ERGO | Munich RE

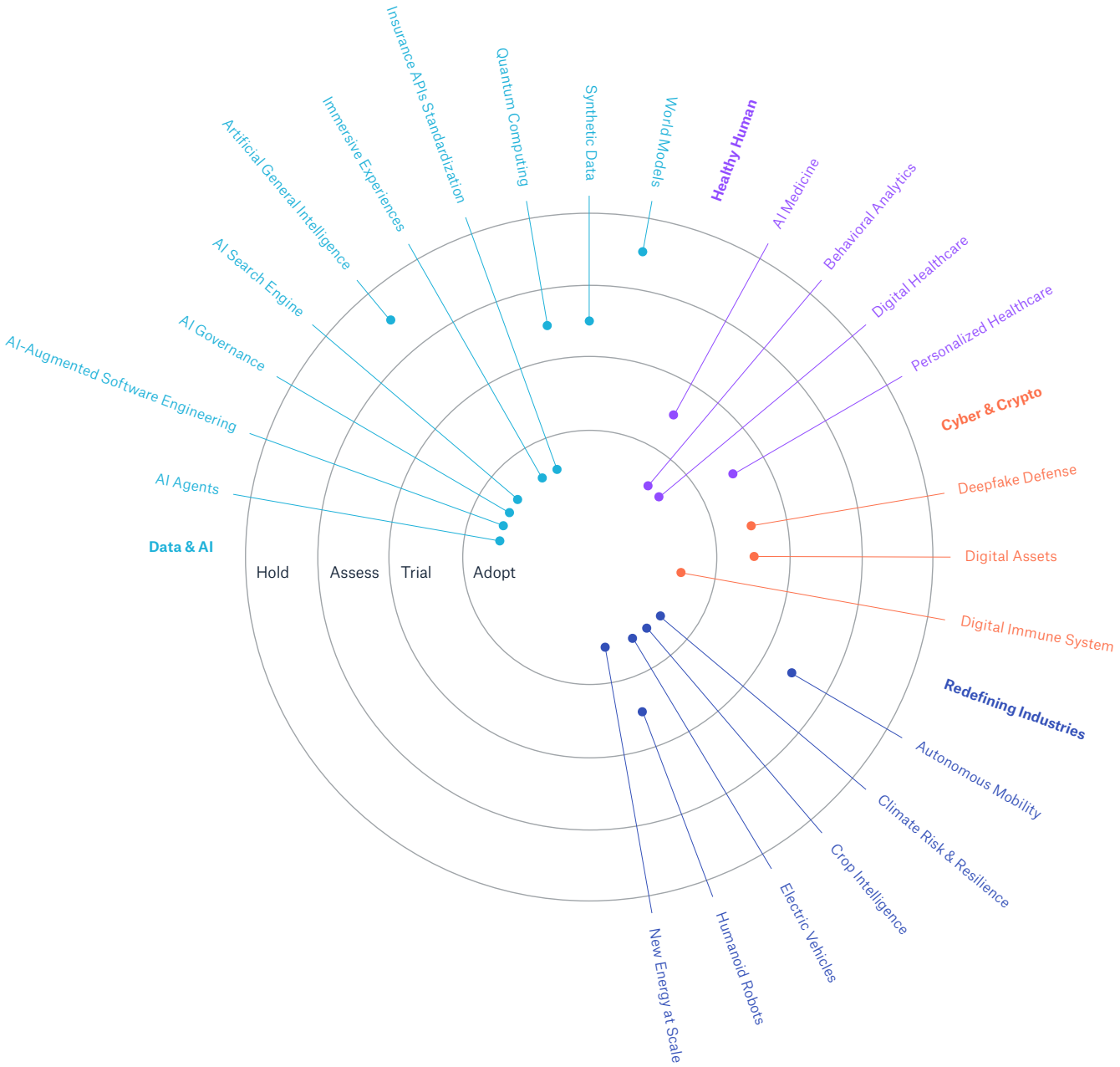
2026 Tech Trend Radar

From trends to transformation at scale – what matters now? Discover our expert perspective for insurance.

Introduction

The Tech Trend Radar 2026, a collaborative initiative of Munich Re Group Technology, provides orientation in an increasingly complex technological landscape for the insurance industry. Developed by insurers for insurers, it aims to support informed decision-making, foster meaningful dialogue, and highlight technologies that require strategic attention today.

Drawing on expertise from business and technology functions across Munich Re Group, the radar offers a focused perspective on selected technology developments, their maturity, and their implications for insurers – helping organizations prioritize investments and translate innovation into sustainable value.



Contents

Message from the Chief Technology Officer

Technology – and current advances in AI in particular – is a defining force in the data-driven insurance industry. Technology is now of central importance to insurers, from risk assessment and efficient operational management to meeting the rising expectations of customers, partners and society. Strategic, disciplined and responsible deployment of technology is crucial to long-term competitiveness.

With our annual update of the Tech Trend Radar, Munich Re provides orientation in a rapidly evolving environment. In the 2026 report, our experts highlight selected developments across Data & AI, Cyber & Crypto, Human Health, and Redefining Industries – domains that are shaping risk, operations and customer needs. While not exhaustive, these are the areas we deem represent the trends on which insurers should focus their strategic attention.

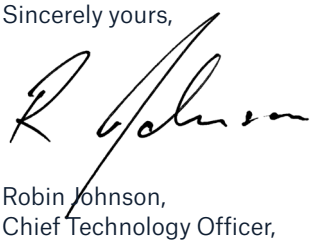
Across all domains, my core belief is this: technology creates value only when embedded in strong governance, clear accountability and ethical frameworks. For example, advances in AI, digital health and operational digitalization offer meaningful opportunities to enhance risk insights, strengthen resilience and deliver more relevant services.

At the same time, they require transparency and a clear understanding of their societal implications to maintain trust.

Once again, this year's Tech Trend Radar aims to provide orientation in a rapidly shifting environment. Our experts look ahead with their best guesses in this report and recognize that the diversity, scale and pace of tech trends will sometimes still surprise us.

I hope to fuel the industry dialog with our Tech Trend Radar, exchange ideas and learn from each other to see even further ahead. I invite you to explore the Tech Trend Radar 2026, which I believe allows an informed assessment of where and how technology is shaping some of the most relevant opportunities and risks for insurers.

Sincerely yours,



Robin Johnson,
Chief Technology Officer,
Member of the Board of Management,
Munich Re

Foreword

Tech Trend Radar 2026 – Technology redefines industries, humans define value

The insurance industry is navigating a period of rapid technological change. Artificial Intelligence has moved from early experimentation into practical application and is increasingly influencing core areas of insurance – from product design and risk assessment to claims handling and the way technology is developed and operated. At the same time, broader technological progress across many industries is gradually reshaping the risk landscape. In this evolving environment, the Tech Trend Radar 2026 aims to provide guidance and orientation on the developments that are likely to influence the insurance business in the years ahead.

This year, we have deliberately focused the Radar on a smaller set of trends. Many technologies that once appeared as early signals have matured; others have become less relevant. What remains are those developments we believe will have meaningful impact on insurance and therefore merit strategic attention. The Radar does not attempt to predict every possible future – rather, it highlights the areas where sustained transformation is already underway.

Data & AI continue to play a central role. Everyday AI has become widely adopted, yet more profound changes are emerging as insurers explore new forms of collaboration between humans and AI systems. Whether described as AI agents or agentic architectures, these approaches have the potential to streamline internal processes and make customer interactions more intuitive. At the same time, falling inference costs and evolving data architectures are influencing how insurers think about technology investment and long-term capability building.

Beyond AI, other developments are shaping the industry. Cyber resilience and digital trust remain essential foundations. The ability to access and standardize data – particularly through sources like electronic health records (EHRs) in the life and health sector – continues to transform underwriting and paves the way for more accurate and informed risk assessments. Meanwhile, the energy transition, new mobility concepts and advances in robotics are creating new opportunities and challenges.

As in previous years, our intention is simply to offer a structured view of developments we consider particularly relevant for insurers. We hope the Tech Trend Radar 2026 supports ongoing discussions within the industry and provides helpful orientation as insurers reflect on how technology may influence their business and the needs of their customers in the years ahead.

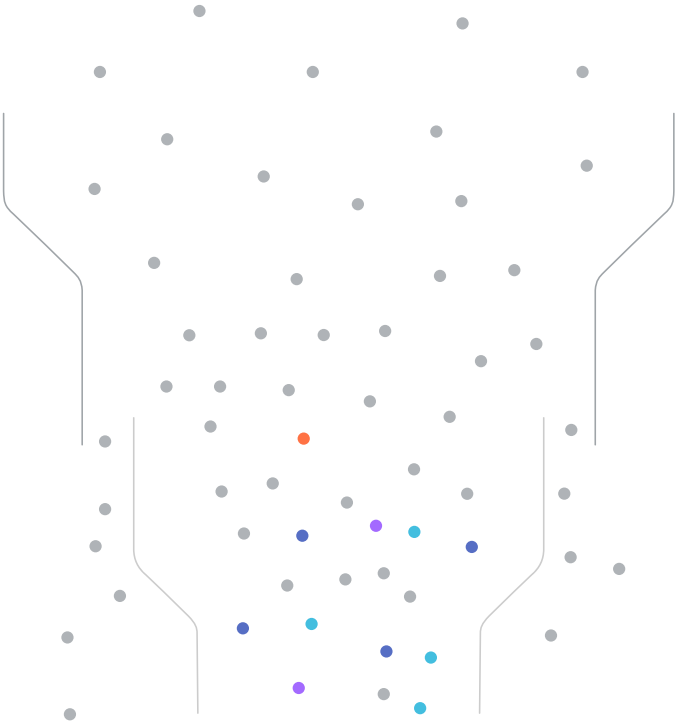
Warm regards,
Martin & Daniel

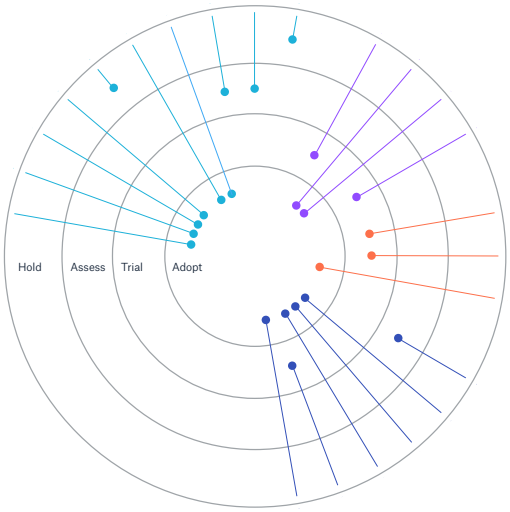
Martin Thormählen
Lead Tech Trend Radar
Business Technology
Munich Re
mthormaehlen@munichre.com

Daniel Grothues
Chief Architect,
Primary Insurance,
ITERGO
daniel.grothues@itergo.com

Our approach

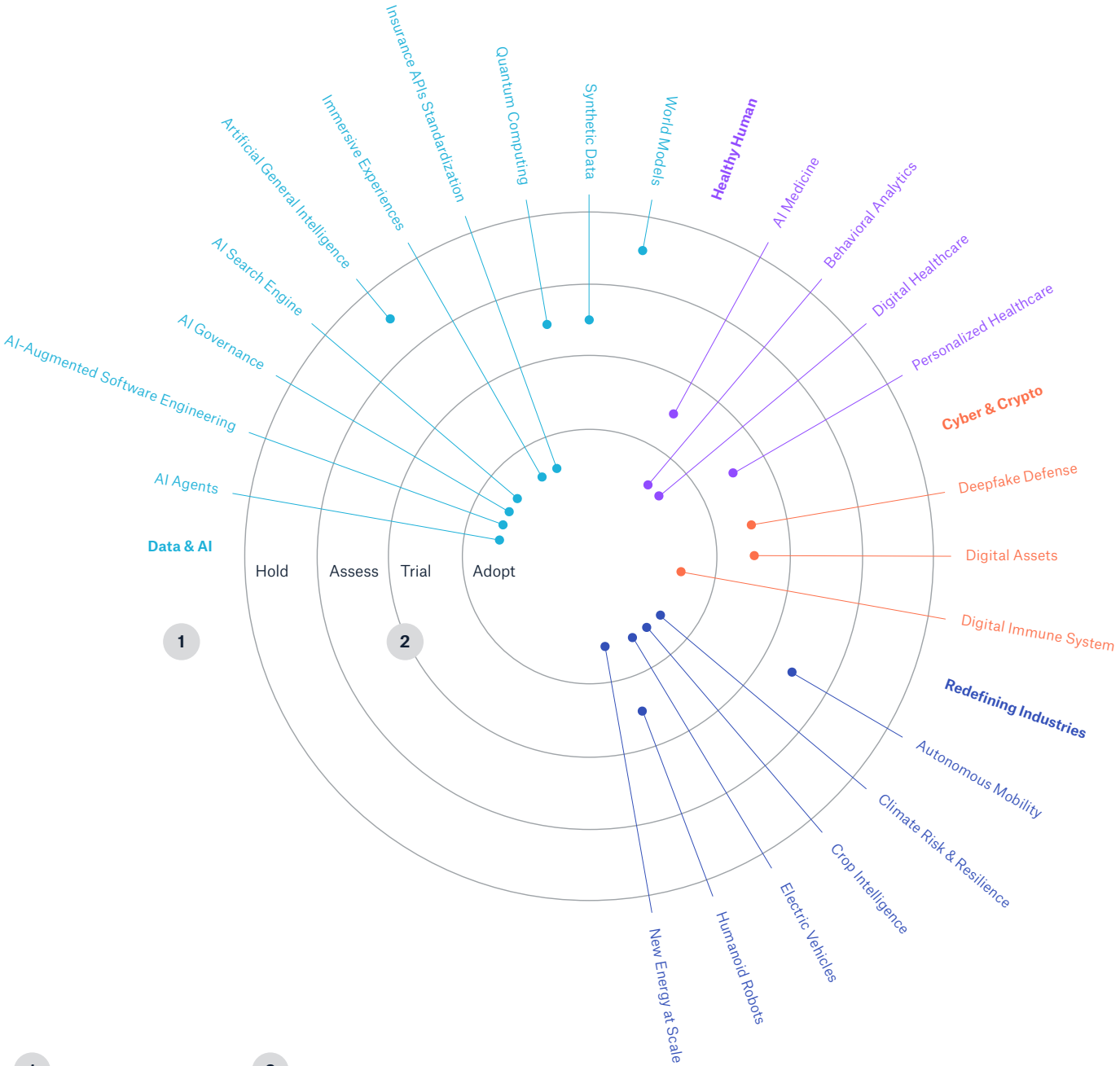
Process	Result
Step 1: Screening Analysis of trend developments Compiling developments and new trends for 2026 with external analysts' reports and internal market know-how, following **three golden rules**: **1.** Technologies that potentially disrupt the insurance industry. **2.** Technologies that potentially change business models. **3.** Technologies that potentially have an influence on the value chain and on internal and external processes within the insurance industry.	Total trends
Step 2: Aggregation and trend selection Definition of trends Aggregating data from screening processes and defining the most relevant trends categorised in four primary fields – and screening for "outdated" trends. Further drill-down and validation with market data and identification of corresponding use cases.	Selected trends
Step 3: Evaluation Assessment of impact and relevance Classifying trends according to their level of relevance for the insurance industry – primary, specialty and reinsurance. Analyzing trend impact along the insurance value chain and deriving opportunities and risks.	4 Trend fields 23 Trends 3 adopted 3 merged 2 transformed 4 niche 1 expired





Disclaimer: References to companies do not constitute or imply endorsement of any company or organization.

How to read this report



1

The report is structured along four trend fields

- Data & AI
- Healthy Human
- Cyber & Crypto
- Redefining Industries

2

Trends are provided with a trend maturity

Adopt
Start taking full advantage of this technology

Trial
First initiatives should be underway in the most affected business areas

Assess
Consider what it may mean for your business

Hold
Add it to your watch list

Adopted, transformed, niche, or expired trends

3 adopted
- AI Democratization,
- Generative AI
- Edge AI

3 merged
- Autonomous interactions into AI Agents
- Non Human Identity into Digital Immune System
- Hydrogen Economy into New Energy at Scale

2 transformed
- Metaverse and Extended Reality into Immersive Experience

4 niche
- Legal Tech
- Trade Secret Protection
- Ubiquitous Connectivity
- Ambient Computing

1 expired
- Decentralized Data Economy

How to read this report

Orientation

Navigation and links

All pages are linked in the table of contents.

The arrow → icons allow you to navigate through the brochure.

Underlined text indicates links that will take you to the corresponding website.

Color coding

Each trend is assigned a color according to the following scheme:

- Data & AI
- Healthy Human
- Cyber & Crypto
- Redefining Industries

1 Data & AI

Data & AI

Trend evolution and impact on the value chain

Data & AI

Data & AI in insurance: From experimentation to scaling execution

The implications of modern data architectures and AI are crystal clear. In 2026, Data and AI trends remain highly dynamic, with the cost per inference continuing to decrease exponentially.

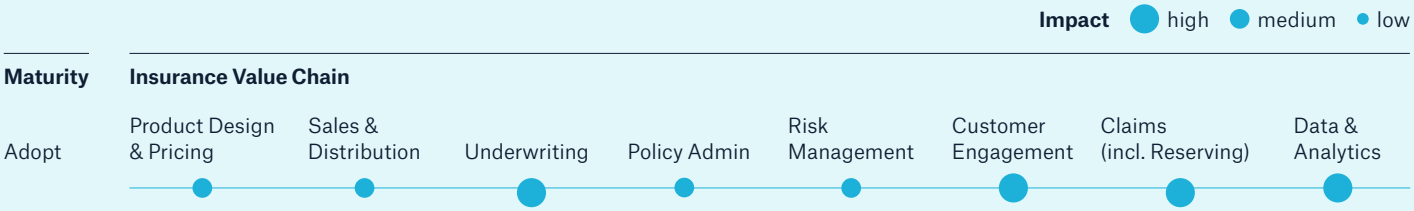
Insurers with the best Data and AI execution strategy will outperform their competitors significantly, as they will avoid expensive data silos and long-term commitments with vendors. Insurers must act on API Standardization, as this is not only an opportunity for business partners but also a prerequisite for efficient AI Agents. Insurers have started rethinking and rebuilding insurers' internal processes to enable both business growth and increasing efficiency. Leading insurers standardize their AI solutions with the right AI Governance built in from the start.

AI is not only reshaping insurance business processes, including distribution via AI Search Engines but also internally, especially through AI-Augmented Software Engineering which continues to reshape how we code and maintain our software stack.

Last year we introduced the young trend Spatial Intelligence as a new trend which has evolved quickly into World Models, with leading research labs working on this intensively – take a look if you want to understand what comes after AI Agents.

Data & AI

AI Agents



Opportunities

- Quality and efficiency gains in all insurance business processes, even for central functions like IT, Procurement, Legal and HR.
- Ability to provide 24/7 customer support.

Risks

- Performance of AI agents can vary, so strong human supervision is recommended.
- AI agents' autonomy can pose security risks, like the unauthorized use of data or systems.

Overview

AI agents are advanced Artificial Intelligence systems that autonomously perform tasks and make decisions aligned with user-defined objectives. Their adoption is accelerating, with many organizations actively piloting these technologies and demonstrating strong interest. Unlike traditional software, AI agents are dynamic – they continuously learn and adapt over time. While advances in technology and robust market momentum are fueling their uptake, concerns around security, performance and trust remain significant. For insurers, agentic AI can become a powerful strategic asset, but risks and transition need to be managed.

Introduction

AI agents are advanced Artificial Intelligence systems that leverage tools and memory to autonomously achieve objectives with minimal human intervention. Unlike traditional software, AI agents adapt in real time, automate repetitive processes and extract valuable insights from data. AI agents excel at tasks that can be broken down into smaller, well-defined components. They benefit greatly from tight feedback loops, which allow rapid error correction and iterative improvement. By handling repetitive tasks with speed and precision, AI agents free employees to focus on higher-value work. In data-rich environments, AI agents can analyze and synthesize information at a scale unattainable by human teams, uncovering patterns and generating insights. AI agents are rapidly gaining traction across industries.

Early adopters have already deployed agents in areas such as claims, underwriting, marketing and sales, customer service, research and development. As they become more prevalent, supervising them will become an essential skill to ensure that they achieve their objectives while upholding standards of privacy, fairness and ethical conduct.

Recent developments

Most organizations are still in the experimentation or pilot phase with AI, but there is already a marked surge in interest and early adoption of the next evolutionary step, AI agents. For software engineering leaders, the development of AI agent frameworks has already become a strategic priority, as these frameworks accelerate the integration of advanced AI capabilities into enterprise applications. According to McKinsey, nearly two-thirds of organizations have not yet scaled AI across the enterprise, but 62% are already experimenting with AI agents. Companies are leveraging AI not only for efficiency gains but also to drive growth and innovation, with workflow redesign emerging as a key success factor. Gartner projects rapid expansion in the use of agentic AI: by 2028, 15% of daily work decisions and a third of enterprise software applications will involve agentic AI. However, Gartner also cautions that over 40% of agentic AI projects may be canceled by 2027, underscoring both the promise and the challenges of this technology. Unlike traditional software, which is often deployed as a one-time solution, AI agents are dynamic: they learn, adapt and make decisions. This means their behavior can evolve or reveal unexpected issues under real-world conditions, therefore presenting a new kind of challenge. To address executive skepticism and ensure responsible deployment, industry leaders like Microsoft, Google, Amazon and Salesforce are investing heavily in observability and governance tools, marking a shift from pilot projects to scalable, production-ready agentic workflows.

"Insurance is a natural home for AI agents – where unstructured data meets complex decisions."

Andreas Nawroth
Leading Expert AI & Quantum, Munich Re

Opportunities

Agentic AI enables the opportunity of automation of complex workflows and enhances the ability to assess risk and support clients empathetically. Multiagent AI systems are poised to handle customer onboarding, risk profiling, pricing, compliance and decision orchestration, acting as virtual coworkers that collaborate and continuously learn from human feedback. Insurers can embed proprietary expertise into these systems, making agentic AI a strategic asset. The shift from traditional predictive models to sophisticated multiagent architectures and multistep reasoning allows collaborative problem-solving, real-time support and enhanced productivity. Agentic coding frameworks utilizing agentic approaches, such as Google's Antigravity, Microsoft's Copilot and Amazon's Kiro, are improving result quality and trust. The first large companies are switching to agent systems as their standard development environment. The integration of agentic features directly into operating systems will enable secure, direct interactions between agents and enterprise data. As agentic orchestration commoditizes the model layer and reduces vendor lock-in, insurers will need to invest in robust data infrastructure and enterprise-wide AI adoption to remain competitive.

Risks

Agents still require guidance and control, as they rely on large language models (LLMs) which reportedly "hallucinate". "Keep[ing] AI on the leash" (quoting Andrej Karpathy, cofounder of OpenAI) is vital to ensure that the result of a long-running, potentially highly autonomic job concludes in an expected result you can trust – especially in complex scenarios requiring a lot of context. Grounding (connecting the model output to verifiable sources of information) is crucial in scenarios where accuracy is key (e.g. extracting an address from a document). Defining the workflow as specifically as possible (i.e., explore – plan – code – submit in agentic coding scenarios) might help to spare humans from debugging AI-generated code. It is essential to encapsulate desired actions in narrowly defined tools instead of granting full access aids for scoping. Lastly, explicitly setting token, time or reasoning budget to ensure budget control are just a few of the many recommended measures. Organizationally, dedicated new roles such as AI Governance are required to comply with legal obligations. Also, as the value of an agent is derived by interacting with other systems, these systems need to be agent-ready, i.e. by exposing discoverable APIs.

Impact for the insurance sector

Agents shine especially in scenarios where the required output can be well described and the task at hand requires combining input and output from various systems in multiple steps. For instance, ERGO uses agentic systems to automate conversations and to optimize their customer contact center. More generally, agents can also handle internal support tickets or marketing tasks and clean data. Multi-year transformation is necessary instead of short-term activities.

> Agentic systems raise the question of which work truly creates value when done by humans – and where agents should take over.

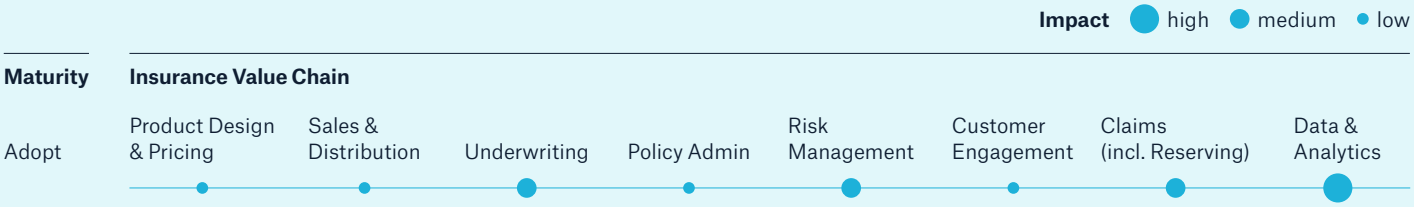
Bernhard Schlegel
Senior Technical Data Specialist, Munich Re

Conclusion

Agents are already creating value today in multiple industries. The insurance industry, dealing with a lot of unstructured data, is a natural fit for LLMs and thus AI agents for a variety of use cases ranging from automating customer interfaces to assisting the actual underwriting, accounting and claims process. However, to maximize the probability of success, the implementation needs to consider multiple factors such as tight technical control, organizational readiness and agent-ready interfaces to other applications to interact with.

Data & AI

AI-Augmented Software Engineering



Opportunities

- Increased productivity through automation of repetitive tasks.
- Faster time-to-market for digital insurance products and feature.
- Cost savings due to reduced manual labor.
- Reduce dependency on Cobol-based legacy systems – rewrite in modern languages.
- Enhanced risk modeling using AI-generated algorithms.

Risks

- Over-reliance on AI, potentially reducing critical thinking skills.
- Security concerns, such as inadvertently introduced vulnerabilities.
- Data privacy issues, including potential exposure of sensitive information.

Overview

AI-Augmented Software Engineering (AI-ASE) is shifting from autocomplete-style assistance to agentic-, intent-driven development. Developers increasingly collaborate with AI systems that understand goals, plan tasks and autonomously generate, test and refine code. This transition is accelerating across industries, with insurers benefiting through faster delivery, stronger analytics and higher operational efficiency.

Tools like Claude Code, OpenAI's code modes or Windsurf let teams focus on intent and architecture while AI agents execute the work. As this model matures, productivity and quality rise. Robust governance, security and compliance are crucial for safe, large-scale AI-ASE adoption in 2026.

Introduction

AI-Augmented Software Engineering now reaches beyond predictive autocomplete and conversational hinting. It is shifting toward agentic-, intent-driven development (Claude™ 2026 State of AI Agents Report). Instead of interacting primarily through traditional software development tools, developers increasingly collaborate with AI systems that understand goals, plan changes, execute multi-step tasks and produce complete software artifacts across multiple files.

Modern tools such as Claude Code, OpenAI's code generation modes, GitHub Copilot, Cursor and Windsurf represent this shift. They move coding away from manual, application-centric workflows toward high-level problem specification, where developers describe intent, constraints and architecture – and AI agents perform the operational work.

Key developments driving this transformation:

- Agentic AI development loops where models plan tasks, write code, run tests, evaluate failures and iterate autonomously.
- Goal-first workflows replacing coding workbench interactions – developers describe desired behavior; agents orchestrate the steps.
- AI-native platforms that treat the codebase as a semantic graph rather than files opened in an editor.
- Multi-agent systems coordinating roles such as planner, coder, reviewer and tester.
- Deep integration through MCP (Model Context Protocol, originally introduced by Anthropic) enabling secure, compliant interaction with enterprise systems and providing traceability and governance.

Unlocking value and challenges for insurers

For insurers, this paradigm unlocks faster delivery of digital solutions, more powerful risk analytics, and improved automation across actuarial and operational systems. But it also introduces new dependencies and governance burdens. Agentic systems must be monitored for correctness, security and compliance – and organizations must maintain internal engineering expertise to validate and guide AI-driven changes.

The shift to agentic development promises major acceleration, but success will rely on strong review processes, guardrails and model governance to ensure reliability, safety and regulatory alignment.

> In AI-Augmented Software Engineering, requirements and architecture become the work – coding becomes the implementation detail.

Florian Eberl
Technical Architect, Munich Re

Data & AI

AI Governance

Impact high medium low

Maturity Adopt

Insurance Value Chain

Product Design & Pricing · Sales & Distribution · Underwriting · Policy Admin · Risk Management · Customer Engagement · Claims (incl. Reserving) · Data & Analytics

Opportunities

- Trust in AI can increase and hence support the adoption of AI.
- Automated and real-time operationalization of AI Governance allows oversight of more autonomous AI systems.

Risks

- The regulatory and standard-setting landscape around AI are being developed, and some points have not yet been fully clarified.

Overview

AI Governance is part of enterprise governance and focuses on enabling the development, acquisition, deployment and use of AI. It combines measures that promote AI adoption and value creation (offensive AI Governance) with compliance and risk management controls (defensive AI Governance). Together, these two dimensions ensure trustworthy and effective AI advancement.

AI Governance is shaped by three major trends. The first is the rapidly evolving global regulatory landscape, illustrated by emerging AI regulations in jurisdictions such as Thailand and South Korea, alongside the early implementation stages of the EU AI Act. The second trend is rapid technological advancement in AI, including the rise of AI agents. The third is that aspects of AI risk management are increasingly being addressed by international standard-setting bodies.

Key topics of AI Governance

In last year's Tech Trend Radar, we outlined specific key challenges that the market faces when specifying AI Governance frameworks and gave concrete recommendations on how to overcome them. This year, we are focusing on key topics that AI Governance units face in their everyday work as adoption of GenAI progresses and AI agents are explored.

