

# sigma

The economics of digitalisation in insurance: new risks, new solutions, new efficiencies

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# Executive summary

Digitalisation has revolutionised value creation within and across sectors, including the insurance industry.

We have created a new index to give indication of how much the digital economy could benefit the insurance industry in different countries.

Digitalisation benefits underwriting and risk mitigation capabilities ...

... but the benefits come with new forms of risk and systemic exposures.

Many leading re/insurers are investing in innovation to further optimise the potential that digitalisation can yet deliver.

Our findings suggest digitalisation of the insurance industry is still in its early stages; transformation is pending.

Digitalisation has revolutionised value creation across firms and sectors. For insurance business, digitalisation will be a source of new growth, new risk pools, and new efficiencies in the industry value chain. More broadly, despite technological break-throughs and much hype in the field of artificial intelligence (AI), the boost to overall economic productivity growth has been weak, coming in at annual average of 1.1% in the OECD countries over the last two decades. We explore this productivity paradox and how digitalisation will likely impact economic growth, labour productivity and inflation, and also the insurance industry in the future.

We analyse measures of digitalisation that matter for insurance based on correlations with insurance penetration. Our new *Insurance Digitalisation Index* rankings give indication of progress made to date in different countries with respect to the digitalisation of insurance. Advanced markets, where physical infrastructure is relatively strong and more people have online connection, rank highest. South Korea, Sweden and Finland occupy the top three spots. Emerging markets rank relatively lower, but they have become more digital and faster over the last 10 years. China, for example, rose 10 places over the course of the 2010–2020 analysis period. Our broader resilience analysis also suggests countries that are more digital are typically more resilient against other exposures, such a natural catastrophe risks.

For insurers, digitalisation changes how risk can be assessed and mitigated with new and more granular data. It enables improved underwriting in life insurance through more holistic and accurate risk pricing using electronic health data from wearables. Risk mitigation capabilities can also benefit, like in the case of the automotive industry with Advanced Driver Assistance Systems. Digital data has become a source of competitive advantage and wealth, as the steady rise in the share of firms' "intangible assets", mostly uninsured, shows. Just 17% of intangibles are estimated to be insured currently, compared with 58% of tangible assets, presenting a growth opportunity for the industry.

The proliferation of digital technology also creates new risks and potential for large losses, however. As digital ecosystems grow, the associated network effects raise business interruption and cyber vulnerabilities. Insurers have developed solutions to protect against such earnings and cash flow risks. With respect to cyber specifically, survey respondents say cyberattacks are the main risk facing business today. This is reflected in the rapid growth in demand for cyber insurance: we estimate global cyber premiums will reach USD 16 billion in 2023, and forecast an increase to USD 25 billion by end 2026. The increased use of Al across the economy, meanwhile, may also raise new liability concerns. A lack of explainability for systems that operate as black boxes can raise challenges in understanding liability attribution.

Digital transformation remains high on the industry agenda. The initial focus was on distribution, seemingly to good effect. In a global survey, we found that more than 40% of consumers in advanced markets had bought new or additional insurance cover online, and that 50% in emerging markets had done so. Insurers are experimenting with digitalisation across the value chain for efficiency gains. For example, we find that in use cases, insurers target a 3–8 percentage point reduction in loss ratios and up to 20% savings in other parts of the value chain. Today 31 of the 50 largest re/insurers invest in insurtech in pursuit of first-mover advantage.

All told, our index results suggest gains from digitalisation are far from exhausted, even in the highest ranking countries. The gap between the laggards (typically emerging markets) and the "best in class" countries remain large, pointing to higher catch-up potential in the former. It means digitalisation is both the source of new risks and solutions. To secure positive return on investment insurers will need to re-engineer workflow processes and invest in data engineering capabilities to maximise the enterprise-wide potential of digital data and algorithms, and adapt to regulatory requirements with respect to data privacy and analytics.

# Key takeaways

## Swiss Re Institute's Insurance Digitalisation Index, country rankings 2010 and 2020

Country	2010 ranking	2020 ranking	2020 fixed broadband subscriptions per 100 inhabitants	2020 mobile broadband subscriptions per 100 inhabitants	2020 internet users as a share of individuals	2020 share of Internet users who have pur- chased online in the last 12 months	2020 busi- ness R&D expenditure in information industries as a percentage of GDP	2020 patents in ICT-related technologies as a percent- age of total IP5 patent families	2020 OECD foreign direct investment regulatory re- strictiveness index	2020 share of digitally deliverable services in commercial services trade
South Korea	1	1	7	10	7	16	2	2	25	25
Sweden	3	2	11	7	4	6	5	3	17	4
Finland	2	3	20	3	5	11	4	4	5	5
US	6	4	13	2	20	15	3	5	22	2
Netherlands	5	5	6	6	9	2	19	10	4	7
Israel	8	6	25	5	14	26	1	9	24	10
Ireland	12	7	23	14	12	8	9	6	13	1
Japan	4	8	17	1	27	21	6	7	15	6
UK	10	9	9	12	3	1	18	11	11	8
Switzerland	9	10	1	16	6	7	17	21	20	3
Denmark	7	11	4	4	1	3	13	22	10	28
Germany	14	12	5	21	8	4	11	16	7	9
Norway	11	13	3	15	2	5	10	17	21	20
France	13	14	2	18	15	12	12	13	14	18
Belgium	17	15	8	22	11	10	7	14	12	17
China	26	16	16	17	28	22	15	1	29	16
Australia	15	17	15	9	13	13	21	15	26	22
Czech Republic	22	18	14	20	16	9	14	27	3	15
Austria	16	19	24	11	17	14	8	19	23	23
Spain	20	20	19	13	10	20	28	23	6	14
Hungary	23	21	18	28	19	19	26	20	8	21
Portugal	25	22	10	25	22	24	25	18	1	27
Poland	19	23	26	8	21	18	20	26	19	24
Slovenia	18	24	21	23	18	17	22	28	2	26
Italy	21	25	22	19	24	25	23	25	16	12
Greece	24	26	12	24	23	23	27	24	9	29
Turkey	27	27	27	27	25	27	16	12	18	19
Mexico	28	28	28	26	26	29	29	29	27	13
India	29	29	29	29	29	28	24	8	28	11

Note: Shading is based on country rankings for each of the variables in 2020: green = highest ranked, red = lowest ranked. Source: OECD, Swiss Re Institute

## Average Insurance Digitalisation Index scores over time, advanced vs emerging markets

In aggregate terms, the emerging markets are closing the digital gap with advanced markets



## Savings potential from enhanced digital capabilities

We found many use cases where automating standardised tasks such as data collection and analysis for underwriting, processing of low-severity, high-frequency claims, and deployment of bots for post-sales customer engagement have yielded savings. Insurers are targeting a 3–8% improvement in loss ratios and savings of up to 10–20% in other parts of the value chain.



■ % of cost base (LHS) → Range of potential savings (RHS)

Note: The chart represents a range of improvements in pilot conditions. Benefits cannot be extrapolated at a company or market level. Sources: Swiss Re Institute analysis of press releases, publications and interviews by insurers, brokers, consulting companies and technology vendors.

## Investing in the insurance industry value chain

More than a third of insurtech investments has been in distribution technology. The other main areas of digital investment have been in pricing and underwriting processes



Source: Swiss Re Institute analysis of 460 insurtech start-up involvement in the process steps of the insurance value chain.

## Intangible risks

Business interruption	Digital technologies offer scalability and network effects, reshaping market dynamics and creating concentration risks. Dependencies on critical digital infrastructure create suppy-chain risks. Insurance solutions can reduce earnings and cash flow volatility.
Cyber	The concentration of digital assets creates systemic cyber risks – a key concern for businesses. Cyber risks are magnified when critical infrastructure is targeted.
Liability and compliance	Industries with high data protection vulnerabilities (eg, healthcare) are more regulated and see more insurance claims. Artificial intelligence raises new liability concerns due to its potential economic impact; lawmakers are responding with new proposed regulations.

## Hazard mitigation area

Transportation and automotive safety	Advanced Driver Assistance System help prevent collisions and can improve driver awareness.
Industrial safety	Sensors can monitor machinery and equipment enabling predictive maintenance and preventing accidents caused by equipment failures.
Smart homes	Automated controls for lighting, security and appliances minimise risks associated with forgotten appliances.
Healthcare	Telemedicine reduces the need for patients to travel, improving access to healthcare. Digital records enable accurate and timely sharing of patient information among healthcare providers.
Natural disaster early warning systems	Digital sensors and data analysis can provide early warnings for earthquakes, hurricanes, floods and other natural disasters, allowing for timely evacuation and preparation.
Construction and workplace safety	Digital modelling of construction projects can identify potential safety hazards early in the design stage, leading to safer building and structures.
Energy sector	Smart grids can automatically reroute power during outages, limiting downtime (less business interruption) and minimising safety risks, such as wildfires.

# Measuring the digitalisation of economies

The diffusion of digital technology has long promised a new age of economic dynamism. Yet labour productivity in the OECD has grown by just over 1% annually since 2000. Traditional metrics such as GDP may fail to adequately capture the economic influence of novel digital technology and historically, the impact of breakthrough technologies can take a long time to materialise. In the long term, we expect overall positive effects of digitalisation on GDP growth, labour productivity, and inflation. To better quantify the impact of digitalisation and future potential where it matters for the insurance industry, we have developed an Insurance Digitalisation Index based on the digitalisation variables that facilitate insurance penetration across countries. South Korea, Sweden and Finland rank in the top three spots, scoring high on measures such as R&D spending and digital connectivity. Emerging markets are catching up to more digitally advanced economies, but the results suggest that all countries can do more the to capture the benefits of going digital.

## The fourth industrial revolution: has it happened yet?

In recent decades, the diffusion of digital technology into nearly every business and workplace, also known as "digitalisation" has reshaped the global economy, and our lives. It starts with digitisation, or the process of converting information into a digital format that enables computation, which in turn enables the digital transformation (ie, the digitalisation) of economic activities by allowing: 1) much more data to be extracted and analysed; 2) greater personalisation and customisation; 3) new kinds of controlled experimentation and optimisation; and 4) new forms of contracts.

Artificial intelligence (AI) is one component of the story. Digitalisation gave rise to new types of data, often personal and non-financial in nature, which have been inputs for new (deep) machine-learning techniques. Advances in Al are increasing the speed, reach and affordability in two main areas: automation (which is facilitated by Al but is not a consequence of AI per se), and predictive accuracy. The excitement over AI comes from its potential as a "general purpose technology" (GPT).<sup>1</sup> These technologies can be applied across many sectors and their diffusion can have long-lasting aggregate impacts on productivity and economic growth.<sup>2</sup> Empirical identification of this relationship is difficult to ascertain but there is research to indicate that digitalisation does exert some degree of influence over macroeconomic parameters, eventually.

Table 1	Factor	Impact	Greater digitalisation
The macroeconomic impacts of digitalisation	GDP per capita	$\uparrow$	supports GDP growth via sensitivity to changes in R&D intensity. However ramifications are not observed immediately due to a lag in enterprise management capabilities.
	Inflation	$\checkmark$	supports lower prices as online marketplaces drive greater price transparency and lower search costs, creating price differentials with brick and mortar retailers. Digital goods and services also face lower input costs, passing cost-savings onto consumers.
	Employment	≁↓	has variable benefits depending on market. Advanced economies likely experience reduced labour market benefits from digitalisation as productivity enhancements allow some jobs to be outsourced, while emerging markets benefit by absorbing lower value-added, labour-intensive tasks.
	Total factor productivity		can close the productivity gap between more and less skilled workers, support efficiency gains in the production of capital goods, and complement labour to raise overall output as well as the value of tasks that human workers can supply.

Source: Swiss Re Institute

From digitisation to digitalisation.

New breakthroughs in AI technology could eventually drive a new productivity boom.

<sup>&</sup>lt;sup>1</sup> GPT not to be confused with generative pre-trained transformer, a novel kind of Al-based large language model used in the popular ChatGPT.

<sup>&</sup>lt;sup>2</sup> The Fourth Industrial Revolution: what is means, how to respond, World Economic Forum, 14 January 2016

The impact of digitalisation on macroeconomic variables varies.

The Solow Paradox redux: digitalisation has revolutionised everyday life, but the impact on productivity is hard to detect.

The benefits (and costs) of digitalisation may not be fully observable in economic statistics.

Traditional inflation measures understate the disinflationary benefits from higher digitalisation.

Efficiency gains from digitalisation may be offset by other trends.

Productivity gains may be in level rather than growth terms, and arrive in waves.

