

THE AGING AND AUTOMATION RESILIENCE INDEX:

BUILDING RESILIENCE
FOR AGING WORKFORCES
FACING INDUSTRY 4.0





Governments and organizations of all sizes are grappling with unprecedented rates of disruption as Industry 4.0 unfolds. New technologies and capabilities have spawned new industries, markets, and economies, laying waste to traditional ones.

This spread of technological innovation presents a serious challenge to workforces around the world. As the use of intelligent technologies proliferates, jobs: particularly routine, repetitive and low-skill ones – will increasingly be at risk of being automated. Older workers, those aged 50 and above, can commonly be found to be employed in these jobs – meaning that older workers will be especially exposed to these risks. At the very same time, populations world-over are aging rapidly: meaning that working-age populations are shrinking, and elderly populations are expanding.

It's hard to overestimate the potential combined threat of aging and automation. Organizations will face pressures on their pension funds, retirement assets and workforce models. Governments will face pressures on their social safety nets. Many individuals, especially older workers, will face job losses. Societies will be challenged to provide healthcare and financial security for populations who are living longer lives.

Pressure and hard choices are inevitable. However, the aging workforce will also present new opportunities to tap into an experienced, eager and highly productive sector of the workforce. The key is preparation. The twin threats of aging and automation require new ideas for managing – and even redesigning – workforces and developing more resilience to the vulnerabilities being presented.

This paper will deploy leading thinking on this subject from Mercer and Marsh & McLennan Insights, to help organizations, governments and workers address the following risks related to societal aging and workplace automation:

- The issues at stake for aging workers
- The specific threats from automation
- Measuring resilience to both societal aging and workplace automation threats by country
- Ideas and best practices going forward



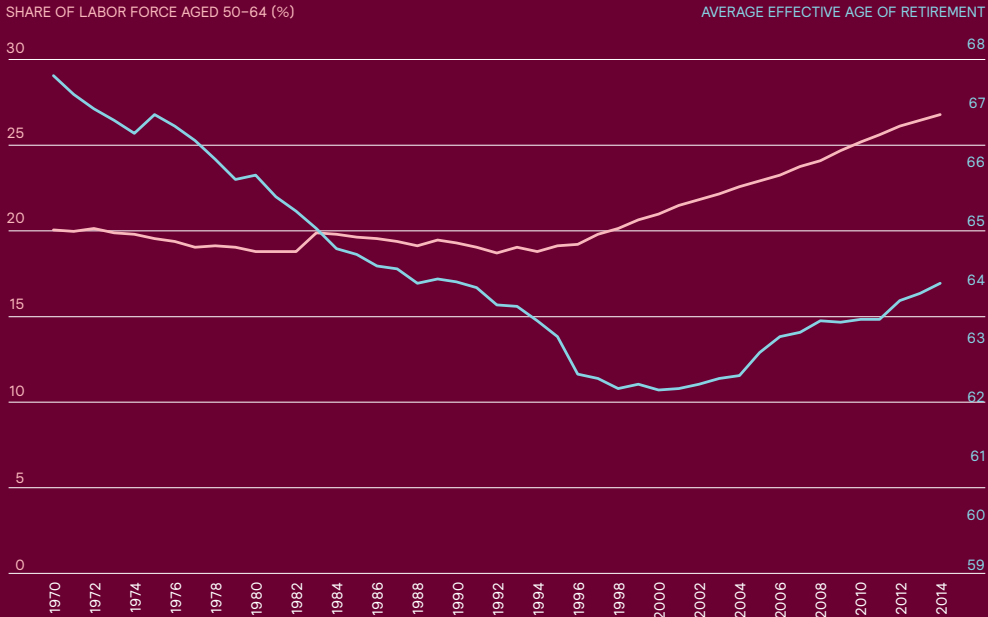
SECTION ONE: THE RISE OF THE OLDER WORKER

The global workforce's aging trends are fraught with risk but also ripe with opportunity.

Young populations are shrinking, and elderly populations are expanding world-over, both in developed and emerging markets, raising concerns around productivity losses. In China, for example, approximately 33% of the working-age population will be above the age of 50 by 2030. These numbers are even larger for some developed nations: 35% for Singapore, and 38% for Japan and Italy. In the USA, 27% of workers will be above the age of 50 in 2030.

However, these patterns often also indicate the rise of the older worker. OECD data shows, for example, that older workers have begun retiring later in life and are becoming more and more active members of the labor market (Figure 1). Clearly, societal aging is far from just a social problem or a harbinger of diminishing productivity. It is an opportunity for firms to capitalize on a new source of labor.

