ERGO | Munich RE

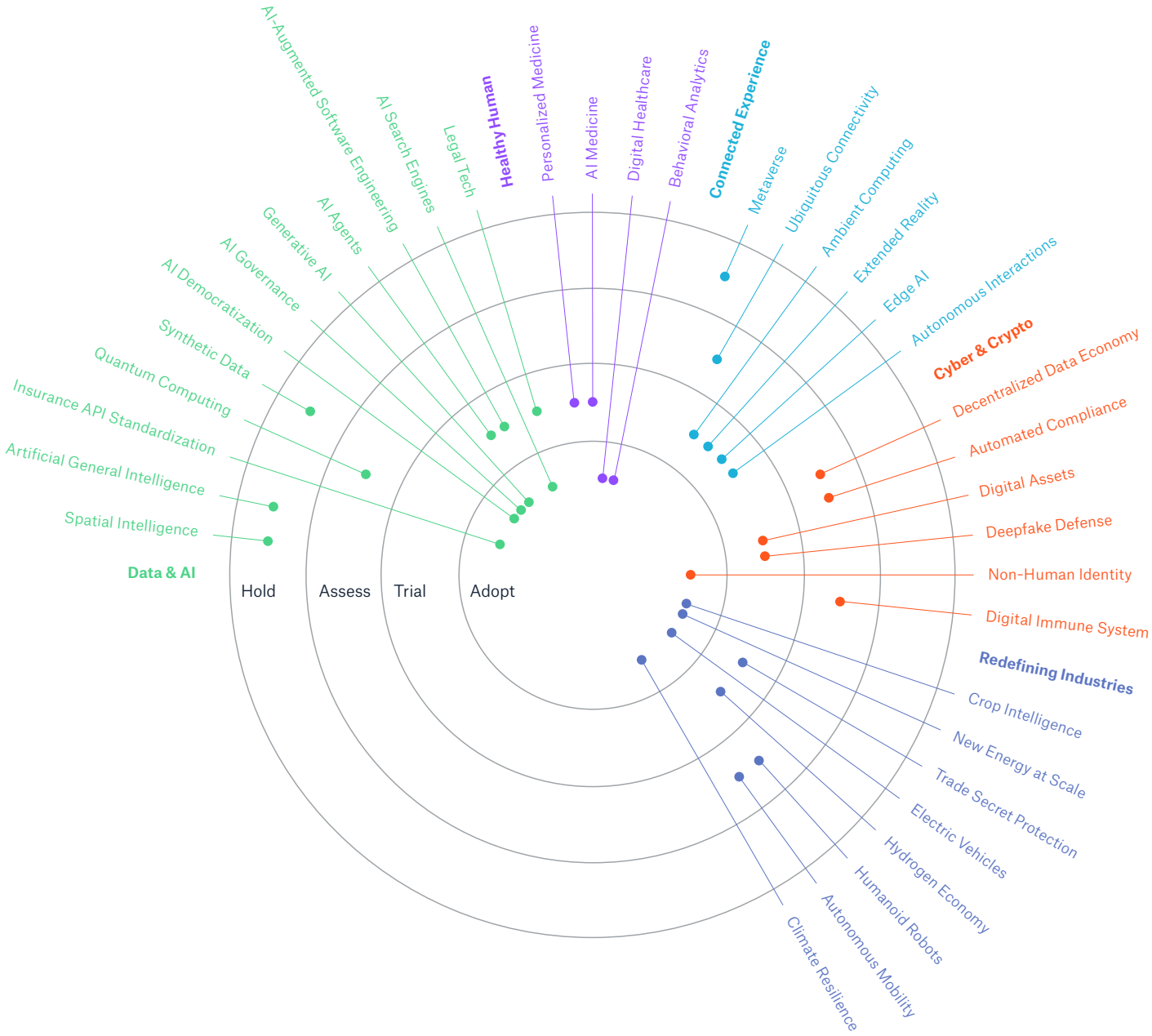
Tech Trend Radar 2025

What innovations will transform insurance in 2025? Explore our expert assessment

Introduction

The Tech Trend Radar 2025, a collaborative initiative of Munich Re Business Technology and ERGO IT Strategy, provides essential information on technology-driven trends relevant to insurance companies. Prepared by insurers and for insurers, it aims to raise awareness, spark new discussions, and unlock new business opportunities.

By leveraging insights from various business and strategy functions within Munich Re Group, and those actionable and objective insights from Gartner® research, the radar offers a comprehensive overview of the latest tech trends, their maturity, and their relevance for the insurance industry, helping insurers make informed decisions and drive growth.



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Foreword

Message from the CEO

Technology is a driving force behind insurers' business success and has long since ceased to be just a supporting factor. The latest edition of our Tech Trend Radar highlights the key trends shaping our industry, for example AI Agents, Spatial Intelligence or Digital Healthcare.

Technological advancements not only have the potential to transform our industry processes and dynamics. At the core of our business, they can act as a catalyst for the emergence of completely new risks, which challenges us and at the same time opens up opportunities. The same technologies that bring efficiency and innovation often also create new vulnerabilities and liability challenges.

In the past, the dual nature of technology has always given rise to new insurance solutions, such as car insurance with extended warranty for electric vehicles, cyber insurance or AI performance guarantees.

Understanding new technologies, their applications and risks, and developing customized insurance solutions for clients based on technological expertise and sound judgement is more crucial than ever for achieving or maintaining a leading competitive position.

We want the expertise gathered in this Tech Trend Radar to help our clients navigate new business opportunities, find the best route to increased operational efficiency and ultimately create more value for everyone on board.

I invite you to explore Tech Trend Radar 2025 and join us on this journey.

Sincerely yours,

Joachim Wenning

Joachim Wenning,
Chair of the Board of Management
Munich Re

Foreword

Tech Trend Radar 2025 – Insurance in the age of intelligence

In 2025, Artificial Intelligence (AI) is a success-critical technological dynamic for the insurance industry, though hardly the only one. To thrive in this fast-changing environment, insurers need a clearly defined long-term strategy and a laser-sharp focus on how technology can help them get ahead.

Our 12th edition of the Tech Trend Radar serves as a guide to navigating these complexities, while also shedding light on the forces currently shaping the industry.

Investments in technology – be it AI Agents, Non-Human Identities, or Spatial Intelligence – should not be made for novelty's sake but to enhance operational efficiency, and to streamline all processes, from sales and underwriting to claims handling. At the same time, an acute awareness of market dynamics is crucial. What appears revolutionary today will become a commodity tomorrow, making it ill-advised to lock into expensive software solutions or develop everything in-house. Instead, the focus should lie on investments that deliver a lasting competitive advantage, while partnerships can be leveraged for those capabilities that won't help set the company apart from its competitors.

Beyond the optimization of insurance processes through AI and automation, this year's Tech Trend Radar highlights major shifts in the industry. The essential ability to access and standardize data – particularly through sources like electronic health records (EHRs) in the life and health sector and ACORD in property and casualty business – is transforming underwriting and paving the way for more accurate and informed risk assessments. At another level, the energy transition, with new opportunities from renewables to energy storage and a growing electric vehicle infrastructure, is unlocking new opportunities in specialty and motor insurance.

At the same time, cyber risks are growing in step with technological progress, underscoring the need for robust protection (which also stands to benefit from technological advances). And rapid evolution always pose challenges for insurers: the need to understand the complex associated risks as quickly and thoroughly as possible, and to mitigate them through innovative risk transfer solutions.

Nevertheless, insurers are well positioned to continue balancing their ability and expertise, so as to align technological ambitions with strategic foresight.