"Trustworthy AI progress happens when ambition and care go hand in hand. By combining strong governance with thoughtful enablement, we create space for innovation – while giving colleagues the confidence that risks are understood, managed, and never ignored."

Dr. Nivien Shafik
Head of AI Governance & Strategy, Munich Re

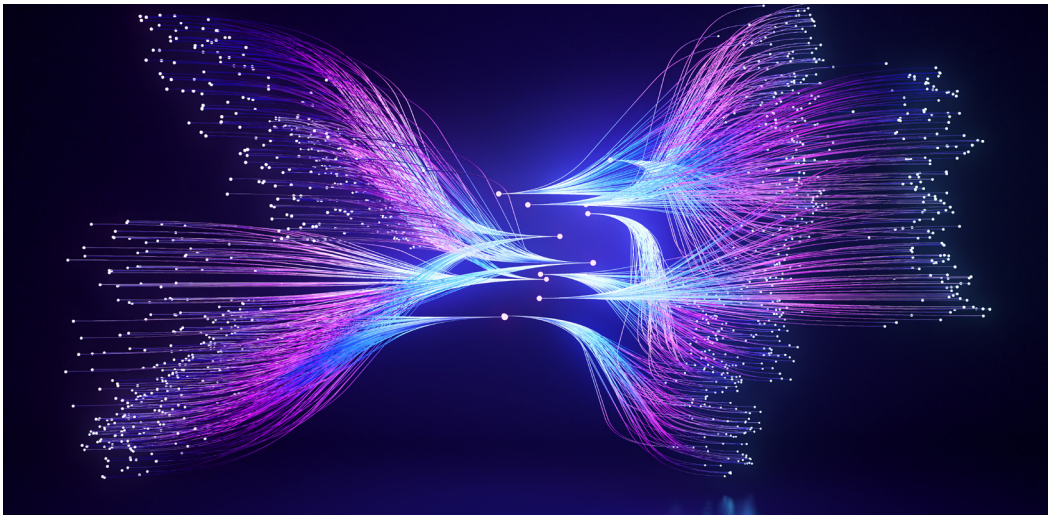
Strengthening trust in AI through governance and change communication

As Generative AI (GenAI) is currently being adopted by organizations, professionals have different paces when it comes to exploring and regularly using GenAI – similar to other technologies. In regulated sectors in particular, trust- and/or risk-based business models, compliance and risk management may be appreciated by colleagues. If offensive and defensive AI Governance go hand in hand, trust in AI technology can thus increase and give confidence to colleagues who are rather slow in adapting to change. More specifically, upskilling and change management communication around AI should be done comprehensively. More risk aware or risk-averse employees can potentially have more trust in AI if they know that the organization is taking care of AI risk management.

Navigating an evolving AI regulatory and standards landscape

The regulatory landscape around AI is still being established and continues to develop. One of the major challenges is the need for clarification of the practical implications of the laws. One example is the continuous updating of the interpretation of the AI system definition in the EU AI Act, as AI technology advances. In addition, as new AI-specific regulations emerge, they need to be mapped to existing AI Governance frameworks and existing sectorial regulations.

Standard-setters are detailing the requirements for AI risk management, but many are not yet available. As AI technology progress accelerates, new standards need to be developed more rapidly too.



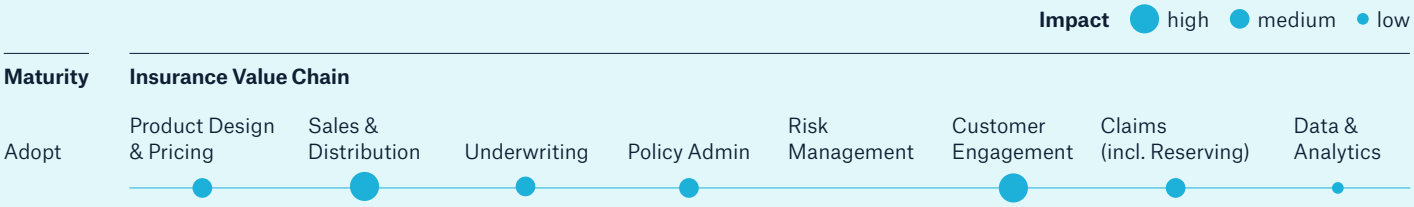
Enabling real-time AI Governance for autonomous AI systems

AI technology advancements like AI agents allow the AI to take actions and act more autonomously. Human oversight thus decreases and implies a need for a machine-based or even AI-based oversight. Human governance concepts can be transferred and should be implemented close to the AI, so that automatic, real time oversight is possible.

Given the evolving regulatory landscape, we have established seven guiding principles for dealing with AI that guide our own development, purchase, deployment and use of AI systems. These are summarized in our publicly available AI Governance Factsheet.

Data & AI

AI Search Engines



Opportunities

- Provide instant, clear answers to customer questions.
- Ensure mentions and citation in AI-generated answers, summaries and comparisons through GEO.
- Influence which insurance products are shortlisted and when customers are routed into regulated sales or advisory processes.

Risks

- Reduced visibility, as customers increasingly rely on AI-supported search systems and less on traditional search engines.
- Difficulties ensuring content is selected and presented accurately by LLMs.
- Loss of influence in agent-driven transactional journeys, as AI systems pre-structure decisions before customers enter regulated sales or advisory processes.

Overview

The emergence of AI search systems is transforming how information is researched and accessed, moving away from traditional keyword-based systems to context-aware, conversational responses. This shift has profound implications for businesses, requiring them to adapt through strategies like Generative Engine Optimization (GEO) to ensure content visibility and relevance. AI search systems excel at delivering personalized, precise answers by interpreting user intent and integrating external knowledge sources.

What initially affected informational queries has now expanded into high-intent decision contexts. Users rely on AI systems not only to understand topics, but also to reduce complexity, compare options and determine decisions. This development is driven by the integration of AI capabilities directly into traditional search environments, as well as standalone generative interfaces. The result is a unified decision layer that sits between user intent and market offerings. To stay competitive, businesses must adjust their content and technical accessibility.

The trend is shifting

The way we search for information is undergoing a dramatic transformation, driven by the rapid emergence of AI search systems. These systems don't just return a list of links, they synthesize information across sources, answer in structured formats, support follow-up questions and often provide citations to help users verify claims.

Models such as Search GPT, Perplexity and Gemini have accelerated a shift away from traditional keyword matching toward conversational, context-aware responses tailored to user intent. This evolution reduces reliance on extensive manual source comparison, making it easier to find precise information. By delivering responses adapted to individual preferences and behaviors, AI-powered search engines enhance both relevance and user satisfaction. A pivotal feature of LLM-based systems is Retrieval-Augmented Generation (RAG), which integrates external knowledge sources, such as databases and specialized documents, into AI responses. While this enhances contextual relevance and mitigates certain limitations of model-training data, the quality and trustworthiness of the retrieved information directly impact the reliability of answers.

In 2025, Google changed its search experience by integrating AI-generated overviews and conversational modes directly into core search results, further extending its long-standing dominance of the search market. AI overviews now appear in roughly 17 – 20% of all search queries, evidencing how generative features have moved from experimental features into mainstream search behavior. This shift changes how results are presented and how users interact with them. Research shows that users encountering AI-generated summaries are significantly less likely to click through to external links, increasing zero-click search behavior and reducing referral traffic for content providers.

How to stay competitive and visible

For businesses, these developments have profound implications. Traditional reliance on organic links and keyword rankings is no longer sufficient. Instead, companies must ensure that their content is effectively interpreted and represented within AI-generated summaries and conversational features. As major search providers respond to competitive pressure by embedding AI deeply into the search experience, visibility increasingly depends on how content is surfaced and used by these generative layers rather than on classic ranking alone.

Businesses should accordingly prioritize the following measures to remain competitive and visible:

- Adapt content for Generative Engine Optimization by ensuring it can be reliably retrieved, interpreted and summarized by AI search systems across search and comparison contexts.
- Shift from keyword optimization to intent- and situation-based content, enabling AI systems to apply information to concrete decision scenarios.
- Closely track early implementations and proposed advertising and placement models that may operate directly within AI-generated answers and comparisons.
- Treat third-party authority signals as a core asset, as AI systems increasingly rely on publishers, aggregators and comparison platforms to assess correctness and relevance.

By adapting to AI search systems, businesses can maintain visibility and influence as search evolves from information access to decision mediation.

"As LLMs integrate apps, agentic capabilities, and advertising models, they are evolving into marketplaces, making them increasingly relevant to sales strategy."

Luisa-Marie Schmolke
Innovation Developer, ERGO

From informational search to decision infrastructure

AI search has progressed from answering informational queries to actively shaping consumer decision processes in commercial contexts. Early generative layers primarily supported upper-funnel intent by helping users orient, define problems, and synthesize background information. More recent iterations increasingly extend into commerce and decision-oriented workflows, including product discovery, comparison, evaluation and purchase preparation.

This expansion is further reinforced by agentic capabilities that structure multi-step tasks, such as refining requirements, shortlisting options and assembling decision-relevant evidence, thereby moving AI search from answering questions to mediating choices.

As these systems enter high-intent queries, they invert the traditional evaluation workflow. Rather than returning ranked links and delegating assessment to the user, AI-supported search systems infer intent, select and aggregate evidence, and surface conclusions or ranked recommendations. Users increasingly treat these outputs as decision-ready, even when they reduce exploration and explicit source-by-source comparison.

During Black Friday, reports linked record-high online demand to the increased use of AI-powered shopping tools and agent-like assistants for product discovery, comparison, and deal evaluation. This suggests that generative systems are already functioning as commerce interface tools, not just answer engines.

The rise of AI-mediated agentic commerce has two intersecting implications for insurance:

1. **Consumer decision journeys are becoming delegated but insurance purchases remain regulated.**

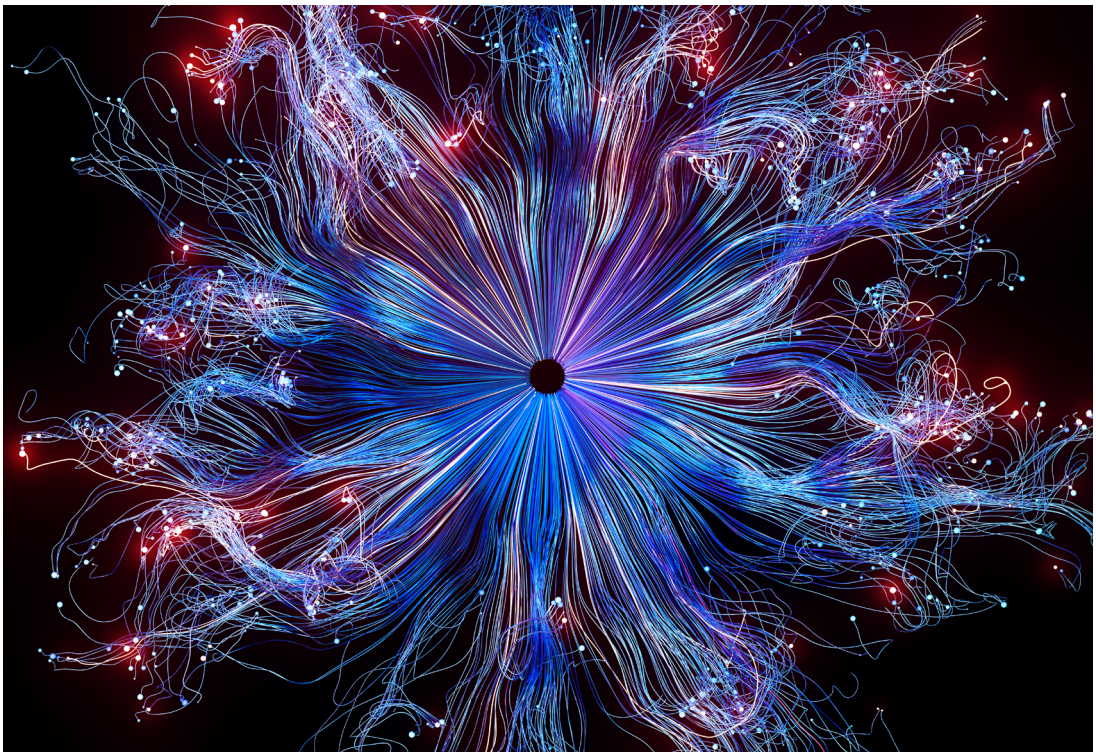
   - In many jurisdictions, an AI agent cannot autonomously execute binding insurance coverage without regulated intermediation (e.g., licensed producers and required disclosures).

   - AI agents may assist with research, comparisons, preference elicitation and pre-application data collection. However, executing a purchase contract usually requires a licensed channel and adherence to regulatory conduct, suitability and disclosure requirements.

2. **Insurers must orient strategies to be integrable by AI agents while preserving compliance. Insurers need to adapt for agentic inclusion as a qualified option in delegated decision workflows.**

   - Machine-readable, structured product evidence: Provide comprehensive, semantically enriched descriptions of coverage elements, exclusions, pricing components and underwriting criteria so that AI agents can reliably interpret and compare offerings without generating misleading or incomplete summaries.

   - Governance and oversight: Establish internal guardrails, approval workflows, conversation logging, auditing and review to ensure that AI outputs for insurance consumers meet regulatory and ethical standards (e.g., suitability, fairness, clarity about the AI's role vs. human advisor).



Data & AI

Artificial General Intelligence

Impact high medium low

Maturity

Hold

Insurance Value Chain

Product Design & Pricing | Sales & Distribution | Underwriting | Policy Admin | Risk Management | Customer Engagement | Claims (incl. Reserving) | Data & Analytics

Opportunities

- Transformation of the insurance industry by automating workflows and driving innovation.
- AI deployment can enhance quality and improve overall efficiency.

Risks

- The uneven intelligence profile of current AI systems means that human expertise remains essential and over-reliance on AI systems should be avoided.
- AGI can introduce new risks, such as sophisticated cyberattacks and fraud, if not properly controlled.

Overview

Artificial General Intelligence (AGI) represents a major milestone in AI, aiming for systems with human-like versatility across many tasks. While current AI models show impressive abilities in certain domains, they also have notable weaknesses. This unevenness means that human expertise remains essential. Recent advances in AI include rapid scaling of model size and dramatic reductions in usage costs. AGI holds tremendous promise for transforming industries such as insurance. However, sustained human oversight and continuous workforce re-skilling will be essential to effectively manage risks and fully realize the benefits.

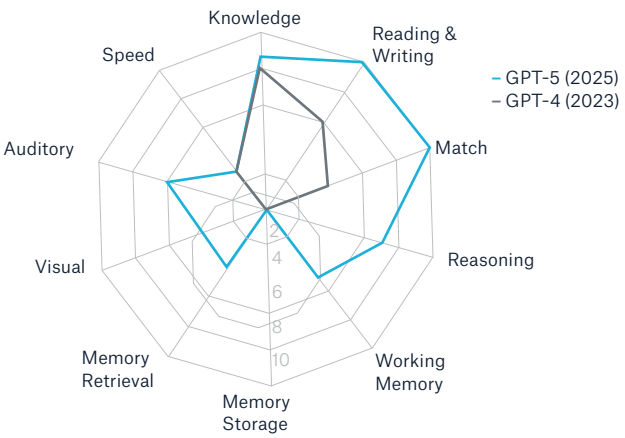


Figure 1: Jagged intelligence profile for LLMs

Source: Munich Re (2026). Jagged intelligence profile for LLMs. Design changes made. Based on Figure 1) The capabilities of GPT-4 and GPT-5. Here GPT-5 answers questions in 'Auto' mode. Taken from: Hendrycks, D. et al. A Definition of AGI. (2025). Available at arXiv:2510.18212 .Licence: CC BY 4.0

Introduction

Artificial General Intelligence stands as one of the most ambitious and debated milestones in the evolution of Artificial Intelligence. Unlike narrow AI systems, which excel in specific domains, AGI is envisioned as an AI that matches or exceeds the cognitive versatility and proficiency of a well-educated adult across a broad range of tasks. However, defining AGI remains contentious. Current AI models reveal a "jagged" cognitive profile (see Fig.1): they can perform impressively in some areas but often display critical weaknesses in other areas. This "jagged" cognitive profile poses significant challenges for the development of safe and reliable AGI. This suggests a future where collaboration between humans and AI systems is much more productive than outright substitution. Moreover, the diffusion of AI into society is likely to be gradual, due to the slow evolution of social and organizational structures, even as technological capabilities accelerate. Meanwhile technological progress remains strong, and the latest AI models represent another substantial step forward compared to their predecessors. Whether AGI will bring about sudden, sweeping changes or a more measured transformation remains uncertain. What is certain, however, is that those who learn to navigate this jagged frontier today will be best positioned for whatever comes next.

Recent developments

The scaling trajectory of Artificial Intelligence remains robust. AI models are expanding rapidly in size, computational requirements and energy consumption, with training compute doubling approximately every five months and dataset sizes every eight months. Remarkably, despite these escalating demands, the cost of utilizing AI models has dropped dramatically – querying a model comparable to GPT-3.5 fell from $20 to just $0.07 per million tokens, a more than 280-fold reduction in approximately 18 months. Notably, smaller models are now delivering results that previously required much larger architectures; for some benchmarks for a given score, a more than 100-fold reduction in model size in two years was observed. AI systems are mastering increasingly challenging benchmarks at an unprecedented rate, even as researchers continue to introduce tougher tests to push the boundaries of current capabilities. Nevertheless, complex reasoning remains a significant hurdle, as even advanced models struggle with tasks requiring robust logical reasoning, particularly at scale. This is addressed by AI agents, which learn to act and optimize in open-ended environments through self-play and simulation. These agents are already outperforming humans in short, focused tasks, though humans still maintain an edge over longer durations. Finally, the sector is witnessing record levels of investment. The four largest internet firms are expected to invest $650 billion in capex this year, representing an increase of roughly 60% compared to the previous year.

Relevance for insurance

AI is poised to rapidly transform the insurance industry by automating workflows, driving innovation and reshaping traditional business practices. The latest advances in agentic AI are now introducing the capability of managing customer onboarding, risk profiling, pricing, compliance and continuous learning, all while ensuring that humans remain engaged in critical customer interactions. Embedding organizational expertise into these AI systems is emerging as a key differentiator and a valuable source of intellectual property. Strategic decisions, such as whether to build in-house AI capabilities or purchase external solutions, will shape scalability and differentiation. While studies show that AI can significantly enhance productivity and quality, they also warn of the risks of over-reliance, which can erode human judgment and expertise. The uneven or "jagged" nature of AI capabilities underscores the importance of both timing and the strategic selection of use cases. Key criteria include the integration of unstructured data, the ability to implement rapid feedback loops for quality assurance, and the capacity for seamless handover to human experts whenever challenges arise. Coding and customer support exemplify such domains, but the landscape of suitable use cases is expanding rapidly. To fully harness the benefits of AGI while mitigating associated risks, insurers must invest in re-skilling their workforce for an AI-native mindset and focus on deploying AI in areas where it improves quality, ensuring positive economic impact through thoughtful human-AI collaboration, all while proactively addressing emerging threats such as sophisticated cyberattacks and fraud.

> The right architecture isn't 'human vs. AI' – but rather a distribution of tasks: agents automate the routine, experts adjudicate the complex tasks.

Andreas Nawroth
Leading Expert AI & Quantum, Munich Re

Potential applications

AI continues to accelerate scientific applications and discovery. AI systems are now achieving near-perfect scores on math or coding benchmarks. In the medical domain, LLMs' clinical knowledge continues to improve, with some benchmarks nearing saturation and studies showing that AI can outperform doctors in diagnosing complex cases and detecting cancer, though here too, collaboration between AI and doctors often yields the best results. There is also significant progress in robotics, particularly with the rise of humanoid robots. In the realm of autonomous vehicles, while widespread adoption has been slower than anticipated, commercial self-driving taxi fleets are now operational in several major U.S. cities. Data indicates that self-driving cars, such as those operated by Waymo, are safer than human-driven vehicles, with significantly fewer incidents and a dramatic reduction in property damage and bodily injury claims compared to human-driver baselines. Also, robotics and autonomous cars will provide huge datasets for the training of the next generation models.

Conclusion

Recent advances in AI extend far beyond traditional scaling of compute resources and data. New approaches leverage "self-play" elements, introduced by Google's AlphaZero, to boost performance independently of human training data. More broadly, the recognition that all digital work ultimately reduces to code means that AI agents capable of coding are emerging as powerful, general-purpose tools, able to automate a vast array of computer-based tasks. While AI can deliver substantial gains in productivity and quality, its capabilities will remain uneven for the foreseeable future. Excessive reliance on AI can therefore undermine human judgment and expertise. Ultimately, the greatest economic benefits are realized when AI is deployed in areas where it excels and is complemented by human collaboration.

Data & AI

Immersive Experience

Impact high medium low

Maturity	**Insurance Value Chain**							
Adopt	Product Design & Pricing	Sales & Distribution	Underwriting	Policy Admin	Risk Management	Customer Engagement	Claims (incl. Reserving)	Data & Analytics

Opportunities

- More immersive consulting and services.
- More efficient learning and working.
- New products and revenue streams.

Risk

- Increasing demands on data protection and cyber security in immersive environments.
- Reputational risks due to data protection (GDPR), misuse, and lack of trustworthiness.
- High investment risks due to fragmented standards and rapid technological change.

Overview

The term “immersive experience” describes the transition from an abstract metaverse vision to Extended Reality (XR) technologies that are already being used in the insurance industry. While the metaverse is considered a long-term concept, technologies such as Virtual, Augmented, and Mixed Reality are already being used in virtual customer consulting, simulation-based risk analysis, or immersive training. This trend marks the shift from visions to practical, scalable applications.

From the metaverse vision to operational application

Immersive experience describes the transition from a visionary metaverse narrative to concrete, usable technologies that are establishing themselves in various industries and value chains. The trend stands for the use of XR technologies in productive business processes and in users' everyday lives. While the metaverse is considered a long-term vision of a fully connected digital space, immersive experience is already showing a maturity that is evident in immersive learning environments, AR-supported work scenarios and virtual collaboration, which are evolving from pilot projects to integral components of modern business models.

The XR market is evolving from a niche to a strategic investment area, with growth from more than $20 billion in 2023 to around $85 billion by 2029. Drivers include declining hardware prices, improved user-friendliness, and use in sectors such as industry, healthcare, and education. The market for XR software and services will reach a potential of around USD 300 billion by 2030. According to Statista, the AR hardware industry is increasing, with sales from around USD 6.3 billion in 2024 to nearly USD 12 billion by 2029. For insurers, the “immersive experience” is seen as the technological basis for key processes such as training, risk assessment, and customer interaction, with questions shifting from ‘if’ to “how” integration and new business models will take place.

1. Learning, training & qualification

XR-based training solutions enable claims adjusters, underwriters, and sales staff to practice complex scenarios in safe 3D environments. VR learners, for example, reduce training times by up to 75% and lower error rates, while increasing confidence in handling complex situations. Immersive learning methods add significant value to training by enabling consistent, cross-location qualification programs and enhancing a blended learning approach that combines classroom, e-learning, and VR to effectively develop specific skills.

2. Risk assessment & underwriting

In underwriting, AR-supported remote inspections and digital twins can be used to assess risks more accurately and efficiently. AR solutions guide customers through data collection, while underwriters receive additional information via overlays. For complex industrial risks, digital twins and VR simulations enable virtual inspections and scenario analyses that can evolve from pilot projects into regular risk management tools.

3. Damage assessment & claims management

XR can support damage assessment through remote inspections, where customers use AR instructions for documentation. Claims adjusters use AR overlays for risk categories and checklists. This improves documentation quality and enables faster, more consistent settlement of complex claims.

4. Customer service, sales, and customer engagement

Immersive experiences are transforming customer interactions by vividly illustrating risks and products. Virtual branches, XR-supported consulting scenarios, and simulations of natural disasters help make abstract insurance concepts understandable and promote customer loyalty. Avatar-based meetings and virtual rooms make it possible to visualize complex policies together and adjust them in real time, regardless of location.

5. Recruiting, onboarding & employer branding

XR experiences are increasingly being used by insurers in recruiting and onboarding to immersively convey professions, work environments, and corporate culture. Applicants can experience typical situations in sales, claims management, or IT in virtual experience formats, giving them a realistic picture of their future role. For new employees, VR onboarding enables hybrid working models to be supported and globally consistent, high-quality content to be rolled out.

6. Prevention & risk engineering

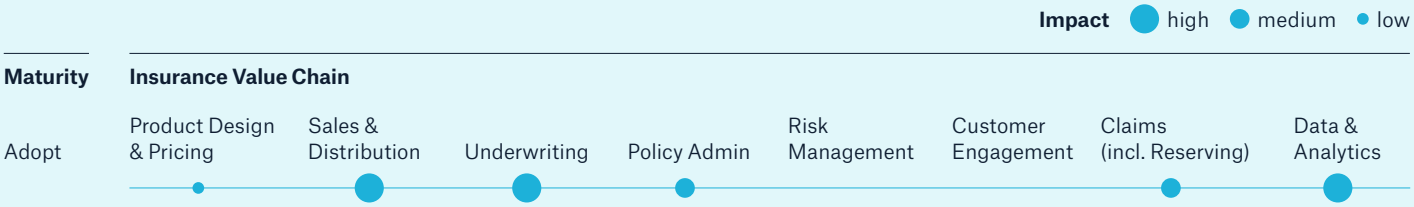
XR-based simulations enable companies and end customers to better understand risks and implement more targeted preventive measures. VR scenarios for occupational safety, cyberattacks, or natural disasters support proactive risk management and make the impact of protective measures immediately tangible. In industrial contexts, virtual inspections and training allow rare but critical events to be practiced repeatedly and safely, thereby reducing the potential for damage.

Outlook: How AI glasses and XR are changing the way we assess and manage risk

As mentioned above, the XR market is currently evolving from a niche to a relevant investment area. This is primarily due to two developments: the implementation of Generative Artificial Intelligence in devices and the miniaturization of hardware. The goal of the new generation of smart glasses and similar devices is to make them suitable for everyday use, which is why they rely on voice control, AI, and camera-based context analysis. This enables completely new forms of information processing, which also opens up new opportunities for insurers. For example, in the areas of risk analysis, damage assessment, or underwriting. As the devices become more widely available, their potential applications could also expand. However, for the devices to become everyday companions, it is necessary for their manufacturers to convincingly combine technology, comfort, data protection, and practical functions.

Data & AI

Insurance API Standardization



Opportunities

- Significantly better customer experience due to faster response times.
- Improved efficiency and savings through automating data entry and reducing errors.
- Critical interoperability capability for seamless data exchanges with new distribution partners.
- Structured, quality-verified data to feed to AI models.

Risk

- Initial implementation efforts require careful execution, including cybersecurity protection.
- An API-driven tech stack creates pressure on the underlying legacy systems, as business partners demand "always on" integration with no downtimes for maintenance efforts.
- Too many proprietary standards can lead to increased costs during adoption.
- Data quality must be ensured.

Overview

Insurance data standards are key to breaking down the silos between distribution partners, primary insurers, brokers and reinsurers. Insurance API standardization creates a common way for insurance systems to communicate, improving interoperability, data consistency, efficiency and security. It makes collaboration faster and easier, whether it involves exchanging risk submission data, handling claims and accounting data, or developing new products. In the long run, this standardization will lead to significant cost savings and improved customer experience and will provide greater flexibility to innovate. Additionally, as we have just entered the era of AI, it will become even more crucial to have structured data that companies can use to run their AI models. In essence: it is ultimately the implementation of a universal language that everyone in the insurance industry can use to share information.

The lack of data standards

The traditional insurance industry has a significant and growing problem in 2026: the relevant data is still mostly shared between the various participants in the insurance value chain in a very outdated fashion. Distribution partners like MGAs and brokers, as well as tied agents (humans), capture data, create Excel or PDF files and submit them to their insurer via email or portals. Yet another distribution partner also creates new files but uses a different document template. The ecosystem is constantly readjusting, testing and validating the exchange of data, as it lacks a common data exchange format that is accepted by most players.

Technological advances are now making the situation worse: the hype surrounding Large Language Model (LLM) and Large Multimodal Model (LMM) systems makes insurers blind to innovating in the industry with a first-principles approach. Instead of pushing for agreement on a common data standard for the industry, most insurers are spending millions of euros on extracting data from incoming documents, creating human-in-the-loop (HITL) systems, and generating additional overhead through their efforts to ensure that the new AI-based systems are highly accurate and ethically acceptable, and because they need to ensure that the systems don't deteriorate over time.

Like the AI industry, the insurance industry also needs to apply first-principles thinking: what are the mandatory key aspects of risk transfer, accounting and claims handling? What is the minimum level of processes, people, data and technology required to exchange data between clients, intermediaries like brokers and agents, and (re)insurers? What is only increasing complexity and therefore adding avoidable costs? How can we avoid becoming even more dependent on technology providers?

The solution

Data standards have the most profound impact on people, processes, technology and data. They impact the efficiency of:

Companies
When adopted company-wide, data standards streamline operations, enhance team collaboration and increase productivity. They reduce the time spent on data collection, allowing teams to focus on higher-value tasks and thereby boosting talent retention and satisfaction. Adopting data standards allows companies to direct their top talent towards high-value opportunities like customer acquisition and business development, rather than mundane tasks such as data entry. This shift enables a focus on strategic initiatives.

Processes
Data standards streamline operations, reduce transaction capacity needs and enable companies to achieve straight-through processing (STP). They create a common understanding of data, allowing it to be collected once and reused across different business areas. This facilitates semi- or even fully-automated systems where information flows seamlessly from the first interaction to the end of the transaction without the need for manual intervention.

Technologies
Adopting data standards allows companies to implement solutions faster and at lower cost by using third-party products instead of proprietary ones. As standards become more common, vendors will be motivated to adhere to them, fostering competition based on value and feature enhancements.

Analytics and AI
Data collection and sharing via data standards will also improve overall data accuracy and consistency. This will not only allow more accurate reporting and AI-based predictions but also enable insurers to innovate on the next level of feature engineering.