Figure 1



Source: Marsh & McLennan Insights analysis of OECD data

There are several notable socio-economic trends at play here that are making older workers more willing and able to work:

Retirement Savings Gap: The gap between the amount of money saved for retirement and the amount needed for retirement is widening globally, largely due to longer life expectancies and inadequate retirement savings programs. Mercer's analysis of this phenomenon shows that this savings gap stood at \$70 trillion globally in 2015 and is projected to reach \$400 trillion by 2050.¹

Personal Motivation: Older workers also frequently cite numerous non-financial reasons for remaining in and returning to the workforce – such as the desire to stay healthy and active, and taking pride and finding self-fulfillment in their work. Research indicates that almost 60% of workers aged 45-plus were investing in new skills for work, and the majority of them reported they were positive and excited about their jobs.²

Renewed Abilities: Older workers today are far more capable than they have been in past decades.³ Technological progress means that physical strength is no longer a key requirement of job performance, opening up many more opportunities for older workers – such as manual factory work using robo-prosthetics. Improvements in healthcare and education levels also mean that in many countries, older workers are as likely to be college-educated as their younger peers and are far healthier than they have ever been. In the US, each cohort is arriving at old age healthier than the previous one.

Unfortunately, as we point out in our earlier report, “[The Twin Threats of Aging and Automation](#)”, employment prospects for older workers are not always so optimistic. Older workers face unique and significant difficulties in the market that younger workers tend not to face. OECD research shows for example that older workers tend to face higher long-term unemployment rates compared to younger workers, and they also often make up a lower proportion of all new hires in a given year.⁴

This means that when older workers lose their jobs, they find it more difficult to find new opportunities – a crucial consideration in light of the Fourth Industrial Revolution. An older worker made redundant due to automation is much less likely to find new work. Much of this can be attributed to misperceptions about older workers and a lack of focus amongst employers with respect to hiring older workers. A recent World Economic Forum report showed for example that only 4% of surveyed companies invested in older workers as a workforce strategy for the future.⁵

¹ We'll Live to 100 – How Can We Afford It? WEF

² <http://www.100yearlife.com/the-book/>

³ Banking on Experience: How Smart Companies are Tapping a Growing Talent Segment to Power Growth in a Time of Change, Mercer (Forthcoming)

⁴ OECD (2013). Back to Work: Re-employment, Earnings and Skill Use after Job Displacement

⁵ http://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf

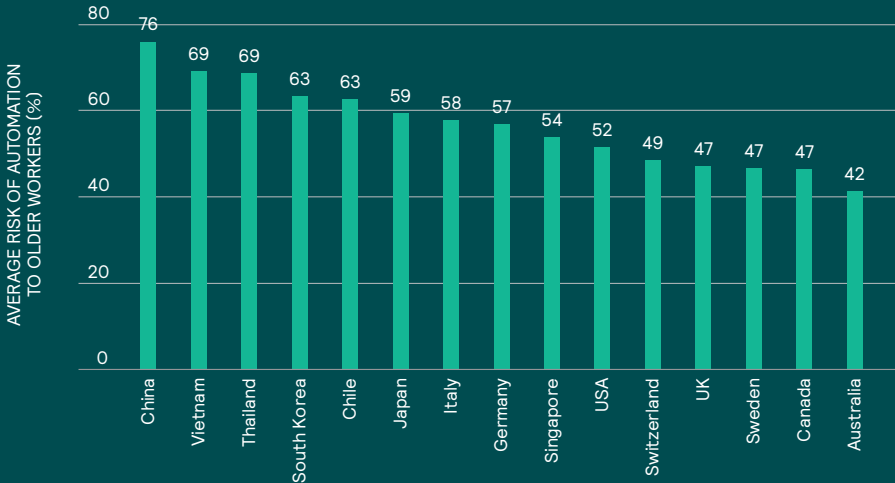


SECTION TWO: THE AUTOMATION THREAT

Although it's a difficult issue to predict, the threat that automation poses to older workers must be quantified. Is it just older workers that are at risk? What job categories are most vulnerable? And what geographical areas are ripe for this workforce disruption?