Warm regards,
Martin Thormählen & Daniel Grothues

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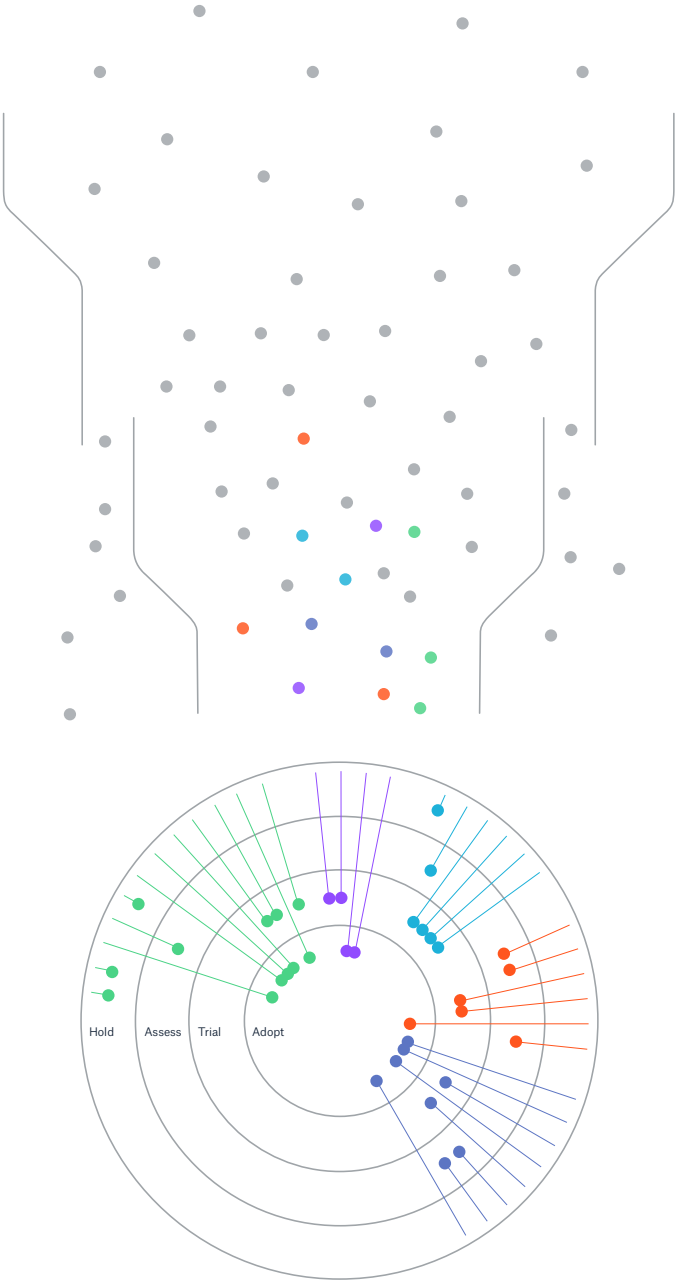
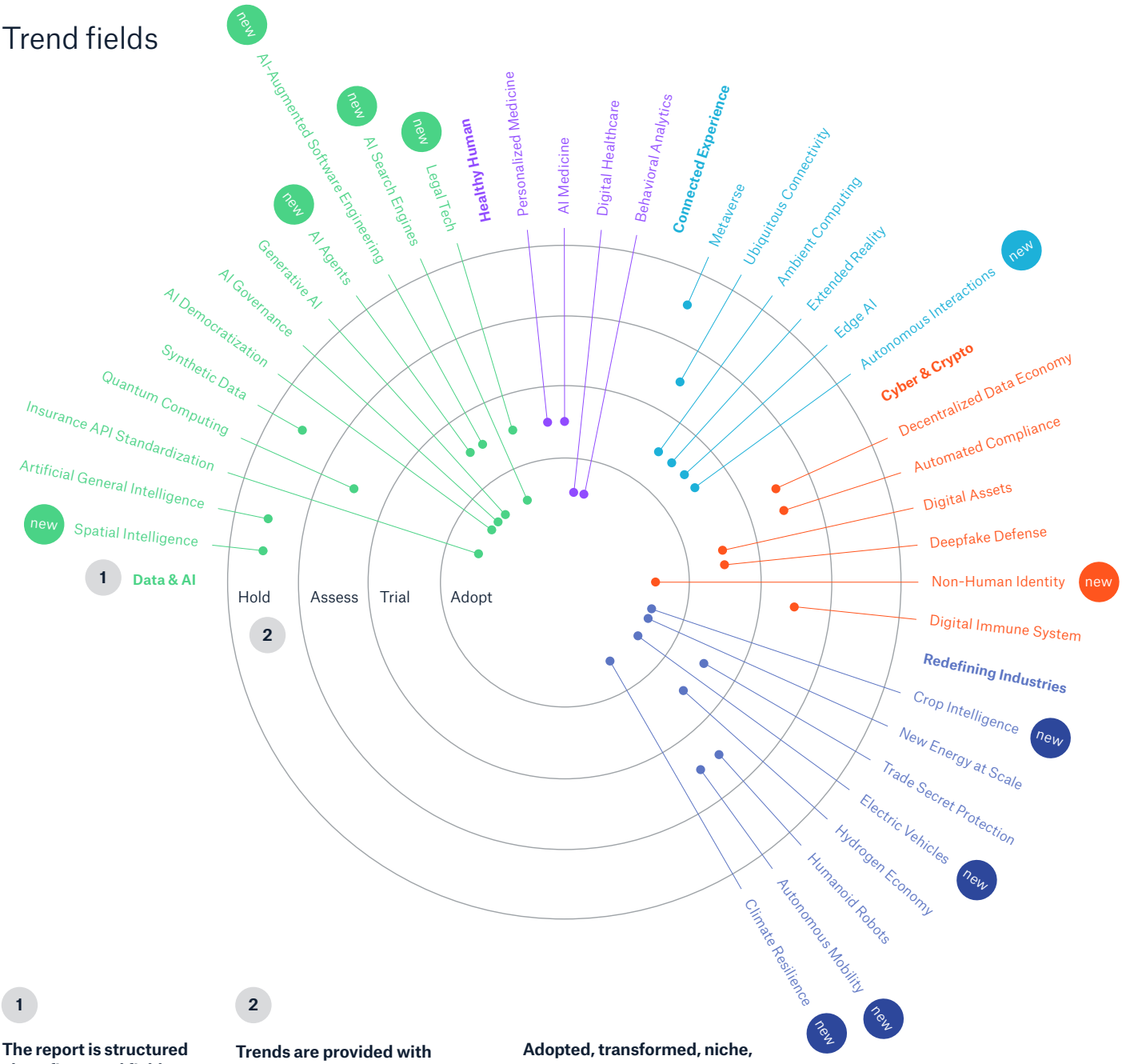
Our approach

Process	Result
Step 1: Screening Analysis of trend developments Compiling developments and new trends for 2025 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 chainand 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 five primary fields – and screening for "outdated" trends. Further drill-down and validation with market data and identification of corresponding use cases. Disclaimer: References to companies do not constitute or imply endorsement of any company or organisation.	Selected trends
Step 3: Evaluation Assessment of impact and relevance Classifying trends according to their level of relevance for ERGO and Munich Re. Analysing trend impact along the insurance value chain and deriving opportunities and risks.	5 Trend fields 36 Trends (11 new, 4 transformed, 9 adopted, 5 niche, 2 expired trends)



How to read this report

Trend fields



1

The report is structured along five trend fields

- Data & AI
- Healthy Human
- Connected Experience
- 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 under-wayin the most affected business areas

Assess
Consider what it maymean for your business

Hold
Add it to your watch list

Adopted, transformed, niche, or expired trends

- Adaptive AI (transformed into AI Agents)
- Data Centric AI (adopted)
- Knowledge Graph (adopted)
- Data Mesh (adopted)
- Human Enhancement (niche)
- Robotic Health (niche)
- Biomanufacturing (niche)
- SuperApps (adopted)
- Automotive IoT (adopted)
- Data Fabric (adopted)
- Edge Computing (transformed into Edge AI)
- Privacy Enhancing Tech (niche)
- Digital Identity (adopted)
- Blue Economy (part of Munich Re Marine Radar)
- Business Resilience (adopted)
- In Space Economy (niche)
- Autonomous Things (transformed into Autonomous Mobility)
- Smart Cities (expired)
- Robotic Revolution (transformed into Humanoid Robots)
- Connected Motor Insurance (adopted)
- Carbon Capture (expired)

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.

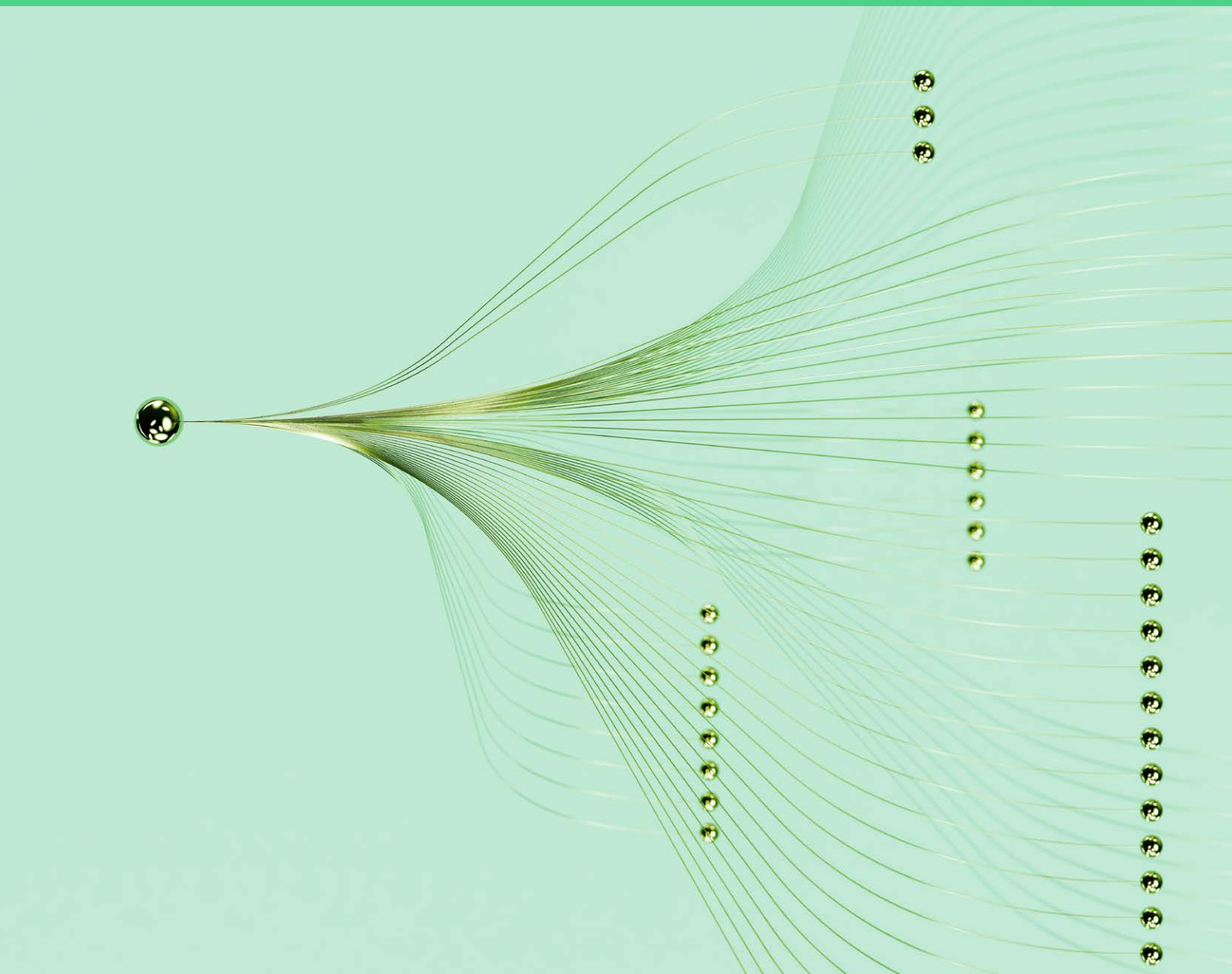
Underlined text indicates links that will take you to the corresponding website.

Colour coding

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

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

1 Data & AI



Data & AI

Trend evolution and impact on the value chain

Data & AI

Data, AI, and the future of insurance: Navigating the intersection of technology and expertise

Not a day goes by without AI capability updates or breakthroughs in infrastructure, foundational models, AI-based systems and new AI investment announcements. And many of these can be translated directly into impacts for our insurance industry: how customers search for insurance products and services will be disrupted by AI-based solutions – which means that relying on classical search engine optimization (SEO) will no longer be enough.