"Reshaping the (re)insurance industry by designing and implementing streamlined processes and adopting data standards can lower operational costs and improve client service. "

Sandro Monaco
Senior Underwriter, Munich Re

The future of API standardization in insurance

As the insurance industry continues to embrace the digital transformation, the role of standardization will become increasingly important.

Future trends may include:

- **Regulatory mandates:** Governments and regulatory bodies may introduce mandates requiring API standardization to ensure consumer protection and market stability (see also European Council).
- **Increased collaboration:** Industry stakeholders may collaborate more closely to develop and adopt universal API standards, promoting a more integrated ecosystem.
- **Global standardization efforts:** International organizations working to establish global data and API standards in order to facilitate cross-border insurance operations and services (ACORD Reference Architecture).

Data and API standardization is the key to unlocking the full potential of digital transformation in the insurance industry.

By promoting interoperability, efficiency and innovation, standardized APIs will be a key means of helping insurers meet evolving customer expectations and navigate the complexities of the modern digital landscape. While challenges exist, collaborative efforts and global initiatives should pave the way for a more connected and efficient insurance ecosystem.

Data & AI

Quantum Computing

Impact high medium low

Maturity	**Insurance Value Chain**							
Assess	Product Design & Pricing	Sales & Distribution	Underwriting	Policy Admin	Risk Management	Customer Engagement	Claims (incl. Reserving)	Data & Analytics

Opportunities

- QC could solve complex problems in weather and climate predictions, battery development, finance, pandemics, logistics, cyber and AI.
- QC enables faster and more granular risk simulation, pricing and portfolio decisions, as well as highly tailored products and individualized coverage structures.

Risks

- Because the timing of quantum advantage remains uncertain, it complicates planning for resource development and the creation of a robust project pipeline.
- QC may endanger current technologies such as IT-security protocols and blockchain.

Overview

Quantum Technology (QT) has made significant strides in recent years. It has seen notable advancements, especially for Quantum Computing (QC) in the number of qubits and their stability. Despite progress, QC still faces some hurdles, and current quantum computers do not yet offer a tangible advantage over classical computers for most applications. The field continues to attract substantial investment, and while QC is not yet ready to replace classical computing, its rapid development and the growing interest and investment suggest a bright future ahead.

Introduction

Quantum Technology (QT) is rapidly advancing, with potential applications becoming clearer. The biggest potential application is Quantum Computing (QC). Technologies like superconducting circuits, trapped ions, neutral atoms and photons are at the core of QC. Quantum computers use qubits, which can represent 0 and 1 simultaneously, enabling theoretically exponential computational power with a linear increase in the number of qubits. This could solve complex problems in areas that are currently bottlenecked by extremely high need for computational power, like climate predictions, battery development, finance, drug research, logistics, cyber and AI. In 2021, Munich Re and nine other leading German companies formed QUTAC (Quantum Computing & Application Consortium) to speed up the transition of Quantum Computing from research to industrial use. Since then, four additional companies have joined QUTAC, and the consortium has published several papers outlining best practices for applying quantum computing in a business context.

> For insurers, Quantum Computing is less about speed and more about unlocking risk patterns hidden in today's most complex insurance scenarios.

Andreas Nawroth
Leading Expert AI & Quantum, Munich Re

Recent developments:
The QC landscape is evolving at a remarkable pace, marked by a rapid increase in the number of qubits within leading quantum processors. For instance, IBM has unveiled the Quantum Nighthawk processor, featuring 120 qubits. Similarly, Google has introduced the Willow processor, equipped with 105 qubits. Notably, platforms based on neutral atoms emerged as one of the leading technologies and have achieved impressive milestones, with QuEra demonstrating the continuous operation of a coherent system with 3,000 qubits. To put these achievements into perspective, current supercomputers can only simulate a perfect quantum computer with approximately 50 qubits. However, today's quantum computers are far from perfect, and consequently only a small fraction of their vast computational potential can currently be harnessed.

To demonstrate practical utility, companies highlight solutions to problems that are intractable for classical computers, even though current results typically apply only to highly specialized cases and are sometimes subject to debate. However, broader and more universally accepted breakthroughs are expected with the advent of fault-tolerant quantum chips – a development IBM anticipates achieving by 2029. The year 2025 is widely seen as a turning point, especially for quantum error correction (QEC). Artificial intelligence has emerged as one of the most effective tools for implementing QEC, with Algorithmic Fault Tolerance (AFT), where error detection and correction are embedded directly into the algorithmic code, representing a major leap forward. Beyond computing, quantum technologies are making inroads into communication and sensing. Quantum communication promises ultra-secure data transmission, while quantum sensing is poised to revolutionize fields like healthcare.

New quantum sensors and imaging techniques could dramatically improve the resolution of medical scans, enabling clearer images of the human body and even mapping the brain's magnetic fields generated by neural activity – capabilities far beyond those of current technologies. Global investment in Quantum Technology is accelerating at an impressive rate, with funding volumes increasing by 50% year over year. In the United States, Quantum Computing companies alone are projected to generate over $1 billion in revenue this year. The economic impact of quantum technology is anticipated to be profound: recent research indicates that the three foundational pillars – quantum computing, Quantum Communication and quantum sensing – could collectively generate up to $97 billion in global revenue by 2035. Quantum Computing is poised to capture the majority of this value.

Potential applications:
Early adopters across industries are exploring quantum computing's potential in several key areas. In materials, BMW Group is advancing sustainable mobility through materials research on fuel-cell catalysts, while SoftBank Corp. is exploring organic materials for next-gen batteries, optical switches and solar cells. These quantum simulations can accelerate material discovery that would otherwise take years through traditional methods.

In financial services, JPMorgan Chase is researching potential capabilities for advanced financial analytics, including portfolio optimization. For industrial and operational optimization, DHL is working on the optimization of complex routing and supply chain decisions across large fleets to reduce costs and improve delivery times and emissions.

Lastly, quantum technology is also reshaping cybersecurity. Cloudflare has deployed hybrid post-quantum resilience cryptography in its infrastructure by default to protect internet traffic against future quantum threats, recognizing that today's encrypted data will become vulnerable once large-scale quantum computers emerge.

Relevance for insurance:
In the insurance sector, Quantum Computing unlocks several key applications. It enables faster and more sophisticated risk simulation, allowing insurers to run complex scenario analyses and Monte-Carlo-simulations to improve understanding of interconnected risks. Moreover, this enhanced computational power supports more precise pricing, with enhanced risk insights enabling insurers to calculate premiums at a more granular level.

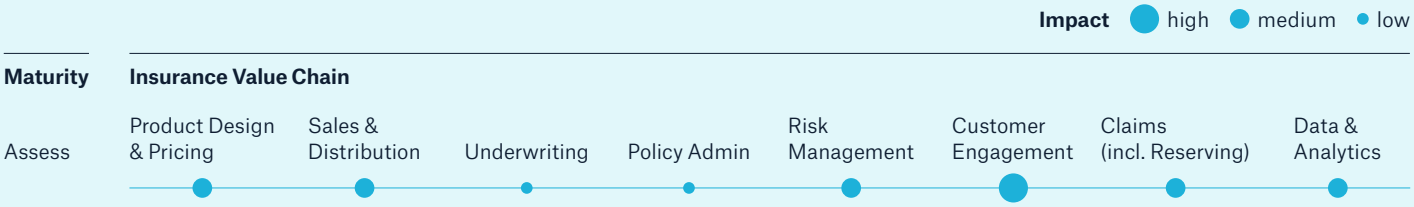
Potential applications include highly complex insurance policies that reflect individual risk profiles more accurately compared to classical computing. For example, quantum technology could enable property-level climate risk assessments or coverage structures tailored to each customer's needs. Beyond pricing, Quantum Computing also enables insurers to optimize complex decisions under various constraints, such as portfolio optimization and effective capital allocation, or how to route claims and operations more effectively.

Conclusion

The timing of quantum advantage for different use cases is not easy to predict. But given the exponential benefits, the different technological paths available, the current progress and the strong investment trends, first useful applications are expected by 2030. While the potential for QC is high, QC may also create security risks for current technologies like encryption. Access to hardware and the stability of early quantum devices may also become a bottleneck for industrial applications. Overall, while Quantum Computing is not yet ready to replace classical computing, its rapid development and the growing interest and investment suggest a bright future ahead.

Data & AI

Synthetic Data



Opportunities

- Scalable and cost-effective alternative when real-world data is limited or sensitive.
- Synthetic data can increase the quality and robustness of AI-model training.
- Enables simulation of catastrophic events, e.g., blackouts, supply chain collapses, climate impacts and critical infrastructure.

Risks

- Ethical considerations and potential biases embedded in synthetic datasets.
- Standards are lacking, as generation technologies are nascent.
- Accuracy and fidelity of poorly generated datasets can mislead decision-makers.

Overview

The insurance industry has been constrained by the very data it depends on – too sensitive to share, too scarce to model rare risks and too regulated to fully exploit. Synthetic data is quietly changing that question. Rapid advancements in Artificial Intelligence allow insurers to replicate the statistical behavior of real customers and claims without exposing personal information. It paves the way for insurers to train models on data they would otherwise not be able to use.

This matters at a moment when regulators are tightening data rules just as insurers are under pressure to automate underwriting, pricing and fraud detection. Synthetic data offers a rare compromise: richer datasets, lower privacy risks and faster innovation. Consequently, the insurance business is increasingly enriched with synthetic data and no longer has to learn only from past experience.

New dynamics in risk modeling

Risk is accelerating. Climate extremes, systemic fraud, cyber threats and sudden behavioral shifts are emerging faster than historical data can explain.

Traditional model training and pricing of risks rely on real-world datasets like claims histories, policy records and loss experience that are often fragmented, highly sensitive and statistically at thin edges to capture rare or emerging events. Accessing and exploiting the data is a challenge with governance and increasing regulatory measures. As a result, insurers are forced to make forward-looking decisions using backward-looking evidence.

Synthetic data changes this dynamic. By enabling the training and testing of models on statistically realistic data without exposing real customers, insurers can now simulate scenarios, stress-test assumptions and develop AI systems beyond the boundaries of traditional datasets.

Generative AI and strategic data assets

Synthetic data is being adopted faster than many leaders realize, in part because it's framed in domain language, such as digital twins in manufacturing, simulated patients in healthcare and test data in software.

From a domain perspective, generative AI enables the creation of synthetic data from text and simulations of real-world behavior to synthetic images and video, including deepfakes that insurers should monitor as a new risk vector. Conversely, synthetic data is increasingly used to train LLMs when real data is costly or restricted, supporting privacy, compliance and regulation (WEF).

Data protection and compliance regulations

The rapidly rising number of AI applications in companies has been accompanied by regulators to ensure reliance on compliant and statistically faithful datasets. As one of the most sophisticated regulations yet, the EU AI Act, for example, considers companies should explore synthetic substitutes before processing personal data.

"The biggest shift ahead is prevention at scale. With enhanced simulated forecasting, insurers can move upstream to reduce loss frequency and improve combined ratios."

Andreas Schumacher
Project Manager Artificial Intelligence, Munich Re

How synthetic data is quietly reshaping insurance

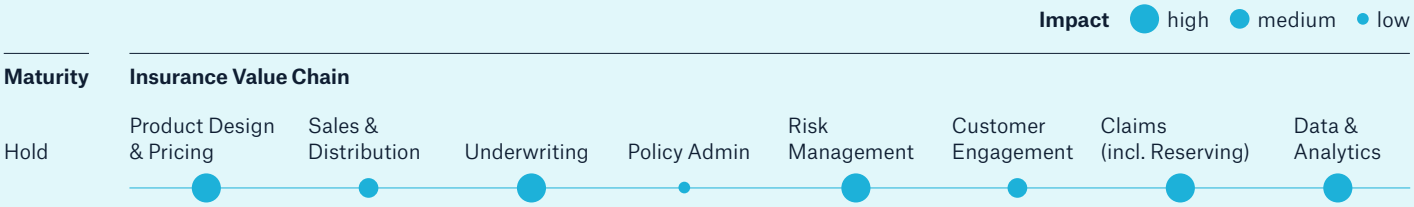
Synthetic data is already creating a first tangible impact across insurance lines. In Property and Casualty, it enables realistic simulation of catastrophic climate events, such as hurricanes, wildfires and floods, allowing insurers to stress-test assumptions beyond historical loss experience. Life insurers are increasingly using synthetic data to close data gaps and improve risk assessment and underwriting accuracy (read more on the future of AI in the insurance industry here). More broadly, synthetic datasets allow insurers to access and analyze sensitive data more safely, test and reduce bias (such as territorial or ZIP-code proxies), and preserve privacy when governance is robust. At the customer level, synthetic data also enables more personalized engagement through targeted messaging and synthetic video content.

Outlook for synthetic data in 2026

While the technology offers meaningful advantages, synthetic data should not be treated as a universal solution. Outcomes hinge on governance and controls, including documented provenance, traceable data pipelines, quality assessment protocols, and safeguards. Without active bias and quality management, synthetic datasets may replicate and potentially reinforce limitations present in the underlying real-world data.

Data & AI

World Models



Opportunities

- Better risk insight: Stress-test risk scenarios far beyond historical data, e.g., for self-driving vehicles.
- Autonomous systems safety: Self-driving vehicles, industrial robots and humanoid assistants will operate with significantly fewer errors. Insurers will be able to leverage these advancements via partnership products tied to safer, model-verified operations.
- Enhanced loss prevention: Customized insurance products for unique regional communities and businesses with specific natural hazards risks.

Risks

- Model bias and data gaps: Biased results if training data does not reflect all world scenarios sufficiently.
- Over-reliance on model outcomes if not validated rigorously.
- Cumulative risk in the event of model failure, model drift or cyberattack.

Overview

World models are AI systems that internalize physics, spatial relations and causal dynamics of the real world. They are rapidly emerging as the next frontier beyond traditional AI and language-centric Large Language Models.

Major AI researchers and global players including World Labs (Fei-Fei Li), AMI Labs (Yann LeCun), Google DeepMind and NVIDIA are transitioning to research previews, early public releases and developer platforms in 2025– 2026. Still, the timeline to broad, robust, multi-domain factual reasoning via world models remains uncertain, but insurers can already begin exploring spatial intelligence for richer risk analysis and risk prevention, especially as extreme weather risks intensify. Once world models become available, the claims frequency of self-driving vehicles and robots will decrease, with pressure on insurance rates for motor and liability insurance.

Introduction

The insurance industry is undergoing a significant transformation in risk assessment and risk management, driven by technology. World models with spatial intelligence, the ability to understand and interpret spatial relationships between different entities, are emerging as a critical technology trend. This trend has been fueled by advances in geospatial analytics, satellite imagery, amateur video recordings and Artificial Intelligence to generate synthetic data. As natural disasters become more frequent and severe, insurers will adopt innovative solutions that provide a clearer understanding of the risks associated with specific properties.

Leading experts in AI research, such as Fei-Fei Li, inaugural Sequoia Professor at Stanford University, Yann LeCun, Silver Professor of Computer Science at New York University, and Demis Hassabis, 2024 Nobel Prize winner in Chemistry, emphasize the importance of world models to allow machines to truly understand real-world environments. Why is this important? Take the simple example of a young adult learning to drive a car: it only takes hours. However, AI systems are still not evolved enough to enable driving safely on all roads and under all weather conditions – after decades of research and testing. This is described as Moravec's Paradox, a phenomenon observed by Hans Moravec and other AI scientists in 1988: what's easy for us, like perception and navigation, is hard for computers, and vice versa.

Latest progress by key players – a clear signal of the growing strategic importance

Fei-Fei Li and World Labs launched Marble in November 2025 with a focus on "spatial intelligence", moving beyond static media to models capable of interacting with geometry and physics.

Turing Award-winning AI pioneer Yann LeCun has founded Advanced Machine Intelligence (AMI Labs), explicitly centered on world model architectures capable of reasoning and planning in physical scenarios.

Google DeepMind's Genie 3 (research preview) and ongoing Project Genie (experimental) initiatives are advancing interactive, real-time world simulations that predict how environments evolve and how actions impact variables over time. These models underpin both agent training and broader AGI research.

Through NVIDIA Cosmos World Foundation Models and physics-oriented simulation engines like Newton, Nvidia is delivering scalable world model infrastructure for robotics, autonomous systems and industrial digital twins, reinforcing the bridge between AI and physics-accurate simulation.

Despite the latest achievements, the ultimate goal of achieving true spatial intelligence and world knowledge remains elusive. The development of a comprehensive "world model" that fully integrates and understands the complexities of our physical environment, including spatial relationships, gravity and dynamic interactions, is still on the horizon. Nevertheless, insurers are already benefiting from advances, especially since the insurance industry is now moving toward more precise models that incorporate real-time geospatial data, moving away from solely relying on historical data and broad geographic zones to assess risks.

Technologies such as satellites, drones and real-time data sets are providing insurers with unprecedented visibility into the risks surrounding facilities. Recent advances have enabled insurers to quickly assemble comprehensive data sets.

For example, the integration of radar-based satellite imagery with drone-captured visuals, as well as creating digital twins, allows insurers to conduct detailed property assessments much more efficiently than traditional methods.

Outlook for world models in insurance

The future outlook for world models in insurance is promising, but also acknowledges that we are still in the early stages of truly understanding and fully modeling spatial relationships, including gravity, dynamics and 3D.

Autonomous vehicles and robots
World models will improve the safety of autonomous vehicles and robots – both operating in diverse environments alongside humans and other machines without smart technology. This will create buyer's trust and new demand for these products. But it will impact motor and liability insurance product pricing as customers will ask for cheaper rates.

Natural hazards
As climate change continues to reshape the risk landscape, insurers equipped with advanced analytical tools will lead the way in providing effective coverage solutions. The global insurance market is expected to grow significantly over the next decade, driven by increasing demand for innovative products that address emerging risks. In addition, as consumers demand more personalized services and proactive risk management solutions, insurers that leverage future world models will be well positioned to meet these expectations.

2 Healthy Human

Healthy Human

From risk coverage to health enablement through AI, data, and personalized care

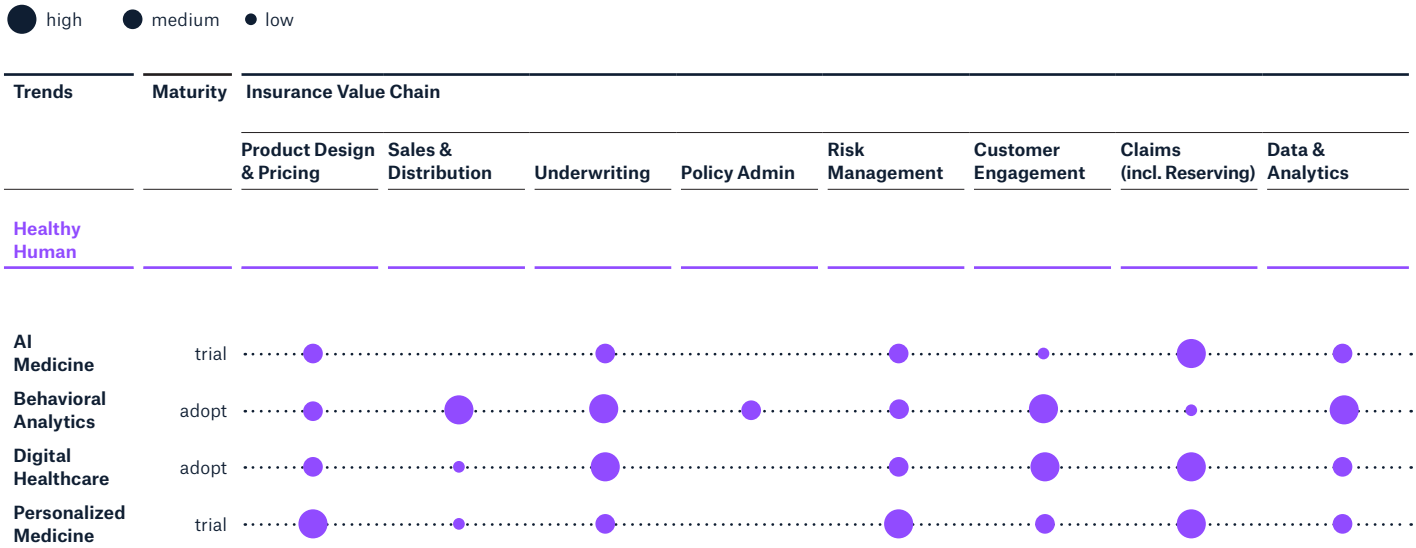
The healthcare landscape is rapidly evolving, driven by advances in AI medicine, digital healthcare, behavioral analytics and personalized medicine. Together, these technologies are transforming how health data is generated, interpreted and applied across clinical and insurance settings, enabling earlier detection, smarter prevention and more accurate decision-making.

For insurers, these developments unlock new opportunities to enhance underwriting, improve risk management and strengthen customer engagement. AI supports decision-making through advanced data analysis and automated underwriting tools, while digital healthcare ecosystems provide real-time, structured health data for more precise assessment and proactive management. Behavioral analytics deepens insurers' understanding of lifestyle and engagement patterns, informing customer segmentation and fraud detection. Personalized medicine adds another dimension by enabling tailored prevention and early-detection strategies that can improve long-term outcomes.

As these technologies converge, they redefine the role insurers can play in supporting healthier lives. Opportunities lie in creating more personalized and effective products, improving claims outcomes and promoting preventive health behaviors through data-driven engagement. At the same time, insurers must navigate challenges around data privacy, regulatory compliance, fairness and the need to preserve risk pooling. This chapter highlights the key trends shaping this shift and the actions insurers can take to harness their potential responsibly.

Healthy Human

Trend evolution and impact on the value chain



Healthy Human

AI Medicine

Impact high medium low

Maturity	**Insurance Value Chain**							
Trial	Product Design & Pricing	Sales & Distribution	Underwriting	Policy Admin	Risk Management	Customer Engagement	Claims (incl. Reserving)	Data & Analytics

Opportunities

- AI enables faster, broader data analysis improving clinical and insurance decisions.
- AI integration in medical procedures and care enhances outcomes and efficiency, impacting mortality and morbidity.
- Rapid advances in agentic AI unlock new automation possibilities.
- AI simplifies complex medical data, easing process automation and innovation.
- AI interprets complex underwriting and claims rules, advancing these functions.

Risks

- Anti-selection: Sophisticated interpretation of entire client datasets can be used by clients to anti select against insurers.
- Regulatory and bias challenges: The introduction is subject to local regulation. In addition, biases continue to hamper the rapid adoption of AI technologies. We also find that there is bias towards younger, healthier and more digitally inclined customers.
- Data privacy concerns: As AI systems become more integrated, ensuring data privacy and security becomes increasingly challenging.

Overview

AI Medicine is revolutionizing healthcare by leveraging Artificial Intelligence to analyze medical data, make predictions and improve patient outcomes. This transformation is spilling over into the insurance sector, affecting various stages of the value chain, from underwriting to claims processing. As AI technologies mature, they offer new opportunities for insurers to enhance efficiency, accuracy and customer service. However, they also present challenges that need to be carefully managed. This chapter explores the current trends in AI Medicine, their potential applications in insurance, and the implications for the industry.

AI in clinical medicine

AI Medicine is already making significant strides in clinical settings, for example facilitating automatic documentation following doctor-patient interactions. We expect doctor-patient interactions to keep evolving. In addition, predictive analytics systems can identify patients at risk of developing specific conditions based on their medical history and demographics. Diagnostic systems use AI to analyze medical images or other diagnostic data to detect abnormalities or diseases, particularly in early cancer detection, through both biomarker-based and visual-based data.

One notable advancement that may present opportunities and challenges to underwriting is the use of full body MRI scans overlaid with generative AI interpretations for preventative screening in affluent North American markets. This approach allows comprehensive health assessments and early detection of potential health issues, although currently not FDA-approved.

CRISPR technology

CRISPR gene editing is a revolutionary technique that allows scientists to precisely edit genomes. This technology is now being used in patients to repair damaged genetic material. The process involves using a guide RNA to direct the CRISPR enzyme to the specific DNA sequence that needs to be edited. Once there, the enzyme cuts the DNA, and the cell's natural repair mechanisms fix the break, either by removing a small piece of DNA or by adding a new piece. This can correct genetic defects and is currently being used in experimental treatments. This is extensively discussed by Min-gyeong Kim et al. (July 2025)

AI is increasingly being integrated into insurance medicine, particularly in underwriting and claims processing.

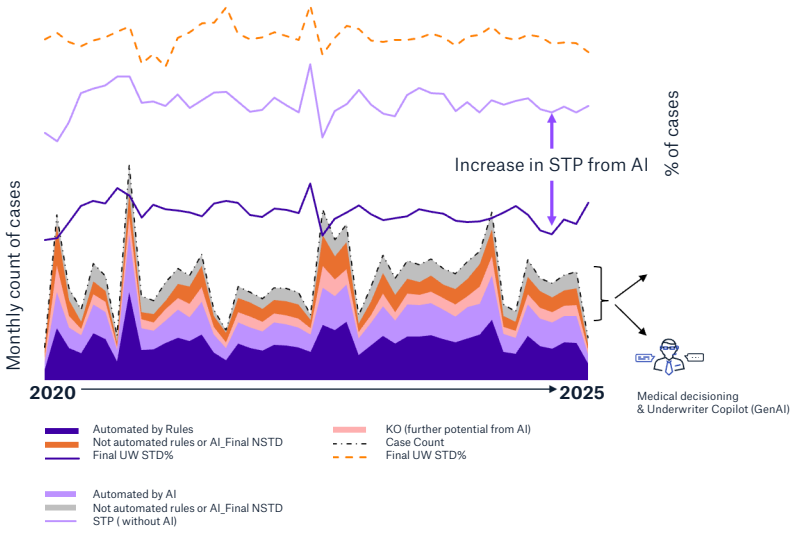
For example, Large Language Models (LLMs) are now able to understand complex medical rules within underwriting guidelines and apply them to underwriting papers. This not only speeds up the process but also reduces the potential for human error. AI can also enhance claims processing by summarizing and interpreting complex medical datasets. This enables insurers to make more accurate and timely decisions, improving customer satisfaction and operational efficiency.

Significant use cases that Munich Re is actively pursuing are in the field of summarizing, interpreting and decisioning on unstructured underwriting data. In last year's report we highlighted the Automated EHR Summarizer from the U.S. market. This year we'd like to highlight how the advancement of AI in medicine is driving progress in underwriting and claims across the Munich Re Group.

AI-augmented Life & Health underwriting and claims

Traditional AI (e.g., machine learning) has already been successfully deployed by Munich Re since 2018 into the new business underwriting process of insurers to uplift their point-of-sale (POS) straight-through-processing (STP) rates. For example, we illustrate below a success story where a 30–35% uplift in STP was achieved for a multinational insurer from deploying Munich Re's machine learning model for instant decisioning. This addresses insurer needs and delivers benefits as described in the infographic.

Success story: AI-augmented underwriting
AI models increased STP by 30–35% with acceptable claims risk



Insurer needs

- Automate underwriting with minimal increase in claims risk
- Reduce turn around time through instant decisions at point of sale
- Improve customer/agent experience
- Reduce customer drop off from medical evidence
- Stay competitive as other insurers transform customer journeys with AI

Benefits

- More instant decisions
- Helps to grow sales by reducing drop off & improving customer experience
- Reduced UW costs
- Agents more productive with faster TAT
- Scales UW capacity without further UW headcount

Graphic by: Lee Sarkin, Chief Analytics Officer, Munich Re, Life & Health, Singapore Branch

Whilst auto-underwriting rule engines and traditional AI deployments improved POS STP, a big number of cases are still being referred for manual underwriting, where backoffice underwriting processes are still manual and error-prone. Insurers are therefore seeking to automate the remaining "last mile" of manual medical underwriting (post point-of-sale).

For this use case, Munich Re has developed the Medical Decisioning and Underwriting Assistant (MDUA) solution, which processes both structured and unstructured data, such as application labs, medical exams and attending physician statements. An orchestrated, agentic workflow integrates various technologies, including LLMs and OCR, to analyze this information. This process generates intelligent summaries and provides recommended decisions to support underwriting. Importantly, the summary directly integrates Munich Re's underwriting manual, e.g., to display what questions Munich Re's underwriting manual requires answered on a given case, the answers and reasoning. This therefore systematically embeds Munich Re's core risk assessment knowledge into the solution, allowing clients' peace of mind regarding the knowledge base underpinning underwriting decisions, but still allowing human experts to review and make final decisions.

"AI for triaging and diagnostics is still in its pilot stages, but it holds immense potential for improving patient outcomes and streamlining healthcare processes."

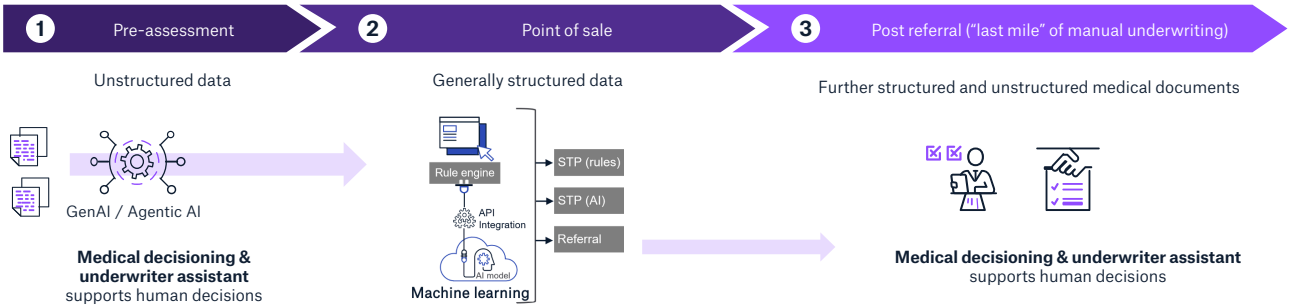
Dr. Hao Liu
Chief Medical Propositions Officer,
Asia, Africa Pacific Region, Munich Re

The illustration below shows a potentially enhanced underwriting process in which traditional AI and agentic AI workflows are applied at multiple points to drive automation, efficiency and consistency. Agentic AI is expected to compliment traditional AI.