Table 1 provides the directional relationship of these influencing factors, though quantifying which of these determinants dominate over the longer run as well as the magnitude of digitalisation's impact is challenging. Some relationships are already well documented; others are hotly debated. For insurers, the impact on the long-term trends in these key variables cannot be ignored. There are broad-based impacts on the growth of claims and demand for insurance driven by economic growth and inflation. There are more specific changes to risk pools which we discuss in chapter two. Finally, insurance is increasingly digitalising its value chain as we discuss in chapter three.

In the past 20 years, expectations of faster economic growth and productivity gains on account of rapidly advancing digital technologies have not materialised. We see similarities to the "Solow Paradox" coined in 1987 by the economist Robert Solow, who highlighted a sharp slowdown in productivity growth dating back to the 1970s despite the rapid development of information and communication technologies (ICT). The internet and ICT revolution of the late 1990s did eventually spark a wave of faster growth (from roughly 2% to 3%) in the US, but productivity reverted to a lower trend rate in the mid-2000s, even before the global financial crisis (GFC). The economic consequences have been significant: for instance in the US, slowing productivity growth from 2005 to 2018 yielded a cumulative output loss in the US nonfarm sector of USD 10.9 trillion, or USD 95 000 in output per worker.<sup>3</sup>

## Explanation 1: the impact of digitalisation is mis-measured

One explanation put forward for the absence of a digital technology-fuelled productivity boom is that it is simply not measured. Traditional national accounting variables, including gross domestic product (GDP), may not fully capture the economic gains from digitalisation. Technology has made it harder to distinguish between consumption and production: time spent in social interactions can have utility while also generating valuable output, consciously or not. And while some work done online is voluntary (eg, open-source software development, crowd-sourced wikis, product reviews) to the benefit of society at large, its value is also not captured by traditional metrics.<sup>4</sup>

For digital goods and services that do not have a price, the associated quality improvements are difficult to estimate and often under-measured in official inflation measures. This has likely contributed to an over-estimation of inflation rates; modest estimates find official inflation rates could be over-estimated by a plausible range of 0.3 to 1.4 percentage points (ppt) per year due to under-adjustment for quality changes.<sup>5</sup> Outlet bias – when consumers shift spending toward (cheaper) online retailers not fully captured in official inflation measures – is likely to have accelerated in recent years as the pandemic diverted spending toward digital channels.<sup>6</sup>

Another measure of productive efficiency, total factor productivity (TFP), is calculated as the residual of GDP growth after traditional inputs such as labour and capital have been accounted for. However, technological progress as represented by other measures (such as patents) can happen at the same time as, for example, reduced competition that may better explain disappointing TFP growth. The surge in equity valuations of large-cap tech firms further suggests traditional growth data must be missing something,<sup>7</sup> as well as highlighting how the capital gains from digitalisation are concentrated in a few firms.

An alternative explanation of weak productivity is that it is more structural and not the result of measurement issues alone.<sup>8</sup> This school of thought argues that the productivity boom in the late 1990s to early 2000s was a one-time level shift instead of a permanent

- <sup>3</sup> The U.S. productivity slowdown: an economy-wide and industry-level analysis Bureau of Labor Statistics (BLS), April 2021. The overall estimated output loss figure represents the difference between 1) the sum of annual real output amounts in the nonfarm business sector from 2006 to 2018; and 2) the sum of annual real output amounts during this period assuming that labor productivity had continued to grow at the same longterm average rate observed from 1947 to 2005.
- <sup>4</sup> Research has suggested that including "free" content raises estimates of GDP growth, but not nearly enough to reverse the post-GFC recent slowdown. See "Free" Internet Content: Web 1.0, Web 2.0, and the Sources of Economic Growth, Federal Reserve Bank Philadelphia, May 2018.
- <sup>5</sup> *The measurement of output, prices, and productivity,* Brookings, 25 July 2018.
- <sup>6</sup> The BLS refreshes its CPI sample every four years, which likely fails to capture shocks like the pandemic and its accompanying e-commerce boom.
- <sup>7</sup> In the top 10 largest listed companies by market capitalisation, eight can be considered digital technology firms in some form (Apple, Microsoft, Alphabet, Amazon, Nvidia, Tesla, Meta, TSMC).
- <sup>8</sup> Does the United States have a productivity slowdown or a measurement problem? Brookings, 2016.

increase in trend. The subsequent slowdown is therefore an expected reversion to longrun trend (see Figure 1).<sup>9</sup> However, that seems overly pessimistic given evidence of recent scientific breakthroughs like deep learning in AI, and the potential for paradigm shifts. A more likely answer to the Solow paradox, in our view, is that productivity driven by GPT-diffusion plays out in multiple waves.<sup>10</sup> The 1995–2004 productivity boom continues to pay dividends today: it may just take more time before those dividends reach a critical mass to spark the next wave.



## The impact of digitalisation may be delayed and spread out over time.

R&D needs to be complemented by other complementary investments to maximise economic impact.

## Explanation 2: the impact of digitalisation lags

Digitisation, digitalisation and computation are not new (the general-purpose digital computer was theorised by Charles Babbage in the 1830s). However, the large-scale implementation of GPTs happens with long lags. The ICT revolution only finally took off in late 20<sup>th</sup> century when many complementary innovations were in place, such as in semiconductor, miniaturisation and networking technologies. The sources of lags in implementing new technology can be better seen at the firm level, such as in the necessary adaptation of business models. Not all firms will adopt new technology if the cost of replacing existing and still serviceable technology is high. Existing research finds that even those firms that have digitalised did not experience immediate performance improvement if at all. Chapter 3 looks in greater detail at the experience of digitalisation throughout the insurance value chain.

New inventions or technologies alone are not sufficient for success. Investments in product design, marketing, customer support, management and worker training are necessary for commercialisation, which takes time. Much of these investments are considered part of firms' "intangible capital", an increasingly powerful force in digital economies. Private sector investments in intangibles are estimated to account for over 16% of GDP in the US,<sup>11</sup> and the accumulation of this intangible capital stock explains much of the growth in value of the top technology companies.<sup>12</sup> We describe in chapter 2 how the accumulation of intangible assets changes the risk landscape.

- <sup>11</sup> Intangible Capital and Modern Economies, Journal of Economic Perspectives, vol 36, 2022.
- <sup>12</sup> Decoding Microsoft, Intangible Capital as a Source of Company Growth, National Bureau of Economic Research, March 2010,

<sup>&</sup>lt;sup>9</sup> R. Gordon, The Rise and Fall of American Growth, Princeton University Press, 2016.

<sup>&</sup>lt;sup>10</sup> C. Syverson et al, *Toward an Understanding of Learning by Doing: Evidence from an Automobile Assembly Plant*, National Bureau of Economic Research, April 2012.

The benefits of digitalisation often serve as a complement to labour rather than a substitute.

Automation's impact on jobs and inequality is complicated: it depends on the skills being automated as well as any policy responses.

The productivity gains offered by technological diffusion will put downward pressure on inflation.

## Technology and the future of labour markets

Much workplace technology improves productivity by saving labour input, for example through automation. This raises the prospect of "technological unemployment", which could put strains on existing unemployment insurance and worker's compensation schemes. Yet the employment-to-population ratio has been relatively stable over the very long-term. One explanation is that the impact of digitalisation and specifically its automation aspect is offset by 1) new job opportunities created by technology; and 2) a shift in demand to services that are harder to substitute. Indeed, automation technology often complements labour to raise overall output, and also the value of tasks that human workers can uniquely supply.<sup>13</sup>

However, even if the total number of jobs have remained stable in the face of technological change, the distribution of the kinds of jobs (and therefore incomes) can change because of technology. Automation of tasks via AI, for example, may or may not increase inequality depending on the distribution of skills in the workforce (as well as any redistributive policies).<sup>14</sup> Greater inequality due to skill-biased technical change increases the risk of social unrest as well as potentially hardening attitudes towards large corporations. Such attitude shifts could be detrimental to corporations and the insurance industry via social inflation and rising liability claims costs. We also have shown in prior research that inequality is a headwind for insurance demand.<sup>15</sup> On the other hand, new research has shown that large language models (LLMs) like ChatGPT can reduce the productivity gap between less skilled and more skilled workers.<sup>16</sup> In this way, when technology substitutes for rare and highly valued skills, it creates more opportunities for the majority of workers without those skills and can therefore reduce inequality. In chapter three we discuss the potential for these technologies to enhance efficiencies in the insurance industry.

#### Digital technology as a disinflationary force

While it is difficult to isolate the impact of technological diffusion on price levels, all else being equal the productivity gains referenced above indicate that digitalisation does exert some downward pressure on inflation (eg, by automating processes, facilitating offshoring service tasks to low-wage economies, or improving inventory management). We expect three primary channels to explain the disinflationary impact of greater digitalisation in the future. First, the introduction of online marketplaces constrains pricing power due to greater price transparency and lower search costs for consumers. This may be somewhat offset by the pricing power gained by new winner-takes-all-type digital business models (see chapter two). Second, inflation differs between brick-and-mortar store prices and those of online retailers<sup>17</sup> who likely face lower costs with much greater economies of scale and scope selling through digital channels (see Figure 2). Third, digital information goods and services are often much cheaper (since digital reproduction is almost costless) or provided free or charge.

<sup>&</sup>lt;sup>13</sup> Why Are There Still So Many Jobs? The History and Future of Workplace Automation, Journal of Economic Perspectives, vol 29, 2015.

<sup>&</sup>lt;sup>14</sup> The Turing Transformation: Artificial intelligence, intelligence augmentation, and skill premiums, Brookings, 12 June 2023.

<sup>&</sup>lt;sup>15</sup> sigma 3/2022 – Reshaping the social contract: the role of insurance in reducing income inequality, Swiss Re Institute, 11 May 2022.

<sup>&</sup>lt;sup>16</sup> E. Brynjolfsson, *Generative AI at Work*, National Bureau of Economic Research, April 2023.

<sup>&</sup>lt;sup>17</sup> One study found that online retailers change prices earlier but do not necessarily change prices by more, nor did they price discriminate using "dynamic pricing" strategies eg, according to the shopper's location. See Are Online and Offline Prices Similar? Evidence from Large Multi-Channel Retailers, National Bureau of Economic Research, March 2016.

#### Figure 2

US headline CPI inflation versus Adobe Digital Price Index Inflation



The services sector does not share the same disinflationary benefits from digitalisation as the goods sector.

The relationship between digitalisation and macro factors suggests a similar dynamic with respect to insurance penetration.

The OECD's Going Digital Toolkit inspired our Index.

However, increasing digitalisation does not necessarily mean general deflation. The services sector has failed to see the same deflationary trend as the goods sector in recent decades. Also known as "Baumol's cost disease", sectors lagging in technological adoption experience productivity growth rates below the economy's average and thus contribute to above-average costs and inflation. Furthermore, lagging sectors can represent a growing share of national output, and slow economy-wide productivity growth.<sup>18</sup> The "cost disease" is particularly relevant for many services industries, where labour represents a higher share of input costs and where potential for transformative productivity growth is more limited. For the non-life insurance industry, wages and labour-intensive services such as healthcare and repair services for homes and vehicles are key drivers of claims inflation.

Given the multitude of potential benefits from digitalisation for economic development, it is important to understand the relative state across countries and over time. We are specifically interested in analysing how digitalisation of the economy impacts the insurance sector. The relationships between digitalisation and macro factors as above suggests that similar dynamics may be at play with respect to insurance sector. These could include automation, new business models, network effects, intangibility of assets and lags in commercialisation and productivity. While digitalisation does have some unique impacts on insurance (see later chapters), ultimately the scale and potential of these impacts is interrelated with the digitalisation of the economy at large. To this end, we present an Insurance Digitalisation Index. The index is a proxy metric that allows a comparison of digitalisation measures relevant for the insurance industry across national economies and over time via a ranking/score.

## Insurance Digitalisation Index

The conceptual framework through which we approach measuring a country's digitalisation is based on the OECD's *Going Digital Toolkit*.<sup>19</sup> This toolkit is divided into seven policy dimensions that aim to cover the whole of the economy and society: Access, Use, Innovation, Jobs, Society, Trust and Market Openness. In our analysis, we focus on those aspects that we tested quantitatively to matter most for the insurance industry: Access, Use, Innovation and Market Openness (see Figure 3).

<sup>&</sup>lt;sup>18</sup> Baumol's Diseases: A Macroeconomic Perspective, National Bureau of Economic Research, May 2006, <sup>19</sup> See OECD Going Digital Toolkit.

Our index covers 29 countries over the 2010–2020 time horizon.

The index is composed of eight indicators, all contributing equal weight.