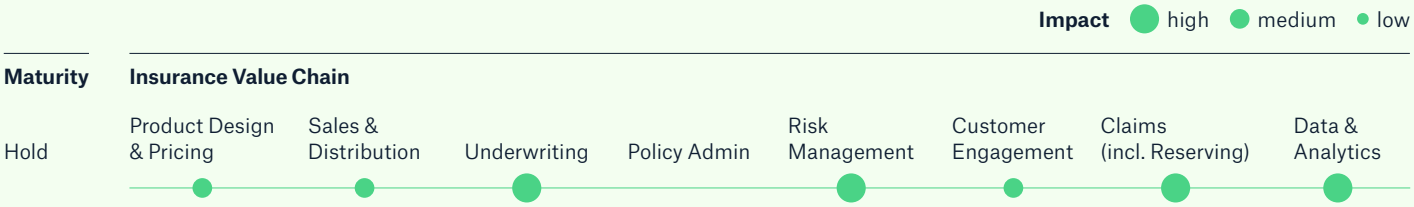
Generative AI is transforming the way how we classify and extract data from documents supplied by brokers, surveyors and insureds. As predicted by Andrew Ng in 2024, the technology has advanced to AI systems with rudimentary reasoning and memory capabilities, which allows insurers to leverage AI for more complex tasks in e.g. underwriting triage and claims triage. And it has also boosted legal technology, helping lawyers and legal teams in all industries to create and review legal documents.

The hype around AI Agents will plateau in 2025, when insurers realize that they first need to differentiate between plain automation, AI workflows, and truly autonomous AI Agents. The current language-based LLMs, LMMs and AI Agents can't understand concepts like 3D or gravity. Accordingly, we have now added Spatial Intelligence to our radar and are curious to see how this technology will evolve. With all the excitement surrounding AI in the media, at home and in our offices, we again address the paramount importance of practicing and monitoring AI Governance.

The trend field was deliberately named Data and AI to emphasize three aspects: that without a solid foundation of data, neither pricing nor AI solutions can be meaningfully grounded and developed; that without evaluation data, AI solutions cannot be sufficiently validated; and most importantly, that AI is not needed if partners exchange digital data directly, which also brings the trend of insurance API standardization back into focus.

Data & AI

Spatial Intelligence



Opportunities

- Enhanced risk assessment through advanced geospatial data analytics
- Proactive disaster management with real-time geospatial data integration
- Customized insurance products for unique regional communities and businesses

Risks

- Data privacy concerns with increased use of geospatial data
- Dependence on technology for risk assessment and management decisions

Overview

AI has progressed from speech and text to 2D image and video reasoning and generation, and is now expanding to create spatial intelligence, which refers to the ability to understand and navigate three-dimensional spaces and environments. The next frontier involves developing a "Large World Model" that not only comprehends the real world in 3D but also incorporates physical laws like gravity. However, the timeline for the availability of this model as a foundation for spatial computing remains uncertain. Insurers will be able to not only visualize and interpret spatial relationships but to develop more accurate pricing models and better risk assessments. As catastrophic events become more frequent, integrating spatial intelligence offers a path to better risk management and operational efficiency, ultimately leading to improved customer satisfaction and reduced losses.

The power of geo-spatial data

The insurance industry is undergoing a significant transformation in risk assessment and risk management, driven Zby technology. Spatial intelligence, the ability to understand and interpret spatial relationships between different entities, is emerging as a critical technology trend. This trend has been fuelled by advances in geospatial analytics, satellite imagery, and Artificial Intelligence (AI). 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 who also established the famous ImageNet, emphasize the importance of spatial intelligence in enabling AI systems to process visual data, make predictions, and act on those predictions in real-world environments. Li emphasizes the importance of spatial intelligence in enabling machines to interact meaningfully with humans and their environment. Her work focuses on developing AI models capable of understanding three-dimensional spaces, bridging the gap between visual perception and physical interaction (more here). Li asserts that achieving true spatial intelligence will open up new applications in various fields, including healthcare, robotics, and urban planning.

Researchers at Texas A&M University have also explored the potential of spatial reasoning capabilities in AI, demonstrating the need for enhanced algorithms to improve machine understanding of complex three-dimensional transformations. Their findings suggest that while current AI models show promise in visual learning tasks, they still struggle with higher-level spatial reasoning tasks compared to humans (more here).

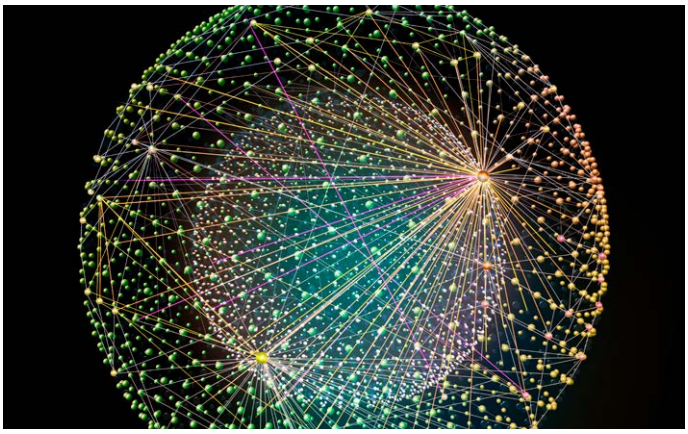
In recent years, the insurance industry has made remarkable progress in leveraging cutting-edge technologies such as Artificial Intelligence (AI) with Natural Language Processing (NLP),Large Language Models (LLMs), and Multimodal Models. In addition, advances in aerial imagery and drone technology have greatly enhanced our ability to collect and analyze data.

However, despite these achievements, the ultimate goal of achieving true spatial intelligence 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. While we have made significant progress in various areas, creating a sophisticated world model that can accurately simulate and predict real-world scenarios remains a challenging and ambitious goal. Initially relying on historical data and broad geographic zones to assess risk, the industry is now moving toward more precise models that incorporate real-time geospatial data. 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 spatial intelligence in insurance

The future outlook for spatial intelligence 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. 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 (RMP).

In addition, as consumers demand more personalized services and proactive risk management solutions, insurers that leverage geospatial intelligence will be well positioned to meet these expectations. Fei-Fei Li's work on AI emphasizes the importance of machines understanding physical space through advanced algorithms capable of extrapolating visual data into three-dimensional environments. This trend aligns closely with the insurance industry's need for improved risk assessment capabilities. By leveraging AI alongside geospatial property intelligence, insurers can gain unprecedented insight into location-specific risks. By integrating geospatial property intelligence into daily operations, insurers can navigate the complexities of climate change with greater confidence and precision.



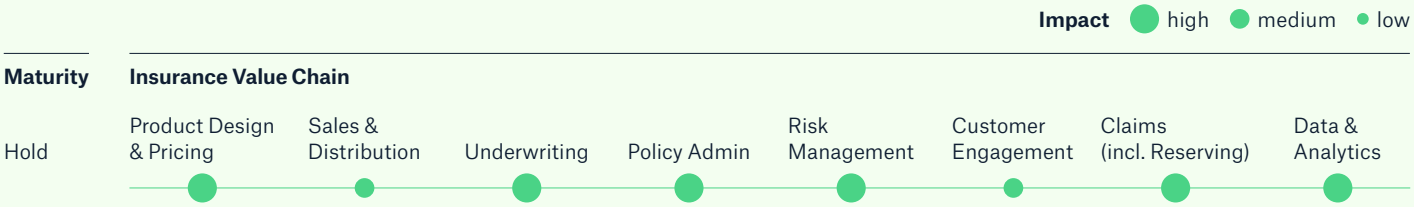
Conclusion

Spatial intelligence is expected to greatly impact the insurance industry by enhancing risk assessment capabilities, streamlining underwriting processes and improving claims management efficiency. By integrating insights from expert research into AI's evolving understanding of spatial relationships with perspectives from other experts in the field, insurers can better address the challenges posed by climate change and catastrophic events.

However, it is important to recognize that we are still in the very early stages of truly understanding spatial relationships in the context of both human cognition and machine learning. True spatial intelligence – where machines fully understand complex environments as humans do – remains a goal for future research and development. As we move towards this goal over time, improving our understanding of spatial intelligence will be key to unlocking new opportunities not only in the insurance sector, but in many other areas where effective decision-making relies on accurate interpretations of space.

Data & AI

Artificial General Intelligence



Opportunities

- Potential to revolutionize most industries
- Improved information extraction and analysis
- Solution for technical tasks like coding
- Automation and optimization can reduce costs and improve overall efficiency.

Risks

- AGI could act in ways that are unpredictable and/or harmful if not properly controlled.
- It may be difficult to align AGI systems with our human values.
- Some experts worry that AGI could pose existential risks to humanity.

Overview

There is no universally accepted definition of Artificial General Intelligence (AGI), but it is associated with an AI system that can exhibit human-like capabilities in most domains. While we don't know when or if we will reach AGI, AI progress in recent years has been faster than expected, and there is confidence that it will continue for some time.

It is assumed that we will see five levels of AI until we reach AGI, and that each level will enable different use cases. These levels can also help us to understand where we are in the development of AGI and how fast we are moving. In particular, they may help to anticipate what will come next and, as a result, how to prepare for upcoming opportunities.

The definition of AGI

When it comes to the topic of AI, the question as to when we will reach Artificial General Intelligence (AGI) has been asked increasingly of late. As there is no universally accepted and accurate definition of AGI, it may be more helpful to think of AGI as a milestone in the development of AI. This development started with simple rule-based and statistical systems and progressed to machine learning (ML) systems.

The next milestone came in the form of narrow AI systems, i.e. systems that have human-like capabilities in a very narrow domain like playing chess, but are useless in other domains. The next expected milestone is artificial general intelligence (AGI) where an AI system can exhibit human-like capabilities in most domains. Further in the future, artificial super intelligence (ASI) is envisioned, where an AI system would exhibit super-human capabilities in most domains.

To make the AGI milestone more precise, recent definitions of AGI focus either on the kind of capabilities, like OpenAI's approach, or the level of capability, like Google's approach. We will use here the leaner approach from OpenAI. Finally, the discussion is moving away from a one-dimensional human–AI comparison to a more nuanced multi-dimensional comparison, which is often referred to as the "jagged frontier".

The path to AGI

If we follow the OpenAI definition of AI, we should see five levels of AI before we reach AGI at the fifth level:

Level 1 - Conversational AI: The system can interact in conversational language with people.

Level 2 - Reasoning AI: The system can perform basic problem-solving tasks through reasoning.

Level 3 - Agents: The system can take actions and use tools on a user's behalf to complete tasks.

Level 4 - Innovators: The system can develop innovations and improve existing processes.