This is important, as automated decisioning is best done via deterministic methods (e.g., rules and machine learning) that are less prone to the current stochasticity of LLM models, further compounded by evolving AI regulations and governance.

GenAI / Agentic AI augment Machine Learning and expert knowledge to drive efficiency, decision accuracy and consistency

Use case example: Medical underwriting



1. **Pre-assessment:**
GenAI / Agentic AI extracts relevant information available and supports human indicative underwriting decisions

2. **"Traditional AI" (Machine Learning):**
enables point-of-sale instant underwriting decisioning, improving beyond rules-based STP

3. **Medical decisioning & underwriting assistant solution** accelerates post-referral manual underwriting using GenAI / Agentic AI and expert knowledge (e.g. underwriting manual) to summarize and recommend decisions. Improves underwriting efficiency, decision accuracy and consistency

Graphic by: Lee Sarkin, Chief Analytics Officer, Munich Re, Life & Health, Singapore Branch

Similarly, agentic AI workflows are being explored for claims processing by summarizing and supporting claims assessment with claims assessment domain knowledge embedded. This enables insurers to make more accurate and timely decisions, improving customer satisfaction and operational efficiency.

The convergence of AI Medicine into practical insurance examples

1. Underwriting
AI can be used to analyze medical records and other data to assess risk more accurately. For example, an AI system can process a large volume of medical records to identify patterns and trends that may indicate a higher risk of certain conditions.

2. Claims processing
AI can automate the claims process by analyzing medical data and determining the validity of claims more quickly and accurately. For instance, AI can compare pharmacy slips and hospital invoices against data points to detect fraud.

3. Customer service
AI-powered chatbots can provide customer service, answering questions and providing information about policies and claims, which can improve customer satisfaction.

"The integration of consumer health data from wearables and genomics into electronic health records will enrich risk profiles and enable more sophisticated risk assessment for insurers."

Dr. Timothy Meagher
VP & Medical Director, Canadian Market, MLMC, Munich Re

Key insight 1

AI Medicine is transforming healthcare and insurance by enabling more accurate risk assessment, faster claims processing and improved customer service. Insurers should invest in AI technologies to stay competitive and meet the evolving needs of their customers.

Recommendation
Insurers should prioritize the integration of AI into their underwriting and claims processes. This can be achieved by partnering with AI technology providers and investing in the development of in-house AI capabilities.

Key insight 2

The rapid evolution of AI technologies presents both opportunities and challenges for insurers. While AI can enhance efficiency and accuracy when utilizing healthcare data in insurance decisioning, it also raises concerns about data privacy, regulatory compliance and potential anti-selection.

Recommendation
Insurers should establish robust data governance frameworks to ensure the responsible use of AI. This includes implementing strong data privacy and security measures, complying with regulatory requirements, and monitoring AI systems for potential biases and ethical concerns.

Healthy Human

Behavioral Analytics

Impact high medium low

Maturity Adopt

Insurance Value Chain

Product Design & Pricing · Sales & Distribution · Underwriting · Policy Admin · Risk Management · Customer Engagement · Claims (incl. Reserving) · Data & Analytics

Opportunities

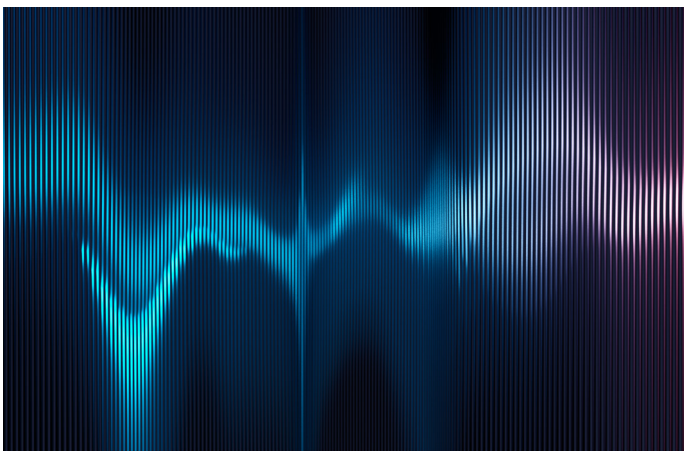
- Behavioral data improves risk assessment by revealing health and lifestyle insights, supporting more accurate pricing.
- It enables precise customer segmentation, helping insurers tailor products to individual needs.
- Aids in detecting fraudulent claims early and reducing losses.
- Allows creation of personalized insurance products that better fit customer preferences and risks.
- Supports proactive customer engagement by offering relevant information and services.

Risks

- Flaws in data or algorithms can perpetuate bias, leading to unfair treatment of some groups.
- Ensuring data privacy and regulatory compliance is costly but crucial.
- Behavioral data may be incorrect or manipulated, risking misinformed underwriting and pricing.
- Customers may reject use of certain behavioral data, such as geo-tagging, affecting acceptance.
- Highly individualized data may hinder forming large risk pools.

Overview

Behavioral analytics can be best described as a system that is set up to collect, monitor and analyze data on individual actions and intentions from digital data that is created or stored by digital devices. Technology in this field is transforming the insurance industry by providing insights into human behavior and how it can be utilized to influence commercial outcomes in insurance. As the amount of data generated across multiple data sources continues to grow, the relevance of behavioral analytics in the insurance value chain increases accordingly. This data can be used to enhance risk assessment, improve customer segmentation and prevent fraud, ultimately leading to more personalized and effective insurance products.



Introduction

The integration of behavioral analytics across the insurance value chain is transforming the way insurers operate, from product design to claims processing. Munich Re is increasingly seeing leading insurance companies invest into their own platforms to gather data and reward customers; the usual use case is to offer attractive rewards for data sharing. The real potential lies in the ability of these devices to collect and analyze behavioral data, which could eventually lead to more personalized and relevant insurance offerings.

Munich Re experts have observed that wearable technology has been present in the market for quite some time, yet the development of deep use cases that significantly impact underlying life and health product rates has not fully materialized. While devices such as fitness trackers and smartwatches have become increasingly sophisticated, the industry is still waiting for these advancements to translate into meaningful changes in insurance product pricing and risk assessment.

Furthermore, recent reports in 2025 highlight that healthcare remains one of the top industries in terms of data creation. According to an analysis by RBC Capital Markets, the healthcare sector is estimated to generate roughly 30% of the world's data, with the average individual generating vast amounts of health-related information daily. This surge in data generation positions insurers to harness valuable insights about their clients, enabling the creation of compelling value propositions tailored to individual needs and behaviors. As wearable technologies continue to advance and integrate deeper with health and lifestyle data, insurers stand to benefit from more nuanced customer segmentation and engagement strategies, ultimately driving innovation in product design and customer experience.

In terms of product design, behavioral analytics can help insurers create personalized products that meet the unique needs of their customers. For example, data-driven insights can be used to tailor complex life insurance products to individual customers' needs, highlighting relevant features and benefits at the most relevant time. This personalized approach can foster trust and confidence in the product, increasing the likelihood that customers will feel it meets their changing needs.

Behavioral analytics is shaping the landscape of insurance underwriting, offering insurers powerful tools to enhance their decision-making processes. By leveraging data on customer behaviors, preferences and interactions, insurance companies can refine risk assessment and pricing strategies, leading to more accurate and personalized underwriting outcomes. These analytics enable insurers to move beyond static demographic factors, incorporating dynamic elements such as lifestyle choices and digital footprints to create a holistic view of each applicant. The result is a more nuanced understanding of risk which supports fairer pricing and fosters greater trust between insurers and policyholders.

In the area of risk management, behavioral data can help detect patterns and anomalies, reducing the likelihood of fraudulent claims. For example, analyzing clients' digital footprints as they complete online risk questionnaires can help identify high-risk clients. Additionally, behavioral analytics can facilitate more effective customer segmentation, allowing insurers to develop targeted marketing campaigns to improve customer retention.

In the area of customer engagement, behavioral analytics can help insurers identify opportunities to engage with their customers and provide them with relevant information and services. For example, data-driven insights can be used to identify customers who are at risk of lapsing their policies, enabling insurers to proactively engage with them and provide them with relevant information and services.

Key insights and recommendations

Invest in customer segmentation: Ensure that behavioral data is being collected to identify which customers are more likely to take up a product based on their needs, thereby reducing distribution costs.

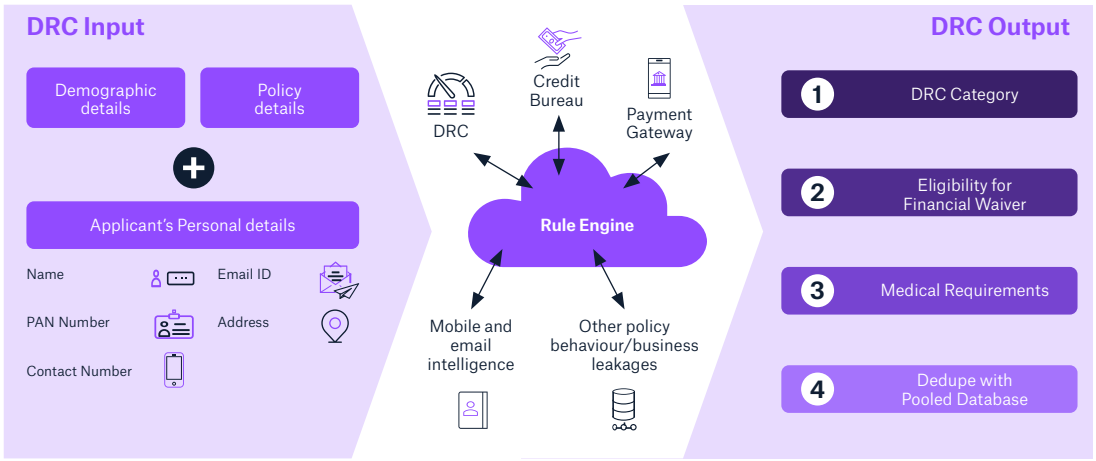
One of the most notable advancements in this area is the Dynamic Risk Calculator (DRC) model, developed by Munich Re for the Indian market. The DRC model integrates applicants' profile information, behavioral data (such as location, distribution channel, identification variables and payment history) and health declarations to generate a comprehensive risk assessment. Unlike traditional behavioral scores, which may rely on limited or historical data, the DRC model employs sophisticated algorithms to analyze real-time inputs, resulting in a cost-effective and market-acceptable alternative for insurers. This approach allows finer segmentation of policyholders, improving the accuracy of risk categorization and enabling insurers to tailor their underwriting criteria and pricing structures with greater precision.

"Markets that have significant growth potential can gain a competitive advantage by leveraging learnings from the way behavioral data has been used by market players in the fast-growing Indian life insurance market."

Michal Nejthardt
Head of Digital Solutions, South Africa and SSA,
Munich Re Africa Branch

DRC Approach

Profile + Individual based risk categorization



Building on the success of the original DRC model, Munich Re introduced DRC Pro, which leverages advanced technologies and data science to further enhance underwriting capabilities. DRC Pro features improved data integration, automation and predictive modeling, making it possible to classify policyholders into multiple risk categories efficiently. The platform streamlines onboarding requirements, reduces manual intervention and supports digital journeys for both applicants and underwriters. With its ability to adapt to changing market conditions and regulatory requirements, DRC Pro is widely regarded as a significant innovation in the insurance industry, helping insurers stay competitive and responsive to evolving customer needs.

Munich Re has observed a remarkable increase in the adoption of the DRC platform in the Indian insurance market. Indian insurers are leveraging behavioral analytics insight through the DRC platform to address the challenges of a diverse and rapidly growing customer base. The infographic illustrates how the platform integrates live data to create real-time underwriting decisions and also shows the growth the platform has seen in the Indian market.

Key insights and recommendations

Develop fraud prevention strategies: Fraudulent claims can be reduced by identifying high-risk clients and focusing the available budget on them.

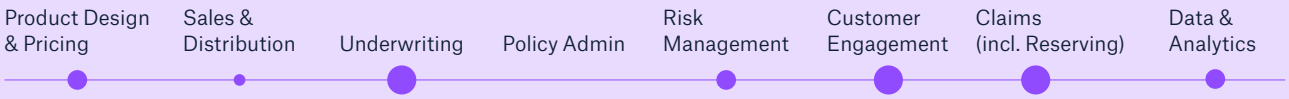
Healthy Human

Digital Healthcare

Impact high medium low

Maturity Adopt

Insurance Value Chain



Opportunities

- Telehealth and remote monitoring enable faster diagnosis and proactive care, helping insurers lower claims and predict risk.
- Integrating EHRs, wearables, and digital therapeutics provides structured data for more accurate underwriting and pricing.
- AI-driven automation streamlines administration, cuts costs, and improves customer satisfaction.
- Rich digital health data supports insurers to create targeted prevention and wellness programs, strengthening customer engagement.

Risks

- Personal health data is highly sensitive; robust governance and consent systems are crucial to protect privacy.
- Clinical acceptance and stakeholder training are needed as long-term efficacy of digital tools remains unproven.
- Regulatory restrictions limit cross-region scaling of health data use, complicating integration efforts.
- Integrating diverse data requires structured data and computing power; data ownership and costs pose significant challenges.

Overview

Digital healthcare describes the use of innovative digital tools and platforms to deliver, monitor and support healthcare remotely and efficiently. By integrating electronic health records (EHRs), telemedicine, wearables, AI-driven diagnostics and at-home testing, digital healthcare transforms how care is accessed, data is utilized and patient pathways are managed. This shift is especially relevant to the insurance sector. Digital healthcare enables data flows between healthcare providers and insurers, as well as precise risk assessment and dynamic pricing, and supports personalized products and prevention services. Its adoption empowers insurers to make decisions based on real-time, structured health data and to improve efficiency, all while elevating customer experience throughout the insurance value chain.

Key insights and recommendations

Invest in digital healthcare solutions that enable the collection, storage and analysis of healthcare data to improve key processes in the insurance value chain, such as underwriting and claims.

Introduction

There are many examples across the insurance markets where digital healthcare is being integrated across the insurance value chain, encompassing product design, underwriting, customer engagement and claims management. For instance, digital healthcare solutions enhance underwriting processes by utilizing electronic health records (EHRs) and other health data to enable more accurate risk assessment. Munich Re has advanced such summarization technologies in North America through its Automated EHR Summarizer solution.

Regarding sales, distribution and client engagement, digital healthcare tools facilitate the provision of personalized health advice and recommendations, thereby improving health outcomes and strengthening customer engagement. Notably, HomeDoctor, a Spanish tech firm that is mostly active in Latin America, offers sophisticated telemedicine and self-testing services. These capabilities create opportunities for integration within the insurance value chain, allowing insurers to deliver comprehensive and tailored health services focused on both engagement and prevention. Central to HomeDoctor's remote service delivery is the innovative CareBox3 multimedia hub. This hub connects patients to healthcare professionals using high-definition videoconferencing, secure messaging and real-time monitoring tools.

The CareBox3 platform enables users to transmit biometric and test data instantly from their homes, making consultations more interactive and comprehensive. Its built-in educational modules provide guidance on self-testing procedures and preventive care, empowering users to take a more active role in managing their health. By integrating voice, video and interactive content, CareBox3 streamlines remote diagnosis and follow-up, reducing barriers to access and extending the reach of digital health interventions to underserved populations. Use cases of using this type of technology in the insurance value chain are currently emerging and could provide new ways to deliver cost-effective health monitoring alongside a health or insurance plan.

> Digital healthcare is transforming the entire healthcare landscape, and it is crucial for insurance companies to strategically invest in these innovations to enhance their operations and deliver superior outcomes for customers. The future holds immense promise for health platforms and interconnected ecosystems, provided that all digital health technologies are unified through a coordinated, centralized approach.

Sebastian Sehr,
Lead of Digital Health, ERGO

Within claims management, digital healthcare technologies are showing progress that they can streamline the process by reducing administrative workload and enhancing customer satisfaction. For example, AI powered chatbots assist policyholders in filing claims and submitting necessary documentation, thereby expediting and simplifying claims handling. Document summarization using AI agents has also shown great promise in 2025 for reducing claims handling effort.

A noteworthy systematic literature review on the "Effectiveness of evidence-based mental health apps on user health outcome" of 38 studies conducted in 2025 shows insights that mental health apps could be leveraged for life and health risk management and managing claim outcomes. This review focused on randomized controlled trials and identified 35 unique mobile mental health applications incorporating Cognitive Behavioral Therapy techniques.

These apps primarily target context engagement and cognitive modification to promote users' mental well-being. Positive results were frequently observed. Effectiveness varied, however, and most studies focused on short-term impacts linked to rapid commercialization. Consequently, further research into the long-term effects is essential to accurately assess these apps' influence on overall mortality, morbidity and, by extension, their implications for life and health insurance.

To ensure the success of the previously highlighted use cases, such as telemedicine, wearable technologies and mental health apps, it is crucial to achieve policyholder adoption, foster ongoing engagement and integrate these solutions within clinical practice.

Key insights and recommendations

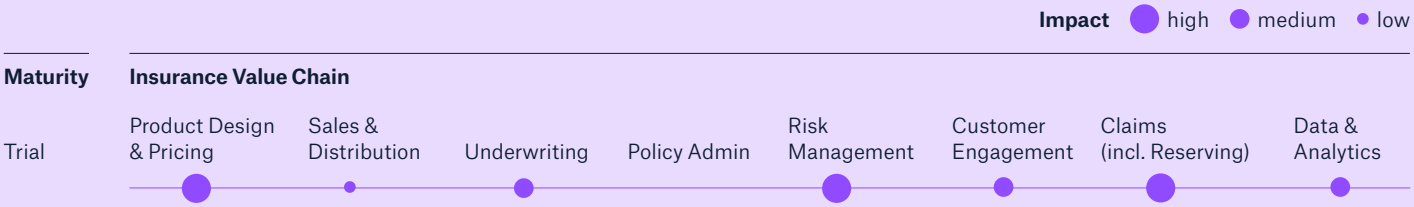
Develop strategic partnerships with digital healthcare companies to offer more comprehensive and personalized health services to customers, enhancing the insurance value chain and improving customer outcomes.

Digital healthcare solutions and their potential for use in life and health insurance

Solution	Potential for use in life and health insurance
At-home diagnostic and lab testing; Telehealth and virtual care	Facilitating underwriting and risk selection; customer engagement and promoting health.
Remote patient monitoring	Connected devices (blood pressure cuffs, glucometers, pulse oximeters, weight scales) stream data from chronic-disease patients, enabling proactive management of hypertension, heart failure, COPD and diabetes. Better control of these conditions, especially in long-term disability claims, can potentially lower hospitalization risk and long-term complications, which translates into lower claim severity and more predictable risk for insurers.
Digital therapeutics	Software-based, often prescription-grade interventions (e.g., for diabetes, insomnia, substance use) have evidence from clinical trials. For insurers, digital therapeutics can be positioned as covered benefits that reduce disease progression and improve adherence, directly impacting long-term mortality and high-cost events.
Health (including mental health) apps and chatbots; wellness apps	Promoting health and better mortality and morbidity outcomes.
Sleeptech	Monitoring sleep has been linked to a wide range of health outcomes in large observational cohorts and meta-analyses, and those same outcomes are core inputs to life insurance risk models. Because wearable and app-based sleep data can stratify risk for these conditions beyond traditional factors, they could become increasingly relevant to underwriting and product design in life insurance. There is interest at smaller insurers in using this data to create a competitive advantage.
Longevity tech	Longevity tech refers to new technologies aiming to extend healthy lifespans, such as AI-driven personalized medicine, senolytics, gene therapies, wearable-derived biomarkers, digital therapeutics and regenerative biotech. Insurers can use longevity tech through partnerships and incentives, leveraging real-time data from wearables and electronic medical records for dynamic underwriting and product innovation, including “living benefits” and payouts for longevity milestones. However, aside from GLP-1 drugs like semaglutide in North America, there is no actuarial evidence yet showing mortality improvement from these technologies. Mortality rates have stabilized post-COVID in most markets, so attention is on when further improvements may occur rather than when these technologies will make an impact on a large scale.
Wearables and fitness trackers	Devices that track steps, heart rate, sleep, activity intensity and sometimes arrhythmias provide longitudinal data on lifestyle and cardiometabolic risk, which are core drivers of mortality and morbidity in insurance portfolios. Insurers can leverage wearable device data to offer wellness incentives and monitor risk, but enthusiasm for this approach has fluctuated over the past five years. Despite periods of hype and waning interest, ongoing advances in wearable technology suggest it may soon become standard in life and health insurance. At this point in time, the most value from this tech in the insurance value chain lies in engagement, behavior change and continuous underwriting overlays.
Health ecosystems; Integrated digital care platforms; Electronic health records (EHR) connectivity and APIs	A digital health ecosystem connects wearable devices, healthcare professionals and digital platforms through secure, standardized interfaces, enabling smooth data flow across hospitals, labs and providers. With proper consent and data governance, life and health insurers can access this system to underwrite and manage risk using real-time health data instead of isolated points. For such benefits, the system must operate at scale and be well-organized, which is still evolving. For example, India is building a comprehensive platform offering digital ID, payments, document management and consent frameworks to enable interoperable health data exchange. In contrast, the U.S. relies on a proprietary digital ecosystem from a leading health technology provider used by most hospitals, processing billions of transactions annually and now integrating patient apps and wearables to support connected health services.

Healthy Human

Personalized Medicine



Opportunities

- Enhanced risk assessment and underwriting accuracy through integration of behavioral and clinical data.
- Early disease detection and prevention, reducing the frequency and severity of claims.
- Development of tailored health and wellness programs, improving policyholder engagement and retention.
- Cost savings from targeted interventions and reduced trial-and-error in treatment selection which insurers can look to integrate into their customer engagement strategies.

Risks

- High costs of advanced diagnostics and therapies limit broad adoption.
- Data privacy and security for health data can make compliance costly and require robust consent frameworks.
- Unmanaged underwriting discrimination or bias risks fines and reputational damage; device and data reliability also affect accuracy.
- Lack of regulatory standardization complicates personalized health data use.
- Legacy system integration and uneven digital infrastructure limit effective data use.

Overview

Personalized medicine is an important and growing medical field where diagnostics and therapies are custom designed to a patient's genetic or unique biological composition. As our understanding of personalized traits for disease progression and treatment improves, this information can also enhance more precise risk assessment, underwriting and claims management, therefore making it important to life and health insurance.

Leveraging advances in genomics, digital health platforms, AI technologies and wearable technologies, life and health insurers can innovate around tailoring products and services to individual policyholders' unique health profiles. This technology trend also promises improved health outcomes, cost efficiencies and enhanced customer engagement. However, it also introduces new challenges around data privacy, regulatory compliance and equitable access. As personalized medicine becomes integrated into mainstream healthcare, it is important to keep abreast of this trend so as to harness its potential at the right time, while navigating associated risks and ethical considerations.

Introduction

Data for personalized medicine nowadays comes from many sources: genomic sequencing, epigenetics, blood tests, electronic health records, behavioral data are only some examples. In addition, wearable health technologies generate real-time physiological data. Driven by AI technologies and machine learning, the sum of this data enables personalized medical insights, as well as genetic predispositions, to create dynamic views of individual health profiles which can be used in life and health insurance applications.

If policyholders can be pooled into more precise risk categories, insurers can offer solutions to not only manage the risk of mortality and morbidity but also influence client engagement to improve health outcomes and thus be able to offer (new) benefits and products in a more efficient manner.

Through the convergence of advanced data analytics and digital health technologies, some insurance stakeholders are experimenting with the benefits of using specific personalized data in the insurance value chain. For example, it is now possible to identify individuals at heightened risk for metabolic conditions such as pre-diabetes by uncovering patterns that would be difficult to detect through traditional analysis. By identifying these common and prevalent conditions early on in a policy duration through active policyholder engagement, both health and claims outcomes can be significantly improved.

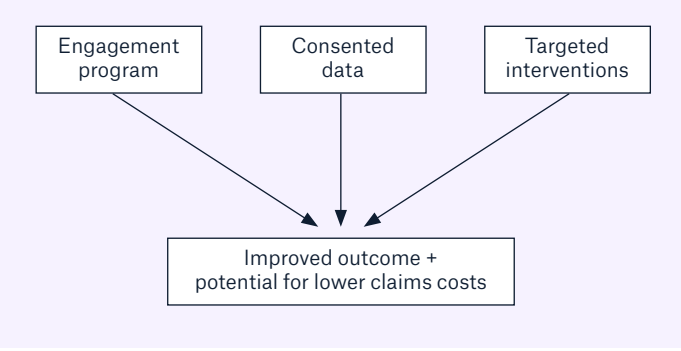
"One polygenic score can inform a tailored care pathway, with the potential to improve health outcomes and reduce claims."

Dr. Pamela Chetty
Chief Medical Officer for South Africa and SSA,
Munich Re Africa Branch

A notable current use case in personalized health management is the emergence of specialized digital healthcare solutions for pre-diabetes detection and intervention. For example, devices are now available for approximately $100 out-of-pocket in some markets, for a 10-day period that allows a user to monitor their blood sugar levels continuously, together with other risk factors. As the technology evolves and becomes more affordable, insurers need to or may want to adopt it as part of their underwriting or policy engagement strategies. For example, Raman spectroscopy for glucose monitoring could be the answer to reduce costs. This technology uses laser light to read a molecular fingerprint of glucose through the skin, without drawing blood. The device shines near-infrared light on tissue, measures how the light is inelastically scattered (Raman signal), and then uses the glucose-specific spectral peaks plus calibration algorithms to estimate blood glucose levels in real time. It is important to note that early clinical validation work is appearing, but it's still not commercialized.

Another promising area is early disease detection, including multi-cancer screening and pharmacogenomics. Innovations such as liquid biopsies allow detection of multiple cancers from a single blood sample, enabling earlier interventions and reducing long-term claims costs. Integrating these diagnostics into post-issuance engagement programs can enhance preventive care and improve patient outcomes, and could reduce long-term claim costs (an example of this is the Galleri multi-cancer early detection test, more here).

Insurers focused on policyholder engagement can leverage personalized medicine technologies to promote preventive care within a digital ecosystem. At this stage, the data from wearables, telemedicine and home diagnostics can be used to deliver personalized health advice, preventive screenings and tailored wellness programs progressing the concept of proactive insurance models. These initiatives not only encourage healthier behaviors through rewards and incentives but can also improve trust between the insurer and policyholder if the programs benefit the policyholder's health and promote further positive reinforcement. It is therefore likely that personalized medicine will blend better in the short term with policyholder engagement after a policy is bought, rather than other use cases such as risk selection, pricing and underwriting.



Key insights and recommendations

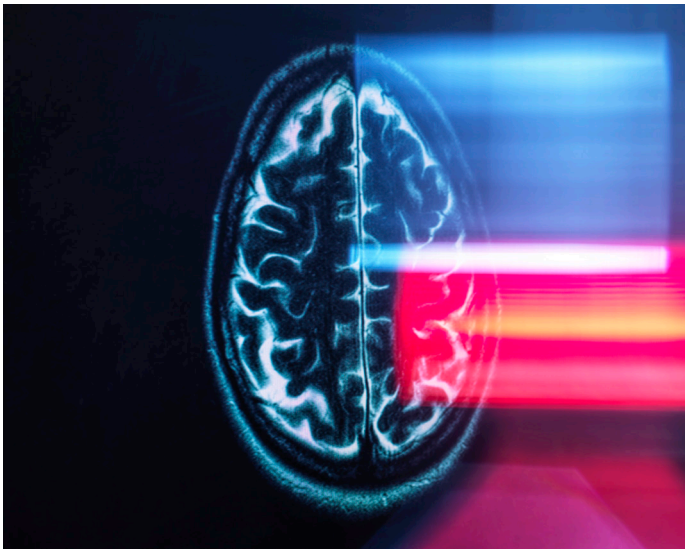
Invest in advanced analytics and data integration: Insurers should prioritize the development and adoption of AI-driven analytics platforms capable of integrating diverse health data sources. This will enable more accurate risk assessment, proactive claims management and personalized policyholder engagement.

A further important consideration to note on underwriting and risk selection is that while personalization offers significant benefits, upholding the fundamental principle of risk pooling is critical. Large, diverse risk groups ensure that insurance remains viable and does not devolve into a mere savings mechanism. Maintaining balance between personalization and collective risk sharing is therefore essential.

Despite its promise, integrating personalized medicine into insurance products presents significant challenges. High costs associated with advanced diagnostics and therapies may limit accessibility and viability for post-policy issuance benefits. Regulatory uncertainty adds complexity, as rules governing AI and personalized medicine are expected to tighten, creating risks that certain investments may need to be unwound. Ethical and fairness concerns also loom large. Insurers must preserve risk pooling principles and guard against discriminatory practices in underwriting and claims management. Protecting sensitive health data is paramount, requiring robust consent frameworks, transparent communication and secure systems to maintain trust. Clear policies on data usage, explicit informed consent and mechanisms for policyholder redress are essential. By integrating these safeguards into product design and operational processes, insurers can demonstrate commitment to ethical innovation and regulatory compliance.

Looking ahead, the future of insurance lies in the responsible integration of personalized medicine, data analytics, and digital health technologies. Early detection and targeted therapies are gaining momentum, and insurers are well-positioned to embed personalized medicine in order to facilitate improved health outcomes, reduce claims costs and strengthen policyholder engagement. Success will depend on robust data governance, transparent consent practices and unwavering adherence to ethical and regulatory standards.