## Methodology

To construct the index, we use annual data from 2010 to 2020 covering 29 countries, of which 21 are advanced economies and the remaining eight emerging markets.<sup>20</sup> The countries in our sample were selected based on data availability across the different indicators over the time sample.

Of over 40 indicators considered from the OECD's Going Digital Toolkit, eight were selected based on the statistical significance of panel regressions against insurance penetration with country and year fixed effects, where we controlled for GDP per capita. All countries, for each indicator and years 2010–2020, have a normalised score between 0 and 1, with 1 being the highest. The scores express each economy's level as a proportion of the best performing country's level. In the case of country missing data, scores were imputed based on the score of the partner indicator forming the other half of the relevant dimension.<sup>21</sup> The eight indicators are assigned equal weight, therefore giving each dimension equal contribution to the overall index. For more detail on these variables, see appendix.



Consumer trust in digital is important for the further digitalisation of insurance business. One important, but absent, variable from the index is *digital trust*. There is no single data point that can define digital trust. It is not a commodity to be bought, not an asset that can be traded, not a risk that can be underwritten. In a commercial sense, the value of trust arguably, is the perceived strength of the relationship between the consumer and provider, which in turn can be disentangled into reliability, security and reassurance.<sup>22</sup> As with all other sectors, trust is relevant for the continued digitalisation of insurance business, when personal and other sensitive data are increasingly leveraged in different stages of the value chain, including in Al-training data. The notion of trust is largely subjective, making it difficult to measure. Surveys serve as the primary data source for quantifying consumer trust due to its elusive nature. The availability of consistent data on trust across multiple years is limited within the OECD Going Digital Toolkit, leading to our decision not to include a "Trust" dimension in our index construction.

<sup>22</sup> See Decoding digital trust: an insurance perspective, Swiss Re Institute, May 2022 and Digital trust II: a consumer perspective, Swiss Re Institute, May 2023.

<sup>&</sup>lt;sup>20</sup> The exception is patents in ICT-related technologies as a percentage of total IP5 patent families as the OECD reports data less frequently. For full details see appendix.

<sup>&</sup>lt;sup>21</sup> The exception to this was Business R&D expenditure in information industries as a percentage of GDP for India, where the 25<sup>th</sup> percentile across OECD countries was used.

Our index shows that all countries have room to grow in digitalising.

Emerging markets have further to catch-up than advanced markets with respect to the digitalisation frontier.

## **Country spotlights**

The first notable takeaway is that all countries score lower than 0.8 at the overall Index level, and that no country leads across all indicators. This suggests room for progress everywhere, and that more work needs to be done to close the digital divide. In 2020, the indicator with the biggest difference in scores between the country ranked 1<sup>st</sup> and 29<sup>th</sup> was Business R&D expenditure in information industries as a percentage of GDP.

Cutting across country groupings, advanced markets on average score higher in the index than emerging economies. This is unsurprising given that our index scores are correlated with GDP per capita (see Figure 4). However, Figure 5 shows that emerging markets are catching up to the frontier (highest ranking) economy at a faster rate than advanced markets on average. Parallels can be drawn with the economic literature on convergence – the tendency for real GDP per capita differences between richer and poorer countries to narrow over time 1960–2019.<sup>23</sup> According to the standard model of economic growth, poor countries will converge with rich country's per capita GDP assuming access to the same technology. Our index reveals that while there is a technological gap between advanced and emerging markets, it is closing, which in turn should encourage GDP per capita convergence. Insurance penetration also stands to benefit as the middle class grows.





Average Insurance Digitalisation Index scores over time for country groups



<sup>23</sup> Convergence or Catch-up?, World Bank blog, 28 February 2023.

Access is an important first step for policymakers to focus on when pursuing digitalisation goals. One way in which emerging markets can begin to close their digital divide with advanced markets at a structural level is through investments in internet accessibility. According to the International Telecommunication Union (ITU), nearly 2.7 billion people across the world are still offline, with a wide variance across continents (see Figure 6).<sup>24</sup> Income divergence is a key factor, as only 26% of low-income individuals were using the internet in 2022 compared to 79% of upper/middle- and 92% of high-income households. Lower-income economies also face higher prices to adopt digital technology. Data-only mobile broadband prices represent 9.3% of gross national income per capita in low-income countries compared to 2.8% for lower-middle-incomes and 1.5% for upper-middle-incomes.<sup>25</sup> Internet penetration has been found to have a strong positive relationship with growth, with a 10-percentage point increase in fixed broadband penetration increasing GDP growth by 1.2% in advanced economies and 1.4% in emerging ones.<sup>26</sup> Insurance can contribute to the expansion of digital infrastructure by providing risk protection covers.



## Figure 6

Internet access as a % of population across geography and income groupings

Source: International Telecommunications Union, Swiss Re Institute

## It should be easier for lagging countries to catch-up towards leading countries than for leading countries to extend their lead.

Before jumping into deeper dives for some of the standout countries, it is important to note that an index score that remains constant does not imply no improvement in the underlying situation. Rather, it is a measure of *digitalisation relative to the best-in-class economy*. Second, countries at the lower end of the table are emerging markets at earlier stages of development. But many have made significant progress in the 2010–2020 period. It is the *catch-up*, rather than being in pole position, that generates faster *growth*.<sup>27</sup> In our index, China's ranking in mobile connection has improved faster than for fixed broadband. Leapfrogging onto newer digital technology avoids what can often be high switching costs in transitioning from legacy systems. Insurers too have a cleaner slate to design products, services and user experience for a mobile-centric value chain.

- <sup>26</sup> Exploring the Relationship Between Broadband and Economic Growth, The World Bank, 2016.
- <sup>27</sup> Innovative Asia: Advancing the Knowledge-Based Economy The Next Policy Agenda, Asian Development Bank, 2016.

<sup>&</sup>lt;sup>24</sup> Internet surge slows, leaving 2.7 billion people offline in 2022, International Telecommunication Union, 16 September 2002.

<sup>&</sup>lt;sup>25</sup> Ibid.

#### Table 2

Index country rankings

Country	2010 ranking	2020 ranking	2020 fixed broadband subscriptions per 100 inhabitants	2020 mobile broadband subscriptions per 100 inhabitants	2020 internet users as a share of individuals	2020 share of internet users who have purchased online in the last 12 months	2020 busi- ness R&D expenditure in information industries as a percentage of GDP	2020 patents in ICT-related technologies as a percent- age of total IP5 patent families	2020 OECD foreign direct investment regulatory re- strictiveness index	2020 share of digitally deliverable services in commercial services trade
South Korea	1	1	7	10	7	16	2	2	25	25
Sweden	3	2	11	7	4	6	5	3	17	4
Finland	2	3	20	3	5	11	4	4	5	5
US	6	4	13	2	20	15	3	5	22	2
Netherlands	5	5	6	6	9	2	19	10	4	7
Israel	8	6	25	5	14	26	1	9	24	10
Ireland	12	7	23	14	12	8	9	6	13	1
Japan	4	8	17	1	27	21	6	7	15	6
UK	10	9	9	12	3	1	18	11	11	8
Switzerland	9	10	1	16	6	7	17	21	20	3
Denmark	7	11	4	4	1	3	13	22	10	28
Germany	14	12	5	21	8	4	11	16	7	9
Norway	11	13	3	15	2	5	10	17	21	20
France	13	14	2	18	15	12	12	13	14	18
Belgium	17	15	8	22	11	10	7	14	12	17
China	26	16	16	17	28	22	15	1	29	16
Australia	15	17	15	9	13	13	21	15	26	22
Czech Republic	22	18	14	20	16	9	14	27	3	15
Austria	16	19	24	11	17	14	8	19	23	23
Spain	20	20	19	13	10	20	28	23	6	14
Hungary	23	21	18	28	19	19	26	20	8	21
Portugal	25	22	10	25	22	24	25	18	1	27
Poland	19	23	26	8	21	18	20	26	19	24
Slovenia	18	24	21	23	18	17	22	28	2	26
Italy	21	25	22	19	24	25	23	25	16	12
Greece	24	26	12	24	23	23	27	24	9	29
Turkey	27	27	27	27	25	27	16	12	18	19
Mexico	28	28	28	26	26	29	29	29	27	13
India	29	29	29	29	29	28	24	8	28	11

Note: Shading is based on country rankings for each of the variables in 2020: green = highest ranked, red = lowest ranked. Source: OECD, Swiss Re Institute

South Korea was the highest performing country at both the start and end of the observation period.

Surprisingly, the US lagged in Innovation.

South Korea tops the index, coming in first across the different variables most frequently and scoring consistently in the top three countries over 2010–2020. This outperformance is due to consistently high scores across the Access, Use and Innovation dimensions. The greatest room for improvement is in Market Openness, with much to be gained if the country could catch up in share of digitally-delivered commercial services trade. Another noticeable trend is how South Korea is falling behind in fixed broadband coverage, despite leading in this indicator at the beginning of the index period.

The US too performs well, ranking 4<sup>th</sup> in the index in 2020, and with the Access, Use and Market Openness dimensions all showing rising scores over the 2010–2020 horizon. The US's overall ranking is dragged down due to it failing to close the gap on Innovation, with the gap for business R&D expenditure in information industries as a percentage of GDP widening between the leader and US between 2010 and 2020.

China is rapidly scaling the Index ranking thanks to clear public sector goals.

sold online) from 0.2% in 2011 to 8.4% in 2021. Over 2010–2020, we observe broadbased catch-up in Access, Use and to a lesser extent Market Openness. China ranks first in filing patents in ICT-related technologies, but lags in business R&D expenditure in information industries as a percentage of GDP. Further catch-up is likely if China's 14<sup>th</sup> five-year plan for 2021–2025 to increase R&D spending by >7% annually is realised. Furthermore, the regulatory authorities have set digitalisation targets for insurance,<sup>28</sup> encouraging insurers to accelerate investment in group-level digitalisation strategies and innovation.

China is catching up rapidly with frontier economies on the index, climbing from 26 out

of 29 countries in 2010 to the middle of the index at 16 in 2020. This rapid progress has coincided with a strong increase in digital insurance penetration (the share of insurance

India has ranked in last place of the 29 sample countries all but one year in the 2010–2020 period. The country's strongest indicator is the share of digitally-deliverable services in commercial services trade. India's mobile broadband coverage lags behind other countries even as its fixed broadband score has begun to increase, which has kept access low. The Use indicators have closed almost half of the gap with the leading country and yet, the share of new life business premiums from digital platforms remains very low, increasing from 0.52% to 1.55% in the 2016 to 2022 period. <sup>29</sup> India's insurance regulatory authority, the IRDAI, has initiated several changes recently to raise digitalisation in insurance. In a move to expand insurance penetration, the IRDAI will allow consumers to purchase life, motor or health insurance directly, and will cut back on the intermediaries involved in any one buying journey. For example, Bima Sugam, an online portal being developed by insurance regulator, will be a one-stop digital platform for consumers to buy insurance online, change insurance agents and settle claims.<sup>30</sup>

#### Digitalisation and macroeconomic resilience

Over the last five years, we measured protection gaps as integral to our insurance resilience indices.<sup>31</sup> We find positive correlations between the different resilience indices and the new Insurance Digitalisation Index to the effect that countries ranking higher in the digital are typically also more resilient with respect other areas of protection gap. For example, the left hand panel of Figure 7 shows the correlation between the digital index and our resilience indices for health, mortality, natural catastrophe and agriculture risks. The right-hand panel shows the country correlations between the digital and natural catastrophe resilience indices specifically. As shown, typically those countries are "more digital" (eg, Sweden, the UK, Israel) also demonstrate more resilience to natural catastrophe exposures. Digitalisation can therefore be a force for closing insurance protection gaps. Gains from better underwriting, risk mitigation, risk measurement etc. from digitalisation should improve the accessibility and affordability of insurance.

<sup>29</sup> Handbook on Indian Insurance Statistics 2021–22, Insurance and Regulatory Development Authority of India.
 <sup>30</sup> See Bima Sugam, General Insurance Council.

Regional disparity in India's digitalisation drags its overall ranking down.

Typically countries that are more digital show greater resilience to other risks.

<sup>&</sup>lt;sup>28</sup> 14<sup>th</sup> FY Planning for Insurtech, Insurance Association of China, 2021.

<sup>&</sup>lt;sup>31</sup> sigma 2/2023, Restoring resilience: the need to reload shock-absorbing capacity, 21 June 2023, Swiss Re Institute.



Cross-country correlation of Insurance Digitalisation Index with Insurance Resilience Indices (latest year, LHS); natcat correlation specifically (RHS)



Insurance is needed to support investments in digital infrastructure.