Level 5 - Organizational AI: The system is capable of performing the work of an entire organization.

Right now, it is believed that we have reached level 2 and that we entered level 3 in 2025, much faster than most people would have believed five years ago. The question as to whether and when we will reach level 4 and 5 is open for debate. Each of these levels offers different opportunities for companies. Level 1 enables information systems, where either the system answers a question directly or retrieves relevant information. Level 2 enables reasoning, helping to solve technical problems (e.g. coding or medical diagnosis/treatment). Level 3 enables agentic process automation and information analysis (e.g. deep research by Google, OpenAI and Perplexity).

Current technological paths to improve AI

The first and initial strategy to improve current AI systems is to increase Training Compute (TC) i.e. the compute resources during model training. While some progress is being made here, especially combined with higher quality data, it seems that returns are diminishing. In more recent times, Test Time Compute (TTC) has been used, where we do not increase the compute for training the model but rather for inference, i.e. the model is given more time and resources to "think" before it answers. One example of this paradigm is the "o" family of models from OpenAI. This currently seems to be more cost-effective than the first strategy. The third strategy involves using a set of specialized models that collaborate instead of a single general-purpose model.

Another strategy is to allow AI systems to use tools (e.g. code execution), dramatically increasing performance in certain domains (e.g. math) with the potential to reduce hallucinations if grounding through internal data or internet access is allowed. There are other more elaborate strategies, especially to increase the data available or to improve the architecture of the AI models.

Emerging risks

As AI systems become more and more advanced, it becomes more and more difficult to ensure that the output and actions of the AI system are aligned with certain principles, which is referred to as the alignment problem. An ambiguous prompt may lead to unintended consequences, especially if the system is at Level 3 or higher, meaning that it can take actions. Some people are even arguing that these systems could give rise to existential risks. In order to avoid unintended consequences, guardrails, strictly controlled access to data and systems, and proper architecture is essential. Understanding and monitoring the reasoning steps for these systems and the conversation between agents will also become key.

Implications for companies

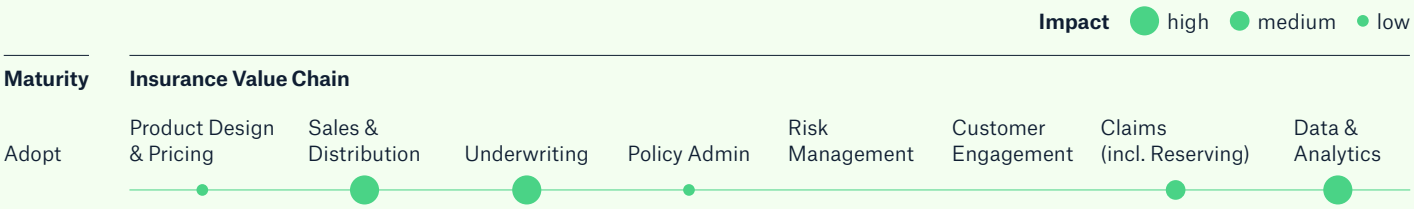
AI, especially at the level of AGI, is a powerful tool that will fundamentally change the way we work and do business. While it offers many opportunities, these will have to be balanced with appropriate risk measures, as with any other powerful technology. The insurance industry has a specific role to play here with regard to risk assessment and pricing. It will be crucial for all companies to understand that each of the five AI levels enables different use cases and that timing is critical to creating economic value. The five AI levels can be used to understand where we currently are and how quickly the technology is moving, but in particular, they can also help to anticipate what will come next, how to prepare and how to realize upcoming opportunities.

> AGI development is moving fast. Understanding it helps us to prepare and realize upcoming opportunities.

Andreas Nawroth
Leading Expert AI & Quantum

Data & AI

Insurance API Standardization



Opportunities

- Significantly better customer experience due to faster response times
- Improved efficiency and savings by automating data entry and reducing errors
- Critical interoperability capability for seamless data exchanges with new distribution partners

Risks

- 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

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, efficiency and security. It makes collaboration faster and easier, whether it involves transferring risk, handling claims or developing new products. In the long run, this standardization will lead to significant cost savings, improved customer experience and providing greater flexibility to innovate. 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 2025: 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 PDF files and submit them to their insurer via email or portals. Yet another distribution partner also creates PDFs 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.

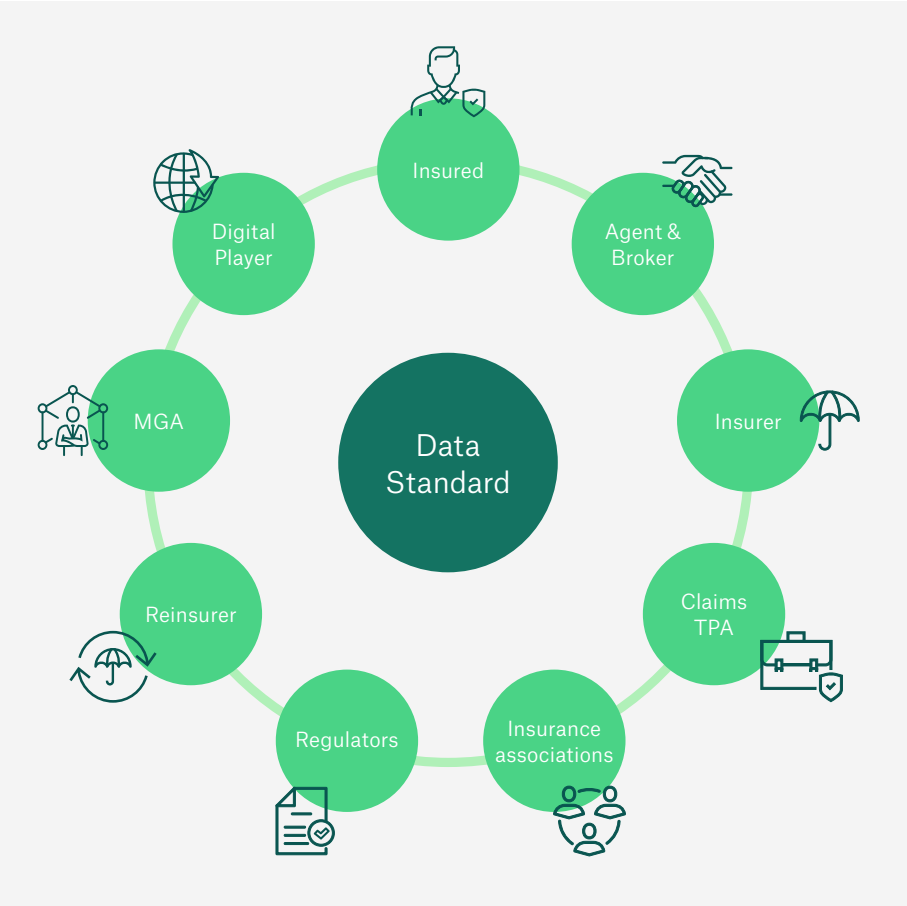
Efficiency impact on companies
When adopted company-wide, data standards streamline operations, enhance team collaboration and increase productivity. They reduce the time spent on data collection, allowing teams to focus on higher-value tasks and thereby boosting talent retention and satisfaction. Adopting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

Efficiency impact on 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.

Efficiency impact on 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.

Efficiency impact on 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.

Figure: Insurance Stakeholder Map
Insurance stakeholder who will benefit from data standardization.



Source: Munich Re

Real-life examples

ACORD data standards
The Association for Cooperative Operations Research and Development (ACORD) is a globally active standards-setting body for the insurance industry, as well as for related financial services industries. Many global reinsurers, insurers and brokers are members of the so-called Ruschlikon initiative, where insurance data standards are discussed and defined.

LMA
The Lloyd's Market Association is advocating for the adoption of ACORD data standards throughout the insurance risk placement and processing lifecycle.

BiPRO e.V.
BiPRO e.V. is a registered association in Germany that promotes data and exchange standardization and implements IT solutions for process optimization between brokers, agents and insurance companies. More here.

FIDA
On December 4, 2024, the European Council agreed to make consumers' financial data more accessible in order to foster transparency and comparability. Read here.

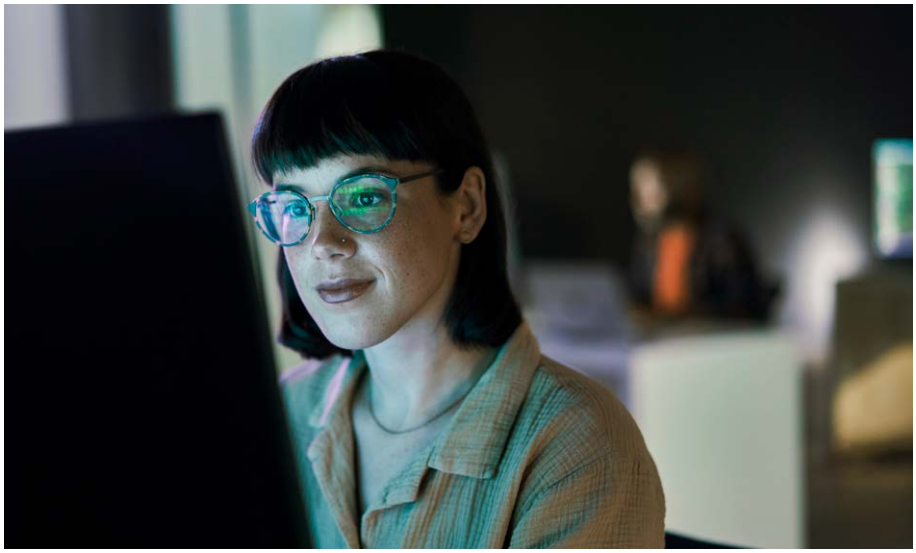
The future of API Standardization in insurance

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
- 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

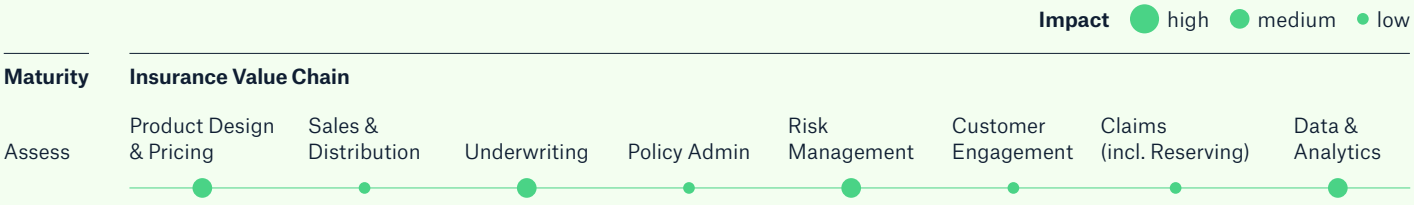
Data and API standardization is the key to unlocking the full potential of digital transformation in the insurance industry.