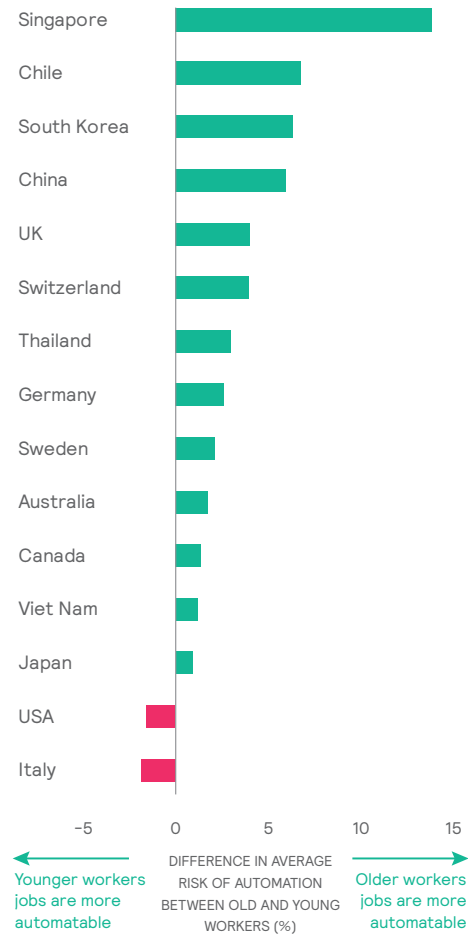
To examine the risk automation poses to older workers around the world, we measured the extent to which older workers are employed in low- and medium- skilled work across a sample of countries, based on occupational data from the United Nations and from national databases. Combining this measure with data out of the Oxford Martin School, which calculated the percentage of automatable tasks done in an occupation (across more than 700 occupations), we compiled weighted average data to show the **Average Risk of Automation to Older Workers** in 15 major economies (Figure 2). The Average Risk of Automation to Older Workers score tells us, on average, the percentage of tasks done by older workers that can be automated in a nation based on the types of occupations those nation's older workers are employed in.

Figure 2



Source: Marsh & McLennan Insights Calculations, UN Data, Frey and Osborne (2017), National databases

Figure 3



Source: Marsh & McLennan Insights Calculations, UN Data, Frey and Osbourne (2017), National databases

The results show that across the 15 nations we examined, the Average Risk of Automation to Older Workers generally sits in the mid- to high ranges of risk (scores of 30% and above). This indicates that older workers in these nations are doing work where 30% or more of all tasks are automatable on average. In fact, most of our selected nations have older-worker populations doing jobs where 50% or more of their tasks can be automated, indicating the acute vulnerability of older workers to automation. Older American workers, for example, are doing jobs that are on average 52% automatable. After expanding our analysis to all 35 countries that make up the OECD, we also found that the average risk of automation to older workers across all OECD countries was 40% and above.

The results also highlight that across the majority of the 15 sampled countries, older workers were at disproportionately higher risk of automation compared with younger workers – particularly so in several Asian markets such as Singapore, South Korea, and China (Figure 3).

The Twin Threats of Aging and Automation report highlights four key driving forces behind these dynamics. These are: education levels, size of manufacturing industries, welfare system strength, and financial system strength.

That is, countries with higher education levels and smaller manufacturing sectors have fewer older workers at risk of automation. Additionally, countries with stronger welfare systems will also have fewer older workers at risk of automation – the stronger the welfare and pension systems in a country, the less likely an older worker will be to remain in low-skill work. Also, the stronger the financial system strength, the more likely it is for an older worker to work independently or start their own business because they can be ensured that they'll be paid by owners and repaid by creditors.

It is crucial that private and public-sector systems work together to facilitate the transition of older workers into either retirement or renewed work using these mechanisms. Failing to reinvest the returns from automation into workers would of course create serious fallout: social and income inequality will increase, as will retirement savings gaps and pressures on pension systems. The current rising tide of labor force-participating older workers could be halted, or, the types of jobs available to older workers could become increasingly low-grade (low-paying, or irregular, for example). Talent shortages will also start to emerge as organizations' newly automated product lines start requiring human complements, particularly in nations where younger working populations are shrinking.



SECTION THREE: MEASURING RESILIENCE

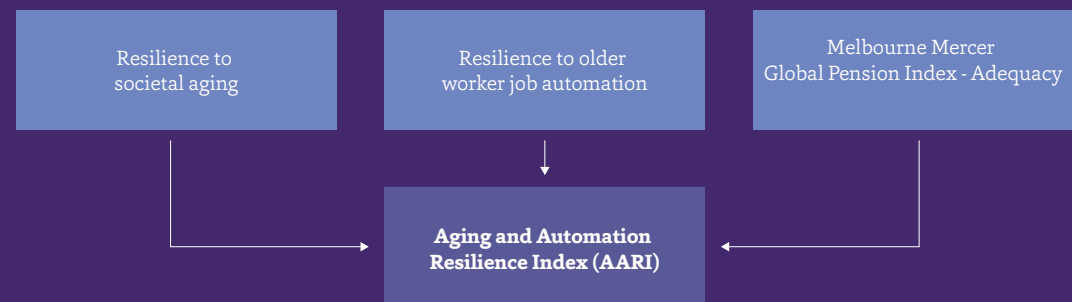
The risk factors regarding career stability and financial security for older workers are clear. However, some countries have created and supported economic and policy conditions that are more resilient to the fallouts of societal aging, and to the risk of older worker job displacement by automation.

To better understand this, we researched and analyzed an aggregated dataset of 20 countries to assess the resilience of each nation to aging populations and older-worker automation.