#### Plenty more to come

As with the aggregate macroeconomic benefits, the potential for further digitalisation of insurance highlighted by the index will take time to show through and will differ by region. Industry digitalisation is to some extent constrained by the digital progress of countries at the macro level, but insurers can nonetheless play their part. For a start, going digital requires the building and operating of various infrastructure assets, which entail various exposures, including construction and operational risks. Insurers can provide risk transfer solutions for these risks, working together with businesses and governments to achieve their digital goals. Digital transformation also goes hand-in-hand with changes to the risk landscape, which we discuss in more detail in the next chapter.

# Digitalisation: implications for risks

Digitalisation contributes to increased economic activity and wealth; this can be seen in a significant rise in intangible assets, which remain mostly uninsured. Only around 17% of intangibles are insured compared with 58% of tangible assets. New business models give rise to new risk pools, in particular for business interruption and cyber exposures. Corporate risk managers have cited cyber incidents as the most important business risk for two consecutive years. We estimate that the global cyber insurance market will reach USD 16 billion of gross written premiums in 2023, up 60% from 2021, and we forecast an increase to USD 25 billion by 2026. The use of AI in business processes raises new liability concerns. Digital technology does not only add new risks, it can improve assessment and underwriting of risks. Examples are the use of medical data from wearables for underwriting in health insurance or usage-based concepts for motor insurance. Finally, digital technology enables risk mitigation, such as safety technology for motor vehicles.

## New wealth, new risk pools

Digitalisation has led to a rise in intangible assets.

Digitalisation has fundamentally reshaped the corporate sector. As firms have shifted from producing physical goods to providing information and services, the composition of their balance sheets has changed too. This reflects in the quintupling of the global value of intangible assets of listed companies from USD 14 trillion in 2002, to USD 76 trillion by 2021 (see Figure 8),<sup>32</sup> equivalent to an increase in intangible assets' ratio to global GDP from 41% to 79%. We expect the long-term uptrend in intangible values will continue after last year's 24% drop due to correction in global stock markets. Recovery in intangible asset value from such shocks has been seen before: after dot com crash, and the 2008 and 2011 financial crises.

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Investment in intangibles is positive for productivity growth.

Investment in intangible assets such as intellectual property, research, technology, software and human capital is not fully reflected in traditional accounting. Much spending that creates intangible asset value is expensed through income statements or considered intermediary expenditure in national accounts. According to McKinsey Global Institute, the investment share of intangibles in the US and 10 European economies<sup>33</sup> rose from 31% to 40% between 1995 and 2019, and has been a factor

<sup>32</sup> Global Intangible Finance Tracker, Brand Finance, 2022.

<sup>33</sup> Austria, Denmark, Finland, France, Germany, Italy, the Netherlands, Spain, Sweden, and the UK.

behind increasing total factor productivity (TFP).<sup>34</sup> Since then, investment in intangibles has continued to outpace that in tangibles, growing by 7.6% annually to 2022 in real terms, compared with a 1.6% decline in tangible asset value.<sup>35</sup>

#### New business models spark innovation in insurance solutions

The high value of intangible assets in business today are significantly uninsured: just an estimated 16.6% of intangibles are insured, compared with 58% of tangible assets.<sup>36</sup> Digital transformation has given rise to new types of business models, most notably the sharing economy. Transportation firms like Lyft and Uber own no cars, and Airbnb owns no rental units. Nevertheless, they are overtaking traditional players in their respective sectors in terms of growth and market capitalisation. Instead of locking up capital to purchase or make physical assets, they achieve growth by connecting demand and supply. The source of value in these businesses stems mostly from intangible assets like data, trust, brand recognition, scale and network effects.

This sharing economy business models implies a shift of operational risks, and a need for new types of protection coverage in three areas. These are insurance for: 1) the operators of shared economy businesses (eg, host protection for a home-sharing platform); 2) those employed by shared-economy businesses (eg, motor and workers' compensation insurance for ride-share drivers, or liability and accident insurance for ondemand-service freelancers); and 3) the end consumers of the services (eg, guest protection for a home-sharing platform). These insurance needs are the force behind the development of innovative risk transfer solutions. For example, in the mobility space, over time shared services will likely increasingly replace private ownership of vehicles. From the insurer perspective, this will necessitate a shift in business mix from personal to commercial lines, as the personal typically exclude cover for commercial usage of vehicles (and homes). Many sharing economy platforms offer insurance to their contractors and customers to avoid unprotected exposures and to build user trust. Some insurers offer specific endorsements for personal lines policies to fill coverage gaps. A variant of these additional covers are usage-based insurance plans that offer commercial cover during the time that a private home is rented, or a car is driven under the name of a ride-sharing company.<sup>37</sup>

#### Intangibles' risks: business interruption, cyber, liability and compliance

As the importance of intangible assets in business grows, increasingly firms will need protection against two types of "intangible risk": the risks that the intangible assets pose (eg, business interruption, cyber); and damage to intangible assets (eg, reputational harm caused by a tweet or computer hack). Additionally, new technologies and business models can be at the core of liability exposures arising from potential violations of tort law or compliance requirement (see Table 3).

#### Table 3

Intangible risks

Risk	
Business interruption	Digital technologies offer scalability and network effects, reshaping market dynamics and creating concentration risks. Dependencies on critical digital infrastructure create suppy-chain risks. Insurance solutions can reduce earnings and cash flow volatility.
Cyber	The concentration of digital assets creates systemic cyber risks – a key concern for businesses. Cyber risks are magnified when critical infrastructure is targeted.
Liability and compliance	Industries with high data protection vulnerabilities (eg, healthcare) are more regulated and see more insurance claims. Artificial intelligence raises new liability concerns due to its potential economic impact; lawmakers are responding with new proposed regulations.

Source: Swiss Re Institute

- <sup>34</sup> Getting tangible about intangibles The future of growth and productivity?, McKinsey Global Institute, 2021.
- <sup>35</sup> Growth rates for tangible assets are defined as non-residential private fixed investment excluding IP products, and intangibles is defined as IP products. Source: US Bureau of Economic Analysis.
- <sup>36</sup> See Intellectual Property, Aon.
- <sup>37</sup> See, for example, *iptiQ and Goboony launch car sharing insurance solution*, iptiQ, 2020.

The sharing economy derives value mostly from services and intangibles...

...and creates changes to insurance protection needs in three areas.

Businesses will need more protection

against the risk that intanglibles pose.

Digitalisation has reshaped market dynamics, creating concentration risks.

Dependencies on critical digital infrastructure create supply-chain risks.

Many insurers themselves are exposed to digital infrastructure risks.

New insurance solutions can reduce earnings and cash flow volatility.

Cyber risks continue to grow and remain a key concern for businesses.

*Business interruption risk:* Digital technologies offer scalability and network effects that allow them to be used with increasing economies of scale and scope. A consequence of this, however, is the creation of concentration risk, potentially of systemic proportions. Some see scalability and network effects as the key factor behind the success of large technology service providers, leading to the formation of "superstar" companies, rich in digital assets that dominate highly concentrated markets.<sup>38</sup> With the supply side subject to significant network effects and first-mover advantage, the digital technology space across different services offered is typically dominated by a few major providers. The concentration raises dependency and supply-chain risks.

This dependence is set to increase in the years to come and is the source of operational risk in information technology (eg, by creating a single point of failure if critical third-party software malfunctions). To this end, some technologies may be considered systemically important.<sup>39</sup> Business continuity planning will likely require recovery procedures of critical services, including adequate insurance coverage of IT resources, as well as cover to reduce the financial exposures firms may face (ie, the ultimate costs of loss of access to offices, critical IT facilities and equipment), and also for casualty risks. Demand for covers to compensate for the costs of service providers' legal responsibility exposures in the event of failing to deliver services to counterparties and customers will likely also rise.

Many insurers themselves are highly dependent on IT infrastructure provided by cloud computer service providers. For instance, according to surveys undertaken by the Bank of England, insurers in the UK deploy machine-learning to support pricing and underwriting processes, and these are often run on cloud services.<sup>40</sup> In a separate report, the central bank emphasises the supply-side concentration risk: the top two third-party providers account for 75% of firms that use cloud services.<sup>41</sup>

Along with the digital transformation of the economy, insurers have also developed solutions that protect earnings and cash flow risks.<sup>42</sup> Business interruption risks shift towards trigger events that are not related to physical risks but to disruptions of networks and the digital infrastructure. Some formerly uninsurable non-core business risks can now be at least partly insured due to the evolution of triggers, indemnity structures, and advances in data quality and in modelling. Examples of perils that can be covered in more innovative ways include non-physical damage business interruption, cyber, product recall, reputational risk, as well as weather and energy price risks.

*Cyber risk:* The digital economy introduces new risks for both intangible and tangible (physical) assets. The rapid growth of the cybersecurity and associated insurance offering reflects growing exposures as software and IT systems become increasingly complex. Corporate risk managers have cited cyber incidents as the most important business risk for two consecutive years, according to the *Allianz Risk Barometer.*<sup>43</sup> Partly as a result, we estimate that the cyber insurance market has reached USD 15 billion of gross written premiums in 2023 from USD 10 billion in 2021, and we forecast an increase to USD 25 billion by the end of 2026. Data breaches and ransomware attacks are the most frequently cited as areas of concern (see Figure 9). This year the frequency of ransomware attacks has remained elevated – accounting for 24% of total cyberattacks – while the average total cost of a data breach is at all-time high of USD 4.45 million.<sup>44</sup> Furthermore, the number of times a vulnerability that cyber criminals have exploited to gain unauthorised access to a system – known as Common Vulnerabilities and Exposures –reached a record high in 2022.<sup>45</sup>

<sup>38</sup> Digital capital and superstar firms, National Bureau of Economic Research, 2020.

<sup>39</sup> Beyond Fintech: A Pragmatic Assessment Of Disruptive Potential In Financial Services, World Economic Forum, August 2017.

- <sup>40</sup> How reliant are banks and insurers on cloud outsourcing? Bank of England,17 January 2020.
- <sup>41</sup> Ibid.
- <sup>42</sup> For more on this topic, see sigma 5/2017: Commercial insurance innovating to expand the scope of insurability, Swiss Re Institute, 2017.
- <sup>43</sup> Allianz Risk Barometer, Allianz Global Corporate & Specialty, January 2023.
- <sup>44</sup> See, IBM Security.
- <sup>45</sup> 2023 Cyber Threat Report, SonicWall, 2023.



# The concentration of digital assets creates systemic risks...

... which are magnified when critical infrastructure is targeted.

For the insurance industry, a main threat is the (lack of) insurability posed by the interconnectedness of digital systems. A 2023 study found that 15% of data breaches occurred because of a compromise at a business partner, and as many as 82% of breaches involving data stored in the cloud. This flags the networked and potentially systemic nature of cyber risk. The best-known example to date of an attack that spread beyond initial targets was Russia's "NotPetya" cyberattack in Ukraine in 2017. Organisations across the world were impacted, resulting in an estimated billions of dollars of damage, according to a White House assessment.<sup>46</sup> It occurred at the start of a rapid increase in significant cyber incidents. The number of incidents recorded by the Center for Strategic & International Studies in 2022 and 2023 are below the 2020-21 peak,<sup>47</sup> but this does not necessarily indicate less risk. It has been partly attributed to a diversion in focus of cybercriminal efforts following Russia's invasion of Ukraine,<sup>48</sup> as well as better incident response measures and a reduction in the number of organisations willing to pay a ransom.<sup>49</sup> Payments to ransomware attacks through cryptocurrencies rebounded in the first half of 2023 as attackers targeted larger well-resourced organisations.50

Risks are amplified when critical infrastructure is targeted. In the US, healthcare, critical manufacturing, government, IT and financial services were targeted most in 2022. This marked a significant increase in attacks and a shift from 2015, when critical manufacturing and energy were the main targets (see Figure 10). Healthcare data breach costs are most expensive, reaching an average of almost USD 11 million per breach in 2023.<sup>51</sup> The sector has become a leading target due to its access to sensitive personal medical and also non-medical data, such as a health record with a policyholder's name and diagnosis and payment information. Cyber criminals can sell the data to other parties, or use it to extract a ransom.<sup>52</sup> Providers have a relatively high propensity to pay a ransom demand due to the time-sensitive nature of critical care, the choice being paying a ransom or risking a patient's health and potentially even life.

<sup>46</sup> Statement from the Press Secretary, The White House, 15 February 2018.

<sup>52</sup> Why is healthcare a top target for cybersecurity threats?, Security Magazine, 13 September 2022.

<sup>&</sup>lt;sup>47</sup> "Significant cyber incidents" are monitored by the Center for Strategic and International Studies (CSIS) and defined as cyberattacks with economic losses of more than USD 1 million. See Significant Cyber Incidents, CSIS.