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



Opportunities

- Quantum Computing (QC) could solve complex problems in weather and climate predictions, battery development, finance, pandemics, logistics, cyber and AI.
- First early applications in estimating extreme risks or asset pricing
- High probability of substantial advancement in QC technology over the next few years

Risks

- Timing of quantum advantage difficult
- QC may endanger current technologies such as IT-security protocols and blockchain
- Access to hardware and stability of early quantum devices may become a bottleneck

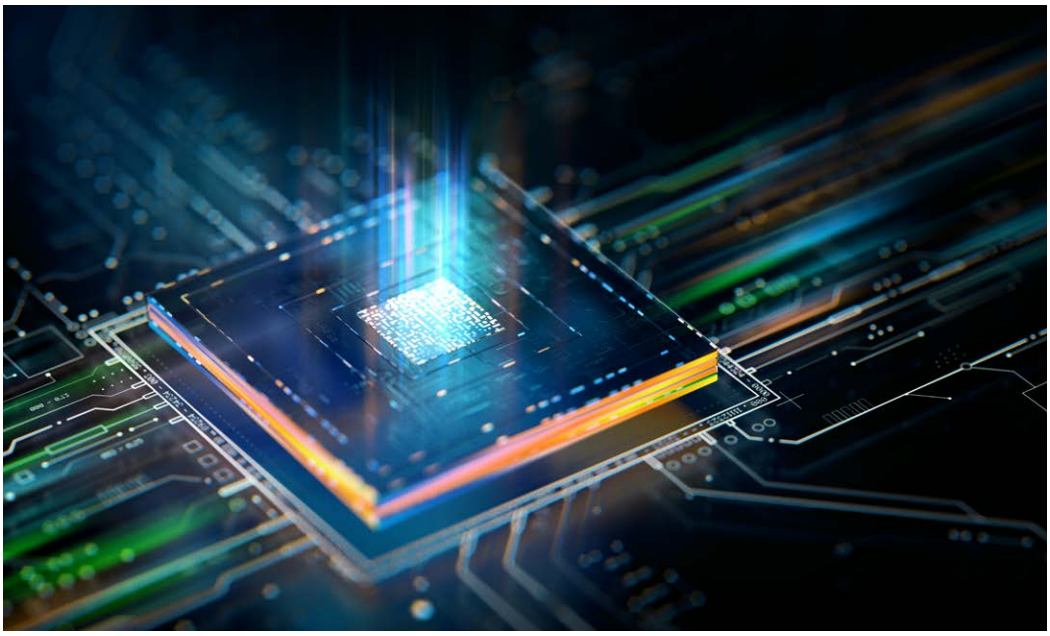
Overview

Quantum computing (QC) has made significant strides in recent years. It has seen notable advancements in qubit counts and stability. Despite progress, quantum computing still faces significant hurdles. Current quantum computers do not yet offer a tangible advantage over classical computers for most applications. The field continues to attract substantial investment, especially in the US and China. 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.

Unlocking quantum potential

The unprecedented power of Quantum Computing (QC) could trigger a new wave of technological advancement over the next five to ten years. Quantum computing has made significant strides in recent years, evolving from a niche field to one with substantial potential for solving complex problems. It is currently based on technologies, like superconducting circuits, trapped ions, neutral atoms, photons or even more exotic technologies. Recent advances are the successful introduction of error correction, earlier than expected and the transition from (noisy) physical qubits to logical qubits. Also AI is influencing the progress of QC. GenAI progress is on one side overshadowing the substantial progress of QC, on the other side, companies like NVIDIA and DeepMind, have come up with ideas, how to integrate GenAI with QC.

Quantum computers use so-called qubits, which, contrary to classical bits, can represent 0 and 1 at the same time. Using a process called “entanglement”, the qubits are combined to a quantum computer. Due to his special combination of the qubits the computational capabilities can increase exponentially. This exponential increase in computational power offers many opportunities. It holds the promise to solve complex problems in long-term weather and climate predictions, battery development, finance, drug research, logistics, cyber and AI. First results are pointing to early commercial applications in estimating extreme risks or asset pricing using Monte Carlo methods or quantum machine learning. In 2021, ten leading German companies, including Munich Re, set up the Quantum Technology & Application Consortium (QUTAC) with the objective of accelerating the transition of QC from research labs to useable industrial applications. Meanwhile 14 companies are part of QUTAC.



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 (more here and here). While the potential for QC is high, QC may also create security risks for current technologies like encryption.

Access to hardware and 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.

"Though AI is currently the main focus, Quantum Computing is a critical technology, that will have as much impact as AI."

Andreas Nawroth
Leading Expert AI & Quantum

Data & AI

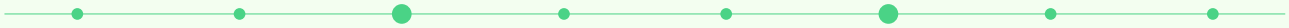
Synthetic Data

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

- Enables creation and analysis of data sets without compromising sensitive information
- Synthetic data can increase the quality and robustness of model training
- Reduces costs and risks of traditional data collection

Risks

- The complexity and nuances of real-world data might not be fully captured
- Challenge of ensuring the representation of the real-world scenarios
- Potential misuse or mis-representation leading to ethical dilemmas

Overview

In the realm of rapidly advancing developments in generative AI models, data becomes a key differentiator in AI model training and cross-domain usage. Conventional data collection and usage often pose significant risks to sensitive and identifiable information. Synthetic data, created by sophisticated algorithms and statistical models, offers a game-changing solution. By replicating the characteristics of real-world datasets without compromising sensitive information, synthetic data is a novel way to approach data-driven innovation, mitigating data privacy, scarcity, and bias limitations.

Synthetic representation of the real world

Synthetic data, which mimics real-world datasets promises insurers potential to unlock new efficiencies and capabilities. It enables privacy-preserving data sharing, ensuring that sensitive customer information remains protected while fostering new solutions and collaboration across teams and external partners. It allows the acquisition of annotations, which are difficult or impossible to obtain in the real world. By generating anonymized yet statistically identical datasets, synthetic data reduces regulatory burdens and enhances data accessibility.

A potential game changer for insurers

Applications for synthetic data is evolving across industries, including insurance, finance, healthcare, automotive and retail. Insurers could benefit in manifold ways. In risk modelling, synthetic data offers the ability to simulate rare events, such as natural disasters or economic shocks that are underrepresented in historical datasets. This enhanced capability allows for better preparation and more precise underwriting practices, especially in regions with limited historical data. When it comes to fraud detection, synthetic data can be applied to generate diverse scenarios and to identify anomalies and fraudulent claims with greater accuracy.

These datasets enable more robust defense against evolving fraud techniques. Furthermore, synthetic data can be also generated to enhance the customer experience by creating highly personalized synthetic marketing materials, such as targeted messages, avatars and videos for campaigns.

GenAI as the powerhouse of synthetic data

GenAI models can learn complex patterns and relationships within data, allowing for the generation of synthetic datasets that are virtually indistinguishable from real-world data. Synthetic data is also being used increasingly to fine-tune AI models, such as large language models and computer vision systems. The AI company Groq, Inc, features models trained entirely on synthetic data that outperform current competitors with a traditional approach in this field.

Outlook for Synthetic Data in 2025

The synthetic data ecosystem features a mix of established players and innovators. Startups like Mostly AI are driving advancements in data generation tools. Cloud providers such as Google and Amazon are integrating synthetic data capabilities into their platforms, enabling scalable adoption and exploring the new frontiers of digital twins.

> Collaboration between insurers, technology providers, and researchers will be essential to fully realize the benefits of synthetic data and to establish it as a fundamental pillar of the industry's future.

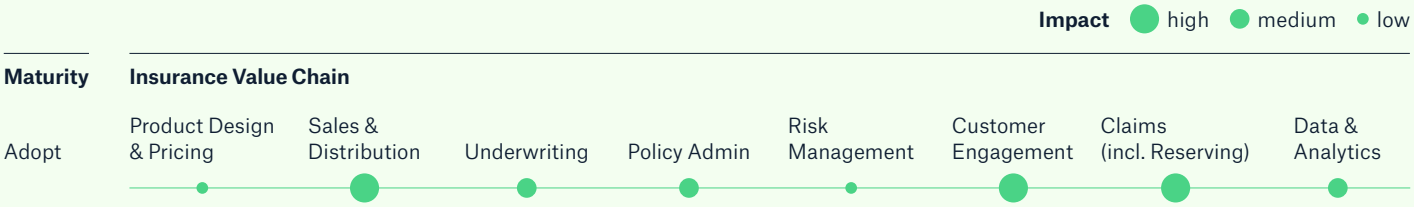
Andreas Schumacher
Project Manager, Artificial Intelligence

Conclusion

Synthetic data holds the potential to drive operational efficiency and customer satisfaction. Nevertheless, challenges in ensuring data accuracy, quality and maintaining stakeholder trust remain, and potential for misuse could also emerge. The rise of advanced generative models are enabling the creation of highly realistic and diverse synthetic data. This, in turn, is fuelling the development of more accurate and reliable insurance models.

Data & AI

AI Democratization



Opportunities

- AI Democratization broadens AI access by reducing dependence on technical experts
- AI Democratization enables small to mid-sized AI use cases

Risks

- Using externally hosted models creates a risk of intellectual property (IP) loss, requiring tailored guidelines
- Over-reliance on easily accessible AI tools may lead to misuse or errors

Overview

AI Democratization aims to make Artificial Intelligence (AI) more accessible to non-technical staff in the insurance industry, such as claims handlers and underwriters, through user-friendly tools like no-code platforms and Large Language Models. This approach accelerates problem-solving, improves decision-making, and boosts productivity across organizations, while robust training ensures the ethical, safe, and effective use of AI technologies.