In this section we will present two analyses, each of which considers the problems of 1) Societal Aging and 2) Older Worker Job Automation, and then consider the factors that will help countries prevent or guard against each problem (which we have defined as “mitigating factors”). In each case we have plotted the results in a graph to demonstrate the resilience of each country to the problem being discussed (the significance of the problem is shown on the x-axis, and the impact of the mitigating factors is shown on the y-axis).

Finally, at the end of this section we take the results of these two analyses and combine them with the strength of each countries' pension index (from the Melbourne Mercer Global Pension Index) to form a holistic ranking of the 20 countries.

Figure 4



MITIGATING FACTORS: SOCIETAL AGING

Societal aging poses an important concern for individuals' financial security: as a nation's population ages, individuals will need to work until later in life to avoid depleting their savings and falling into financial hardship. Due to unique difficulties older workers face in the labor market, the potential fallouts can be serious. Are some countries better positioned than others to weather the fallouts of societal aging in the coming decades? To tackle this question, we will take projected Old-Age Dependency Ratios for 2040 as a starting point (see x-axis in Figure 5) and then consider five mitigating factors that may help a country maintain their current retirement system. The following five factors were normalized and then equally weighted to produce our "Mitigating Factors Score for Societal Aging" (see y-axis in Figure 5):

1. Labor force participation for 55–64 year olds (in 2017)
2. Labor force participation for 65+ year olds (in 2017)
3. Change in labor force for 55–64 year olds (between 2007–2017)
4. Change in retirement period (the difference between life expectancy and pension eligibility age, between 2017–2027)⁶
5. The level of pension fund assets expressed as a percentage of GDP (in 2017)⁷



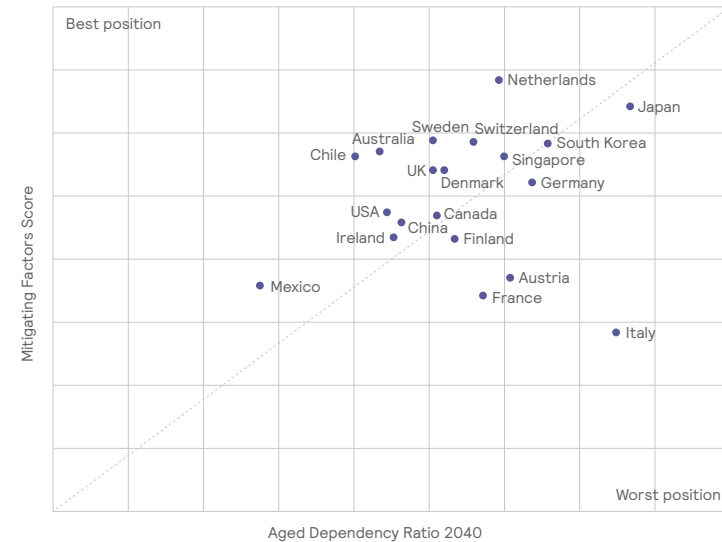
IN FOCUS: THE MITIGATING FACTORS FOR SOCIETAL AGING

Mitigating factors 1, 2 and 3 reflect the extent to which older workers are active members of their labor forces, and how that has changed over time. A higher or increasing workforce participation rate at older ages will provide older workers with income to offset the consequences of a higher old age dependency ratio.

Mitigating factor 4 reflects the projected change in years of the retirement period for workers between 2017 and 2027 due to pension reforms: countries whose older workers are in retirement for a shorter period will experience less strain on their retirement systems.

Figure 5 shows the relative position of each country with respect to their old age dependency ratios and the impact of the five mitigating factors.⁸ Countries near the bottom-right of the Figure are in the worst position: they both face relatively high rates of aging and lack sufficient mitigating factors to allay the fallouts. Countries near the top-left of the Figure are in the best position: they are aging relatively slowly, and have sufficient mitigating factors to address the relevant fallouts.

Figure 5



Our analysis indicates that several European and Asian countries are not currently well-positioned to counter the significant effects of their aging populations. Notable European countries that stand out in this regard include Italy, Germany, Finland, Austria and France, while notable Asian countries that stand out include South Korea, Singapore and Japan.

⁶ Note that for two nations – Denmark and the Netherlands – the 2027 Pension Age estimate used is likely to be slightly lower than what the actual Pension Age in 2027 is likely to be. From 2027, both nations will be indexing their Pension Ages to Life Expectancy. Latest available years for this projection are used (2025 for Denmark and 2022 for the Netherlands, which are the last years until which Pension Ages won't be Indexed to Life Expectancy).

⁷ Note that this measure does not include assets from public reserve funds and insurance contracts, and is therefore different from what is used in the MMGPI.