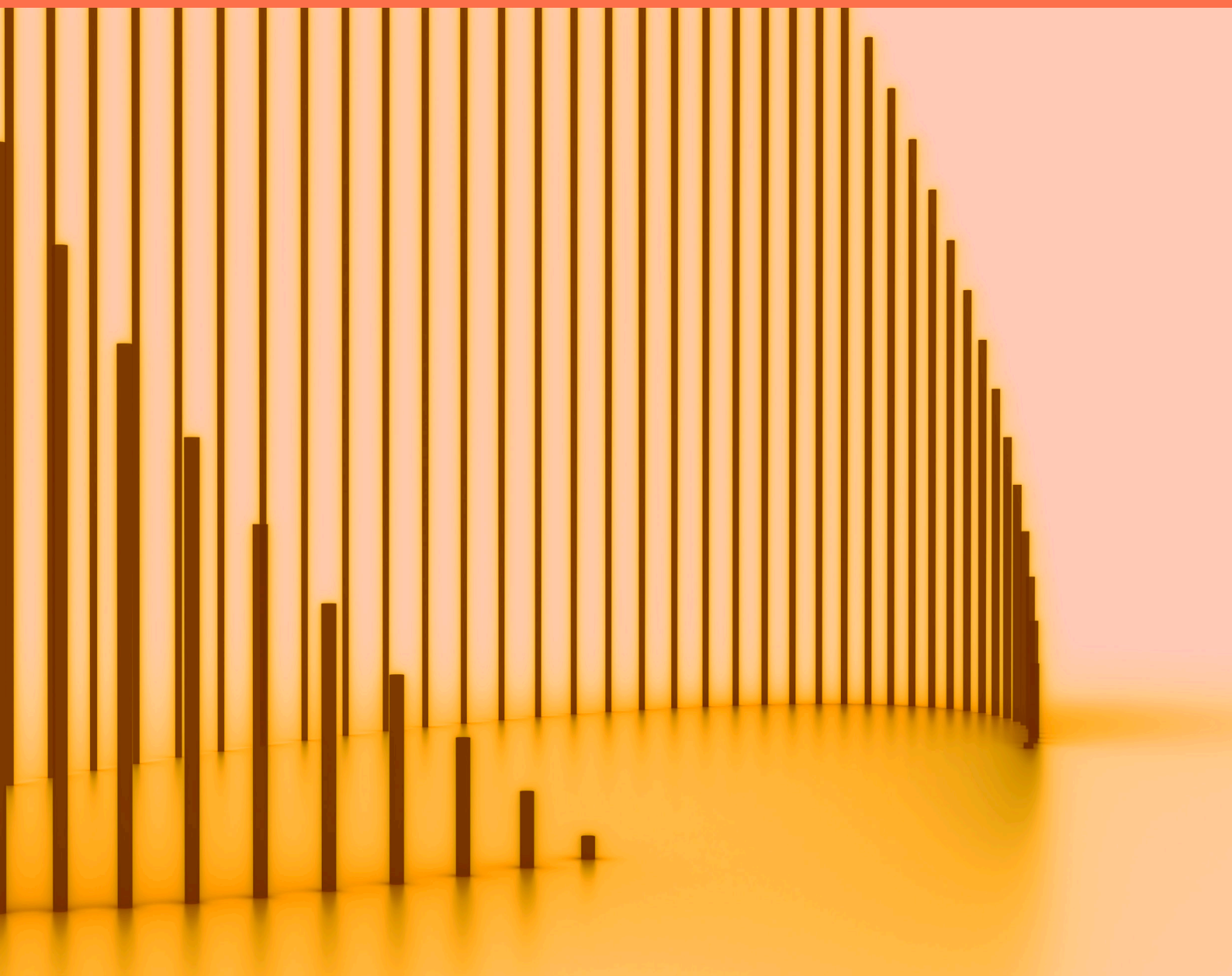
By prioritizing these principles, insurers can unlock the full potential of personalized health technologies and deliver resilient, trustworthy products for the future.

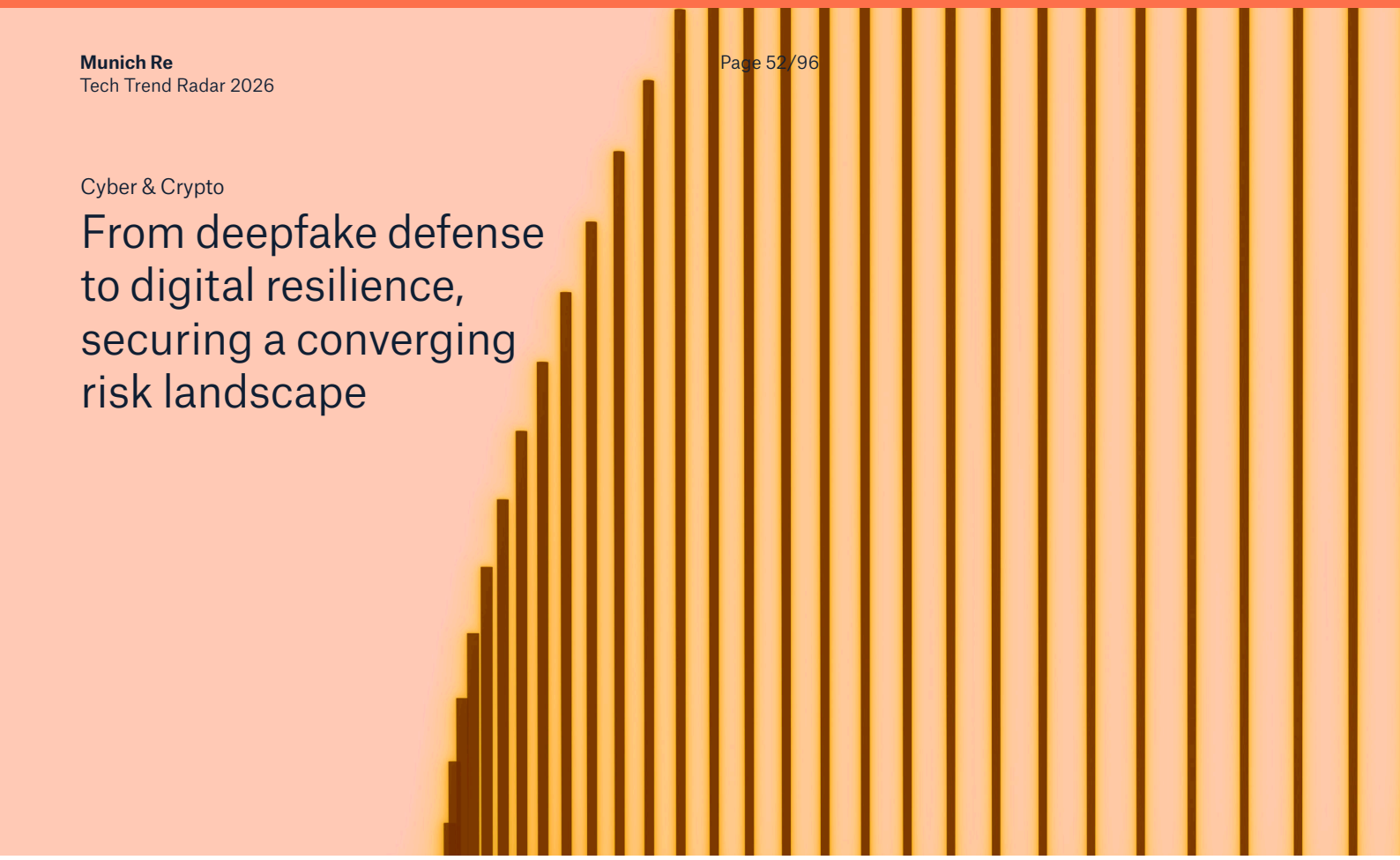


Key insights and recommendations

Establish robust data governance and ethical standards: To build trust and ensure compliance, insurers must implement clear policies for data privacy, consent and the ethical use of personalized health information. Engaging with regulators and industry stakeholders will be essential for navigating evolving legal and ethical landscapes.

3 Cyber & Crypto





Cyber & Crypto

From deepfake defense to digital resilience, securing a converging risk landscape

The digital risk landscape is increasingly shaped by the convergence of global interdependence and technological sophistication, particularly advances in AI. In this context, we see an increase in deepfake and disinformation threats on the one hand, and on the other, we expect an increase in deployment of digital immune system (DIS) capabilities, and a maturation of digital assets.

Deepfake and disinformation risks are rising as generative AI enables realistic synthetic media used for fraud, manipulation, or reputational harm. Although detection tools improve, attackers continually adapt, making reliable identification challenging. Insurers and clients depend on layered verification, stronger authentication, and greater digital awareness. Protecting trust will require technical safeguards, clear processes, and ongoing vigilance.

The Digital Immune System (DIS) offers a holistic approach to strengthening resilience across IT environments. By integrating continuous validation, autonomous testing, observability, and automated remediation, DIS aims to reduce system failures and improve cybersecurity. Advances in Generative AI may strengthen these capabilities but introduce new risks requiring governance, oversight, and skilled personnel. Organizations with mature DIS may face fewer severe incidents, yet DIS remains one aspect of broader risk management.

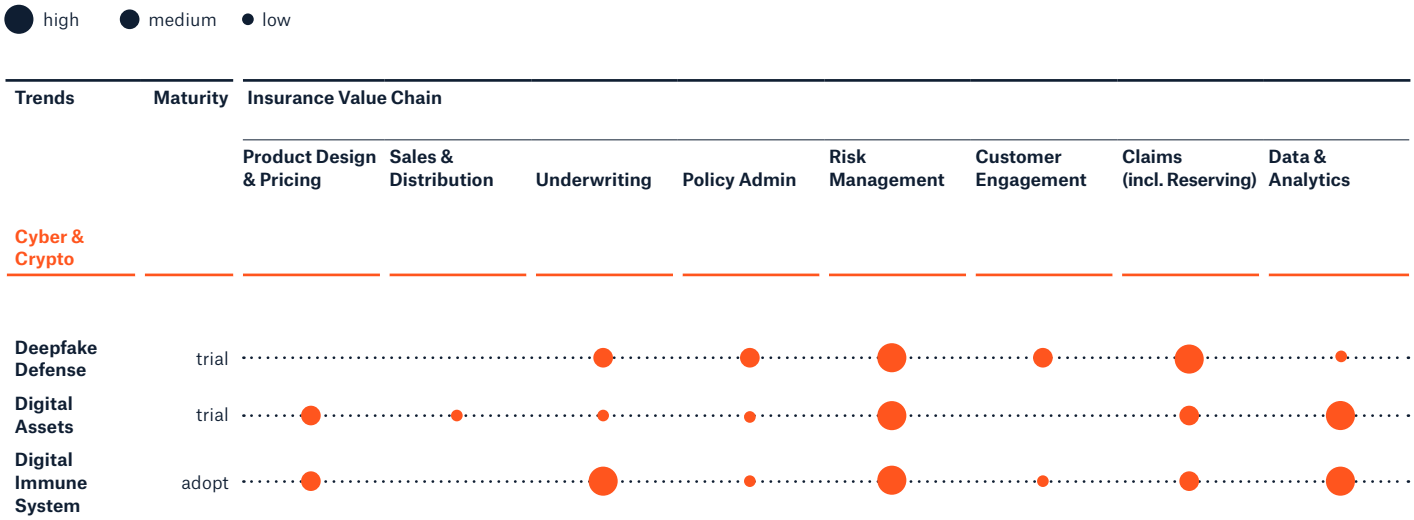
The digital-asset ecosystem is maturing, supported by institutional involvement, clearer regulation, and better technical standards. However, risks remain around stablecoin design choices, shared infrastructure dependencies, and links between traditional and decentralized finance. While transparency and resilience improve, evolving AI-driven attacks and concentration across providers demand careful monitoring. For insurers, prudent risk selection, robust exposure tracking, and solid technology understanding are essential.

Together, these trends show how cyber and crypto risks are evolving, highlighting the need for insurers to adapt assessments and capabilities in the years ahead.

For deeper insights into today's cyber risk landscape, see our new annual report: Cyber insurance: Risks and trends 2026.

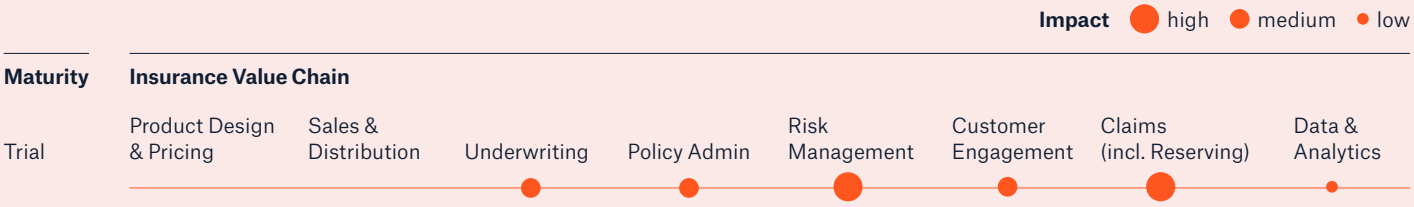
Cyber & Crypto

Trend evolution and impact on the value chain



Cyber & Crypto

Deepfake Defense



Opportunities

- Development of AI tools for detecting and mitigating synthetic media (e.g., detecting fraudulent information during policy applications).
- Educational campaigns to raise awareness about deepfake risks and recognition and safe digital practices like multi-factor authentication.
- Opportunities for insurers to develop new products such as coverage for reputational harm or financial losses caused by synthetic media.

Risks

- Easy access to tools that require no technical skills can lead to a flood of fake inputs (e.g., emails, calls).
- Failure to detect deepfakes can lead to regulatory and compliance issues.
- Missteps or lack of transparency could erode public confidence.

Overview

Deepfake and disinformation defense encompasses the identification, mitigation and prevention of manipulated media and false information. Through the application of advanced AI technologies, organizations can detect synthetic content, verify the authenticity of media and protect against the exploitation of deepfakes for fraudulent activity, identity theft, impersonation and disinformation campaigns which may result in financial and reputational harm. Establishing a comprehensive defense strategy is essential for sustaining trust, safeguarding sensitive data and preserving the integrity of communication channels. As deepfake technology advances, the implementation of robust detection mechanisms and initiatives to raise awareness are critical components in effectively addressing these complex risks.

Introduction

In today's digital world, deepfakes and disinformation have become serious risks to trust and information quality. Deepfakes, created with generative AI, can produce realistic fake audio, video and images. While the technology itself is advancing quickly, its misuse enables identity theft and fraud and weakens confidence in digital content.

Disinformation, which is the intentional spread of false information, further increases these risks. It can damage social stability and democratic processes and is now one of the key challenges of the digital age. Deepfake technology is improving at a fast pace, making it harder to tell real content from fake content. Criminals use these tools for financial and strategic gain, for example by impersonating executives in fraud schemes or spreading fake political messages to influence opinions. The impact goes beyond individual cases and reduces trust in media, companies and institutions worldwide.

Risks and challenges

Deepfake detection must be highly accurate, as even small errors undermine trust. While machine learning and multimodal analysis (e.g., facial cues, audio, metadata) have improved detection, advances in deepfake technology continue to outpace existing tools. Research shows that some signals, such as heart rate patterns (rPPG), are no longer reliable indicators (Seibold et al.). Relying on single detection factors increases false results, making continuous innovation and multi-dimensional analysis essential. Without effective and transparent solutions, deepfakes erode trust in digital media.

Deepfakes and insurance

Deepfakes pose a growing threat to the insurance industry, impacting fraud prevention, operational integrity and regulatory compliance. These synthetic media technologies enable highly convincing falsifications of video, audio and images, creating significant vulnerabilities across core business processes.

Deepfakes create serious vulnerabilities for insurers by enabling fraudulent claims through manipulated media, making verification costly and complex. They may, for example, distort underwriting processes by misrepresenting property conditions, leading to inaccurate premiums and coverage gaps. Cybersecurity risks rise as deepfakes facilitate impersonation attacks that authorize fraudulent transactions or access sensitive systems. These challenges increase operational costs, erode customer trust and damage brand reputation. Failure to detect deepfake-related fraud can also result in regulatory breaches, privacy violations and legal liabilities.

Additionally, deepfake-related risks present opportunities for innovative insurance products, such as coverage for reputational or financial harm caused by synthetic media.

Building a proactive defense

Primary insurers must adopt a layered strategy combining technology, human expertise and customer awareness. Key measures include:

- Advanced detection technologies integrated into underwriting and claims workflows to identify suspicious content early;
- Human oversight and scenario-based training to complement automated tools, helping staff to recognize subtle manipulation and respond appropriately;
- Transparent verification protocols that define clear procedures for authenticating identity, documents and media content, reinforcing trust with customers and regulators;
- Multi-factor authentication for all sensitive communications, reducing the risk of impersonation or unauthorized access;
- Incident response planning with clear responsibilities and escalation pathways to ensure rapid action when fraud is suspected;
- Customer awareness initiatives to educate policyholders on risks, best practices and verification techniques, strengthening overall resilience against digital deception.

"Insurers must invest in advanced detection technologies, implement robust verification protocols and develop comprehensive incident response plans. Employee training and public awareness initiatives are critical to fostering vigilance."

Daniel Ansons
Senior Digital Consultant, Group Communications, Munich Re

Conclusion

Deepfakes are no longer a theoretical risk but a tangible challenge for insurers. As synthetic media becomes cheaper, more realistic and widely accessible, it directly threatens trust across underwriting, claims handling and customer interactions. Insurers that proactively invest in detection technologies, robust verification processes and digital literacy will be better positioned to protect both their operations and their customers. Ultimately, defending digital authenticity is not only a risk mitigation exercise but a strategic imperative to preserve trust, resilience and competitiveness in an increasingly AI-driven insurance landscape.

Cyber & Crypto

Digital Assets

Impact high medium low

Maturity

Trial

Insurance Value Chain

Product Design & Pricing | Sales & Distribution | Underwriting | Policy Admin | Risk Management | Customer Engagement | Claims (incl. Reserving) | Data & Analytics

Opportunities

- Growing institutional participation drives demand for risk transfer, positioning insurers as key partners in a maturing market.
- Adoption of cybersecurity frameworks and standards like NORS enhances underwriting transparency and data-driven risk assessment.
- Regulatory measures such as MiCAR and the U.S. GENIUS Act embed insurance in licensing, fostering stable demand.
- Client diversity across consensus and execution layers enables coordinated efforts to reduce concentration and tail risks.

Risks

- Shared dependencies in stablecoins, cloud, custody, oracles, and validators require aggregate exposure tracking and limit management.
- AI-enabled intrusion techniques continue to create ongoing security challenges.
- Rapid regulatory shifts and high-profile failures demand disciplined client selection and compliance oversight.
- Assessing custody, validator, and smart-contract risks demands technical expertise that remains scarce.

Overview

The digital asset industry has matured significantly, integrating with traditional financial markets through ETFs and tokenized securities. Three interconnected risk categories – stablecoin design, infrastructure concentration, and the growing interdependence between traditional finance (TradFi) and decentralized finance (DeFi) – require careful assessment, but are becoming increasingly manageable as the market matures. As major financial institutions increase their exposure to digital assets and regulatory clarity improves, insurers who develop specialized expertise can capture meaningful opportunities while prudently managing concentration risks.

"Underwriting digital assets means looking beyond the protocol level. The real exposure sits in shared dependencies – technology providers, oracle networks, custody platforms – that connect seemingly independent risks."

Milan Kästner
Risk Analyst, New Tech Underwriting, Munich Re

The convergence of Three Risk Vectors

Stablecoins:
Evolving toward greater resilience
Stablecoins have become critical infrastructure linking digital assets with traditional finance. The 2022 TerraUSD collapse – erasing roughly $40 billion – accelerated the market's shift toward fully reserved models. Today's leading issuers, Tether and Circle, maintain reserves exceeding $250 billion, primarily in U.S. Treasury bills. Their scale and role as primary liquidity for digital-asset markets create tangible spillover channels to money-market funding and payment systems.

Regulatory frameworks are improving stability. Under the GENIUS Act (2025), U.S. issuers must provide monthly reserve attestations, while Europe is refining MiCAR implementation. This increased transparency and oversight supports more underwritable risk profiles.

Digital Euro preparations advance

In Europe, the landscape of payment providers such as PayPal, Visa, and Mastercard could soon be complemented by a new option: paying with the retail digital euro. In October 2025, the European Central Bank (ECB) concluded the preparation phase for the issuance of digital cash for everyday payments. If the legislative process progresses as expected in 2026, a pilot exercise could commence in 2027. The digital euro's technical architecture would not be based on distributed ledger technology (DLT), but would adopt key design principles from DLT to achieve high performance and reliability.

Infrastructure concentration: Improving but requiring vigilance
The ecosystem has made continuous progress in reducing client-software concentration. On Ethereum, execution clients are now more evenly distributed, with Geth at roughly 41% and Nethermind at about 38%, while consensus clients are led by Lighthouse (48%) and Prysm (23%). This demonstrates that coordinated efforts can reduce concentration risk. Nevertheless, dependencies remain: about half of all validators still operate common client pairings, leaving room for correlated failure scenarios.

Reliance on shared oracle infrastructure persists, with one provider serving roughly 67% of DeFi protocols, although multi-oracle architectures are increasingly being adopted. A significant portion of node and exchange infrastructure also depends on a few technology and hyperscale cloud providers, including widely used custody- and key-management platforms that underpin institutional activity. These shared dependencies can create correlated operational exposures if a major provider experiences downtime or a security breach.

As threat actors adopt AI-enabled attack techniques, these shared layers require ongoing monitoring – but the shift toward multi-vendor architectures and stronger cybersecurity practices shows that concentration risks can be actively mitigated as the ecosystem matures.

"Digital assets are no longer an emerging risk – they're becoming core infrastructure. Insurers who build expertise now will define the market for the next decade."

Dr. Andre Knoerchen
Head of New Tech Underwriting, Munich Re

DeFi-TradFi integration: Manageable interconnections
Integration between DeFi and TradFi has increased correlations – Bitcoin-S&P 500 correlations reached historic highs during 2024 – representing market normalization rather than systemic contagion. DeFi's composability creates dependency chains, but circuit breakers and emergency-pause mechanisms are becoming more common. Traditional institutions bring established risk-management practices, supporting more familiar, insurable risk profiles.

The insurance market response and path forward

The digital-asset insurance market remains niche but is expanding, driven by institutional demand for protection. Leading entities comply with ISO 27001, SOC 2 Type II, and NIST, while developing specialized standards like NORS. These efforts significantly improve underwritability. Smart-contract risks require careful exposure management because protocols often share oracle providers, contract libraries or liquidity pools – a "same-infrastructure" concentration that necessitates robust aggregate tracking.

Key recommendations for insurers:

1. Build specialized capabilities:
Develop expertise through targeted hiring, training and specialist partnerships.

2. Implement aggregate tracking:
Monitor exposures across shared dependencies, similar to catastrophe-model accumulation management.

3. Prioritize well-governed counterparties:
Focus on audited, well-controlled entities adhering to recognized standards.

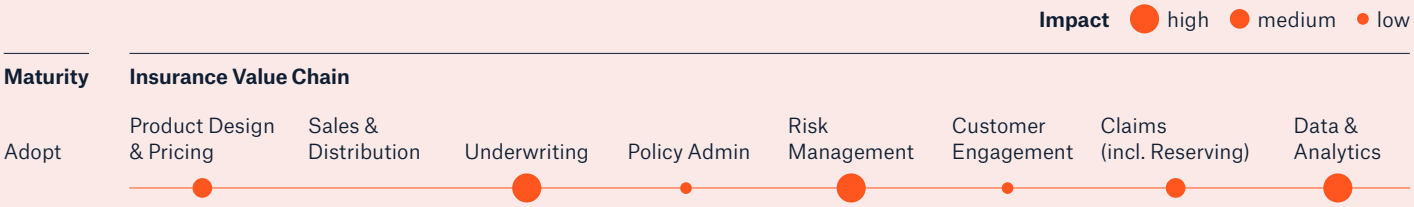
4. Start conservatively:
Offer modest limits on well-understood risks, expanding capacity as expertise grows.

Key insight

Digital asset systemic risks require careful management. At the same time, the market is progressing toward greater resilience, supported by regulatory frameworks, diversified infrastructure and increasing operational standardization. This environment creates a complex but attractive opportunity for insurers. Developing expertise and robust risk management capabilities early can position insurers to participate meaningfully in the long-term growth of this asset class.

Cyber & Crypto

Digital Immune System



Opportunities

- Improved cybersecurity and reduced risks
- Lower costs due to fewer security incidents
- More accurate risk assessments
- Better customer experience
- More robust underwriting data

Risks

- Potential over-reliance
- Data privacy risks
- Requires sophisticated governance by qualified personnel, who are in short supply in the market

Overview

Improvements in cybersecurity at all levels, from software development to active risk management, are influencing the rapid development and deployment of digital immune system (DIS) capabilities. A DIS is a holistic approach to an entity's entire IT infrastructure, aiming to optimize the user experience and reduce system failures. As this technology expands and improves, all components of the insurance value chain benefit from greater resilience, enhanced transparency and an improved user experience. For re/insurers, entities that employ proven DIS are easier to underwrite, resulting in fewer claims and increased profitability.

A holistic approach

Gartner originally conceived the digital immune system as a collection of practices and technologies used in software design, development, operations, and analytics. The system aims to mitigate risks and improve cybersecurity and resilience. Key elements of a digital immune system include continuous validation, autonomous testing, chaos engineering, observability and auto-remediation.

According to Precedence Research, the global digital immune system market was valued at an estimated US$ 30 billion in 2025, and could increase to as much as US$ 110 billion by 2035.

Most of the major advances in the DIS can be attributed to advances in Generative AI. Generative AI works in tandem with existing technologies and practices to allow for more efficient and accurate autonomous testing, simplify chaos engineering, document observations, and provide automated remediation and continuous validation. As these technologies and processes improve human supervision, maintenance, documentation, and contribution to the continuous development of the DIS become essential. Due to the challenges presented by increasingly sophisticated and ever-evolving threats, the systems also have to evolve to reflect and outpace the threat landscape.

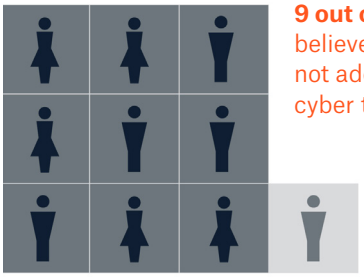
According to The Business Research Company's Market Report 2026, cyber threats are driving the digital immune system market. In particular, the increased frequency, severity and sophistication of phishing and malware attacks, interconnectivity and technology vulnerabilities are resulting in greater interest in and need for the sort of coordinated approach that digital immune systems can provide.

However, there is an antagonistic dimension to consider: insufficient or lack of awareness about digital immune systems or associated technology is the major hurdle for the adoption and the growth of the market.

Insurance implications

Before the concept of Digital Immune Systems is fully implemented companies worldwide are at risk to be vulnerable. This is also evident in our latest Global Cyber Risk & Insurance Survey 2026: Nearly 9 out of 10 C-Level respondents believe their companies are not adequately protected against cyber threats. The growing intersection of AI-driven risks and cyber exposure is particularly critical.

Insurers must continue to improve their internal cyber resilience, and improve their cyber insurance offerings recognizing the increasing cyber exposure due to the exponential advances of Large Language Models. Cyber insurance, in particular, will see fewer and less severe claims related to cyberattacks. Data breaches, particularly those due to cyberattacks, will also become less frequent. Business interruption, perhaps the costliest component of cyber remediation, will likely decrease as well, since the DIS provides a documented system roadmap that can reduce recovery time.