Empowering people to use AI effectively and responsibly

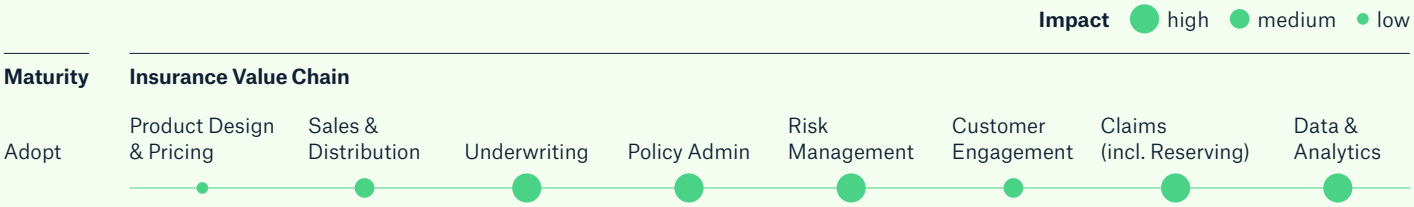
AI can deliver significant competitive advantages, from personalized pricing to predictive claims management. However, AI adoption has been anything but uniform – often confined to technical experts, it can create silos that slow innovation and limit value creation. Functional experts – such as underwriters, claims handlers, and customer service representatives – play critical roles in the insurance value chain but often lack the tools or knowledge to effectively harness AI in their workflows.

AI Democratization breaks down these barriers, equipping employees across the organization with the tools needed to leverage AI. No-code/low-code platforms allow non-technical staff to develop and deploy AI solutions, accelerating problem-solving and removing bottlenecks. Embedded AI integrates automation and predictive analytics into workflows, enabling employees to make faster, data-driven decisions. In turn, LLMs enhance productivity by summarizing claims, analyzing policies, and generating personalized communications at scale.

However, broader AI access is accompanied by certain risks, e.g. misuse, over-reliance, and amplified bias in decision-making. Externally hosted GenAI models also introduce IP risks, requiring clear governance. Robust training programs and compliance measures are essential to mitigating these risks. Employees must receive both technical training and guidelines on using AI ethically. Without such safeguards, insurers run the risk of unintended consequences that could erode trust and create operational vulnerabilities.

Data & AI

AI Governance



Opportunities

- Interplay between offensive and defensive AI Governance allows a balance to be struck between compliance and AI advances in an enterprise.
- Adaptive AI Governance frameworks allow the changes in an ever-developing legal environment to be accommodated.

Risk

The regulatory landscape around AI is being developed and some points have not yet been fully clarified.

Overview

AI Governance is a part of enterprise governance dealing with enabling AI development and purchase in a compliant way. This includes fostering AI adoption (offensive AI Governance) and compliance and risk management-related measures (defensive AI Governance). The combination of offensive and defensive governance is the key to promoting AI advancement in a compliant way. The regulatory landscape around AI is still challenging, which is being partially covered by the appearance of AI-related standards and codes of practice. This requires adaptive AI Governance frameworks.

Key challenges of designing AI Governance

In last year's Tech Trend Radar, we described the emerging regulation landscape and its complexity, and proposed a four-step approach to establishing AI Governance on an enterprise scale. The focus was on the design phase, where a lot of decisions on the structure of AI Governance (e.g. centralized vs. decentralized approach and degree of regulation) are made. This year, we will outline specific key challenges that the market faces when specifying AI Governance frameworks and give concrete recommendations on how to overcome them.

Smooth interplay between offensive and defensive AI Governance is key

Offensive governance in an enterprise traditionally covers enabling the achievement of business goals, e.g. business revenue or process optimization. In terms of AI Governance, the offensive part might take the form of setting up development platforms, employee training sessions, and (centralized or decentralized) support in implementing AI use cases. Defensive governance, on the other hand, concentrates on managing AI-induced risks and ensuring compliance. Specifically, for AI Governance this might be implemented as AI compliance gates and enterprise-wide binding guidance on AI, as well as the degree of regulation in the different stages of the AI system lifecycle.

As with other emerging technologies, businesses initially focus on the offensive side of AI Governance, identifying use cases and deploying the most promising ones in production. Similarly to other tools like Big Data or Cloud Computing, the regulatory landscape lags behind the technological advancements, allowing quite a broad field for experimentation. As AI slowly became a standard part of the value delivery, a complex interplay of regulations around AI and predictive models, most notably, the EU AI Act, also evolved. That led businesses to establish defensive AI Governance structures. This became even more relevant in 2025 when some parts of the EU AI Act, e.g. prohibited AI practices and General Purpose AI Model requirements, became binding.

When establishing an AI Governance structure, companies are faced with the need to balance the offensive and defensive sides of AI Governance to strike a balance between allowing the rapid introduction of AI capabilities into business processes and, at the same time, guaranteeing compliance with regulations and managing risks connected with the use of AI in production. This is probably the biggest challenge and, at the same time, the major opportunity in governing the use of AI in an enterprise. There is, unfortunately, no one-size-fits-all solution, and it is also probably a moving target requiring constant re-evaluation of the setup. This strongly depends on the AI strategy and risk appetite of an individual enterprise. Furthermore, the key to success is constant alignment between defensive and offensive AI Governance. An example of a balanced approach might be to allow for a broad field for experimentation at an early stage, followed by a stricter compliance gate before putting AI into production.

"The key to successful AI Governance at enterprise scale is now to find a balance between defensive and offensive AI Governance, thereby ensuring compliance and promoting AI advances at the same time."

Dr. Alina Nizamutdinova
Project Manager AI

The regulatory landscape around AI is still developing and needs clarification

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 definition of an AI system in the EU AI Act.

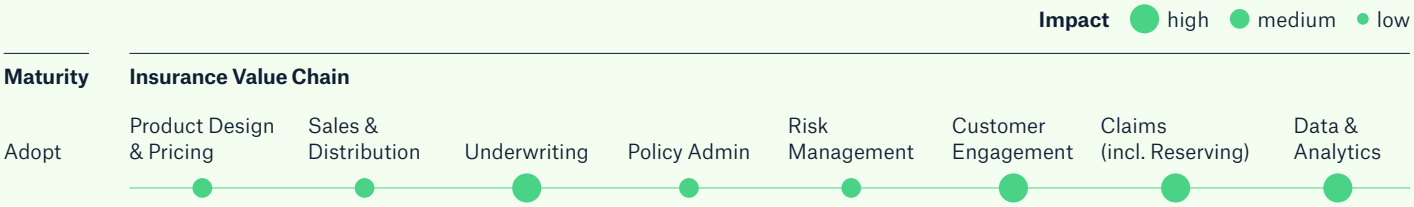
The need for clarification is being partially covered by position statements and the emergence of related standards, e.g. the standard for AI developed by the National Institute for Standards and Technology in the US. We expect to see more clarification in the future, which at the same time will make the implementation of requirements more actionable, but will also narrow the action space for that.

An adaptive AI Governance framework is a necessity

The developing regulation landscape, as well as the rise of AI-related standards, implies a need for adaptive AI Governance frameworks. A robust AI Governance framework must be able to respond quickly to compliance-related changes, while also overseeing new AI trends. In addition to flexibility by design, continuous monitoring and adaptation, a strong feedback mechanism from internal stakeholders paired with benchmarking against industry contribute significantly to resilient and, at the same time, adaptive AI Governance.

Data & AI

Generative AI



Opportunities

- Improved risk assessments and personalized pricing models, which allow insurers to offer tailored policies that meet individual customer needs
- Optimization of operational aspects like customer interaction and claims handling, which leads to higher efficiency and customer satisfaction

Risks

- Insurers must navigate evolving regulatory environments (e.g., EU AI Act), which can be challenging, costly and time-consuming
- AI models are becoming increasingly specialized, making integration and interoperability key aspects to prevent rapid obsolescence

Overview

The integration of Generative AI into the insurance industry is yielding promising results, with many companies successfully harnessing its power to enhance aspects like risk insights, efficiency, and customer experience. Recent advances in training data, specialized models, and reasoning approaches have significantly improved the quality and capabilities of Generative AI, making it an attractive solution for insurers seeking to boost their efficiency and effectiveness and stay competitive.

Adoption of Generative AI in the insurance industry

Over the past year, Generative AI has made significant strides in transforming the insurance industry, building on the foundation established in previous years. This progress has made the technology more accessible and its applications more clearly defined, paving the way for increased adoption and innovation in the sector.

Specialized models have emerged, demonstrating the technology's ability to tackle specific insurance-related tasks, including insight generation, chatbot features, and the automation of routine processes. Generative AI-powered chatbots can e.g. optimize customer service, while automated data analysis can support underwriting and claims processing. As the technology continues to evolve, its impact on the insurance industry is likely to become more pronounced, particularly in areas where data-driven decision-making is critical.

The adoption of Generative AI models is set to bring significant improvements to the insurance industry. Insurers can expect to see enhanced policy customization, improved fraud detection and increased operational efficiency by leveraging these technologies. While the potential benefits for insurers are substantial, it is crucial to address key challenges like data privacy, integration, and the models' limitations, like bias and hallucinations. As insurers continue to adopt and refine these models, they can anticipate meaningful gains in customer experience and overall business performance, as already recognized by 40% of insurance executives. Responding to growing customer expectations and operational demands requires insurers to proactively adopt and integrate generative AI technologies to stay competitive in the rapidly evolving environment.

Fine-tuning Large Language Models (LLMs) with their own data allows insurers to adapt these models to their specific needs. By calibrating them for e.g. industry-specific or company data, insurers can improve performance, reduce bias, and increase accuracy. This customization enables more effective policy analysis, claims processing and customer communication, ultimately driving business value and efficiency.

"Generative AI helps insurers enhance risk assessment, customize policies, and optimize claims handling."

Dr. Matthias Kaper
Senior Data Scientist

Insurance companies have effectively integrated Generative AI to enhance operations. For example, Definity Insurance has utilized Generative AI to streamline customer service at its contact centers, reducing call durations and improving support quality. Canara HSBC Life Insurance has launched "OmniGen AI", a tool that generates insights from various data points to inform underwriting decisions. And Westfield Insurance has collaborated with IBM to streamline code explanation and documentation, thereby boosting operational efficiency. These initiatives showcase AI's role in advancing efficiency and customer experiences in the insurance sector, despite often-challenging regulatory environments.