⁸ Source: Based on MMGPI 2016 Chapter 4. See Appendix for detailed methodology

The data reveals a variety of reasons behind these seven nations' vulnerabilities. Although South Korea, Singapore, Japan and Germany have relatively active older worker populations and have made forward-looking pension age reforms, the outsized rapidity of their aging problems will still pose risks for their populations. Four out of our five European nations of concern also all have less than 10% of their GDP in pension assets (the exception being Finland).

Italy, France and Austria's older worker populations also have room to become more active in their labor forces: in all three countries, just over half of all older workers (53–56%) participate in working life. By contrast, in some countries in the first quadrant of our scatterplot such as Sweden and Switzerland, more than three-quarters of all older workers are in the labor force. The combination of low pension assets and low older-worker labor participation presents risks for these nations as they age.

MITIGATING FACTORS: OLDER WORKER JOB AUTOMATION

Industry 4.0 puts older workers – particularly those employed in medium- to low-skilled work – at risk of either losing their jobs altogether or being pushed into irregular or under-paid work. These dynamics will also endanger older workers' abilities to fund their retirement. Are some countries better positioned than others to weather the potential fallout of older worker job automation in the coming decades? As in the previous section, we will take the Average Risk of Automation to Older Worker scores⁹ as a starting point (see x-axis in Figure 6) and consider four mitigating factors that will aid in protecting nations from the fallout of older worker job automation (see y-axis in Figure 6) to answer this question.

As mentioned, our Twin Threats of Aging and Automation report put forth four key themes that explained why certain countries had more older workers at risk of automation than others. We selected our four resilience indicators for each country based on these themes. These factors were normalized and then equally weighted to produce our “Mitigating Factors Score for Older Worker Job Automation”:

- 1. Education Levels:** The World Economic Forum's (WEF's) Human Capital Index scores (for 50–64 year olds in 2017)
- 2. Industrial Structures:** Massachusetts Institute of Technology (MIT)'s Economic Complexity Index scores (in 2017)
- 3. Welfare Systems:** General government final consumption expenditure (as a % of GDP in 2027)¹⁰
- 4. Legal Rights to Financing:** The World Bank's Legal Rights to Financing scores (in 2017)

⁹ As mentioned, this score reflects the average percentage of tasks done by older workers that can be automated in a nation, based on the extent to which those older workers are employed in low- or medium-skilled occupations.

¹⁰ Data from Business Monitor International (BMI)



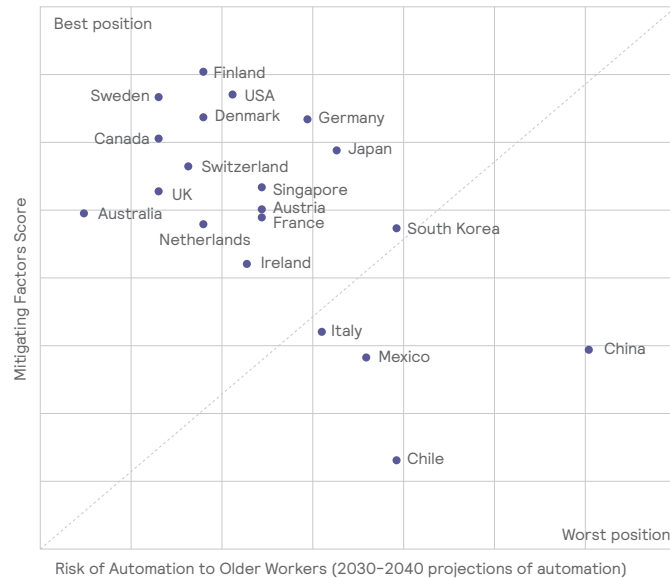
IN FOCUS: THE MITIGATING FACTORS FOR OLDER WORKER JOB AUTOMATION

Mitigating factors 1 and 2 reflect socio-economic conditions in a nation that can mitigate the effects of the risks of older worker automation. Mitigating factor 1, the WEF's Human Capital Index, measures the knowledge and skills people possess in a nation's workforce. The higher the quality of the workers and their skills and capabilities, the more resilient they will be to job automation – even if they are employed in low or medium-skilled work. Similarly, factor 2, MIT's Economic Complexity Index, measures the productive capabilities of a nation. The more complex and high-quality the industrial capabilities of a nation, the more resilient it will be to workplace automation.

Mitigating factors 3 and 4 reflect policy and legal conditions in a nation that can mitigate the risks of older worker automation. General government final consumption expenditure as a percentage of GDP determines the level of financial support a population can expect from their government. The World Bank's Legal Rights to Financing Index score reflects the strength of legal protections for creditors and debtors, reflecting the security a population can expect from its financial system.

Figure 6 shows the relative position of each country with respect to their Average Risk of Automation to Older Worker scores and the impact of these four mitigating factors. Countries near the bottom-right of the Figure are in the worst position: they both face relatively high risks of experienced-worker job automation, and additionally lack sufficient mitigating factors to allay the fallout. Countries near the top-left of the Figure are in the best position: their experienced workers do not face severe risks of job automation, and have sufficient mitigating factors to address the relevant fallouts.