<sup>&</sup>lt;sup>48</sup> How cybercriminals have been affected by the war in Ukraine, The Economist, 30 November 2022.

<sup>&</sup>lt;sup>49</sup> Mid-Year Update: 2023 SonicWall Cyber Threat Report, SonicWall.

<sup>&</sup>lt;sup>50</sup> Crypto Crime Mid-year Update: Crime Down 65% Overall, But Ransomware Headed for Huge Year Thanks to Return of Big Game Hunting, Chainalysis,12 July 2023.

<sup>&</sup>lt;sup>51</sup> Ponemon Institute, op. cit.

#### Figure 10





Source: NCCIC/ICS-CERT (2015), FBI (2021, 2022), Swiss Re Institute

Industries with high data protection vulnerabilities are more regulated and see more insurance claims.

Al raises new liability concerns due to its potential significant economic impact.

Policymakers are well aware of the potential for the misuse of AI.

**New liability and compliance exposures:** Insurance losses from system breaches tend to accrue in industries with high data protection regulatory environments, as the associated costs, including legal, mount in the years after a breach event. Potential corporate liability has increased with rules introduced at local and federal levels. For example, the US Securities and Exchange Commission has adopted a cybersecurity disclosure rule whereby breaches and other events must be reported within four days of an incident being deemed "material". And New York City has implemented a law prohibiting employers from using automated decision tools to evaluate job candidates or employees,<sup>53</sup> unless certain requirements are met.<sup>54</sup>

The use of artificial intelligence (AI) in business processes raises new liability concerns, in addition to regulatory compliance and potential allegations of bias from automated decision making.<sup>55</sup> For example, AI systems can make mistakes (model risk), especially if they encounter situations outside their training data, and injuries or damage can result when AI controls physical machinery. A lack of explain-ability for advanced systems such as deep neural networks, which operate as black boxes, can cause challenges in understanding and justifying liability decisions. This is important in regulated industries like finance and healthcare. Additionally, the attribution of liability will become more complex as AI systems learn and evolve over time.<sup>56</sup>

Lawmakers and regulators are alert to the potential for misuse of AI technology and are responding accordingly as the use of AI and AI-generated content grows ever more pervasive.<sup>57</sup> In June 2023, the EU Parliament adopted a set of proposed rules – part of Europe's Artificial Intelligence Act – that, when agreed, will make for the most restrictive framework overseeing AI technology globally. The rules will now be negotiated with EU member states before taking final form in Iaw. They include a full ban on AI for biometric surveillance, emotion recognition and predictive policing. There is also a disclosure requirement for when content is AI-generated using systems like ChatGPT.<sup>58</sup> The US Federal Trade Commission is also reviewing AI risks, noting that it "is focusing intensely on how companies may choose to use AI technology, including new generative AI tools,

- <sup>53</sup> The rules were adopted by the New York City Department of Consumer and Worker Protection on 6 April 2023 for Local Law 144. See *The New York City Council – File #: Int 1894–2020.*
- <sup>54</sup> Employers or employment agencies using automated employment decision tools must meet three conditions: a "bias audit", a summary of results, and certain notices provided to employees or job candidates. See DCWP NOA for Use of Automated Employment Decision making Tools (cityofnewyork.us).
- <sup>55</sup> See, for example, *Artificial Intelligence and Algorithmic Liability*, Microsoft Corp and Zurich Insurance Group Ltd, 2021.
- <sup>56</sup> See, for example, *Product Liability for Defective AI*, University of St. Gallen, 20 July 2023.
- <sup>57</sup> Tech executives meet senior US officials for 'frank discussion' of Al risks, Financial Times, 4 May 2023.
- <sup>58</sup> MEPs ready to negotiate first-ever rules for safe and transparent AI, European Parliament, 14 June 2023.

in ways that can have actual and substantial impact on consumers."59 Insurers will need to keep abreast of all developments in this field and adapt to changes in regulatory requirements with respect to data privacy and the use of data in analytics.

## More holistic and accurate risk assessment

Digitalisation is transforming risk underwriting. Insurers leverage large sets of data generated by connected devices, aka internet of things (IoT), to gather real-time information on insured assets and adjust premiums based on actual usage. Alternative data from social media and others complement traditional sources for more comprehensive risk assessment. Advanced data analytics and machine learning can enable more accurate risk assessment and customised pricing, while automation streamlines underwriting processes. The shift to dynamic pricing, fraud detection using algorithms and enhanced customer experience are additional benefits.<sup>60</sup>

## Case study: wearables in health insurance

In health insurance, underwriting is data driven. Risk assessment has improved over time as access to more and different sources of data has expanded. For example, ubiquitous wearables (eg, smartwatches and smartphones) are transformative "general purpose consumer goods". Physical activity is likely the most common health metric that wearables monitor and track.<sup>61</sup> As networked digital measurement devices, they capture detailed and high-frequency electronic health records (EHR), allowing for more complete assessment of a wearer's health status than ever before.

For insurers, a silver lining from the COVID-19 pandemic is that it accelerated consumers' digital adoption and their willingness to share data. As people turned to remote working, online shopping and digital apps to help manage their daily needs, their familiarity with and trust in using digital technology has accelerated. Swiss Re's COVID-19 Consumer Survey in 2022<sup>62</sup> showed a clear migration for insurance customer touchpoints and personal healthcare monitoring to online platforms. Use of Health & Wellness (H&W) apps is high among those under 40, for mental health, weight control, nutrition and physical health. The survey also found that consumers, particularly in emerging markets where accessing financial services can be difficult, were relatively more willing to share personal health data (see Figure 11). Providing incentives such as discounted premiums also increase data sharing and seems very effective in more advanced economies.



- <sup>59</sup> The Luring Test: AI and the engineering of consumer trust, US Federal Trade Commission, 1 May 2023. <sup>60</sup> See, for example, The impact of artificial intelligence along the insurance value chain and on the insurability of risks, The Geneva Papers on Risk and Insurance-Issues and Practice, 2021.
- <sup>61</sup> Principles of alternative data for underwriting, Swiss Re, 2022.
- 62 Swiss Re global COVID-19 consumer survey 2022, Swiss Re Institute, June 2022.

Advanced data analytics can improve risk assessment; automation can make underwriting processes more efficient.

Health underwriting is data-driven, wearables are a new source of highfrequency health data.

The pandemic has accelerated digital adoption as well as willingness to share more personal data.

Figure 11

## Approaches to alternative data in healthcare insurance has different levels of risk, cost and benefits.

Summary of applications of wearables

Table 4

The application of wearables and EHR in health insurance can take five forms (see Table 4).<sup>63</sup> For example, for some health insurance product lines, the data from wearables technology is additive to the existing data and helps improved modelling accuracy by allowing more risk differentiation ("Addition" in the table below). The more radical alternative is to use the data to replace metrics currently used ("Replacement"). This has more potential for cost saving if the alternative data is found to perform just as well as traditional data in risk assessment. However, it could also lead to new risks such as antiselection and incorrectly priced risk, if dropping traditional measurements means missing higher risk applicants who are also more incentivised to apply

Application	Cost	Benefits	Risks
Addition	Low additional cost if data can be obtained cheaply	Better predictive power and improves risk stratification	Low risk strategy
Ongoing	More onerous as need to track on an ongoing basis	Potential mortality and lapse savings	Low programme engagement and ongoing usage
Substitution	Potential for reduced costs	Some correlation to existing data	Some increased anti-selection
Replacement	Significant cost reduction	Increased put-through rates and sales	Significant increased anti-selection
Personalisation	Reduced costs	Increased put-through rates and sales	Still unknown but potential to create a low-risk approach

Note: green represents benefits, yellow/red are costs and risks. Source: Swiss Re Institute

Digitalisation can produce better and granular health data, allowing more accurate measurement of risks.

However, there remain bottlenecks to adoption and digitalisation of the value chain is far from complete.

The demand for more structured data (eg, for use in machine learning) can be met by digital solutions like natural language processing software. In theory, wearable devices should be a win-win for insurers and insureds. Insurers can monitor and price risks more efficiently, the outcomes being lower premiums, shorterduration risk assessment, less onerous onboarding, and more personalised health information for insureds. There will also be dynamic gains over time: the better individual health data is, the more insurers can design personalised and dynamic insurance protection to suit the unique and changing needs of customers, and also encourage healthy lifestyle by offering incentives (eg, discounts on premiums).

The promise of EHR has not always lived up to expectations. There have been instances in which EHR-driven insurance products initially generated a lot of interest not matched by subsequent sales. Challenges are often due to digitalisation of only one or a few parts of the insurance value chain, meaning the benefits of digitalisation may not be fully realised. For example, cases in which users still need to manually submit health records demonstrate that more investment and innovation are needed. On the data submission side, even a small step like having to manually upload data once every three months can lower the attractiveness of a cover to consumers. In the future, the solution may come from new continuous glucose monitors and devices that are more accurate and networked, in order to enable automated data uploading. On the flipside, however, easing the operational burden on consumers in this way can create data security risks.

Digitalising whole healthcare systems is a complex task. At the macro level a major challenge is data quality. For example, standardising different prescription codes between doctors, hospitals and pharma companies within one country is hard enough. In the US alone, there are 1 billion healthcare encounters each year, and more than 1 million different codes tracked by hundreds of vendors. Insurers working in multiple markets will have to deal with different coding systems and data formats. Often, such unstructured data cannot be used reliably for machine learning processes, for instance as used in underwriting. Digital technology can provide solutions. For example, unstructured data sometimes still comes in paper form in certain markets where face-to-face sales via an agent is the dominant distribution channel. This can be digitalised starting with optical character recognition technology, and then further transformed into more structured data with natural language processing technology to fit a standardised

format that can be used for automated digital health underwriting. LLMs can also help sort and structure data more efficiently.

## Improving risk mitigation

Digitalisation creates new risk pools, and also can be used to improve risk mitigation processes. The increased use of data and data analytics, in particular of sensor technologies and the networking of factories, buildings, machines and other physical objects can reduce the frequency and severity of accidents, for example with smart home applications and the adoption of sensors in plants and equipment. Some key areas where digital technology can play a role in hazard mitigation are:

- Transportation and automotive safety: Advanced Driver Assistance Systems (ADAS) like adaptive cruise control, automatic emergency braking, and lane departure warning help prevent collisions and improve driver awareness. (see case study below).
- Industrial safety: Sensors and connected devices can monitor machinery and equipment for abnormalities, enabling predictive maintenance and preventing accidents caused by equipment failures. Real-time monitoring systems can detect leaks, fires, or other hazardous events in industrial settings and trigger immediate responses.
- Smart homes reduce hazards by providing automated controls for lighting, security, and appliances, minimising risks associated with forgotten appliances or leaving lights on. Integrated sensors and remote monitoring also enhance safety by alerting homeowners to potential dangers such as leaks, fires, or unauthorised access.<sup>64</sup>
- Healthcare: Digital health platforms (telemedicine) allow remote consultations, reducing the need for patients to travel and improving access to healthcare.<sup>65</sup> Digital records (EHR) enable accurate and timely sharing of patient information among healthcare providers, reducing medical errors.
- Natural disaster early warning systems: Digital sensors and data analysis can provide early warnings for earthquakes, hurricanes, floods, and other natural disasters, allowing for timely evacuation and preparation.<sup>66</sup> Digital technology can monitor air quality, water levels, and pollution, helping to manage environmental risks.
- Construction and workplace safety: Digital modelling of construction projects can identify potential safety hazards early in the design stage, leading to safer buildings and structures. Workers can wear smart helmets or vests that monitor their vital signs and location, enhancing safety and enabling rapid response in emergencies.
- Energy sector: Smart grids can automatically reroute power during outages, minimising downtimes (less business interruption) and preventing safety risks, such as wildfires.<sup>67</sup> Digital sensors can detect equipment malfunctions in power plants and substations, reducing the risk of accidents.

## Case study: motor risks

However, the rapid evolution of sensors and computing power is key to advances in car safety technology, and thereby overall road safety also. New research indicates that autonomous vehicles are significantly safer than those driven by humans. In the context of strengthening risk mitigation in driving, technologies like ADAS and, as a longer-term prospect, the autonomous car, have the potential to reduce accident frequency.<sup>68</sup> Most new vehicles today include some form of automated assistance that supports drivers in emergency interventions, such as emergency braking and comfort enhancement (eg,

- <sup>65</sup> See, for example, *Digital Health: Is the euphoria justified*?, Geneva Association, 2020.
- <sup>66</sup> The importance of early warning systems in disaster risk reduction, ILO, 13 October 2023.
- <sup>67</sup> See for example *Digital Smart Grid Resilience: Wildfire Mitigation and Reliability*, Cleantech, Oct 2020.
  <sup>68</sup> A joint Swiss Re/Waymo study found evidence to suggest autonomous driving reduced the frequency of property damage claims by 76% compared with baseline human drivers' claims. See *Comparative Safety Performance of Autonomous- and Human Drivers: A Real-World Case Study of the Waymo One Service, September 2023.*

Digitalisation will transform motor risk pools and make them complex.