Think harder: Reasoning models

The latest evolution in Generative AI has given rise to models that "think harder" and can engage in more complex reasoning. These models, called reasoning models, work by breaking down complex problems into smaller, more manageable chunks. This allows them to analyze data in a more human-like way, identify relationships between different pieces of information, and provide clear explanations for their conclusions. Imagine a model that can think step-by-step, considering different approaches to a problem before coming up with a solution. This process takes marginally longer but results in more accurate and reliable outcomes. Its most notable representative is OpenAI's o1 model, which demonstrated human Ph.D.-level accuracy for various scientific benchmarks. The successor, o3, released in December 2024, surpasses o1's performance significantly but is also slower and much more expensive.

The power of Small Language Models

Advances in training data have significantly improved the quality of LLMs, enabling better generalization and performance through increased diversity, size, and synthetic data augmentation. The use of a substantially larger amount of training data, which is now better curated and more thoughtfully selected, has also expanded models' capabilities, allowing them to learn and generalize more effectively. Furthermore, the use of mixture of experts (MoE) models, which combine multiple specialized models, has boosted performance.

While LLMs of ever-increasing size have evolved in recent years, the trend is also being influenced by the use of Small Language Models (SLMs). Designed with a relatively small number of parameters, SLMs perform impressively on language tasks while consuming minimal computational resources. They offer faster inference times and can run smoothly on devices with limited processing power, including smartphones. Their lower energy consumption not only reduces costs but also minimizes environmental impacts. While they may struggle with highly complex tasks and provide less nuanced understanding, they are sufficient for a vast number of tasks. Notable examples include Microsoft's Phi series and Meta's Llama series. SLMs are employed in chatbots, text summarization, sentiment analysis, language translation, and content generation – striking a balance between performance and efficiency. Yet new architectures are appearing that combine the advantages of both LLMs and SLMs, where the strengths of both are used for the respective tasks.

"Strategically combining broad-scale intelligence of Large Language Models and precision of specialized models delivers accurate and cost-effective GenAI solutions in insurance."

Andreas Schumacher
Project Manager Artificial Intelligence

Specialized and multimodal models

Specialized models, such as coding and multimodal models, represent another significant advance in Artificial Intelligence. Coding models are designed to assist with programming tasks, including code generation, debugging and optimization. Multimodal models can process and interpret multiple types of data like text, images, audio, and even video – simultaneously, enabling more sophisticated and integrated applications. In the insurance industry, these models offer transformative use cases by combining and understanding the relationships between various modalities. For automated underwriting, multimodal models can analyze textual information alongside images of properties or assets to assess risks more accurately. In claims processing, they can expedite evaluations by interpreting photos of damage, generating reports, and even detecting fraudulent claims through pattern recognition. This not only reduces processing time but also improves accuracy and customer satisfaction. The rapid advances also address growing integration demands and risks of obsolescence.

New closed- and open-source models

Generative AI is rapidly advancing, with proprietary solutions and open-source models competing for both the best performance and the highest efficiency. Open-source models reveal their details and can be deployed on their own infrastructures, while closed-source models are not available to the public and are commonly operated by the vendor itself. Examples of closed-source models are OpenAI's GPT series, Anthropic's Claude and Google's Gemini AI, Microsoft's Copilot and NVIDIA's Fugatto.

Open-source models include Meta's Llama series, Databricks' DBRX, and EleutherAI's GPT-J or Mistral's Mixtral and multimodal Pixtral models. DeepSeek's open-source R1 model demonstrates competitive results with leading models at a low training cost. Perplexity.ai has published a more neutral derivative: "R1 1776".

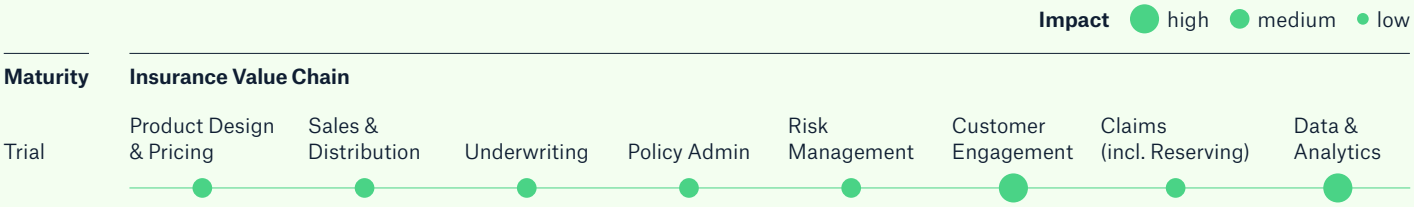
Emerging trends and outlook

The convergence of Generative AI with computer vision and natural language processing (NLP) is transforming industries across the board. By interpreting and generating multimodal data, AI systems can now better understand and interact with the world.

A prime example of this evolution is Google's NotebookLM, an AI-powered research assistant that can summarize information and provide insights from user-supplied documents, even in a podcast-like summary. Another promising approach employs agentic systems where LLMs combine various skills to complete abstract tasks.

Data & AI

AI Agents



Opportunities

- Efficiency gains in all areas, especially coding, customer engagement, and data analytics
- Ability to provide 24/7 customer support
- Help in designing new insurance products

Risks

- AI agents' autonomy can pose security risks, like the unauthorized use of data or systems
- AI agents can raise ethical questions, making human supervision essential
- Ensuring compliance with global data protection and AI regulations is crucial

Overview

AI agents are advanced Artificial Intelligence systems designed to autonomously complete tasks and make decisions based on user-defined goals. These agents can interact with external systems to take actions in the real world, making them more capable than traditional generative AI, which primarily focuses on content creation. AI agent workflows have at least three components: understanding the goal and potential results (by applying LLMs), breaking the goal down into smaller tasks (planning, memory), and executing these tasks using their knowledge base and the tools available (tool use). AI agents are a recent development with immense potential, and one that can be adopted quickly.

AI agents – their potential

AI agents will rapidly transform our world. According to Gartner, by 2028 one-third of all enterprise software applications will include agentic AI, up from less than 1% in 2024, and at least 15% of day-to-day work decisions will be made autonomously through agentic AI, up from zero percent.

Initially, Large Language Models (LLMs) were primarily used to generate content, mostly in text form. Integrating additional capabilities like planning and tool use has changed the focus from content generation to task completion. AI agents can now exhibit complex reasoning, remember past interactions, and adapt their behavior in response to feedback (adaptive AI), making them far more versatile and capable than their predecessors.

AI agents can create significantly more economic value compared to the initial LLMs because they are designed to autonomously perform tasks, make decisions, and interact with their environment. Completing a task using LLMs is similar to micro-managing, where each step is discussed and evaluated by the user. AI agents perform these steps on their own, as determined by the user, mimicking a competent co-worker. This autonomy and versatility enables businesses to streamline operations, reduce costs, and ultimately create greater economic value in many areas like complex workflows, code documentation, and the modernization and automation of repetitive tasks.

The advent of agentic AI will also create new risks, such as targeted and advanced cyberattacks that give rise to "smart malware". This will require innovations to address the unique risks and threats posed by systems that depend on LLMs and GenAI.

Emerging tech products utilizing AI agents

In the tech ecosystem, GenAI model providers, cloud vendors, and the open-source ecosystem are heavily investing in developments concerning AI agents. Platforms like Microsoft's Copilot, Amazon's Bedrock and Google's Vertex AI will support the scalable implementation of these solutions, while open-source frameworks like Autogen, LangGraph and CrewAI will drive innovation and adaptability. More specifically, companies are now also starting to offer embedded services in the finance sector. The payment provider Stripe is one example, offering a software development kit (SDK) for embedding Stripe services in agentic systems.

Also in the insurance ecosystem, various technology providers are advancing the efficiency gains made possible by the implementation of AI agents, particularly in areas like customer support, automated underwriting, and claims processing. AI agents have also sparked renewed interest in robotic process automation by replacing rigid, predefined rules in processes with a more adaptable approach that employs LLMs to plan and automate workflows. In the field of agentic process automation, the first technology providers have now entered the market.

AI agents at Munich Re and primary insurers

At Munich Re, we leverage AI agents to enhance our portfolio for clients. In our automated underwriting platform, REALYTIX ZERO, AI agents power a Copilot feature that accelerates the design and adoption of new, digital insurance products. This enables our clients to significantly reduce the time required to bring new insurance products from concept to launch.

Primary insurers are also starting to recognize the enormous potential of GenAI for process automation in high-volume/high-frequency operations scenarios. However, given the high risk of errors or unintended outcomes, and the strict regulations regarding AI, companies are currently shying away from letting AI have full agency over how to approach and execute a given process, especially if it involves transactional resources.

In contrast, agentic Retrieval-Augmented Generation (RAG) has been identified as a low-risk application of AI agents, providing higher efficiency and superior accuracy than traditional RAG, especially across large corpora of knowledge resources. It is a complex and instructive, yet contained example of an arbitrary orchestration of layered LLM resources autonomously supervised by a leading LLM acting as the agent.

Another area of conservative experimentation with agentic automation approaches involves supporting complex scenarios in underwriting workbenches. Non-transactional tasks (e.g. data collection or scenario calculations) can even be proactively and autonomously executed without explicit approval. This human/machine collaboration will significantly enrich underwriters' working environment.

> The future isn't about having more AI agents, but about making them do more.

Andreas Schumacher
Project Manager, Artificial Intelligence

"AI agents are quickly emerging as a path to the large-scale adoption of LLMs in the insurance industry."

Matthias Beuerle-Liegel
Data Analytics Spezialist

Outlook

AI agents will redefine the insurance industry, driving efficiency, accuracy and personalization. This technology will transform underwriting, claims management, and customer engagement. In underwriting, AI agents can autonomously analyze diverse datasets – from customer profiles to market trends and real-time risk indicators – to deliver accurate risk assessments and personalized policies. Advanced multimodal models enhance these capabilities, allowing AI systems to process and interpret a variety of data types, including images and geospatial information. Claims management may see end-to-end automation, with agentic AI-powered systems being used to validate claims, detect fraud, and coordinate document verification. Customer engagement will also be transformed, with AI agents anticipating individual needs and offering proactive risk management advice.

Despite these advances, challenges remain. Ethical considerations, such as ensuring fairness in risk assessments and compliance with regulations, are critical. Accordingly, investments in AI for risk management practices and policies, as well as platforms for managing and monitoring agent-based systems, need to be carefully considered. The codification of relevant knowledge, strategic tech planning, and human-in-the-loop control mechanisms should also be considered. To capitalize on AI agents, it is helpful to consider how to best train and manage a blended digital and human workforce.