Figure 6



Our analysis shows that the countries that are most vulnerable and least-resilient to fallout from older worker job automation are the developing countries in our sample – China, Chile, and Mexico in particular. With large manufacturing and agriculture bases that widely employ older workers, these nations both face some of the highest Risk of Automation to Older Worker scores, and lack the mitigating factors to combat these risks.

Meanwhile, Italy and South Korea stand out as outliers amongst the developed countries in our sample – with Italy scoring particularly poorly amongst our developed nations in terms of the strength of its mitigating factors. Despite having a wide welfare net, Italy suffers due to its High Risk of Automation to Older Workers score. The skill base of Italy’s older worker labor force and the nature of the goods Italy produces leave the nation additionally vulnerable to automation risks. Conversely, while Germany and Japan face similar Risk of Automation to Older Worker scores to Italy, the complexity of their goods and the skill base of their older workers will mitigate much of these risks.

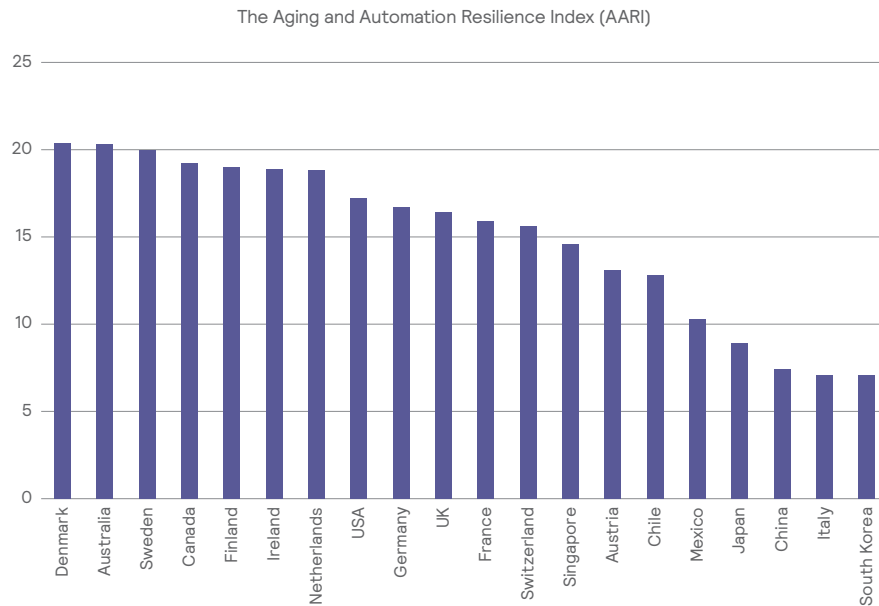
RESILIENCE TO AGING AND AUTOMATION: THE AGING & AUTOMATION RESILIENCE INDEX (AARI)

We have combined the power of the mitigating factors analysis we have conducted here along with the Melbourne Mercer Global Pensions Index (MMGPI) to produce the Aging and Automation Resilience Index (AARI, see Figure 7). The first two pillars of this index are comprised of a ‘Resilience Score’ for the risks associated with societal aging and with older worker job automation: a score that is a combination of the y- and the x-axes in Figures 5 and 6. The MMGPI’s measure of the ‘Adequacy’ of a country’s pension system judges the design and structure of a nation’s pension system – using metrics such as the replacement rate of the pension system and the minimum pension an individual may receive – and this measure makes up the final third pillar of our Index.

Taken together, the three pieces of the AARI allow us to compare countries based on their ability to provide better or worse outcomes for older workers in the coming decades through three lenses: resilience to societal aging, resilience to older worker job automation, and the strength of the retirement system.

Figure 7 shows the final index scores.

Figure 7



| Country | MMGPI Adequacy Score | Resilience to Societal Aging Score | Resilience to Older Worker Job Automation Score | Final Index Score |
|-------------|----------------------|------------------------------------|---|-------------------|
| Denmark | 7.70 | 5.81 | 6.92 | 20.4 |
| Australia | 4.72 | 7.86 | 7.75 | 20.3 |
| Sweden | 5.61 | 6.57 | 7.79 | 20.0 |
| Canada | 6.56 | 5.30 | 7.37 | 19.2 |
| Finland | 7.23 | 4.44 | 7.37 | 19.0 |
| Ireland | 8.01 | 6.18 | 4.74 | 18.9 |
| Netherlands | 7.36 | 5.67 | 5.81 | 18.8 |
| USA | 3.81 | 6.72 | 6.69 | 17.2 |
| Germany | 8.20 | 3.19 | 5.30 | 16.7 |
| UK | 3.53 | 6.08 | 6.83 | 16.4 |
| France | 8.12 | 2.80 | 5.00 | 15.9 |
| Switzerland | 3.58 | 5.41 | 6.64 | 15.6 |
| Singapore | 4.93 | 4.36 | 5.29 | 14.6 |
| Austria | 5.71 | 2.32 | 5.07 | 13.1 |
| Chile | 3.83 | 8.46 | 0.48 | 12.8 |
| Mexico | -0.80 | 9.10 | 1.99 | 10.3 |
| Japan | 2.75 | 1.65 | 4.54 | 8.9 |
| China | 2.60 | 6.16 | -1.33 | 7.4 |
| Italy | 5.63 | -1.42 | 2.92 | 7.1 |
| South Korea | 0.91 | 3.36 | 2.85 | 7.1 |