Data-driven technology is at the core of new safety technologies.

<sup>&</sup>lt;sup>64</sup> Smart Homes: Potential to Transform Insurance?, Conning, 2023.

cruise control). Studies have found ADAS reduces the risk of accidents in commercial trucking. For example, a 2020 study in the US found that forward collision warning (FCW) and automatic emergency braking (AEB) systems could eliminate more than two out of five crashes in which a large truck rear-ends another vehicle.<sup>69</sup> Private passenger vehicles with ADAS showed a 27% reduction in bodily injury claims frequency and a 19% reduction in property damage frequency.<sup>70</sup> And in China, Swiss Re analysed data on warning rates and claims frequency, and found that frequency in commercial trucking fell in the months following the installation of ADAS technology in vehicles.<sup>71</sup>

There are fewer barriers on account of privacy concerns in the commercial motor segment than personal to the installation of data-collecting systems in vehicles. This includes the use of monitoring technologies. Integrating telematic technology in commercial vehicles using live warning, online timely intervention and offline safety management activities can improve driving behaviour. This can further reduce claim frequency and loss ratios.

On the flipside, from the insurance perspective, while technology may well reduce accident frequency, claims severity may increase due to the higher repair costs of cars that employ the safety technology.<sup>72</sup> ADAS-equipped vehicles often have higher initial costs, and repairing or replacing these components can be more expensive due to their higher complexity.<sup>73</sup> Until full autonomous driving is attained for a significant portion of the fleet, drivers will still need to remain alert. In terms of accidents, over-reliance on technology and compensating driver behaviours may reduce some of the promise of new safety technologies. Motor insurers need to understand the differential impacts of various types of technologies on claims, and the differences in performance between brands, models and generations of technology.

For the foreseeable future, personal motor insurance will continue to bear most losses from motor accidents. That said, over time the proliferation of advanced technologies will subject vehicle manufacturers to new risks, including larger product liability and other specialty exposures. Given the complex nature of more automated systems, including those driven by advanced AI, the origin of risk and legal liability will become more opaque.<sup>74</sup> Product liability and cyber risks in particular will be areas of growth areas in motor insurance. Product liability risks will arise from the expanded use of safety technology, as personal exposures are replaced by commercial ones, to the extent that the car or manufacturer, rather than the driver, is legally responsible for safe driving. These legal determinations will also depend on public perceptions of ADAS technology,<sup>75</sup> and cyber exposures will rise as part of the enhanced sophistication of autonomous driving technologies and the move to a shared economy model for mobility.

- <sup>69</sup> *Study shows front crash prevention works for large trucks too*, Insurance Institute for Highway Safety, 3 September, 2020.
- <sup>70</sup> True Impact of ADAS Features on Insurance Claim Severity Revealed, Lexis Nexis Risk Solutions, November 2021.
- <sup>71</sup> Opportunities behind complexity: A data-driven risk assessment for China's truck insurance, Swiss Re, 2023.
- <sup>72</sup> Compendium of HLDI collision avoidance research, Highway Loss Data Institute, December 2020.
- <sup>73</sup> Consumer experiences with crash avoidance feature repairs, IIHS, February 2023.
- <sup>74</sup> On the emerging risks of automation: the case for Autonomous Vehicles, Swiss Re Institute, July 2021.
- <sup>75</sup> See, for example, Public Perception and Autonomous Vehicle Liability, Harvard Business School Research Paper Series Working Paper, 2023.

Commercial trucking faces less barriers to employ tracking-based safety technology.

Benefits from lower accident frequency may be offset by higher repair costs.

The future deployment of autonomous driving will change the nature of motor liability.

# Digitalising the insurance value chain

Digitalisation of the insurance value chain is already "business-as-usual", but the attention has shifted. Insurtech investments highlights other emerging trends: we find that 31 of the world's 50 largest re/insurers have invested in insurtech firms and the initial focus in distribution has turned toward operational efficiency gains and improvements in underwriting and claims. Insurers are targeting a 3–8% improvement in loss ratios and savings of up to 10–20% in other parts of the value chain. Machine-learning techniques and artificial intelligence can further improve efficiency, although potential for misuse and/or mistakes mean many processes will still need human input. Realising the potential of digital technology will typically require re-engineering of some workflow process and, crucially, an upgrade in an insurer's data engineering capabilities. Insurers will need to remain abreast of regulatory requirements with respect to the use of new sources of data, especially in underwriting and claims settlements.

## Improving operational efficiency

The first wave of digitalisation made the value chain more efficient. The next wave will better connect critical processes.

Digitalisation is making the insurance value chain more efficient. Insurers have cited benefits in terms of generating insights into insureds and process automation (eg, faster claims settlement), more targeted cross- and up-selling, and improved fraud detection. But challenges like inadequate data engineering capabilities and conflicting priorities have hindered adoption. And in this context, technology remains a priority. Global insurer IT spending is forecast to rise by 2.9% in 2023, and to continue to grow at the same annual rate through 2025.<sup>76</sup> In the next wave of digitalisation, insurers will look to consolidate existing gains, and better connect critical processes to adapt existing value propositions and tap into new risk pools.

<b>Figure 12</b> Digital data and the insurance value chain	Product development	>	Marketing & Distribution	>	Pricing & Underwriting	>	Policy admin and claims
	<ul> <li>Embedded products for new risk pools</li> <li>Shorter product development cycles</li> <li>Market segmentation and personalisation</li> <li>On demand, usage-based insurance</li> </ul>		<ul> <li>Digital marketing</li> <li>Intermediary recruitment and retention</li> <li>Improved customer experience</li> <li>Engagement with digital ecosytems</li> <li>Al-driven robo- advisors</li> </ul>		<ul> <li>Smart processes for triage and routing</li> <li>Auto-fill/verify data for underwriting</li> <li>Predictive / prescriptive underwriting techniques</li> <li>Al to enhance risk assessment</li> </ul>		<ul> <li>Loss mitigation</li> <li>Reduce fraud</li> <li>Improve efficiency and speed of claims processes</li> <li>Self-service apps to improve post sales experience</li> </ul>
	Source: Swiss Re Institute	ł					

Product development, marketing and distribution can benefit from advanced data analytics solutions.

Data analytics enables growth by assessing attractiveness and size of business segments, accelerating product development and go-to-market strategies. Many insurers have successfully used behavioural economics to improve targeting, bidding and engagement. Small, inexpensive modifications based on such behavioural insights can have a big impact. More targeted product design, improved customer experience and post-sales engagement (eg, loyalty programs, health apps) are steps to improve client retention. This will translate into efficiency gains since renewals tend to be much less expensive than new business acquisitions.

<sup>&</sup>lt;sup>76</sup> Forecast: Enterprise IT Spending for the Insurance Market, Worldwide, 2021–2027, 1023 Update, Gartner, 2023.

Automation can result in significant potential efficiency gains.

materialisation of savings will be slow across the industry and is overlayed by rising expenses due to parallel trends of higher complexity of risks. We analysed US lines of business over the last decade and found that expense ratios in personal lines declined by 3.2 percentage points. These are the lines where digitalisation of operations and digital distribution are more prevalent. In commercial lines, where risks and underwriting are becoming increasingly complex, declines in the average expense ratio were 1.9 percentage points.<sup>77</sup>

Insurers have started many pilot programs to augment their portfolio data with external datasets for purposes of portfolio steering. Interviews with industry executives suggest that insurers target a ~3% to 8% improvement in loss ratios under real business conditions (see Figure 13). There is anecdotal evidence of early benefits but it is difficult to quantify the overall impact, unlike A/B tests in simpler areas like automation. Also, achieved benefits are sometimes lower than hoped for because of delayed or missed opportunities to take decisions based on new insights.

The industry has many examples where automating standardised tasks such as data

collection and analysis for underwriting, processing of low-severity, high-frequency claims, and deployment of bots for post-sales customer engagement have improved expense ratios. Based on third party research and the analysis of case studies, we estimate that the use of digitalisation in claims handling has the potential to reduce loss adjustment expenses by up to 25% and general expenses by as much as 20% (see Figure 13). These numbers reflect the more promising pilots rather than a ubiquitous application across all lines and functions, where average cost savings will be smaller. The



Note: The chart represents a range of improvements in pilot conditions. Benefits cannot be extrapolated at a

company or market level. Source: Swiss Re Institute analysis of press releases, publications and interviews by insurers, brokers, consulting companies and technology vendors<sup>78</sup>

ompanies and technology vendors/s

Better data quality allows insurance to be embedded into digital life and facilitate new markets.

## Digital product design and development

**Innovative embedded products for new risk pools:** New products will emerge with granular data collection and analysis, enabled by digitalisation. For example, solutions for personal cyber, use of cryptocurrency exchanges, or IoT infrastructure risks are already being developed.<sup>79</sup> Insurance is also being integrated into digital ecosystems (see *Digital insurance ecosystems take shape in China*). Ecosystems are two-sided markets: they combine a variety of services and vendors on one platform in a "business-to-business-to-customer" (b2b2c) model. For example, in China, shipping insurance is embedded into online shopping platforms such as Taobao, JD, etc that customers can purchase easily as

- <sup>78</sup> See for example Digitalization in Insurance: The Multibillion Dollar Opportunity, McKinsey & Company, 2020; and The productivity imperative in insurance, August 2019, McKinsey & Company.
- <sup>79</sup> Bitflyer and Mitsui Sumitomo are selling insurance for users of Cryptocurrency, while Munich Re and Relayr have developed customised insurance products to facilitate IoT infrastructure investments.

Figure 13

Potential savings from digitalisation – illustrative scenario

Better portfolio steering can reduce claims

costs by potentially 3 to 8%.

<sup>&</sup>lt;sup>77</sup> Source: Swiss Re Institute based on data from Conning.

an added item on checkout. Online shipping insurance has become a key segment for Zhong An and Cathay<sup>80</sup> although profitability is low due to strategic trade-offs. <sup>81</sup> Embedded insurance is also intrinsic to the sharing economy. For instance, medical covers for drivers who offer their services via ride hailing platforms is now customised through usage-based insurance (eg, Didi, Grab).<sup>82</sup> Premiums are deducted per journey and sums insured rise as more rides are served.

**Shorter product development cycles:** It takes six to 12 months for a traditional insurer to bring new products to market, partly due to factors like legacy IT and a lack of agility.<sup>83</sup> By contrast, with cloud-based core systems and more effective data processing, digital insurers can launch products in weeks or even days, and also shorten the time for product iterations after launch. Business modules offer flexibility to remove, add or extend scope of coverage features based on consumer feedback. For example, an online medical insurance product offered by ZhongAn in China saw 22 iterations within eight years since launch in 2016. Most of the iterations were to correct flaws or expand coverage.<sup>84</sup>

## Marketing, sales and distribution channel optimisation

**Intermediary recruitment and retention:** Sophisticated digital portals and platforms are now a minimum requirement for insurers to retain brokers and agents. Such insurerrun digital portals make it easier for intermediaries to access account and policy information, loss history, and other tools on a self-service basis. For example, this year AIG launched its new broker portal in the US, and is set to make it global in 2024.<sup>85</sup> Insurers also use digital systems to identify individuals most likely to become successful agents. For example IptiQ's Rapport platform, which is a machine learning tool that makes recommendations to agents about which insurance products would best enhance a consumer's risk protection profile.<sup>86</sup>

**Improved customer experience:** Insurers have deployed digital technology to increase the effectiveness of targeted marketing. Despite early successes, however, digital initiatives do not necessarily generate expected outcomes. For instance, digital shopping tools which guide potential customers to discounts and special cover can go unused, even in a mature market like the US. Last year, a study found that 54% of US P&C insurance shoppers did not use any of the available tools during the quote process.<sup>87</sup> To this end, digital initiatives could benefit from behavioural economics to disentangle interaction effects. Swiss Re, for example, helps insurers evaluate the impact of different behavioural biases through A/B tests in the context of sales and retention.<sup>88</sup> Some new studies take an even more holistic approach and observe the customer journey from start to finish.<sup>89</sup> In China, insurers are offering more services to sharpen their value proposition. For example, Ping An Health's app provides insureds with online medical advice from doctors at top tier hospitals. Such services proved popular during the COVID-19 pandemic,<sup>90</sup> and also help improve customer retention.<sup>91</sup>

<sup>91</sup> Ping An Health 2021 Annual Report mentioned the Zhenxaing Run service. which provides CI policyholder with health management and improves retention rate.