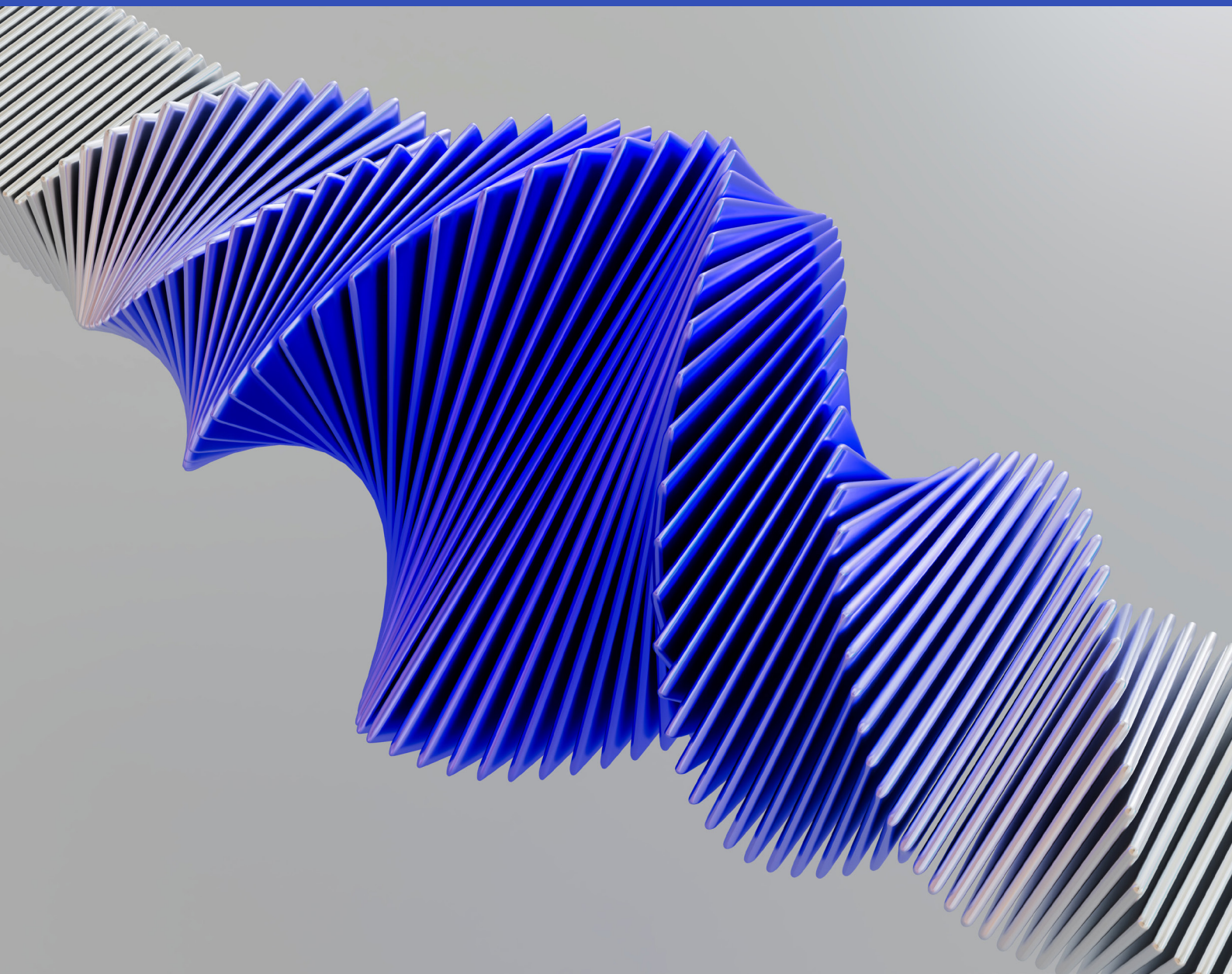


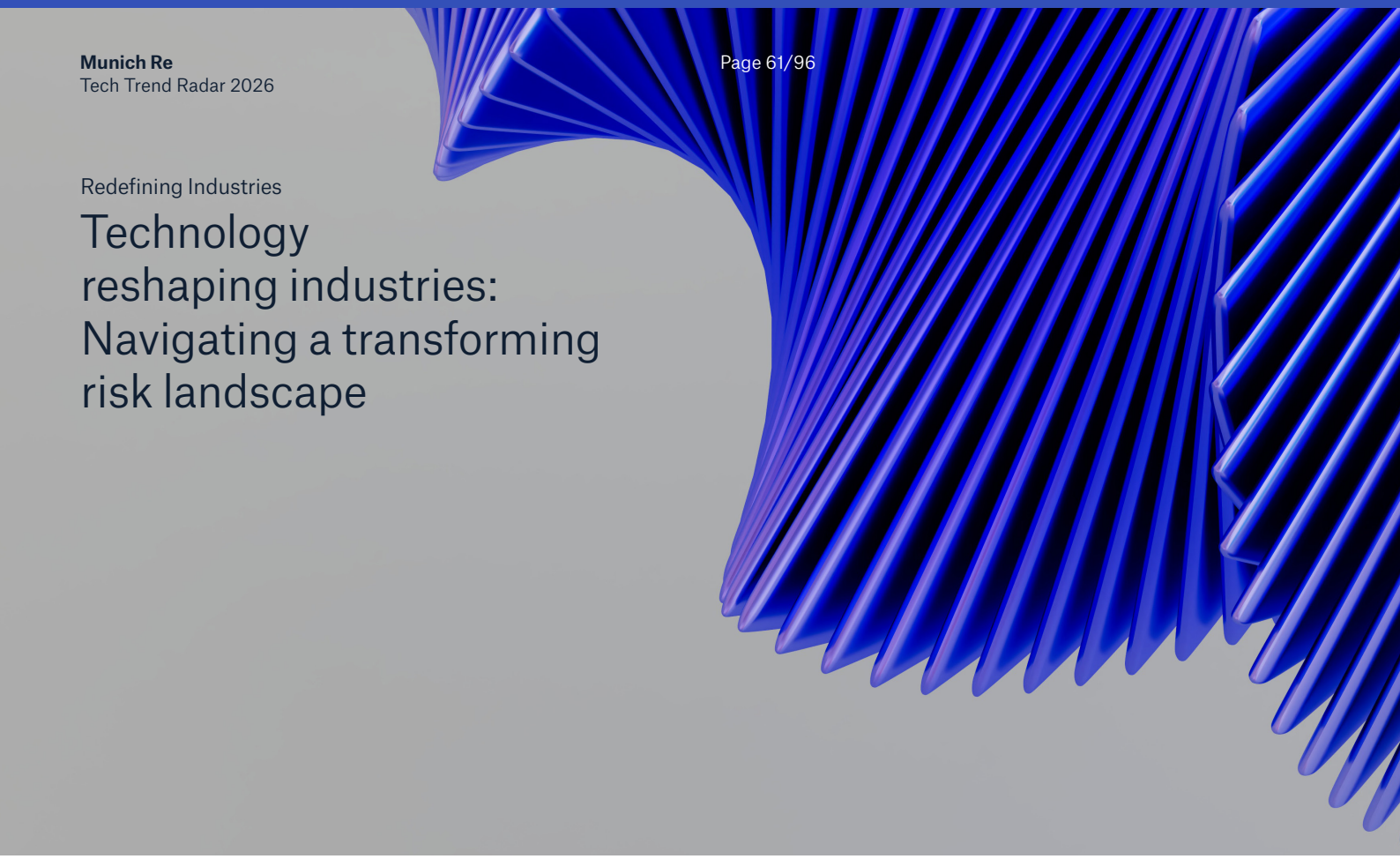
9 out of 10 C-Level respondents believe their companies are not adequately protected against cyber threats.

Conclusion

Digital Immune Systems will make further advancements over the coming years. The advent of Generative AI, together with rapid developments in quantum computing, will undoubtedly help us gain an advantage over malicious actors and facilitate new gains in risk mitigation and management. However, similar technology may be used by bad actors against enterprises, institutions and population. Hence, a positive balance will be desirable.

4 Redefining Industries





Redefining Industries

Technology reshaping industries: Navigating a transforming risk landscape

The convergence of rapid technological progress and shifting market dynamics is reshaping traditional industries, which has profound implications for the insurance sector.

The expansion of solar, wind, battery storage, and grid infrastructure is accelerating due to New Energy at Scale. While this transition creates significant growth opportunities, it also introduces new technical, operational, and regulatory risks that require specialized insurance expertise.

Another structural shift is the evolution of electric vehicles (EVs). A notable development is the increasing presence of Chinese manufacturers in the global market, who often combine advanced battery technology with robust software integration. This changes risk profiles regarding repair costs, supply chains, cybersecurity, and residual values, which directly impact motor insurance models.

Following massive advancements in Artificial Intelligence over the past twelve months, a similar acceleration is expected in robotics. Humanoid robots are transitioning from prototypes to real-world industrial and service applications, raising new questions about liability, safety, and product performance.

Meanwhile, autonomous mobility is redefining responsibility in transportation. As control shifts from drivers to manufacturers, liability structures and insurance products must evolve accordingly.

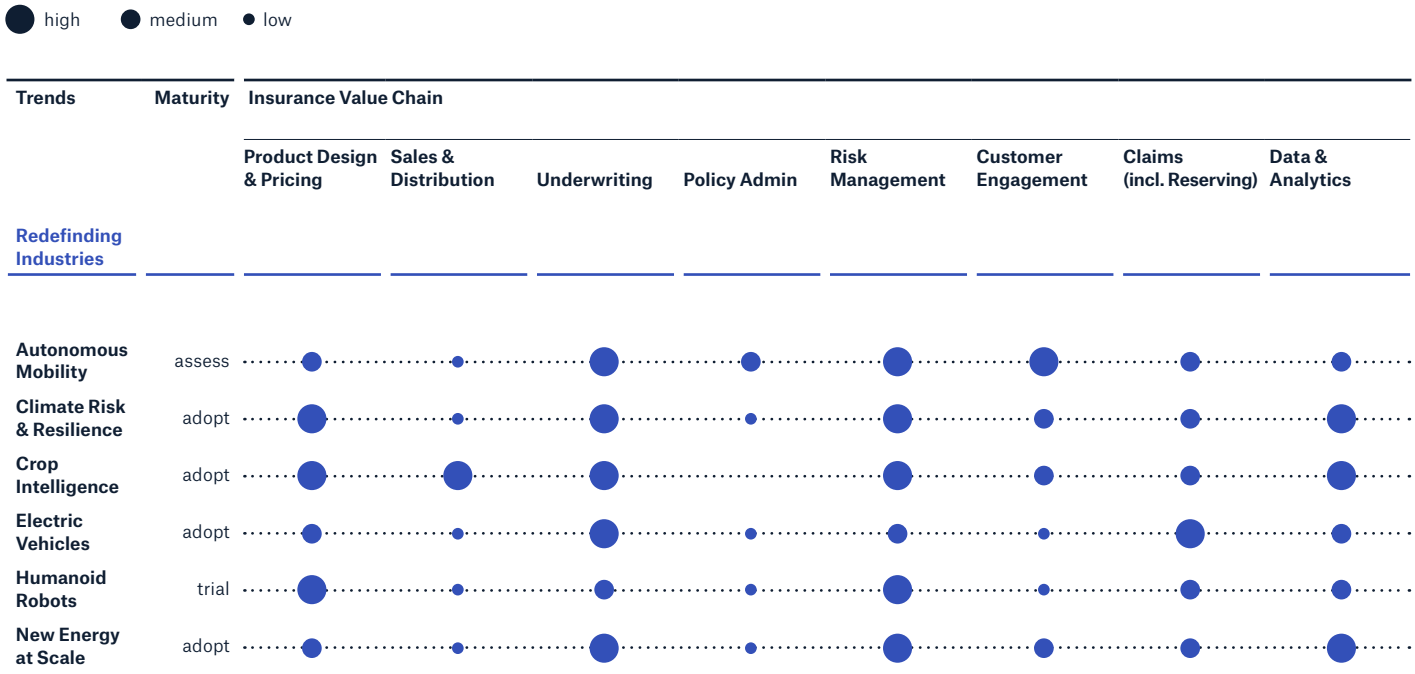
Climate risk and resilience remains a long-term driver of change, pushing the industry to transition from a reactive approach to risk transfer to one that anticipates climate impacts, strengthens prevention measures, and invests in more robust modeling, capital allocation, and resilience strategies. In this new landscape, insurers play a critical role.

Finally, crop intelligence is transforming agricultural risk management through satellite data, IoT sensors, and AI-driven analytics. More precise crop monitoring and yield forecasting allow insurers to transition from reactive claims processing to proactive, data-driven underwriting and parametric solutions.

Together, these trends signal a structural transformation of the insurance landscape that requires continuous innovation, technical depth, and adaptive risk management.

Redefining Industries

Trend evolution and impact on the value chain



Redefining Industries

Autonomous Mobility

Impact high medium low

Maturity Assess

Insurance Value Chain

Product Design & Pricing · Sales & Distribution · Underwriting · Policy Admin · Risk Management · Customer Engagement · Claims (incl. Reserving) · Data & Analytics

Opportunities

- Creates opportunities for insurers to develop new products and services tailored to the unique risks associated with AV technology.

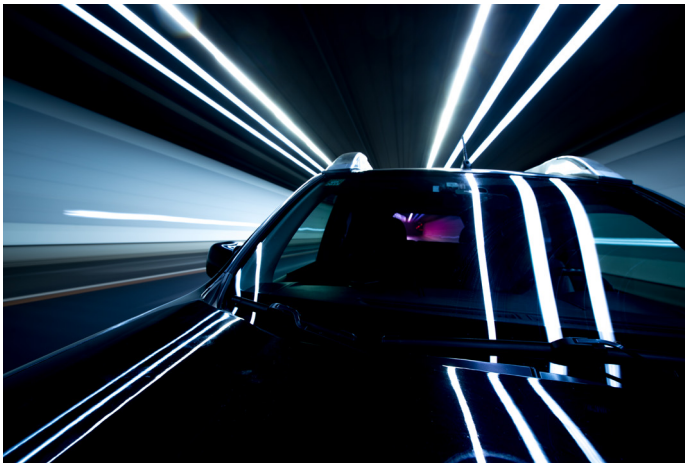
Risks

- Significant erosion of the addressable premium pool for motor lines due to reduced claims frequency and shifting legal frameworks away from human-led liability models.
- Concentration of liability and risk of systemic failure or cyber events affecting large groups of vehicles simultaneously.

Overview

The transition toward fully autonomous vehicles (AVs) represents one of the most significant structural shifts the motor insurance sector may face in the coming decades.

While the technology continues to evolve, uncertainty remains regarding adoption timelines, regulatory alignment, consumer trust and infrastructure readiness. We will look at the potential implications for insurers under three market penetration scenarios – low, medium and high – with a focus on how insurers may need to adapt their underwriting, pricing, operational capabilities and strategic positioning when it comes to motor insurance and AVs.



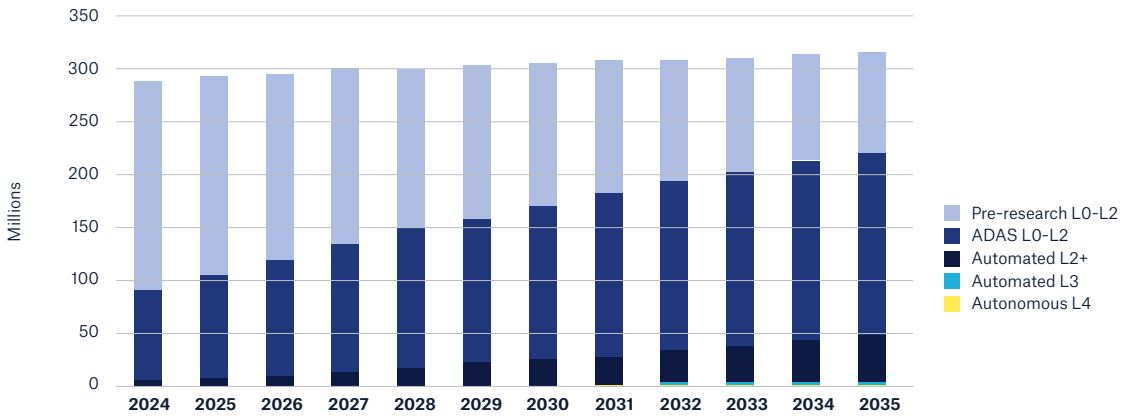
Introduction

Before diving into the potential implications for insurers, let's first take a quick recap on what is meant by "Autonomous Mobility". The Society of Automotive Engineers (SAE) has defined six levels of automation ranging from 0 (no automation) to 5 (full automation), with each level representing an increasing degree of vehicle autonomy.

Level 5 represents the ultimate goal, where the vehicle can perform all driving tasks in any condition without any human intervention. So where are we today with level 4 and 5 AVs, and what are the industry projections? There is a high degree of uncertainty regarding the level of market penetration and timeline. Recent projections from S&P Global Mobility suggest that even in the US, a market deemed to be one of the AV front-runners, we will likely see only marginal market penetration of Level 4 and 5 autonomous vehicles by 2035, with gradually increasing levels of automation gaining market share in the coming years.

Whilst the timeframe for mass adoption is likely still decades in the future (at a minimum, the existing global car parc takes roughly 15 years to churn, and AVs are not ready for mass roll-out in 2026), what is less clear is the level of market share full AVs will represent in the future.

Figure 3: USA Vehicles in Operation by Autonomy Level, 2024 – 2035



Source: S&P Global Mobility, Autonomy Tech VIO Forecast Q2 2025

We will now explore three potential market penetration scenarios and what this might mean for insurers.

Within a **low penetration scenario**, where AVs remain a niche, urban-centric proposition with AVs primarily controlled under commercial fleets and used for ride-hailing purposes or specific deployments, human-driven vehicles continue to dominate roads. The current addressable motor market remains largely intact; insurers will experience evolution rather than disruption. Underwriting and pricing approaches still rely on traditional rating factors (driver behavior, age, experience, geography) and remain largely fit for purpose.

Liability remains primarily with human drivers. There are likely to be occasional disputes over software involvement, which may require enhanced technical investigations, but the core claims and liability model remains. Insurers may begin building internal expertise in emerging liability frameworks without wholesale restructuring.

Even in a low-penetration scenario, there will be opportunities for insurers to participate in the full AV segment. Those insurers who choose to do so will need to develop the technical competencies, operational structures and strategic partnerships in order to do so effectively.

Within a **medium penetration scenario**, where AVs become progressively mainstream but coexist with human drivers for an extended transitional period, insurers face a hybrid environment in which AVs and traditional vehicles coexist – this represents the most complex scenario.

Traditional underwriting and pricing models become less relevant as human-driven and autonomous vehicles demonstrate different loss patterns. Insurers will need to evolve their rating approaches to reflect these diverging risk profiles by incorporating a wider range of real-time data, such as driving behavior, system-performance indicators, software reliability measures and cyber-risk metrics, alongside other AV-specific risk factors.

Loss frequency may decline overall, but claims variability increases due to system failures, mixed-traffic interactions and high-severity repair costs.

Liability continues shifting from drivers towards manufacturers, with multi-party liability disputes between software and infrastructure providers becoming more common. To address these disputes, insurers will likely require advanced forensic capabilities and standardized access to vehicle sensor and event data recorders. Claims handling will demand both engineering expertise and new legal frameworks.

Strategically, insurers may need to reconsider capital structures, reserving strategies and reinsurance protections to reflect emerging systemic risks.

In a **high penetration scenario**, where AVs represent the majority of vehicles, human driving gradually diminishes and eventually becomes the minority. This results in a structural transformation of the motor insurance market. With fewer collisions, the addressable market shrinks significantly, meaning insurers may need to diversify into adjacent markets to maintain revenue scale.

Traditional underwriting and pricing methods based on human-related risk factors become obsolete.

Liability predominantly shifts to manufacturers, software developers and mobility operators. Claims become more technically complex but less frequent, characterized by systemic software failures, coordinated cyberattacks on fleets, or infrastructure malfunctions.

In order to address these risks, insurers are required to build deep engineering and technological expertise and potentially reorganize technology-centric underwriting teams.

Preparing for an uncertain future

Across all scenarios, insurers should consider several actions:

- Invest in data capabilities, including partnerships with OEMs and infrastructure providers.
- Develop flexible underwriting frameworks that can incorporate new types of risk signals.
- Strengthen cyber-risk expertise, recognizing AVs' dependency on connectivity.
- Engage proactively with regulators to shape future liability regimes and data-sharing standards.
- Diversify product portfolios, including product liability, cyber and mobility-focused solutions.
- Enhance technical claims capabilities to handle increasingly complex investigations.

"Regardless of whether we achieve a global car parc of fully autonomous vehicles, the phases of increasing autonomy levels and market penetration represent a significant shift for the industry. Success will require insurers to evolve beyond traditional behavioral assessment; the ability to decode the complexities of software reliability and systemic technical integrity will be fundamental."

Neil Munro
Principal, Insurance Consulting, Munich Re

Conclusion

While the future trajectory of autonomous mobility remains uncertain, its implications for insurers are profound. Whether adoption remains limited or becomes widespread, insurers must be prepared for changes in liability, evolving claims dynamics and the growing importance of software and data. By investing early, diversifying their risk expertise and adapting their operational models, insurers can position themselves to manage emerging risks and capitalize on new opportunities in all penetration scenarios.

Redefining Industries

Climate Risk & Resilience

Opportunities

- Early identification of climate-related risks supports underwriting accuracy and portfolio resilience.
- Event-related exposure analysis enable insurers to understand potential impacts quickly and adjust risk concentrations.
- Access to tools that measure physical climate risks and their financial impacts helps prevent avoidable losses.

Risks

- Insufficient data or outdated risk models can undermine assessment quality.
- Issuing policies in high-risk zones without adequate control can weaken underwriting profitability.
- Delayed identification of affected policies following a loss event can compromise response effectiveness, increase claims costs, and erode the customer experience.

Overview

Natural disasters continue to cause hundreds of billions of dollars in damage each year, with insured losses exceeding US$ 100bn annually. While geophysical risks such as earthquakes remain largely unchanged, weather disasters are becoming more intense or more frequent depending on region and peril, contributing to rising overall losses. The strongest upward trend stems from high-frequency weather events – severe thunderstorms, hail, tornadoes, floods, and wildfires. These "non-peak perils" increasingly shape the loss landscape.

Climate change is intensifying many of these weather-related hazards. As the Earth continues to warm, societies, economies, and the insurance industry must adapt to evolving risk patterns.

For insurers, in-depth risk knowledge is essential to offering sustainable capacity and maintaining affordability. Strengthening resilience – through prevention, improved building standards, land-use planning, and increased public risk awareness – is a societal priority. Insurance plays a central role by cushioning financial losses and helping individuals, businesses, and governments recover quickly. Closing protection gaps, especially in developing regions, is key to improving global resilience.

Against this backdrop, the trend of Climate Risk and Resilience highlights the increasing need for reliable climate intelligence. Insurers require transparent, data-driven insights to assess physical climate risks, anticipate potential impacts, and support risk-adequate decision-making across underwriting, portfolio steering, advisory services, and claims.

Munich Re brings decades of scientific and industry expertise to understanding natural hazards, socioeconomic loss drivers, and climate impacts. We strengthen clients in their risk management and support climate mitigation, including through innovative solutions for renewable energy and climate-relevant technologies. Furthermore, digital tools such as the Location Risk Intelligence Platform play an important role in operationalizing climate intelligence. By providing natural hazard and climate related data, event insights, and automated risk controls, such platforms help insurers integrate climate considerations into their decisions and strengthen portfolio resilience.

Climate intelligence as a foundation for resilience

As the risk of extreme weather events rises, traditional models based solely on historical averages are losing relevance. Insurers and brokers increasingly rely on dynamic, data-driven insights to understand exposure, assess potential impacts, and support prevention-oriented decision-making.

By integrating climate risk data and analysis into core workflows, insurers can uncover where the potential for damage is greatest. This helps to sharpen underwriting and pricing decisions, as well as advisory services. Examples include the following:

- **Underwriting:** Hazard data supports risk evaluation at the point of quote, and live extreme weather event monitoring allows automatic enforcement of risk controls (binding restrictions).
- **Portfolio management:** Exposure analysis of historical event footprints helps identify concentration risks and supports strategic rebalancing.
- **Client advisory:** With location-specific insights, brokers can help clients reduce their risk exposure – for example, through protective measures – thereby improving insurability and supporting resilience.
- **Claims:** Near real-time event data accelerates response times and supports efficient claims handling during catastrophes.

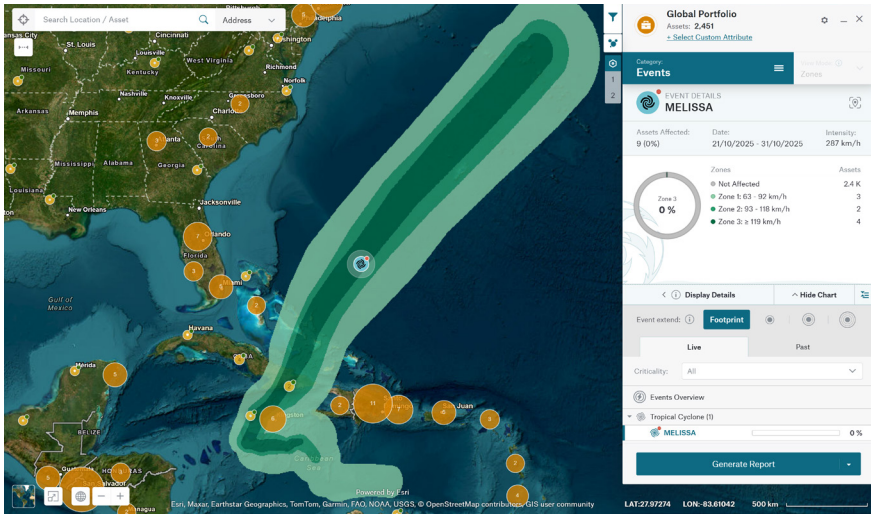
"Data-driven climate risk strategies empower insurers and brokers to emphasize prevention in their portfolio optimization."

Thilo Horner
Senior Product Manager, Insurance Solutions Munich Re

This shift supports a broader industry movement from reactive loss compensation toward anticipating climate risks and strengthening resilience.

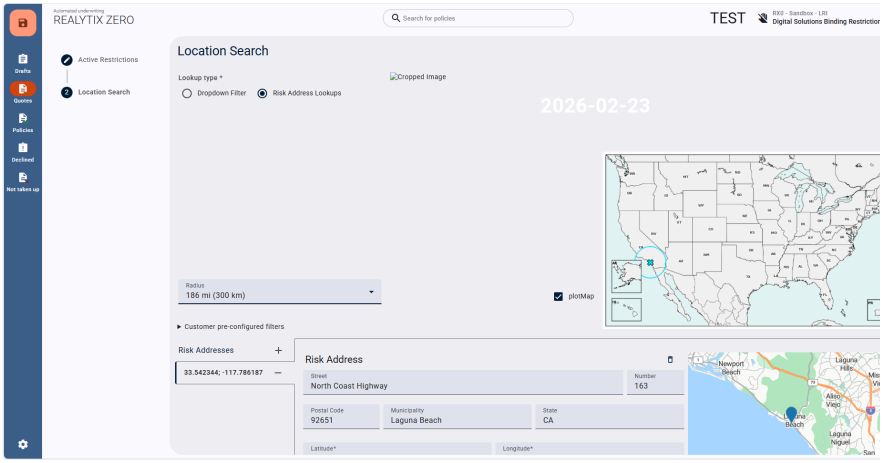
Munich Re's Location Risk Intelligence Platform supports these activities by providing access to natural hazard and climate-related information. Functions including event monitoring and automated binding restrictions can be integrated into underwriting or policy administration systems to help insurers apply risk appetite consistently and respond more quickly to emerging threats. Using such tools enable insurers to embed climate intelligence into everyday decisions.

Events: Understanding natural hazard patterns



The Events feature of Munich Re's Location Risk Intelligence Platform provides data on historical and ongoing natural catastrophes, including tropical cyclones, floods, and wildfires. Users can determine whether a location has been affected in the past or is currently experiencing an event.

Binding Restrictions: Ensuring compliance with internal risk protocols



Using the Binding Restrictions service, underwriters can automate decisions about quoting or binding new business in areas affected by imminent natural catastrophes.

A shift toward proactive climate risk management

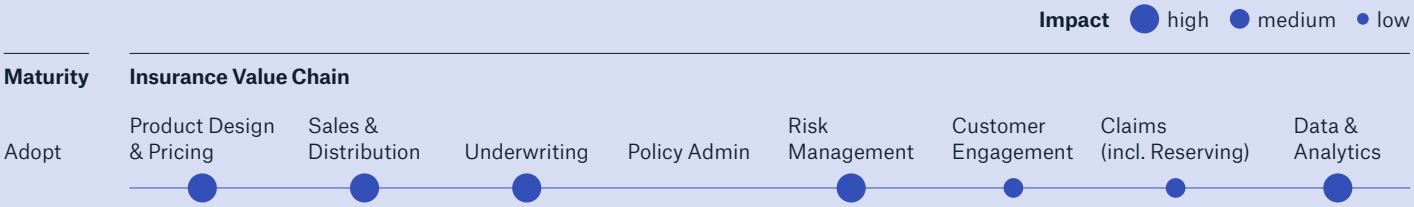
Automation reduces manual effort and cuts out the need for continued process oversight, which boosts effectiveness. Insurers achieve long-term portfolio optimization and prevent possible future loss.

In addition to natural hazard event intelligence, automated risk controls (binding restrictions) reflect a broader industry movement toward dynamic, data-driven strategies. Underwriters and brokers are increasingly able to understand exposure, measure potential impact, and respond to events with greater speed and accuracy.

More than ever, insurers and brokers are becoming strategic partners, guiding clients through uncertainty and supporting long-term climate resilience.

Redefining Industries

Crop Intelligence – Remote Sensing in Crop Insurance



Opportunities

- Supporting sustainable farming by monitoring crop health and resource use.
- Expanding insurance to more farmers, including smallholders, by lowering costs and building trust.
- Enabling continuous crop monitoring for faster, more accurate claims settlement and proactive risk management.

Risks

- Technical limitations and data accuracy challenges: Satellite imagery can be affected by resolution limits or obstructions (e.g., cloud cover), and interpreting the data correctly requires sophisticated models and expertise.
- Legal and privacy risks: The use of detailed geospatial data raises regulatory questions and privacy concerns. Insurers must navigate data protection laws and ensure farmer consent when using remote-sensing data.

Overview

Remote sensing – one of the main trends in the crop insurance market – refers to using technology to capture, process and interpret information about crops and rural areas without being physically on site. It primarily involves satellite imagery (and increasingly drone footage) to assess risks, monitor crop conditions and speed up claims processing. In doing so, remote sensing plays a leading role in helping insurance companies offer more customized products for farmers, which promotes greater insurance uptake and a better experience for policyholders. Despite substantial progress in recent years, a significant protection gap remains. Remote sensing is a key enabler for bridging this gap, as more insurers and governments worldwide adopt these tools to extend coverage. In 2026, advanced remote sensing data – from high-resolution satellites to drone-based sensors – will be widely used to enhance crop insurance offerings around the world.

Recent innovations

Several new technologies and approaches are advancing remote sensing applications in agricultural insurance:

High-frequency satellite imagery (incl. SAR radar)
Near-real-time observation of crops with frequent revisits (even daily). Radar imaging that penetrates clouds ensures all-weather monitoring of fields, improving risk assessment in cloudy regions and during critical growth periods.

AI and machine learning analytics
AI models analyze multi-source data (imagery, weather, soil) to predict yields and flag anomalies. This automation improves risk analysis, enhances underwriting accuracy, and can even detect potential fraud or moral hazard early.

Drones and IoT sensor integration
Drones capture ultra-high-resolution visuals, and on-ground sensors (soil moisture, weather) provide real-time field data. Combined with satellite data, these tools enable precise detection of stress or disease hotspots and guide timely interventions.

Parametric/index-based insurance models
Index insurance products use remote-sensed metrics (e.g., rainfall, NDVI) as triggers for payouts. This allows automatic, fast claim settlements – often within days – once an index threshold is reached, greatly improving customer experience and reducing administrative costs.

"In an agricultural market characterized by high-risk heterogeneity, vast territorial scale and climatic challenges, innovations in risk assessment can play a fundamental role in the sustainable expansion of Crop Insurance in Brazil and worldwide."

Walter Proença
Agro Underwriter, Munich Re do Brasil Resseguradora S.A.