Our analysis indicates that Denmark, Australia, and Sweden stand out as positive examples in the fight to guard against aging and automation. Despite their aging populations, their impressive pension and welfare systems – as well as their increasingly active and skilled older worker populations – will prevent serious fallout. Other aging nations are not so lucky. China, Italy and South Korea in particular are aging rapidly and have older workers at high risk of automation, and severely lack mitigating effects. For South Korea and China, the inadequacy of the structure of their pension systems will endanger older populations as well.

Building resilience in these nations will involve both targeted solutions for rehabilitating, reskilling and redeploying older workers at risk of job automation, as well as for enabling broad macroeconomic measures that can increase retirement system sustainability, such as economic growth, and pension system reform.



SECTION FOUR: NEW IDEAS FOR A NEW PROBLEM

Aging workforces and automation doesn't have to be a dark intersection. The effects of automation will depend on a wide variety of factors, some of which we have tried to capture here and in our other research on the subject. Automation will not necessarily be an automatic job destroyer, and determining its exact effects are next to impossible. What we can say, however, is that today's landscape of widening inequality and unprecedented rates of technological progress pose new kinds of challenges for workforces that we haven't seen before – but with the right approaches, these challenges can become opportunities.

The effects of workplace automation will need to be tempered with realistic solutions and new ideas. The future will depend on innovation. Old ideas about the aging workforce need to be reworked. New ideas need to be valued. In several separate papers due shortly, Mercer explores the increased productivity gains that can be experienced by having an age-diverse workforce. These important trade-offs should not be ignored when reviewing the implications of this topic.

Mercer has developed three such ideas that it believes can help organizations and governments manage the future of aging workforces.

1. Shared responsibility: Responsibility for the financial security of aging workers does not fall into the exclusive provenance of employers or governments. Responsibility for future success will be shared: governments will need to provide a backstop against poverty for the segments of the workforce that have not planned for or that simply can't afford retirement. They must also create a framework for organizations; setting out guidelines and a blueprint for best practices.

Employers must provide a solid and safe environment in which their employees can work and access the appropriate benefit programs, as well as offer flexibility and supported phased transitions from working to not working. They need to ensure employees are protected through various important life events, such as illness, long-term disability, retirement and death.

The individual's responsibility is to prepare for these events and for potential reskilling. Recognizing the distribution of responsibilities will go a long way in expanding nations' long-term savings asset base, increasing access to adequate re-skilling and educational resources, and ensuring a social and regulatory safety net for older workers as well as optimizing potential for economic growth.

2. Pooling and sharing: Workers who are in the later stages of their career, or indeed, anyone in jobs which will be affected by automation, would benefit from approaches that would help to "elasticize" the workforce. An elastic workforce stretches the boundaries of employers, allows employees to better manage the hours they work and creates more opportunities for workers to thrive.

At present, approaches such as a 'Talent Pooling Consortium' are being explored with our clients in order to do just this. This type of program will allow individuals to enter, and benefit from, the freelance economy and more flexible approaches to working. Without placing their full-time future in a single company that may not provide the stability they're looking for, older workers can enter a 'pool' of workers that specialize in certain skills and provide the decades of experience that other labor pools just don't have, or be utilized for mentoring and coaching other generations in skills missing from their own repertoires. Such pools can then be accessed by a variety of organizations with these needs. Innovative approaches to elasticizing workforces can be instrumental in boosting workforce participation and job quality for older workers.

3. Recalibration and planning services: Workers can prepare for transition rather than be disrupted by it. That planning should focus on integrating financial decision making with physical health and future career opportunities, together with any necessary skills re-development. Organizations can help employees plan a new course for the future by essentially creating career path assessments for those three areas – in fact, prototype models for these assessments are currently being trialed in the UK.