Technology applications have enabled insurers to bring products significantly more quickly to market.

Introducing new self-service capabilities to attract and retain agents and brokers.

Applying behavioural analytics can help improve user experience design

<sup>&</sup>lt;sup>80</sup> Zhong An's 2022 Annual Report mentioned shipping insurance consists of 36.7% of company's premium, Cathy's Annual Disclosure Report showed more than half.

<sup>&</sup>lt;sup>81</sup> Premium scale approaching USD 5 billion, liability insurance, return insurance are main types of insurance, National Business Daily, 31 July 2022. Since 2010, insurers have cooperated with online shopping platform Taobao, to reimburse shipping fees to customers when they returned products.

<sup>&</sup>lt;sup>82</sup> Inclusive insurance protects SME and new citizen, Xinhua, 30 June 2022.

<sup>&</sup>lt;sup>83</sup> Product innovation: The new imperative for insurers in Asia, McKinsey & Company, 2021.

<sup>&</sup>lt;sup>84</sup> ZhongAn Online Annual Report, 2022, ZhongAn Online P & C Insurance Co., Ltd., 2023.

<sup>&</sup>lt;sup>85</sup> AIG Unveils a Refreshed AIG.com and Digital Broker Portal Focusing on Brand Position and Advancing Its Multi-Phase Digital Transformation, AIG, 2023.

 $<sup>^{86}</sup>$  See How AAA Life and IptiQ partnered to driver superior customer outcomes, IptiQ.

<sup>&</sup>lt;sup>87</sup> J.D. Power 2022 U.S. Insurance Digital Experience Study, J.D. Power, 2022.

<sup>&</sup>lt;sup>88</sup> A/B tests compare two versions (A and B) of a customer experience using two different sets of users. For example an insurer might show 50% of site visitors a green 'ask for quote' button and the other 50% a blue button. A comparison of user responses can support data-driven decision making.

<sup>&</sup>lt;sup>89</sup> See Mobile ethnography helps insurers understand digital customer behaviour, IptiQ.

<sup>&</sup>lt;sup>90</sup> Number of online medical consultations reached 1.1billion in Ping An Good Doctor, EEO.com, 12 February 2020.

Sophisticated digital distribution platforms offer bindable quotes, and rich online functionality.

Digital distribution channels have become more widely accepted, as shown both from

survey and penetration data.

**Digital price comparison:** Online platforms present multiple insurance products and providers in a single place, providing consumers with more price transparency and lower search costs. The most sophisticated platforms use data verification tools to obtain immediately bindable quotes, allowing customers to complete the process seamlessly online. While there is a cost, it is typically paid by insurers for successful sale (usually fixed amount per policy). The net benefits to insurers from reduced marketing spend should outweigh the costs. Underwriting costs too can be lowered if customer data can be entered once and shared across the insurers listed on the platform. In addition, automated "robo-advisors" can be integrated into this digital distribution channel to further enhance the customer experience. These platforms offer additional services that can have the side-benefit of fostering customer loyalty (eg, help SMEs upload and compare policies, generate vendor certificates, and asset tracking).

**Increase in digital distribution channels:** According to SRI's 2022 Consumer Survey, insurers' online sites/apps are already the main distribution channel.<sup>92</sup> More than half of respondents in China and India had purchased some form of insurance using online channels during that time (see Figure 14). For emerging markets overall, the share was 50% and for advanced markets, more than 40%. While mobility constraints during the pandemic may have been one cause of much higher-than-normal online activity, the purchasing habits are likely to stick given continued improvements in convenience, speed and the overall online experience. Note however, that our survey also found that the majority of those who bought insurance online first consulted with an agent or broker. Digital distribution is not yet a full substitute for other channels, but more like an addition or complement.

## Figure 14

Survey responses on the use of digital distribution channels, 2022 data

Insurance purchase channels 60% 50% 40% 30% 20% 10% 0% Other Insurer's Insurance Bank/ Nononline site/app agent/broker financial traditional institution distributors Advanced markets Emerging markets Total markets

Purchase channel through an insurers' website/mobile application 70%



<sup>92</sup> Swiss Re global COVID-19 consumer survey 2022, op. cit. Surveyed households could choose multiple answers. The answers do not represent market shares since multiple channels may be involved in a purchase and a household may have purchased more than one policy. The percentages rather reflect the experience of insurance-buying households with the various distribution channels.

Source: Swiss Re Institute

Digitisation will enable more forward-looking underwriting.

Submission level accuracy can be improved with granular customer data.

Data generated by cars will become increasingly important in risk selection and pricing.

Digital innovation is emerging for various commercial lines of business.

#### **Digital underwriting**

Along with the use of big data, Al is expected to be eventually used widely in risk assessment and underwriting. Given the level of confidence needed to deploy new technologies in underwriting, fully digitalised/automated Al and ML-enabled systems are still not accurate enough for use at scale. This also means that algorithms cannot be relied on to fully replace traditional risk assessment, except in simpler lines of business such as motor. This said, digitalisation can complement existing processes, including classifying and segmenting risk as finely as possible for more accurate risk pricing. Travelers estimates that Al has improved business classification, a critical underwriting input, by more than 30% in its select accounts business.<sup>93</sup>

**Smarter mechanisms for triage and routing:** Improved algorithms can be more effective than current processes to sort surges in incoming insurance claims or underwriting requests. As an example, Prudential Financial has used machine learning to reduce underwriting time in L&H from 22 days to seconds and eliminated physical exams for some cases.<sup>94</sup> Increasingly, digitalisation of geographical, personal and asset information will be leveraged by insurers to auto-fill proposals, offer risk scores, and verify the data quality of submission data. For example, about 85% of submissions for Chubb's business owners' policies for SMEs flow straight through without human intervention.<sup>95</sup>

**Usage-based motor insurance:** Modern cars generate large amounts of data about a car and its driver through telematic sensors that monitor driving performance. This information can help insurers more accurately price risk, and create a nudge toward safer driving. Manufacturers have direct access to the data generated by modern cars, and better understand of driving automation technology and its implications for accident frequency and severity. For insurers, this is an opportunity to partner with manufacturers to offer user-based insurance products to the customers. However, in many cases questions around data privacy are barriers that still need to be overcome.

**Digitalisation in commercial lines:** Increasingly, commercial insurers are making use of digital technology in portfolio steering and risk selection. By leveraging third-party digital data overlaid with their own information, they can derive insights on potential risk accumulation, such as that caused by a concentration of high-value properties exposed to specific hazards. For example, the utility sectors' liability exposure is increasing due to infrastructure that can spark fires.<sup>96</sup> Utilities may operate in wildfire prone regions (eg, network operators, tree cutters). Using third-party digital data on, for instance, locating sources of ignition such as power lines and rail tracks, insurers have a deeper view as to areas of potential fire risk accumulation.

Digital insurance platforms in China are active in all parts of the value chain including designing and distributing digital insurance.

Embedded insurance products are distributed alongside the many services offered through widely used platforms.

## Digital insurance ecosystems take shape in China

Insurance intermediary platforms backed by Bigtechs in China have fostered largescale digitalisation of insurance, more so than in some other sectors. Platforms like Ant Insurance and WeSure hold insurance agency or broker licenses, but they offer more services than traditional intermediaries. They cooperate with insurers from the beginning of the value chain, using their data collection and analytics capabilities to help insurers price risk and design digital insurance solutions. The collaboration continues post-sale with the intermediary platforms also assisting insurers on client operations such as processing claims settlement.

The insurance products offered on digital platforms are usually standardised and affordable. Ant Insurance and WeSure seek to be one-stop shops offering comprehensive options for different coverage needs from health, home, travel and pet insurance, and also life and pension products.<sup>97</sup> Their parent groups, Alibaba and Tencent, respectively, own two "super apps" AliPay and WeChat, which each have more than 1 billion users.

- <sup>93</sup> Second Quarter 2023 Results, The Travelers Companies, Inc., 20 July 2023.
- <sup>94</sup> Disrupting The Insurance Industry: Prudential's Data And AI Driven Transformation, Forbes, 5 June 2023.
   <sup>95</sup> InsurTechs Take Note: Chubb's Digital Marketplace Serves 1,000 Agents a Day, insurancejournal.com,
- 12 February 2019.
   <sup>96</sup> Ignitions explain more than temperature or precipitation in driving Santa Ana wind fires, Science Advances, vol 7, 2021.
- <sup>97</sup> See Ali Ant insurance and WeSure official websites and apps.

The platforms partnering with insurers have unrivalled customer bases and insights into their behaviours.

By cooperating with digital platform operators, insurers can access a much larger customer base but will likely need to pay for that access.

Insurers are also building up their own ecosystems, especially in motor and health.

Other platforms are more vertically integrated and sell embedded insurance. For example, online ride-hailing platform Didi provides customised medical insurance to drivers based on distance driven.<sup>98</sup> And Meituan, a platform on which users can search (and rate) restaurants among other leisure activity facilities provides liability cover to restaurants on its network such as against claims of poor food quality.<sup>99</sup>

The intermediary platform business model is reshaping insurance by changing the traditional supply-demand interactions. Platforms hold detailed insights on a huge number of consumer interactions, which is a major competitive advantage. This has pushed insurers towards becoming more customer-centric, such as by increasing client engagements and creating more usage-based/tailored covers. And as one-stop platforms, bundling of add-value services with insurance is common. For example, customers who have purchased pet insurance on Alipay can access free health examination and vaccine for the pets, as well as vet consulting services.<sup>100</sup>

COVID-19, which heightened consumer risk awareness while limiting physical mobility, supported further growth of digital platforms. In 2021, 8.4% of insurance sold in China was distributed through digital channels.<sup>101</sup> Cooperating with online platform holders gives insurers access to more consumers and the enriched data and analytics capabilities of the platform partners to improve risk modelling, underwriting and claims processes. However, in this relationship the platform holders typically control access to customers, future innovations, data collection and analytics capabilities. With these advantages, they can charge high commissions. This can squeeze earnings, particularly of small- and medium-sized (SME) insurers.

Market-leading insurers are now striving to build ecosystems and networks of their own, typically in the health lines. Starting from one insurance app, they expand the range of services offered as well as the frequency of interactions to build client loyalty in addition to new sources of revenues. Ping An for instance, has several service platforms providing auto services including expert Q&A, maintenance, etc. to millions of auto insurance policyholders. With data accumulated from multiple platforms in its ecosystem, the pricing precision is improved further and more data is more available for claims and settlement processes.

## **Digital claims management**

**Loss mitigation and reducing claim severity:** Alerting policyholders to the potential threat of liability, or damage to life and/or property, has become more feasible with digital technology. For example, insurers covering natural catastrophe prone areas collect data to trigger early warnings before a disaster strikes and continuously monitor associated data readings. In agriculture, satellite remote sensing on soil condition/crop types and related processing algorithms enable more accurate crop damage assessment. Digitalisation is especially suited to cases of fraud involving large classification of data and anomaly detection, such as identifying re-use of photos: a recent analysis found the same photo used in 44 different insurance claims that had been submitted.<sup>102</sup> Using multiple data sources and predictive modelling, insurers can identify fraudulent patterns more quickly. Like Travelers does, for instance, using Graph Neural Network models with deep learning algorithms to look for suspicious connections.<sup>103</sup>

Over a third of insurers have adopted advanced analytics at scale, with adoption expected to increase to over two thirds in 2023.<sup>104</sup> Digital adoption is typically higher among insurers with global scale. Based on current trends, more widespread industry adoption could take several years (see Figure 15) as smaller insurers grapple with conflicting priorities. It can be that insurers overlook specific conditions that make a

- 98 Xinhua, op. cit.
- <sup>99</sup> Meituan Food Delivery official app.
- <sup>100</sup> Ali Ant insurance official app.
- <sup>101</sup> Internet insurance annual report, Insurance Association of China.
- <sup>102</sup> Insurance Fraud Finds a New Enemy in Verisk's Advanced Image Forensics, globenewswire.com, 2023.
   <sup>103</sup> Gartner Announces Winners of the 2022 Eye on Innovation Award for Financial Services for the Americas, Gartner Inc, 2022.
- <sup>104</sup> Advanced analytics: Insurers move forward despite obstacles and competing priorities, WTW, 2021.

Loss prevention and mitigation action is more scalable, using big data and deep learning algorithms.

Specific conditions must be met for success to translate across the industry.