Remote sensing and crop insurance: Transforming risk management

Agriculture is inherently vulnerable to climatic risks, pests and environmental fluctuations that can devastate production and lead to significant losses for farmers. Agricultural insurance plays a fundamental role in mitigating these risks and providing financial protection. However, traditional approaches to risk analysis, crop monitoring and claims handling have often been labor-intensive, slow and imprecise. This is where remote sensing has matured into a revolutionary tool for the sector. By leveraging satellite images, aerial drones and IoT sensors, insurers can now monitor crop development continuously and at scale. This capability has transformed underwriting and claims: insurers globally are blending conventional insurance with data-driven models (for example, using satellite indices in area-yield or parametric covers) to reduce costs and improve responsiveness. In short, remote sensing allows crop insurance to be more data-driven, proactive and tailored to actual field conditions, which boosts both insurer confidence and farmer trust.

Remote sensing and the underwriting process

Policy underwriting – the assessment and pricing of risk for a farm or crop – traditionally relied on on-site field surveys and limited historical data. Today, remote sensing enables underwriters to access rich, objective information about a location's risk factors without a physical visit. For example, satellite-derived vegetation indices like NDVI (Normalized Difference Vegetation Index) reveal crop health and vigor over time. Examining these indices across multiple seasons provides a vast data pool on each region's performance and risk profile. Insurers also integrate moisture indices and radar imagery (which penetrates clouds) to get consistent readings.

Armed with these insights, underwriters can offer customized coverage tailored to each field's risk profile. For instance, if a remote-sensing analysis shows that a field stays productive even during drought, the insurer might charge a lower premium to reflect its resilience. This data-driven approach gives insurers greater confidence in risk selection and pricing, while helping to reduce adverse selection (so that an insurance portfolio isn't only attracting the most at-risk farms). Additionally, machine learning models can automatically flag anomalies – such as unexpected crop growth patterns that could indicate hidden issues – further improving underwriting accuracy and consistency.

Continuous crop monitoring and risk mitigation

Throughout the growing season, frequent satellite imagery (updated every few days) provides near real-time data on crop health. This enables insurers to spot issues early – such as water stress, pest outbreaks or disease – often before they would be noticed on the ground. Early detection means they can take action to mitigate losses. For example, an insurer might alert a farmer about early signs of drought stress or suggest specific interventions to prevent a minor issue from becoming a major loss. In this way, the insurer acts as a risk management partner rather than just a claims payer.

This continuous monitoring also supports dynamic portfolio management. Aggregating remote-sensing data across all insured fields gives a near-real-time view of the overall exposure. If a drought is starting in one region, the insurer sees it in the data and can respond – for instance, by adjusting reserves or advising clients in that area to prepare. Some insurers share summary remote-sensing insights with farmers, so they can make more informed decisions as well. Drones complement satellites by performing targeted checks: if satellite data flags a particular location as problematic, a drone can fly over to provide a closer look. Combining wide-area satellite coverage with targeted drone follow-ups helps insurers manage portfolios more effectively while giving farmers added oversight of their crops.

Faster and more accurate claims settlement

The claims process is often called the moment of truth in insurance: when a loss occurs, the speed and fairness of the payout define the product's value. Remote sensing has transformed crop insurance claims by allowing insurers to assess damage within hours rather than days or weeks. High resolution satellite and aerial imagery can sometimes replace on site inspections entirely.

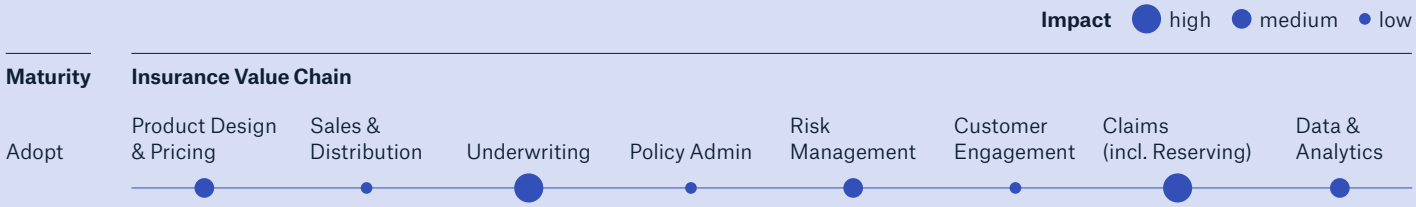
Remote sensing also enables parametric insurance, where payouts are triggered automatically by data – such as a satellite based drought index – without claims filing or field visits. These index products are now common worldwide, with some programs settling claims in under 72 hours. Faster, more objective payouts improve farmers' experience, reduce insurer costs and limit fraud.

Challenges remain: cloud cover can limit image quality, analytics expertise is required, and the use of detailed geospatial data raises privacy and regulatory concerns. Still, remote sensing is becoming indispensable in agricultural insurance and is central to the sector's digital future.

Munich Re's own Agro Digital Suite (ADS) exemplifies this trend: ADS provides field-level risk scoring (leveraging satellite, climate and even ESG data) and an "Agro Cockpit" for real-time portfolio management. Early use of ADS in Brazil has been promising – insurers have remotely evaluated tens of thousands of hectares and expanded crop insurance into new, previously underserved regions using these tools. Remote sensing is fundamentally shifting crop insurance from reactive to proactive. By embracing these technologies, the industry can offer farmers better protection, support sustainable agriculture and build a more resilient, tech-enabled agricultural sector for the years ahead.

Redefining Industries

Electric Vehicles



Opportunities

- New customer fears like range anxiety, residual value, and fire risks.
- Motor insurance and affinity products address EV concerns (e.g. battery warranty, charging roadside assistance).
- Enhanced data collection for pricing and underwriting.
- EV claims handling to improve overall processes.
- Partnerships across insurance value chain, from new to established players.

Risks

- Shift in underlying risk drivers impacting
  - frequency through change in driving behavior, driving characteristics, car usage, etc.
  - average claims cost due to increased repair costs or specific workforce training.
- Less frequent but more complicated to extinguish EV fires.
- New risks related to connectivity and software-predominance of EV, such as cyber-related risks.

Overview

Despite headwinds due to global trade uncertainties and policy shifts in some markets, global EV adoption has risen in 2025, with EV sales in 2025 above 20 million, up from 17 million in 2024. This accounts for approximately 25% of cars sold worldwide, up from 20% in 2024, continuing to impact the (re)insurance industry and the performance of motor books.

Out of these 20 million vehicles sold in 2025, more than three-quarters were produced by Chinese manufacturers, leading to a strong influx of innovative models, significant technological developments and key evolutions on vehicle risk profiles.

Insurers are therefore advised to maintain a proactive approach when it comes to EV adoption in their respective markets, from providing the right products and services, to developing new pricing techniques and establishing specific EV claims management and new partnerships.

The adoption of EV technology is altering customer insurance needs and changing risk profiles. Additionally, the transition from mechanically defined to software-defined vehicles is underway. To stay ahead, we recommend that insurers adapt their products, pricing and claims management proactively to reflect the evolving EV landscape, exploring new partnerships and services to remain competitive.

Even though EV technology has evolved significantly over the past 24 months, EVs are no longer an emerging trend. Many insurers have already adapted their motor products or developed new products specifically tailored to EVs. Nevertheless, not all risks and opportunities have been fully addressed. What will be new for many insurers, and is likely to remain a trend in the coming months, is the increasing dominance of EVs from Chinese manufacturers. More than three-quarters of the EVs sold globally in 2025 were produced by Chinese manufacturers.

The global expansion of Chinese EV manufacturers is creating structural changes in motor insurance. As Chinese OEMs enter multiple international markets, insurers must proactively reassess partnerships and portfolio steering.

Chinese EVs are often considered technologically advanced. At the same time, they are frequently priced more competitively than Western counterparts. However, lower vehicle prices do not automatically result in lower claims costs.

Advanced component integration, complex battery systems and sensor-heavy architectures can increase repair complexity and claim severity.

Highly integrated vehicle designs introduce new underwriting considerations. Production techniques, structural integration and performance characteristics may affect repairability, loss severity and driving behavior. Risk assessment therefore requires a more granular, model-specific approach.

Access to manufacturer data will be critical for accurate risk scoring and pricing. However, challenges remain regarding data accessibility, analytical capabilities and market-specific regulatory environments. Motor insurance structures differ significantly across markets, limiting the transferability of insights.

"Although new EVs tend to be more affordable, this difference in purchase price is not mirrored in their claims costs. The long standing assumption that vehicle value reliably predicts claims expenses is being seriously challenged by the emergence of new EV manufacturers."

Thibault Imbert
Principal, Insurance Consulting, Munich Re Singapore

Implication for insurers

The rise of EVs represents a combined technology, data and ecosystem challenge. Insurers will need stronger technical expertise, improved data integration and adaptive underwriting frameworks to stay competitive in an increasingly electrified and software defined mobility landscape.

Redefining Industries

Humanoid Robots

Opportunities

- Reduction in workers' compensation claims by moving humans out of hazardous tasks.
- A new product category for insurers with evolving business models, like Robotics as a Service (RaaS).
- Move pricing from proxies to telemetry, e.g., robot hours by task type or collision events.

Risks

- Correlated loss events, e.g., vulnerabilities or bodily injury potential.
- Complex liability landscape for integrators and humanoid provider.s
- Tightening regulations as adoption ramps up and emerging safety standards.

Overview

Humanoid robots are entering a pivotal moment, evolving from future concepts in science to become a multipurpose operating workforce. From eldercare to energy sites, warehouses and factories, the range of areas in which humanoids will be used is growing rapidly. They are ushering in a new era of industrial operation. For insurers, this creates new opportunities and risks that emerge in the increasingly shared spaces of humans and robots. The accumulation control of humanoids as cyber-physical fleets raises multifaceted issues regarding equipment, software and autonomy.

The rise of the cyber-physical workforce: Why humanoids are no longer science fiction

Humanoid robots have captured the imagination of a human-like machine for decades, but always seemed years away from delivering economic value. In 2026, the question changes for executives, with a transition from labs' prototypes and impressive roadshows to a rising multipurpose operating workforce. It marks a structural shift in the global labor landscape bigger than "new machines": software-defined, sensor-rich, increasingly autonomous systems that can be deployed into human-built environments without redesigning the world around them. Unlike industrial robots operating behind cages, or mobile robots confined to controlled routes, humanoids are meant to work with us, often in close physical and social proximity. They don't need special ramps or magnetic floor strips – they use the stairs. For insurance leaders, this is a fundamental redrawing of the boundaries of workplace safety, liability and enterprise risk.

The expanding deployment horizon

The human-like form makes them attractive precisely because they fit the world as it exists. Humanoid companies use the embodied physical-AI to simulate, train and validate new behaviors for robots and to advance the development of new applications. It allows enterprises to deploy automation without redesigning facilities, retooling every aisle or rebuilding interfaces, which is accelerating adoption in a staggering breadth of environments, like:

- **Industrial:** Hazard-heavy environments such as energy, heavy manufacturing and high-risk inspection are early proving grounds because of fewer humans in harm's way, fewer lost-time incidents and less exposure to extreme conditions.
- **Logistics and warehousing:** Humanoids promise more than "pick-and-place." They're being positioned for end-to-end flows in cluttered, changing environments where variability has historically limited automation's reach.
- **The interactive economy:** In hospitality, retail, and elder-care, the emergence of "cobotics" – robots designed for shared workflows and human-facing interaction, where value comes from physical assistance plus basic social interface and where digital efficiency meets human empathy.

> Humanoids will relieve humans from the riskiest and repetitive work, but they also bring software-defined accumulation risk the moment they operate in close proximity to people.

Andreas Schumacher
Project Manager Artificial Intelligence, Munich Re

Risk is moving fast

Humanoid deployments are moving from pilots to production, and insurers will have to adapt. For example, Agility Robotics' Digit has now surpassed 100,000+ real-world picks and transfers in commercial operations at a GXO site. Figure AI also reported an 11-month deployment running 10 shifts, with 90,000+ parts loaded and 1,250+ runtime hours in an automotive production line.

The insurance paradox: New values and new liabilities

The major shift that humanoids bring to the global labor landscape is the operating model. They extend robotics automation into spaces built for humans, as a cyber-physical workforce that can be deployed, updated and governed at scale. For insurance leaders, this creates a new reality changing the shape of claims. On the one hand, the opportunity is massive due to a significant reduction in workers' compensation claims and, on the other, a new cyber-physical liability arises due to autonomous, heavy-moving machines in close proximity to people. The IEEE Humanoid Study Group's work underscores why standards must evolve to address humanoids' unique risk profiles, because these machines operate in "managed instability" and in dynamic environments where predictability is harder to guarantee.

Why this opportunity is attractive

- Loss prevention at the source. Moving humans out of dull, dirty and dangerous tasks can reduce compensation frequency and severity and dampen downstream GL exposure when fewer people are in harm's way. Robots don't get back strain or suffer from fatigue-related accidents.

- A new product category for insurers. The market is forming around OEMs, integrators and operators who need coverage that blends physical damage, cyber triggers, operational disruption and third-party liability into one coherent fleet offering.

- Pricing moves from proxies to telemetry. Fleet telemetry makes utilization-based services and underwriting plausible: robot hours by task type, near-miss and collision events, maintenance cycles, supervised vs autonomous modes turning "we think it's safe" into measurable exposure.

The risk that can scale quickly

- Accumulation and correlated loss. The same shared stack that enables connected fleet scaling also creates correlated failure modes that can propagate across many robots, and potentially across multiple insureds, turning cyber into casualty, property and business interruption in one event.

- Responsibility complexity in claims. When something goes wrong, liability can fragment across hardware OEM, software vendor, model provider, integrator and operator.

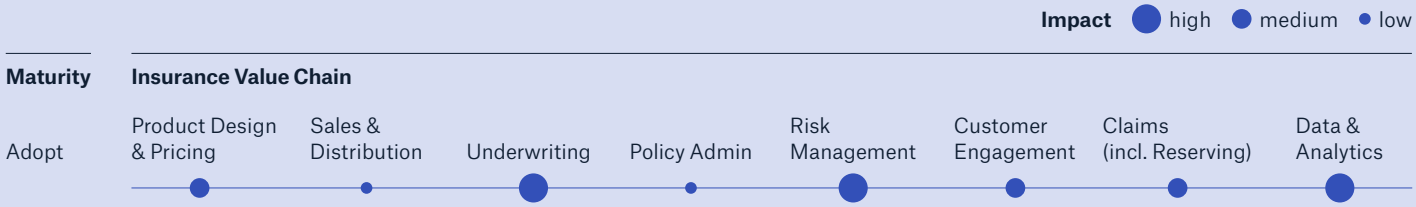
- Regulatory tightening. As adoption scales, requirements will harden, especially around safety, data collection in shared spaces, and AI governance.

Outlook

The humanoid commercialization roadmap is accelerating. Hyundai has published deployment of Boston Dynamics' Atlas at its manufacturing plant, beginning in 2028 and expanding capabilities in stages. Meanwhile, real operational milestones show that the pilot-to-production curve is already underway. The core risk isn't the robot, It is the shared software and human proximity, which can turn isolated issues into correlated losses. The time to set the market standards through taxonomy, controls, wording and telemetry-driven pricing is now, while capacity and product design are still malleable.

Redefining Industries

New Energy at Scale



Opportunities

- Rapid growth in clean energy, including solar, wind, green hydrogen, and advanced nuclear, creates opportunities in power generation, grid infrastructure, and energy services.
- Insurance-backed performance guarantees can enhance investor confidence and support sector growth.
- Market reforms like capacity mechanisms and contracts for difference drive demand for innovative risk transfer solutions to manage price volatility and supply uncertainties.

Risks

- Rapid innovation introduces untested technologies and operational risks, mainly for novel projects.
- Renewable assets face greater vulnerability to extreme weather events, which might increase loss frequency and complexity.
- Expanding distributed generation and global supply chains raise operational and integration risks.
- Weather-dependent generation can cause supply fluctuations, requiring flexible grids and backup solutions.

Overview

IPCC assessments indicate that limiting global warming to 1.5°C requires reaching net-zero greenhouse-gas emissions around mid-century, implying a rapid transformation of global energy systems. The urgency is evident, as 2025 ranked among the hottest years ever recorded, highlighting the need for accelerated CO_2 reductions. Clean energy deployment is expanding rapidly, with global renewable capacity projected to more than double by 2030 – an increase of roughly 4,600 GW, led primarily by solar photovoltaics. Achieving this expansion requires parallel investment in transmission grids, energy storage, and digital solutions capable of integrating variable solar and wind output, maintaining system stability and reliably balancing electricity supply and demand.

Grid expansion as prerequisite for the energy transition (power grid)

Upgrading and expanding the electric grid is essential to support large-scale renewables. Because many big solar and wind parks are far from consumption centers, significant investment in transmission lines and interconnectors is needed to transport power to consumers. New high-voltage corridors (including subsea cables linking offshore wind farms) are under development in regions like Europe, North America and Asia to enable broader sharing of renewable energy. These efforts will facilitate balancing – for instance, excess wind power in one area can be sent to offset a lull in another.

However, grid development is struggling to keep pace with demand. The IEA reports that over 3,000 GW of renewable projects worldwide are waiting in queue for grid connections, highlighting the urgency for infrastructure expansion. To meet climate targets, global grid spending will need to rise dramatically (on the order of $600 billion per year by 2030, up from about $410 billion in 2025. Distribution grids are also evolving rapidly. The rise of the "prosumer" – households and businesses that both consume and produce power – means local networks must handle two-way electricity flows. Utilities are deploying digitized smart grids (smart meters, sensors and automated controls) to better manage real-time demand and supply at the distribution level. Advanced software and AI-driven grid management tools are now being used to predict renewable output and orchestrate resources more efficiently. As the grid becomes more intelligent and inter-connected, stakeholders are placing greater emphasis on cybersecurity and grid resilience to safeguard against outages, whether from cyber threats or extreme weather events.

Storage

Energy storage has become a cornerstone of the renewables revolution, providing flexibility to account for the intermittent nature of solar and wind. In particular, battery energy storage systems (BESSs) have seen a rapid scale-up. 2025 marked a tipping point where global battery storage capacity surpassed 250 GW, overtaking pumped hydro as the world's largest active storage fleet. Around 100 GW of new BESS was added in 2025 alone – nearly three times the additions in 2023 – reflecting massive year-on-year growth. These grid-scale batteries can smooth out short-term fluctuations by storing excess power (for example, midday solar surplus or nighttime wind) and releasing it during peak demand or when renewable output is low. The expanding use of big batteries, from California to China to Germany, underscores their falling costs and fast response capabilities. At the same time, safety remains a priority: industry best practices are evolving after a series of battery fire incidents in recent years. Enhanced fire suppression systems, improved battery chemistries and strict spacing and monitoring protocols are being implemented to mitigate fire and thermal runaway risks in large BESS installations. Beyond lithium-ion batteries, other storage technologies are gaining traction to address longer-duration needs. Green hydrogen is a prominent example – using surplus renewable electricity to produce hydrogen via electrolysis, which can later be used as fuel for power generation or industrial processes.

According to the Global Hydrogen Compass 2025, by late 2025, more than 500 green hydrogen projects worldwide had attracted over $110 billion in investment, reflecting hopes that hydrogen can serve as a large-scale energy carrier and seasonal storage solution. Traditional pumped hydro storage is also expanding where geography permits, and emerging solutions (such as flow batteries, thermal storage and gravity-based systems) are under active development. Together, these storage advancements are improving the reliability of renewable-heavy power systems and reducing reliance on fossil-fueled backup power.

> In the Electric Age, renewable energy powers a system where electricity is intelligently distributed, stored, and shared.

Dr. Tobias Aigner
Senior Project Manager, New Energy, Munich Re

Geothermal energy

Geothermal power is gaining renewed attention as a reliable complement to variable renewable generation. While solar photovoltaics are expected to drive the majority of global renewable capacity additions in the coming years, followed by wind, hydro and bioenergy, geothermal energy is projected to expand steadily and reach record installation levels in several markets. Countries such as the United States, Japan and Indonesia, alongside a growing number of emerging economies, are advancing geothermal deployment to provide stable, dispatchable low-carbon electricity. Unlike weather-dependent sources, geothermal plants can deliver continuous baseload power, supporting grid stability and reducing balancing requirements. For insurers, geothermal projects present opportunities linked to long asset lifetimes and predictable output, alongside specific risks related to subsurface exploration uncertainty, drilling performance and induced seismicity.

At the local level, municipalities increasingly view geothermal energy as a reliable option to strengthen energy security and reduce dependence on fossil fuels, particularly for district heating and industrial heat applications. However, high up front drilling costs and uncertain exploration outcomes remain major barriers to project development. Munich Re's Exploration Risk Insurance addresses this challenge by covering financial losses if drilling does not achieve the expected geothermal resource, thereby improving project bankability and supporting investment decisions by public utilities and local authorities. Further details on the insurance solution and project risk management approach are available here.

Power markets

The surge of low-cost renewable generation is fundamentally changing power market dynamics. In many countries, periods of high wind or solar output have led to very low or even negative electricity prices, whereas periods of scarcity (e.g., a windless evening) can send prices soaring. This increased volatility is challenging the traditional "energy-only" market model. To ensure security of supply, regulators are introducing capacity mechanisms that pay providers for maintaining standby capacity or flexibility. For example, capacity auctions or reserve contracts are now used in several markets to incentivize gas peaker plants, storage operators or demand-response aggregators to be available during grid stress periods. Such mechanisms, along with enhanced grid integration, aim to prevent blackouts and price spikes as the share of weather-dependent generation rises. Meanwhile, energy companies and large consumers are seeking ways to manage the financial risks of this new volatility. Risk transfer solutions are evolving in response: utilities and developers increasingly use hedging instruments (like power purchase agreements and renewable energy derivatives) to lock in prices or revenues, and novel insurance products are emerging to cover things like volume risk (shortfalls in expected production due to low sun or wind) or price risk (unexpected market price extremes).

> The energy transition is leading to significant changes in the risk landscape for power producers and grid operators. Tailored risk transfer solutions can mitigate these risks.

Bernhard Müller
Underwriting Manager Power & Utilities, Munich Re

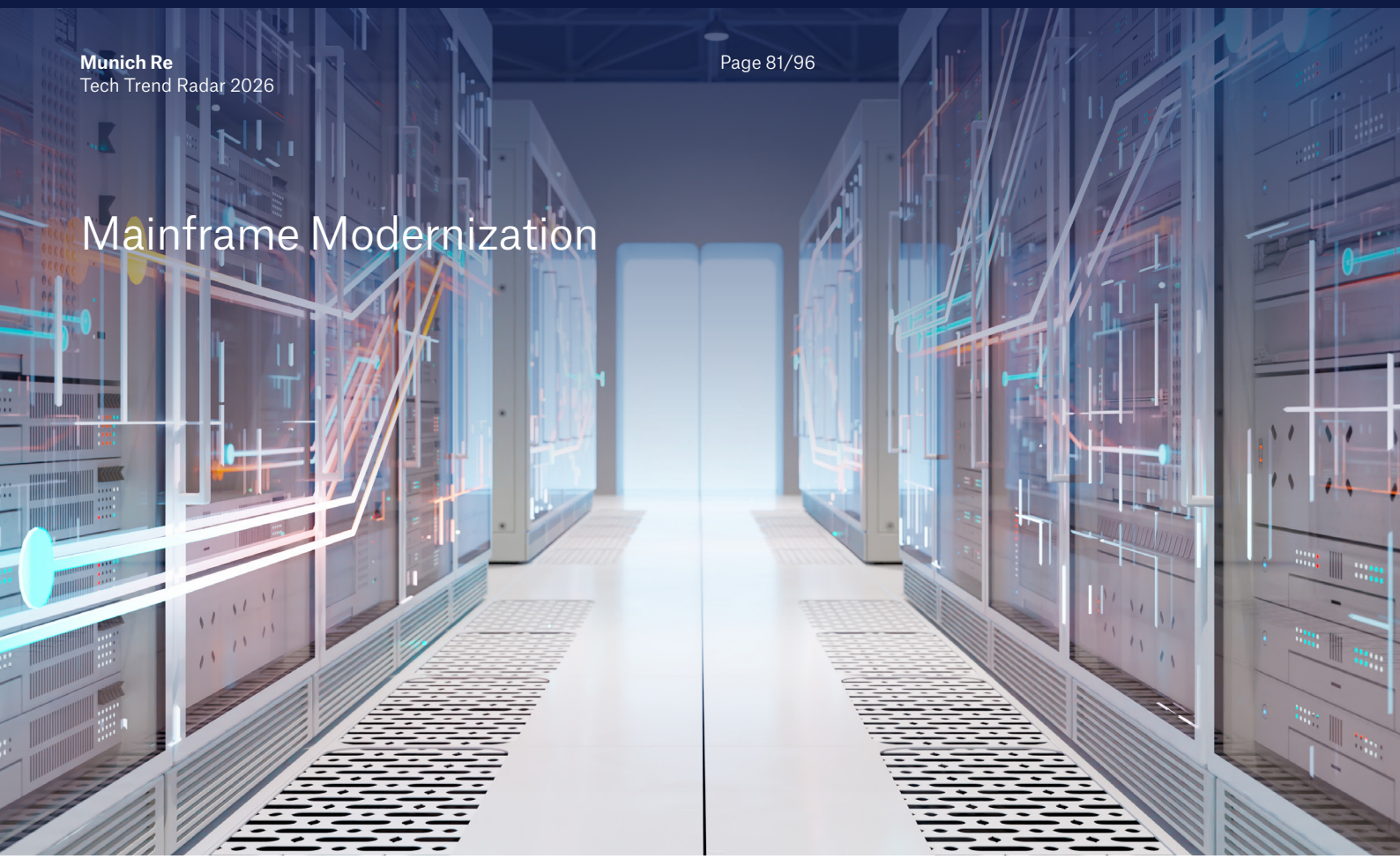
Munich Re and other insurers are actively supporting these needs by offering tailored products – from construction and operational insurance for renewable and storage projects, to performance guarantees for new technologies, to coverage that buffers producers or off-takers against extreme market conditions. These financial innovations complement technological advancements, together enabling the "New Energy at Scale" trend to proceed with greater confidence and stability in the pursuit of a net-zero future.

→ Data & AI
→ Healthy Human
→ Cyber & Crypto
→ Redefining Industries
→ **Specials**

5 Specials

The Tech Trend Radar 2026 features two carefully selected Special Topics that address issues of immediate relevance for insurers but fall outside the scope of emerging technology trends:

- Mainframe Modernization
- Operational Technology Cyberattacks



Mainframe Modernization

Introduction

Mainframe platforms still handle many critical workloads for large enterprises in financial services. Insurers depend on mainframes for policy administration, claims processing and underwriting. Yet the architectures underlying these systems were designed decades ago and are increasingly misaligned with demands for flexibility, scalability and real-time insight. While these systems remain reliable, they are becoming costly and complex to maintain, with limited documentation and a shrinking labor pool for legacy programming languages. Today, 70% of mainframe professionals have worked in the field for more than two decades, highlighting the urgency of addressing impending retirements and knowledge loss. Modernization is thus not about discarding proven platforms. It is about enhancing them to support digital initiatives, improve customer experience and reduce operational risk.

"Modernizing mainframes isn't about replacing what works – it's about meeting changing customer expectations, reducing risk, and preparing for the next decade of insurance innovation."

Daniel Grothues
Chief Architect Primary Insurance, ITERGO

Challenges facing insurers

Rising costs and technical debt
Mainframes are licensed based on processing capacity, so insurers already pay substantial fixed fees regardless of utilization. This model conflicts with the pay-as-you-go economics of cloud services and causes costs to spiral as transaction volumes grow. Decades of accumulated code changes increase system complexity and also create technical debt in applications that slow innovation and complicate integration with new systems. Some organizations are troubled by technical debt of their mainframe platforms caused by a lack of investment following the invalid expectation that the platform could be retired soon.

Shrinking expertise
The pool of professionals capable of maintaining these systems is shrinking. Most original Common Business-Oriented Language (COBOL) developers have retired, and new graduates prefer cloud native development. In addition, companies are facing shortages of mainframe-specific skills deemed critical for transformation. In a recent study conducted by the IT infrastructure services provider Kyndryl, 45% of the respondents state they lack cybersecurity expertise and 41% are missing knowledge in integration and modern tooling. Further underscoring the talent gap, nearly three-quarters of organizations rely on external partners to support modernization.

Integration and architectural complexity
Legacy applications are usually built as one large, tightly connected system. Because everything is linked together, it's hard to connect these older systems to digital front-ends or analytics platforms.

Often, integration complexity and the risk of downtime or data loss are major barriers to modernization. Projects that attempt to rewrite all legacy code at once often fail due to underestimated complexity, budget overruns and staff turnover. Similarly, lift-and-shift migrations that emulate mainframe environments in the cloud can leave organizations locked into legacy architectures without realizing anticipated benefits, such as improvements in flexibility, cost savings and innovation.

Organizational misalignment and lack of strategy
Successful modernization requires alignment between technical goals and business outcomes. Enterprises should focus on business transformation rather than technology alone and ensure stakeholder alignment from the outset. Without a clear strategy, modernization efforts can stall due to conflicting priorities or insufficient executive support.

Regulatory and security pressures
A large survey of executives reports that 94% of organizations say regulatory compliance strongly influences their modernization plans.

While mainframes are renowned for robust technology and security, they are often slow and complex to adjust, challenging organizations to adapt to changing regulatory requirements. For instance, new data privacy laws require insurers to provide real-time access to customer information and maintain detailed audit logs, which legacy systems may struggle to support.

Pathways to modernization

Insurers can modernize through several approaches, often combining them to balance risk, cost and agility.

Rehosting and replatforming
Rehosting moves applications from legacy platforms to new hardware with minimal code changes ("lift and shift"), while replatforming includes moderate changes to optimize for the new platform environment. These approaches can deliver cost relief, performance gains and mitigate technical risks, but leave much of the monolithic code intact.

Replacement
For many capabilities previously run as custom solutions on the mainframe, the market today offers standard software solutions. By migrating to these offerings for non-differentiating processes, insurers can focus on their core business.

