI: Computer Assisted Web Interview
<b>Sample size(s):</b>	n=21,427 (China n=3,063; France n=3,051; Germany n=3,078; Greece n=3,031; Italy n=3,066; UK n=3,070; US n=3,068)
<b>Sampling time:</b>	2022/11/02 to 2022/11/15
<b>Length of interview:</b>	The median length of interview varied between 24 and 32 minutes depending on the country.
<b>Sampling frame:</b>	The sample type is a non-probability sample recruited and stratified on basis of representative quota distributions (quota sample).
<b>Sampling procedure:</b>	Using YouGov's proprietary sampling technology, quotas are framed based upon the census or profile of the required population in the beginning. This frame is the basis on which the sampling software controls the flow of members into each survey. The sampling software randomly selects from the available panel, and allocates to surveys according to the quotas set. YouGov's sampling software includes a router. This removes the potential for self-selection on surveys, and increases the ability to deliver lower incidence samples within a short time frame. Panelists receive an invitation email containing a survey link. When they access the link the router checks against quotas on all live surveys and allocates them to a survey for which they qualify. Thus, panelists are not invited to a specific single survey, reducing the risk of early response bias, social desirability or other motivational biases.
<b>Survey pretest:</b>	For testing functionalities, the online survey was soft launched from 2022/11/02 to 2020/11/03. Based on the results, no adjustments were implemented.
<b>Questionnaire:</b>	Huawei, in collaboration with Prof. Dr. Anna Schneider (lead), Prof. Dr. Ulrike Fasbender, and Prof. Dr. Fabiola Gerpott provided the master questionnaire in English. YouGov reviewed the questionnaire and translated it into the local languages required for the target countries.
<b>Data preparation and analysis:</b>	The survey data was processed by YouGov and provided in a SPSS data set. Incomplete cases were removed from the data set. Cases from the pretest as well as cases with duplicate cookie ids were removed. Analyses were done in R.

# The author

## **Prof. Dr. Anna Schneider**

Hochschule Trier, University of Applied Sciences

Since 2017, Anna Schneider is Professor of Business Psychology. Her research interests and teaching revolve around the impact of digitalization on consumer behavior, and in particular how people communicate and interact with emerging technology. Anna is a member of various research associations and sits on the scientific board of the Wissenschaftliches Institut für Infrastruktur und Kommunikationsdienste (WIK) – a renowned communications and internet policy think tank. Recently, she also joined the scientific advisory board of the SINUS Institute. Drawing on more than 20 years of hands-on experience in market research, she regularly advises public and private organizations on surveys as well as qualitative research projects.

Bring digital to every person, home and organization for a fully connected, intelligent world.

**Copyright©2023 Huawei Technologies Co., Ltd.  
All Rights Reserved.**

The information in this document may contain predictive statements including, without limitation, statements regarding the future financial and operating results, future product portfolio, new technology, etc. There are a number of factors that could cause actual results and developments to differ materially from those expressed or implied in the predictive statements. Therefore, such information is provided for reference purpose only and constitutes neither an offer nor an acceptance. Huawei may change the information at any time without notice.