Use of analytics in the claims value chain

case successful (eg, differences in the operating and regulatory environment, availability of data). Some applications, for instance fraud detection, are dependent on country-specific variables, and require teams to calibrate scenarios and algorithms to reflect the local culture.



Source: Swiss Re Institute adapted from Willis Towers Watson surveys<sup>105</sup>

**Modernising claims analytics:** A number of insurers have digitalised workflows in triaging, routing, validating and corresponding with third parties. The ambition is to reduce the cost of claims processing through automation. Areas where insurers report higher savings include those where information is well structured in standardised formats. For example, insurers use natural language processing to uncover subrogation opportunities by finding clues in claims adjusters' notes and other documentation.<sup>106</sup> Also, policyholders may use a phone camera or other remote device to document damages and submit a small motor or property insurance claim through an app. Modernising claims analytics can also lead to shorter response times. For example, in China, for more than 70 L&H insurers that disclosed detailed 2022 claims data, average claims processing time was 1.3 days, with small ticket claims settled even quicker, in 0.31 days.<sup>107</sup> And in the US, when Hurricane lan made landfall in the Gulf of Mexico last year, insurers were able to leverage the power of data and technology to predict, prepare and respond to catastrophes of this scale and support their clients.<sup>108</sup>

## Insurtechs in the insurance value chain

Insurtechs, technological innovators in the processes of insurance business, are a good place to observe digitalisation trends in the industry's value chain. Our analysis has found that re/insurers invest in around a third of insurtechs that are active today, especially in start-ups that act as Managing General Agents (MGA), digital insurers, aggregators, and those focussed on improving distribution channels.<sup>109</sup> Established insurers engage with insurtechs to gain early knowledge of opportunities offered by new technologies, and to access new talent. Our research finds that as of March this year, 31 of the 50 largest re/ insurers (by assets) have invested in insurtechs. The scale of engagement would likely be

- <sup>107</sup> Internet insurance claims and innovations report in China, May 2023.
- <sup>108</sup> Looking up during a storm, Swiss Re, 19 December 2022.
- <sup>109</sup> A managing general agent is a specialised type of insurance agent/broker with, unlike traditional agents/ brokers, vested underwriting authority.

Figure 15

Modernising claims analytics with automation reduced the cost of claims processing once data is digitised.

Three out of five of the largest re/insurers invest in insurtech start-ups.

<sup>&</sup>lt;sup>105</sup> Ibid. and Advanced analytics: Are insurers living the dream? 2019/2020 P&C Insurance Advanced Analytics Survey Report (North America), WTW, 2019.

<sup>&</sup>lt;sup>106</sup> The Latest Launches From FastTrack, American Claims Management, Policygenius, carriermanagement.com, 11 February 2022.

	higher if we count those insurtechs with which re/insurers are partners or customers. Investments on their own, however, are no guarantee of success of integration into existing processes. As with any strategic investment, insurers need to ensure effective collaboration, particularly where culture and working practices may not align.
Digital MGAs and insurers use technology to enhance underwriting quality.	Seven years ago, a first wave of investment interest in insurtechs was mostly in the field of distribution technology. Current interest is targeting technology that can be used to improve underwriting quality. These include a new breed of MGAs that are often early digital adopters relative to traditional carriers, using data and technology as a competitive advantage to reduce losses and expenses. <sup>110</sup> Re/insurers work with several MGAs that have data related to risk, but often lack the historical claims data that traditional carriers have. The value proposition is the combination of the two, to develop better risk or rating models that inform risk selection and risk management.
The route to profitability is a challenge for full stack digital insurers.	Full-stack digital insurers are fully licensed, regulated and maintain solvency capital. These so-called disruptors focus on niches where mainline insurers do not compete heavily, mostly because policy sizes are small, e.g. renters and pet insurance. A number of such insurers have launched public offerings (IPOs), but share prices have since fallen heavily. This likely reflects investors' concerns over expanding profitably, given heavy spend on marketing, elevated natural catastrophe activity, and inflation in property and auto lines. Rising loss ratios could force rate increases and re-underwriting of existing contracts. Both actions negatively impact customer loyalty since price is often a significant determinant of insurance purchasing decisions.
A third of insurtech start-up investments have been in the distribution field.	A mainstay of investments in insurtech, however, remains in the area of distribution, in particular, channels that improve policyholder engagement and satisfaction, sometimes broadly defined as "user experience" or "UX". Close to a third of investments in insurtech start-ups are in the field of distribution (see Figure 16). Established insurers deploy best practices learned from these ventures, and it could be that traditional carriers soon outperform insurtechs on digital engagement with customers, at least in the US. A survey undertaken this year found that while

## Figure 16

Insurtech funding in the insurance value chain (inner circle = process step in value chain; outer circle = per type of insurance product)



contact information and updating their profile.111

Source: Swiss Re Institute, CB Insights

<sup>110</sup> MGA-insurer partnerships in a highly digitized future, Swiss Re, 2023. Managing General Agents or MGAs are customer facing and take on underwriting activities, but always partner with a third-party risk carrier that is ultimately liable for the claims.

insurtechs offer better policy information research, traditional insurers are better at improving the customer journey, including ease of making digital payments, locating

<sup>111</sup> J.D. Power 2023 U.S. Insurance Digital Experience Study, J.D. Power, 2023.

# Going digital: success factors

Insurers can better prepare for the digital future.

Successful implementation of digital technology in insurance business is dependent on data availability, interpretability requirements, system complexity and regulation. Insurers can better prepare themselves for the innovations of the future by using AI technology to digitalise and automate their data processing. To this end and to secure positive return in investment (ROI) from spending on digital transformation over the long-term, insurers need to consider the following factors:

Investment needed to maintain system quality and robustness: Integrating a new digital system will likely require workflow process re-engineering and constitute most of the deployment costs. Further, maintaining the integrity, security and privacy of a new system will require a large upfront cost. Surveys show that as time passes, fewer insurers struggle with infrastructure or data warehouse constraints, but rather face conflicting priorities and lack of time: a sign that digital initiatives are likely now an integral part of 'business-as-usual' (see Figure 17).<sup>112</sup>



Production-ready data strategy: Often, enterprise deployment fails because of poor data engineering. The same surveys indicate that insurers have made slow progress on this front, reporting issues with data quality, and lack of staff to analyse the data. A takeaway from our conversations with industry participants is that in the financial services sector, firms typically start off with developing an algorithm and then under-invest in data engineering. For transformative impact enterprise-wide, the reverse is needed. In an end-to-end enterprise process, high-quality data engineering tends to outperform high-quality algorithms with low-quality data.

## Figure 17

Biggest challenges preventing insurers from becoming more data-driven, 2017, 2021

- Interpretability and trust: Wholesale replacement of processes will likely require regulatory approval. Insurers should educate decision makers that models inform, but do not replace. For example, AXA XL has a team that focuses on explainable AI, in order to explain models to users.<sup>113</sup> As a best practice, fairness in assessment should be embedded into the end-to-end systems development lifecycle. In 2022, Swiss Re helped refine the Fairness Assessment Methodology of the Monetary Authority of Singapore.<sup>114</sup> Fairness was tested for gender and ethnicity in life insurance predictive digital underwriting. The assessment found a satisfactory result on ethnicity, but a potential disadvantage for male over female customers at similar level of actuarial risk. One suggestion was to introduce mitigation to rectify the imbalance in gender.
- Regulations: insurers need to keep up-to-date: Last but not least, insurers will need to monitor and adapt to regulatory changes with respect to the use of new sources of data and analytics, especially in underwriting and claims. New tools and approaches, however, also bring novel challenges, for which insurers will need to implement new risk management procedures. Regulators are growing more familiar with advanced analytics initiatives and have approved "pilot" programmes in different regions. But they are also raising questions, particularly around the impact on consumers and the use of consumer data. Insurers need to bear in mind other regulatory aspects such as competition law, as well as any contractual restrictions on the handling of client data.

 <sup>&</sup>lt;sup>113</sup> ChatGPT and Beyond: How Insurers Are Using AI, carriermanagement.com, 6 June 2023.
 <sup>114</sup> A journey into Responsible AI: Veritas Fairness Assessment Methodology & Toolkit for the Financial Industry, Swiss Re, 28 March 2022.

# Appendix

## Composition of the digital insurance index

Indicator	Dimension	Source	Definition of Indicator	Rationale			
Fixed broadband subscriptions per 100 inhabitants	Access	The OECD Going Digital Toolkit, based on the OECD Broadband Portal http://www.oecd.org/sti/broadband/ broadband-statistics and the ITU World Telecommunication/ICT Indicators Database.	This indicator measures thepopulation's uptake of fixed broadband technology, expressed as the number of subscriptions per 100 inhabitants to services with an advertised download speed of 256 Kbps or greater.	The digitalisation process relies on accessible technological infrastructure, which serves as a fundamental requirement for individuals, businesses, governments, and society to engage with digital services. As more devices and people connect online, its significance grows.			
Mobile broadband subscriptions per Access 100 inhabitants		The OECD Going Digital Toolkit, based on the OECD Broadband Portal http://www.oecd.org/sti/ broadband/broadband-statistics and the ITU World Telecommunication/ICT Indicators Database.	This indicator measures the uptake of mobile broadband technology by the population, expressed as the number of subscriptions per 100 inhabitants to mobile network services offering speeds of 256 Kbps or more (such as high speed packet access (HSPA) and long- term evolution (LTE) networks).	The essential role of technological infrastructure in driving digitalisation extends beyond mere connectivity to encompass connected devices. Mobile broadband serves as a critical element in enabling this connectivity, especially as the online populace and device count surge.			
Internet users as a share of individuals	Use	The OECD Going Digital Toolkit, based on the OECD ICT Access and Usage by Households and Individuals Database, http://oe.cd/hhind.	This indicator measures Internet users as a share of individuals.	Thriving within a growing digital economy and society mandates harnessing the power of the Internet.			
Share of Internet users who have purchased online in the last 12 months	Use	The OECD Going Digital Toolkit, based on the OECD ICT Access and Usage by Households and Individuals Database, http://oe.cd/hhind.	This indicator reflects the prevalence of online purchases by Internet users as a share of all Internet users.	Realising the full potential of digital technologies and data is contingent upon proficient utilisation and skillful applcation. Online purchases, indicative of advanced online activity, can also capture the sophistication of a nation's e-banking and e-payment infrastructure, as well as cultural preferences concerning online transaction security, privacy, and consumer protection			
Business R&D expenditure in information industries as a percentage of GDP	Innovation	The OECD Going Digital Toolkit, based on the OECD Analytical Business Enterprise R&D (ANBERD) Database, http://oe.cd/anberd, and the Main Science and Technology Indicators (MSTI) Database, http://oe.cd/msti.	This indicator measures business expenditure on R&D (BERD) performed by businesses in information industries, irrespective of funding source, as a share of gross domestic product (GDP).	The pivotal role of R&D, especially in information sectors, is a catalyst for driving digital innovation.			
Patents in ICT- related technologies as a percentage Innovation of total IP5 patent families		The OECD Going Digital Toolkit, based on the OECD STI Micro-data Lab: Intellectual Property Database, http://oe.cd/ipstats.	This indicator measures patents in information and communications technology (ICT) as a share of total IP5 patent families by country of ownership.	This indicator is one way of guaging the ICT sector's technological development. Intangible assets (including patents, organisational capital and software) promote digital innovation.			
OECD Foreign Direct Investment Regulatory Restrictiveness Index	Market Openness	The OECD Going Digital Toolkit, based on the OECD FDI Regulatory Restrictiveness Index Database, http://www.oecd.org/investment/ fdiindex.htm.	The OECD Foreign Direct Investment Regulatory Restrictiveness Index (FDI RRI) measures four types of statutory restrictions on FDI: 1) foreign equity restrictions, 2) screening and prior approval requirements, 3) rules for key personnel, and 4) other restrictions on the operation of foreign enterprises. The FDI RRI is a composite index that takes values between 0 and 1, with 1 being the most restrictive.	Open financial markets in conjunction with investment models that foster private investments in communication infrastructure, technologies, and knowledge- driven capital, entice foreign direct investment (FDI) and lay the groundwork for a comprehensive growth trajectory fueled by digital transformation.			
Share of digitally- deliverable services in commercial services trade	Market Openness	The OECD Going Digital Toolkit, based on the OECD International Trade in Services Statistics (ITSS) Database and the WTO Trade in Commercial Services Data.	This indicator measures digitally-deliverable services as a share of total commercial services trade. It includes both imports and exports, and it provides an indication of the importance of digital services trade across countries.	Digital technologies and Internet access have streamlined the process of purchasing, vending, and delivering various services online and across borders.			

Source: Swiss Re Institute

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