Hybrid modernization and modern programming languages
Many insurers retain mission-critical processing on the mainframe while layering modern services on top. Modern programming languages have been supported on mainframes for more than two decades, offering a larger talent pool than traditional COBOL. Converting COBOL applications into these languages makes them eligible to run on specialized processors which are licensed at a fraction of the cost of standard cores.

This hybrid approach allows insurers to expose core systems through APIs, support DevOps practices and gradually refactor legacy code.

Refactoring into modular services
Refactoring breaks monolithic applications into smaller, loosely coupled services. Advanced tools now use generative AI models trained on enterprise code bases to accelerate this process. New tools can perform discovery (inventorying program flows), refactoring (decoupling functions into modular business services) and transformation (converting modules into classes in a modern, object-oriented language using a domain-specific AI model). By automating translation and providing code suggestions, these tools help developers preserve business logic while migrating to more agile architectures. However, knowledge preservation for the machine-generated code remains a challenge.

Incremental migration supported by AI
Some insurers opt to migrate off the mainframe entirely but do so incrementally to manage risk. This strategy begins by selecting a discrete application, reimplementing it and running it in parallel with the legacy system until outputs match. AI tools assist by analyzing code, synthesizing documentation and accelerating testing. This gradual approach enables insurers to realize cost and agility benefits sooner while maintaining operational continuity.

Using AI for code and documentation improvements
Another path involves applying AI to improve existing code and documentation. AI assistants can analyze legacy code and comments, identify dependencies and generate high-quality documentation, reducing the risk of knowledge loss. These tools also provide refactoring suggestions and help developers transition code to modern languages, leveraging existing expertise without starting from scratch.

Benefits and return on investment

Modernization delivers measurable benefits. Kyndryl's survey of global executives found that organizations that modernized applications on the mainframe achieved a median return on investment (ROI) of 288%, while those that moved workloads off realized an even higher ROI of 362%. The same survey estimated that deploying artificial intelligence and generative AI on mainframes could yield US$ 12.7 billion in cost savings and US$ 19.5 billion in new revenue over the next three years.

Furthermore, modern interfaces and cloud platforms deliver digital agility, enabling insurers to roll out products rapidly and respond to market changes. Migrating workloads to modern languages and specialized processors supports DevOps practices and shorter development cycles.

Modernization also improves data accessibility and analytics. Real-time access to policy and claims data enables predictive analytics for underwriting, fraud detection and customer segmentation. The ability to centralize data on modern platforms enhances the use of generative AI in operational workflows.

Finally, modernization improves compliance and security, as strengthening interfaces and audit trails enables insurers to meet evolving regulations more effectively.

Organizational considerations

Ensure stakeholder alignment and a clear strategy
Successful modernization hinges on aligning technical goals with business outcomes. Industry experts emphasize the need for stakeholder alignment from the outset and a clear roadmap for transformation as, without shared objectives, projects risk stalling or failing.

Choose the right roadmap
Quick wins from rehosting can provide immediate cost relief, but long-term value comes from hybrid and refactoring strategies. Insurers should develop phased plans that align with business priorities and risk management frameworks.

Align modernization with compliance
Modernization plans must meet regulatory requirements from the outset. Collaboration between IT, risk management and compliance teams ensures that new architectures enhance, rather than compromise, data protection and resilience.

Build multiskilled teams
Not least, modernization requires expertise in legacy systems, cloud infrastructure, cybersecurity and AI. 70% of organizations report difficulty finding this mix of skills, so insurers should invest in training and, if reasonable, consider partnering with external specialists.

Leverage AI responsibly
AI tools accelerate discovery, refactoring and translation, but must be validated. Experts caution that AI models can hallucinate or introduce errors if not properly governed. Rigorous testing and oversight are therefore essential.

Conclusion

For the insurance sector, modernizing mainframes is not a bout discarding tried and tested systems but about unlocking potential in a digital age. Insurers can reduce costs, enhance agility and deliver superior customer experiences by adopting a hybrid architecture, leveraging modern programming languages, refactoring monolithic applications and using AI tools for code and documentation improvements, as well as migrating selected workloads incrementally. This change process requires thoughtful planning, investment in talent and also partnerships, as well as the responsible use of AI to enhance efficiency and accuracy.

When executed effectively, modernization empowers insurers by reducing technical risks, improving data accessibility, strengthening compliance and security, and thereby fostering innovation that sustains competitiveness well into the future.

Operational Technology Cyberattacks

Overview

Operational Technology (OT) systems are becoming more attractive targets for cyberattacks. What used to be focused on financial gain in the Information Technology arena is now expanding into OT systems. Because OT systems support core facility and business functions, attacks can range from disruptive – such as disabling elevators or building access – to catastrophic damage, including releasing hazardous materials or triggering cascading power outages. Many OT systems lag behind IT systems in design, maintenance and security, increasing their vulnerability.

Introduction

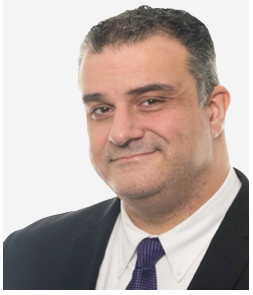
Operational Technology (OT) systems have become targets for cyber criminals seeking financial gain, intellectual property, retribution, terrorism or other objectives. Attacks on OT systems can involve:

- Theft of process information or OT application code
- Modifications that halt critical processes or business functions
- Ransomware encrypting OT systems
- Damage to equipment controlled by OT
- Manipulations that create fire, explosion, contamination or safety hazards

While attacks to date have been industry-specific, concerns are rising that critical infrastructure – electrical grids, pipelines, transportation and communication networks – could be next. Many of these systems rely on aging infrastructure and are increasingly interconnected with IT networks or exposed through remote access.

> OT systems are an attractive focus for hackers. However, they often require greater skill and a less concentrated target, so attacks have not been as active as the IT systems.

Paul Morris
Principal Engineer, Insurance Engineering, HSB



"Supervisory Control and Data Acquisition (SCADA) systems are at the heartbeat of our modernized grid control system. It is critical to maintain and protect these assets from infiltration by state adversaries and cyber terrorists. Engineering to protect critical cyber assets is a must from design to operation moving into the future, and the future is now."

Vincenzo Pagliuca
Principal Electrical Engineer, Insurance Engineering, HSB

Recent developments:
As cyberattacks on IT systems mature, there are many characteristics of OT systems that make them particularly vulnerable, such as:

- Aging infrastructure: many systems are 30 – 40 years old
- Application code: proprietary code that is often adapted for internet connectivity
- Infrequent upgrades and patching: OT systems often run for long periods of time without any changes
- Interconnectivity through numerous generic and custom APIs linking OT to IT and the internet

OT systems control everyday functions like building access, elevators, HVAC and transportation, where an attack can cause major inconvenience. However, they also control critical systems like power generation, transmission and distribution, pipeline management, oil refining and chemical manufacturing, where an attack could lead to major property damage, equipment failure and public safety risks. Strengthening these systems is therefore essential.

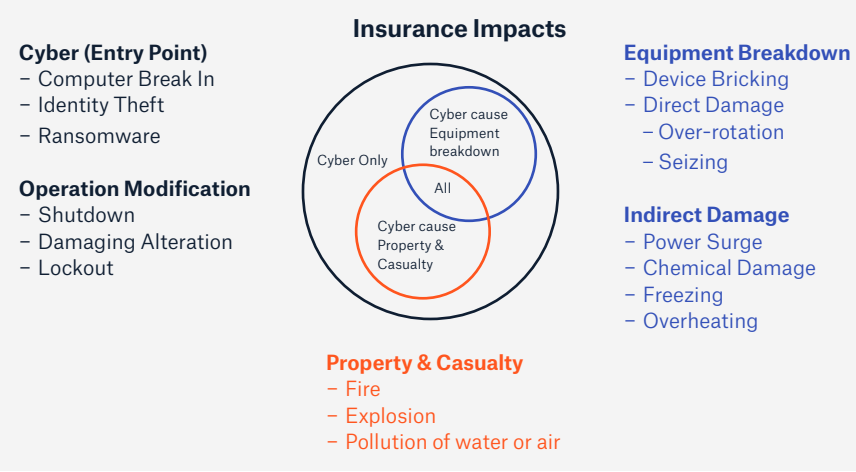
Potential applications:

Processors that control OT equipment take the form of various types of Process Control Systems (PCSs) or Integrated Control Systems (ICSs). While all of these systems are vulnerable to attack, there are systems that support critical infrastructure called Supervisory Control and Data Acquisition (SCADA) systems. Cybercrime poses a catastrophic risk to the U.S. electrical grid, for example, particularly the Bulk Power System (BPS) and its transmission networks. Hacking critical infrastructure like SCADA systems, substations and communication networks can trigger regional or nationwide blackouts. To mitigate these threats, robust cybersecurity frameworks like the NERC Critical Infrastructure Protection (CIP) standards are essential for protecting electronic control systems from tampering. Although we mentioned the example of the U.S. power grid, the threat exists globally (Europe, Asia, South America, etc.). In Europe, grid cybersecurity standards are also very stringent and, if implemented appropriately, can help protect grid-critical assets and help prevent cascading outages.

Attacks on OT can shut down entire production lines, disrupt supply chains, and cascade across industries. Attacks on OT critical infrastructure can also be dangerous. Beyond just having equipment stop functioning or creating cascading outages, malfunctioning equipment that has been hacked can injure workers, release hazardous materials, ignite fires, explode or cause other catastrophes, including loss of life.

Relevance for insurance:

Cyberattacks can impact multiple areas that are covered by different insurance policies



Cyberattacks on OT systems are currently covered by several insurance offerings, depending on the damage:

- Cyber insurance for ransom, IP theft or code manipulation. Cyberattacks on OT systems are increasing. Currently most of the impact is on the OT systems themselves.
- Equipment Breakdown for physical damage to machinery. Damage to machinery can be a result of direct damage and indirect damage. Direct damage is where the attack specifically targets a piece of machinery. Indirect damage is where impact to a process causes damage to machinery, such as molten product hardening, change in temperature or sudden loss of electrical power.
- Property & Casualty for resulting property damage (damage to property can be a result of fire, explosion, contamination and other impacts)

This is similar to coverage in the IT environment. However, it is unlikely that an IT cyberattack will result in property damage.

Some of the most important cyber risk countermeasures are:

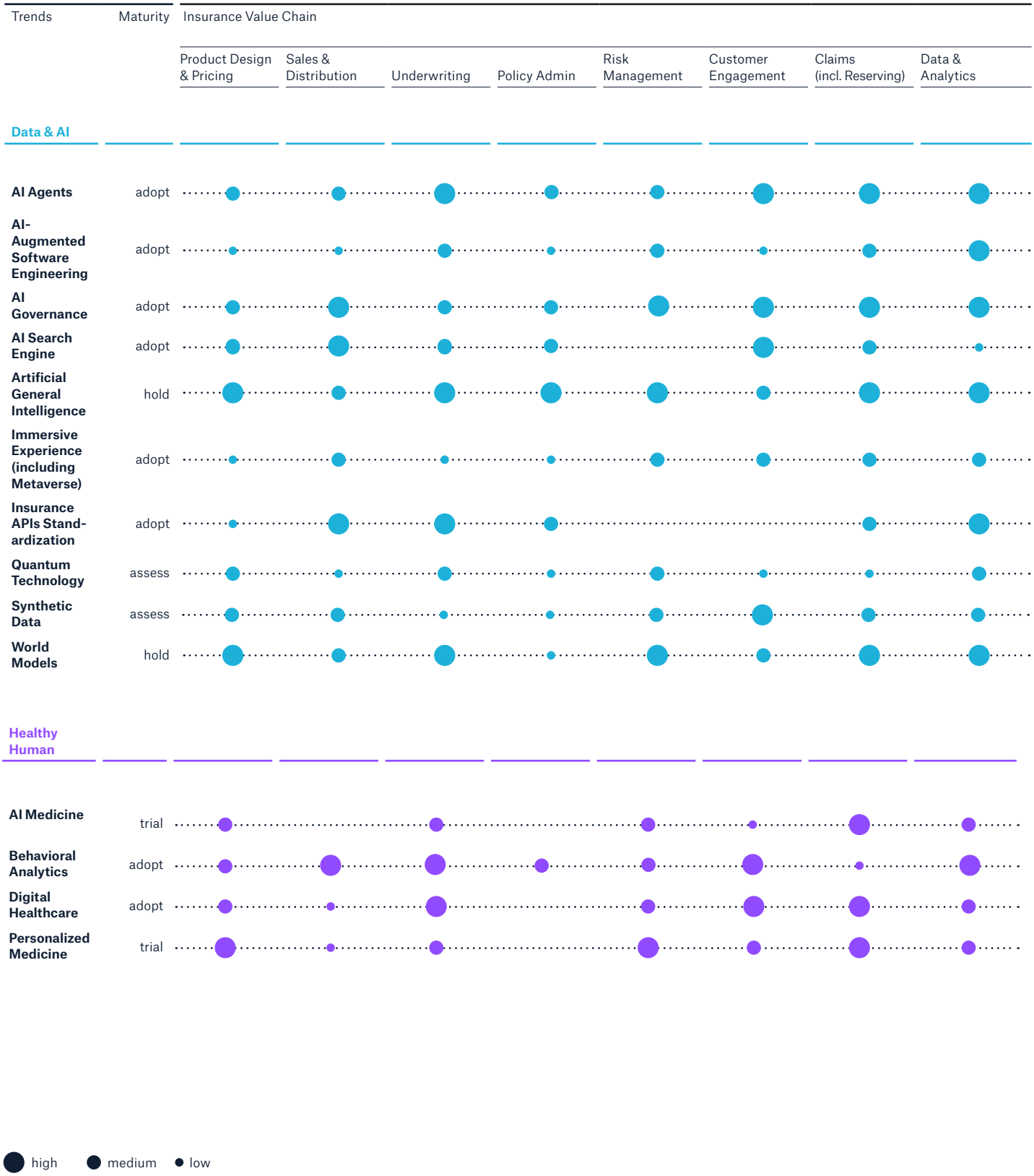
- Use of firewalls, air-gapped environments and network separation ensures that control system assets are isolated from the corporate network. Serial communication protocols are used for transmission substation communications to significantly reduce cybersecurity risks.
- Use of encrypted and secure authentication mechanisms ensures that access to systems is performed in a secure manner. Advanced encryption standards and strong authentication controls are applied. Data storage is performed in binary formats where feasible, with limited reliance on SQL servers where not operationally required.
- Security monitoring and incident response capabilities are in place to enable timely detection, containment, and mitigation of potential cybersecurity incidents.
- Industrial control systems are not directly connected to the internet. Communication is performed via serial-based protocols.
- Secure remote access is enabled through controlled solutions such as Virtual Private Networks (VPNs).
- Default system accounts are removed, disabled or renamed where possible.
- Account lockout mechanisms are implemented to reduce exposure to brute-force attempts.
- Data diodes are deployed for critical large generating assets, allowing one-way, real-time digital data transmission from plant environments to the corporate network.
- Wireless digital systems undergo regular vulnerability testing.

Conclusion

Cyberattacks on OT systems pose a serious risk to business operations, equipment or property. While IT attacks are primarily focused on financial reward, OT attacks threaten the very functioning of an enterprise or critical infrastructure that supports entire regions or industries. Both the frequency and severity of OT attacks are expected to rise. Enterprises must prioritize system upgrades and enhanced security to reduce vulnerabilities and protect these essential systems.

Impact on value chain (1/2)

How technology impacts the insurance business



Impact on value chain (2/2)

How technology impacts the insurance business

Our solutions

Data & AI

aiSure

aiSure provides insurance coverage for losses resulting from errors made by AI systems, including incorrect outputs or flawed predictions.

Insure AI

Automated Underwriting Platform (AUP) for facultative and corporate business

Munich Re F&C´s Automated Underwriting Platform (AUP) bundles all digital insurance solutions for business with facultative risks, as well as corporate insurance coverage.

Automated Underwriting Platform

Cert2Go

Cert2go's fully digital and automated underwriting process enables users to efficiently reinsure small to medium-sized single risks, accelerating workflows and streamlining administrative workload. Cert2go is one of the key technologies for F&C's Automated Underwriting Platform (AUP). Currently, Cert2go is available for all property, as well as a number of casualty lines of business.

cert2go

Location Risk Intelligence

Location Risk Intelligence is a modular SaaS platform that enables clients to understand, measure and manage risks from natural hazards and climate change on a global scale. In underwriting, risk management and portfolio steering, a detailed assessment of exposure is necessary due to the increasing threat of natural disasters.

Location Risk Intelligence

Two new functions in the platform are of particular interest to insurers: "Events", which provides historical and near-realtime information on natural catastrophes, and "Binding Restrictions", which offers automated underwriting decision support. In "Events", mapped footprints of past events support scenario analysis and pricing validation. During ongoing events, insurers can identify exposed policies and estimate potential insured values within the affected area. Post-event data can help verify loss locations and prioritize claims handling. Using "Binding Restrictions", underwriters can automate decisions about quoting or binding new business in areas affected by imminent natural catastrophe risks. When integrated into an underwriting platform like Munich Re's REALYTIX ZERO solution, it automatically prevents policies from being issued until the threat subsides.

REALYTIX ZERO

REALYTIX ZERO is a cloud-based, automated underwriting platform designed to help insurers launch, distribute and scale new or existing products with speed and precision. With REALYTIX ZERO, you can digitize, automate and deploy any insurance product within days – and adapt it in real time using our nocode/lowcode tools and seamless API integrations.

Our new GenAI-driven capabilities, including the CoPilot for even faster product configuration and our advanced Submission Data Intake features, elevate the platform to the next level of underwriting efficiency and innovation.

REALYTIX ZERO

Our solutions

Healthy Human

alitheia

The transformative risk assessment engine and instant decisioning system is designed to help life insurance carriers and distributors efficiently scale, enhance the customer experience, and manage risk – enabling them to grow with confidence.

alitheia

ALLFINANZ SPARK and NOVA

The automated underwriting platform provides life and health insurers with a flexible rule set that allows them to change rules, reflecting their unique underwriting philosophy and business strategy, as well as to integrate third-party data through data exchange.

Automated underwriting solutions

CLARA

The claims assessment solution for life insurers structures disability claims intake with the help of rule-based interviews to streamline the end-to-end process.

Proven to reduce the decision time by 50% when compared to conventional claims handling, this solution results in a better customer experience and more efficient processes, opening opportunities for structured data collection and giving a better understanding of incidence rates for better claims assessment.

CLARA

CLARA plus

This solution for disability calculation allows insurers to automatically calculate the degree of disability, leading to faster claims decisions and higher reactivation rates with lower administration costs.

CLARA plus

Dynamic Risk Calculator Pro

The Dynamic Risk Calculator Pro empowers life insurers to transform their risk assessment workflows. By combining Munich Re's deep risk expertise with alternate data insights, it helps enhance customer onboarding processes with greater speed and certainty. It has been designed for the Indian market.

DRC pro

iRisk

The next-generation risk assessor and selector for primary insurers and reinsurance clients integrates Munich Re underwriting rules, algorithms and risk scoring based on external data sources to provide more accurate risk selection at the application stage.

Munich Re Digital Solutions

Medical Decision Platform

Built for medical underwriting at scale, the Medical Decision Platform reduces manual effort, accelerates customer onboarding and enhances fraud detection in Life & Health underwriting in the Indian market.

MDP

Our solutions

Healthy Human

MIRA PoS

The automated underwriting solution empowers life insurers to make underwriting decisions quickly. The solution is based on Munich Re's underwriting guidelines, regularly updated to reflect the latest risk research and market trends.

MIRA PoS

MIRApply Insured

The web-based applicant interview solution streamlines the application process for life insurers by providing underwriters with reliable risk assessment and a risk-rating proposal based on our constantly updated underwriting guidelines, making the process faster and more accurate while optimizing the customer experience.

MIRApply Insured

Next Generation AI-Augmented Underwriting

The latest underwriting solution for life and health insurers that combines deep domain knowledge, responsible AI, data, modern technology and risk acceptance to assess risks at the point of sale.

Advance with confidence

Predictive Underwriting Solution (Predictor)

Predictor is an additional module to the SPARK or NOVA system, leveraging predictive technologies to enhance underwriting processes with an increased processing rate, reduced evidence collection and improved customer experience.

AI for insurance

SHIELD

Our claims system is designed to allow health insurers to automate their medical claims adjudication, detect potential fraud, waste, and abuse, and justify denials with the right medical reasoning.

SHIELD

SMAART

SMAART is a comprehensive claims reserving, portfolio monitoring, and pricing system for health insurance businesses, providing a 360-degree view of performance and enabling the management of portfolio profitability. It offers tools to manage health business reserves, monitor policy and product performance, handle renewals, and inform pricing decisions, all while considering factors like seasonality and medical trends to make accurate projections. SMAART is leveraging a user-friendly experience and robust, actuarially-sound methodology.

SMAART

Our solutions

Cyber & Crypto

Cyber Navigator

Cyber risk management for personal lines
Cyber Navigator is a personal cyber-safety platform that helps individuals and families proactively manage digital risk across their identities, devices, finances and online activity. Users have access to cybersecurity experts through Cyber Concierge, who provide practical guidance to help interpret alerts and take effective action when needed.

The platform combines identity and credit monitoring, personal data removal, privacy and device-protection tools, and ongoing education with clear, prioritized recommendations. By pairing continuous monitoring with actionable guidance and expert support, Cyber Navigator helps people recognize threats early, prevent fraud and account compromise, and respond quickly when issues occur – turning cybersecurity into a manageable, everyday practice rather than a reactive response.

Cyber Navigator

Cyber Safety

Cyber risk management for commercial lines
Cyber Safety is HSB's continuous cyber risk management platform designed to help small and mid-sized businesses proactively reduce cyber risk and improve resilience. The platform combines automated vulnerability scanning, dark-web credential monitoring, website and application assessments, and actionable remediation guidance with employee training, policy management, and one-on-one advisory from cybersecurity experts.

Rather than focusing only on incident response, Cyber Safety helps organizations continuously identify weaknesses, prioritize improvements and implement practical safeguards across people, processes and technology. The result is measurable reduction in exposure to common threats such as phishing, credential compromise and ransomware, while also improving cyber maturity, supporting compliance and improving underwriting outcomes.

Cyber Safety

Digital Asset Protection

Cyber risk management for personal lines
As the blockchain ecosystem matures, it introduces new and complex risk exposures for businesses and investors operating in the digital asset economy. The continued growth of digital assets and decentralized applications is driving demand for specialized insurance solutions that enhance operational resilience and market confidence. Munich Re's Digital Asset Protection Solutions are designed to address these evolving risks by combining deep risk expertise with tailored insurance capabilities, helping clients safeguard digital assets and operate securely in an increasingly dynamic environment.

Digital Asset Protection

HSB Home Cyber Protection

Homeowners are becoming increasingly vulnerable to cyber threats as their personal and professional lives become more connected. With over 15 years of expertise in cybersecurity, HSB offers products and services to help homeowners mitigate these risks, respond to breaches and recover from cybercrimes, providing them with the necessary knowledge and support to protect themselves in a rapidly evolving digital landscape. Recently enhanced with HSB's proprietary Cyber Navigator risk management services, HCP offers a distinctive combination of insurance and service capabilities, positioning it strongly in the market.

HSB Home Cyber Protection

Squalify

As a wholly-owned subsidiary of Munich Re, Squalify provides a software-as-a-service platform that helps companies quantify and manage cyber risk. It uses a battle-tested model, licensed from Munich Re, to provide realistic financial loss metrics and transparency on cyber exposure. Squalify has access to industry-leading data from over 1 million cyber claims, combined with proprietary algorithms, allowing for accuracy and scalability. By transforming complex cyber risk data into clear, financial insights, Squalify enables decision-makers to evaluate cyber risk, prioritize investments and align cybersecurity strategies with business objectives.

Cyber Risk Quantification for the Boardroom

Our solutions

Redefining Industries

Epidemic and Pandemic Risk Solutions

Epidemic and Pandemic Risk Solutions (ERS) provide comprehensive risk transfer and investment solutions to protect against catastrophic disease outbreaks. This offering addresses the insurance gap for non-damage business interruptions caused by epidemics. It includes coverage for business interruption, temporary site closure and other specific epidemic-related risks. The solutions are tailored for various industries, including hospitality, manufacturing, retail, mining and construction, leveraging proprietary models and strategic partnerships to ensure robust risk management. More broadly speaking, pandemic specialty risk covers are also available for other lines and cedents, such as Affirmative Pandemic Reinsurance. Munich Re's ERS function as market maker and Munich Re has a Unique Selling Proposition in this field.

Epidemic and pandemic risk solutions

FIVE

FIVE provides investment indices for savings and retirement products, accessible via reinsurance with Munich Re Markets. It offers a diversified, rules-based approach to manage risk and potential returns. FIVE supports insurers by bundling investment and guaranteeing components, ensuring cost efficiency and robust product expectations. It provides access to a broad investment spectrum and can be implemented efficiently in liquid markets. FIVE's strategies are designed to be transparent and aligned with client performance goals.

FIVE

Infrastructure Risk Profiler

Infrastructure Risk Profiler is a comprehensive service designed to enhance the performance of infrastructure investment portfolios. It provides a detailed analysis of six key risk dimensions: macroeconomics, technology, natural hazards, execution, operations, and market conditions. This approach allows investors to make informed, reliable decisions by understanding the overall risk profile of their projects. The service aims to save time and money while boosting investor confidence through transparent and thorough risk assessments.

Infrastructure Risk Profiler

IoT Sensor Solutions

Insurers are increasingly using Internet of Things (IoT) sensors to strengthen risk prevention, elevate customer experience and unlock new product and coverage opportunities. Sensor Solutions by HSB®, part of Munich Re, helps insurers design and implement sensor-based programs across commercial and personal lines to address common risks such as water leakage, frozen pipes, fire, and equipment failure. By combining real-time sensor data with customer interaction and operational data, we deliver data intelligence and AI-driven risk insights that help predict and prevent losses, improve portfolio performance and enable more proactive engagement with policyholders.

Internet of Things (IoT)

1.2.5 Talaria

Talaria is an embedded credit insurance solution designed to streamline end-to-end credit underwriting for small and medium-sized enterprises (SMEs). Integrated seamlessly into B2B platforms, it enables efficient invoice data processing and automated credit assessments. Talaria leverages Munich Re's expertise in data analytics and machine learning to deliver risk-intelligent scoring and underwriting decisions. This solution reduces manual effort, improves decision accuracy and makes credit evaluation more accessible and efficient for SMEs.

Talaria Solutions

Team

Martin Thormählen
Senior Program Manager, Lead Tech Trend Radar, Munich Re

Daniel Grothues
Chief Architect Primary Insurance, ITERGO

Marius Bloch
Business Analyst, Munich Re

Michal Nejthardt
Head of Digital Solutions South Africa and SSA,
Munich Re Africa Branch

Georgina Neitzel
Head of Innovation Lab, ERGO Group AG

Dr. Esther Nagel
Consultant Business Development, Munich Re

Michael Hild
New Work Evangelist, Munich Re

Daniela Schuler
Enterprise Architect, ERGO

Contributors

Andreas Schumacher
Project Manager Artificial Intelligence, Munich Re

Bernhard Müller
Underwriting Manager Power & Utilities, Munich Re

Christian Bernecker
Solutions Architect Data & AI, Munich Re

Daniel Ansons
Senior Consultant, Munich Re

David N. Fischer
Senior Product Manager, Climate Risk, Munich Re

Dr. Hao Liu
Chief Medical Propositions Officer,
Asia, Africa Pacific Region, Munich Re

Dr. Andre Knoerchen
Head of New Tech Underwriting, Munich Re

Dr. Andreas Nawroth
Leading Expert AI and Quantum, Munich Re

Dr. Bernhard Schlegel
Senior Technical Data Specialist, Munich Re

Dr. Meike Mischo
Head of Digital Transformation, ERGO Group AG

Dr. Nivien Shafik
Head of AI Governance & Strategy, Munich Re

Dr. Pamela Chetty
Chief Medical Officer for South Africa and SSA,
Munich Re Africa Branch

Dr. Tobias Aigner
Senior Project Manager, New Energy, Munich Re

Florian Eberl
Technical Architect, Munich Re

Luisa-Marie Schmolke
Innovation Developer, ERGO Group AG

Matthias Nawrocki
Head of Metaverse, ERGO Group AG

Milan Kästner
Risk Analyst, New Tech Underwriting, Munich Re

Neil Munro
Principal, Insurance Consulting, Munich Re

Paul Morris
Principal Engineer, Insurance Engineering, HSB

Sandro Monaco
Senior Underwriter, Munich Re

Sebastian Sehr,
Lead of Digital Health, ERGO

Thibault Imbert
Principal, Insurance Consulting, Munich Re

Thilo Horner
Senior Product Manager, Insurance Solutions, Munich Re

Dr. Timothy Meagher
VP & Medical Director, Canadian Market, MLMC, Munich Re

Vincenzo Pagliuca
Principal Electrical Engineer, Insurance Engineering, HSB

Walter Proença
Agro Underwriter, Munich Re

Contact Munich Re

Martin Thormählen
Lead Tech Trend Radar
Business Technology
Munich Re
mthormaehlen@munichre.com

Contact ERGO

Daniel Grothues
Chief Architect Primary Insurance
daniel.grothues@itergo.com

Picture credits: Organic Media / Getty Images; Yuichiro Chino / Getty Images; Eugene Mymrin / Getty Images; Eugene Mymrin / Getty Images; Moyo Studio / Getty Images; piranka / Getty Images; Luis Alvarez / Getty Images; Andrew Brookes / Getty Images; 00one / Getty Images; Micha Pawlitzki / Getty Images; gerenme / Getty Images; Andriy Onufriyenko / Getty Images; piranka / Getty Images; Me 3645 Studio / Getty Images; aire images / Getty Images; Westend61/ Getty Images; Alllex/ Getty Images; Yaroslav Kushta / Getty Images