Training workers can be a significant expense to organizations. At a minimum, employers should demonstrate a detailed understanding of exactly the types of training that will best address skills gaps, regardless of age. This targeted approach offers reassurance that training efforts will not be wasted. Individualized assessments can identify current levels of competence, skill or knowledge in one or more areas and can compare that competence level to the level required for the position in question or another position within the organization.¹¹ Using the gains made from automation to reinvest in older worker skills, training and redeployment will intensify the complexity of countries' human capital and of the goods they produce, which will go a long way to mitigating against the fallouts of automation.

Organizations have much to benefit from investing the productivity gains from automation into their human workers, as older workers are more and more willing and able to remain in or re-enter workplaces around the world. Working together with governments to invest in and reskill older workers would help redeploy them in the workplace, and provide firms with a fresh source of vitality in a world of shrinking young labor. Technological developments and the automation of work offer organizations and governments a unique opportunity to evolve in Industry 4.0.

¹¹ <https://www.shrm.org/hr-today/trends-and-forecasting/research-and-surveys/Documents/Preparing%20for%20an%20Aging%20Workforce%20-%20Strategies,%20Templates%20and%20Tools%20for%20HR%20Professionals.pdf>

APPENDIX

CALCULATING MITIGATING FACTOR SCORES

To measure the resilience of nations to the twin threats of societal aging and widespread workplace automation, we selected several ‘mitigating factors’ that would aid in preventing fallout from each trend (aging and automation respectively). The factors we selected and their relevance have been discussed.

The calculations began with considering the mean and distribution (or standard deviation) of each mitigating factor for our sample set of 20 countries. Using these metrics, we normalized our data such that for each of the five factors that would mitigate against the Aged Dependency Ratio Risk, a score between 0 and -2 was given to each country (with an average of -1 across all countries). For the four mitigating factors for the Risk of Automation to Older Workers, a score between 0 and -2.5 was given to each country (with an average of -1.25 across all countries).

These scores were equally weighted for each country to produce the final Mitigating Factors Score (reflected on the x-axes of Figures 5 and 6 above). Because there were four mitigating factors for the Risk of Automation and five for the Aged Dependency Ratio Risk, the average Mitigating Factors Score for both risks across all countries was 5.

Example:

| Indicator | Average Across the 20 Countries | China: Raw Indicator Score | China: Scaled Indicator Score | Sweden: Raw Indicator Score | Sweden: Scaled Indicator Score |
|---|---------------------------------|----------------------------|-------------------------------|-----------------------------|--------------------------------|
| Human Capital Index | 71.5 | 67.72 | -0.65 | 73.95 | -1.63 |
| Economic Complexity Index | 1.4 | 0.69 | -0.53 | 1.81 | -1.66 |
| General government final consumption expenditure (% of GDP) | 17.6 | 16.2 | -1.06 | 24.2 | -2.18 |
| Legal Rights to Financing | 6.3 | 4.0 | -0.71 | 6.0 | -1.18 |
| Mitigating Factors Score (Automation Risk) | 5 | | 2.95 | | 6.65 |

Note: scores may not sum due to rounding

CALCULATING THE RETIREMENT RESILIENCE INDEX

The Retirement Resilience Index relies on three pillars: The MMGPI Index, our Resilience to Societal Aging analysis, and our Resilience to Older Worker Job Automation analysis. The calculations that were made for each of these pillars were as follows:

- 1. The MMGPI Adequacy Score:** The MMGPI scores are a weighted average of scores that measure pension systems' adequacy, sustainability and integrity. We scaled the final MMGPI's Adequacy scores for our 20 countries to a scale between 0 and 10.
- 2. The Resilience to Societal Aging Score:** We normalized the 'Old age dependency ratio in 2040' metric (the x-axis on Figure 5) to be scaled from 0 to 10. We then subtracted this score from the Mitigating Factors Score for Societal Aging to create this Resilience score. This score was normalized to a scale between 0 and 10.
- 3. The Resilience to Older Worker Job Automation Score:** We normalized the 'risk of automation to older workers' metric (the x-axis on Figure 6) to be scaled from 0 to 10. We then subtracted this score from the Mitigating Factors Score for Older Worker Job Automation to create this Resilience score. This score was normalized to a scale between 0 and 10.

These three values were then equally weighted to produce the Final Index Score.

Example:

| Country | Mitigating Factors Score (Aging Risk) | Scaled Old Age Dependency Ratio Score | Resilience to Societal Aging Score | Mitigating Factors Score (Automation Risk) | Scaled Risk to Older Workers of Automation Score | Resilience to Older Worker Job Automation Score | MMGPI Adequacy Score |
|---------|---------------------------------------|---------------------------------------|------------------------------------|--|--|---|----------------------|
| China | 4.58 | 3.38 | 1.20 | 2.95 | 12.09 | -9.15 | 53.4 |
| Sweden | 5.88 | 4.25 | 1.63 | 6.65 | 2.61 | 4.03 | 67.6 |

Note: scores may not sum due to rounding

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