By embracing AI agents, insurers can achieve groundbreaking improvements in operational efficiency, customer satisfaction, and competitive advantage. This technology promises to set a new benchmark for innovation and agility in the insurance industry.

"Agents are key to creating economic value from GenAI.

Dr. Andreas Nawroth
Leading Expert, AI & Quantum

Data & AI

AI-Augmented Software Engineering

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

- Increased productivity through automation of repetitive tasks
- Faster time-to-market for digital insurance products and features
- Cost savings due to reduced manual labor
- Enhanced risk modeling using AI-generated algorithms

Risks

- Over-reliance on AI, potentially reducing critical thinking skills
- Algorithmic bias, leading to unfair outcomes
- Security concerns, such as inadvertently introduced vulnerabilities
- Data privacy issues, including potential exposure of sensitive information

By recognizing these challenges and opportunities, organizations can unlock the full potential of AI-ASE while ensuring robust, secure, and fair implementation.

Overview

AI-Augmented Software Engineering (AI-ASE) is transforming the software development landscape by boosting efficiency, accuracy, and creativity. According to Gartner, by 2027, 70% of all developers are expected to be using AI-driven coding tools, up from less than 10% today. This shift will enable sectors like insurance to gain competitive advantages, such as improved risk modeling, streamlined data processing, and faster deployment of digital solutions. However, organizations must balance innovation with ethical considerations in order to harness AI-ASE effectively.

Innovation by AI-Augmented Software Engineering

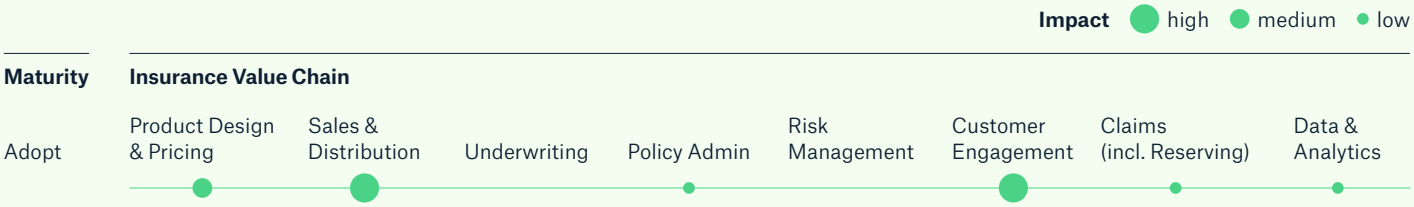
AI-Augmented Software Engineering leverages Artificial Intelligence to revolutionize development processes. From code generation and debugging to automated testing and CI/CD optimization, AI tools are increasingly becoming indispensable. For example, AI can detect potential security vulnerabilities in code and recommend fixes, while advanced code completion tools like GitHub's Copilot can intuitively anticipate developers' intentions. Moreover, natural language interfaces like chat-based tools empower developers to iteratively refine code, generate tests, and handle traditionally tedious tasks with ease. By reducing manual effort and minimizing errors, AI enables companies to deliver better services while optimizing operational costs.

This growing reliance on AI is evident in platforms like GitHub, where AI is integrated seamlessly across the ecosystem, and in Google's Project IDX, Cursor, and Windsurf, which were designed with AI support at their core. For sectors like insurance, where technology is essential, AI-Augmented Software Engineering offers a competitive advantage. Companies can innovate by streamlining data processing, improving risk modeling, and accelerating the deployment of digital solutions. In addition, studies show that incorporating AI into the development cycle increases developer satisfaction, helping retain talent in competitive markets. In countries with unfavorable demographics, it also reduces the pressure to compete for new talent.

Keyfact
By 2027, 70% of all professional developers will use AI-powered coding tools, up from less than 10% today.

Data & AI

AI Search Engines



Opportunities

- Provide instant, clear answers to customer questions.
- Use LLMO to improve visibility and enhance customer engagement.
- Deliver personalized product suggestions through optimized conversational content.

Risks

- Reduced visibility, as customers rely less on traditional search engines.
- Difficulties ensuring content is selected and presented accurately by LLMs.
- Adapting content strategies to meet AI Search Engine requirements.

Overview

The emergence of AI Search Engines 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 Large Language Model Optimization (LLMO) to ensure content visibility and relevance. These AI Search Engines excel at delivering personalized, precise answers by interpreting user intent and integrating external knowledge sources. To stay competitive, businesses must embrace conversational content, structured data tailored for this evolving search paradigm.

Beyond keywords: The new era of AI Search Engines

The way we search for information is undergoing a dramatic transformation, driven by the rapid emergence of AI Search Engines. These models, with their ability to process and generate human-like text, are reshaping the search experience. For over two decades, Google has dominated this space, holding a 91% market share in the $50 billion search advertising market (Harvard Business Review, 2024). However, LLMs like Search GPT, Perplexity, Gemini, and YOU are driving a shift away from traditional keyword-based search engines toward conversational, context-aware responses tailored to user queries.

Unlike traditional search engines that rely on keyword matching, AI Search Engines interpret user intent and deliver personalized, contextually relevant answers in a conversational format. This evolution eliminates the need for users to scroll through countless links, 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.

LLMO: Mastering LLM visibility in the new search landscape

This shift has also given rise to a new field: LLM Optimization (LLMO). Just as SEO revolutionized visibility in traditional search engines, LLMO is becoming essential in the LLM-driven landscape. Businesses must strategically adapt to this paradigm by ensuring their content aligns with how LLMs retrieve and present information. Mastering LLMO will determine which brands thrive in this new environment.

Disrupting the search giants
The rise of AI Search Engines is challenging the dominance of link-based search engines like Google. This disruption has profound implications for the search advertising industry:

- Reduced reliance on links: AI Search Engines generate direct answers, decreasing website traffic and visibility for businesses reliant on organic search.
- New advertising paradigms: Once available, companies must integrate promotional content directly into LLMs as opposed to relying on traditional search ads.
- Content adaptation challenges: Businesses must restructure their digital presence, ensuring it's optimized for conversational search to remain discoverable.

For businesses, adapting to this shift isn't optional – it's essential for maintaining relevance and visibility in a landscape where traditional search models may soon become obsolete.

Navigating AI Search: How to stay competitive and visible
AI search isn't just a technological shift – it's a strategic imperative for businesses. To thrive in this new paradigm, it is vital to:

- Adapt your content for LLM Optimization (LLMO): Ensure your website content aligns with how LLMs retrieve and present information, using natural, conversational language and well-structured data.
- Focus on personalization: Leverage LLM capabilities to meet user needs with tailored, context-aware responses.
- Monitor AI Search Advertising options: Stay ahead by scanning the market for new advertising options such as sponsored queries and product ads within AI Search Engines and continuously refine your content to remain visible and competitive.
- User-generated content is given more weight in the output. Consequently, LLMO also means optimizing content on third-party or social media platforms.

By embracing AI Search Engines, businesses can adapt to the disruption of traditional models and seize opportunities to enhance user experiences and drive innovation. The future of search belongs to those who adapt – and the time to act is now.

Key strategies for LLMO

- Aligning content with Natural Language Queries by using conversational tone and incorporating content
- Using well-structured and hierarchical (meta-) data to aid retrieval
- Ensuring information is accurate and frequently updated

Insurance searches: How AI search personalizes and simplifies the process

1. Streamlined insurance discovery
Consumers often begin their insurance research online. LLMs revolutionize this process by offering instant, conversational answers. For instance, a user asking, "What's the best health insurance for a family of four in Germany?" would receive a clear, personalized response, eliminating the hassle of interpreting dense documents or exploring multiple websites.

2. Personalized recommendations
LLMs analyze user behavior to deliver highly personalized suggestions. Tailored responses are provided for specific questions.

3. Simplified comparison shopping
Customers often struggle to compare policies across providers. LLMs simplify this by aggregating data and presenting side-by-side comparisons of key factors – premiums, deductibles, and benefits – in an easily digestible format.

4. Addressing common questions
LLMs can anticipate and answer frequently asked questions instantly. For example, a query like "What's the difference between term and whole life insurance?" is met with concise, clear explanations, improving consumer understanding.

Data & AI

Legal Tech

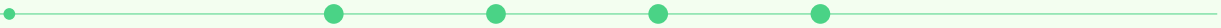
Impact high medium low

Maturity

Trial

Insurance Value Chain

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



Opportunities

- Lawyers, firms and law departments: Greater efficiency and accuracy drive higher job satisfaction and higher profitability
- Consumers: Automated processes improve accuracy of legal advice and lower costs, resulting in greater access to, and satisfaction with, legal services

Risks

- Professional ethics: Lawyer regulation may conflict with some uses of technology. For instance, several lawyers have been disciplined for not properly supervising and confirming the accuracy of results when using generative AI for drafting legal documents submitted to the court
- Loss of skills over time: Over-reliance on technology may lead to lack of creativity and forward thinking by lawyers

Overview

For lawyers, generative AI is increasingly being incorporated into legal drafting and research. Legal support technologies, including remote depositions and court appearances, AI-assisted transcription and translation, e-discovery, data mining, calendaring, conflict checking and matter management are also evolving rapidly due to innovations in AI. For consumers, online legal services that provide legal advice and document templates make access to justice cheaper and more widely available.

Legal technology is being used increasingly by lawyers and law firms

Legal support technologies, including remote depositions and court appearances, AI-assisted transcription and translation, e-discovery, data mining, calendaring, conflict checking and matter management are evolving rapidly due to innovations in AI. For consumers, online legal services that provide legal advice and document templates make access to justice cheaper and more widely available. Insurance is being impacted by new legal and regulatory technologies, particularly in those lines that cover third-party and regulatory sanctions.

Commercial lawyers and law departments

Generative AI is being increasingly incorporated into legal drafting and research. New technology allows more open-ended queries and focused results. Contract review and even contract language generation are also experiencing increased use and popularity. Generative AI is even employed for plotting litigation strategies. A survey conducted by US Legal Support found that, in 2023, “21.25% of respondents used AI for legal research, document management and predictive analysis. In 2024, that share has risen to 25.92%, an increase of 21.98% year-over-year (YoY). This was reflected in our results, as privacy and security concerns are the biggest factors considered when law firms vet legal technology vendors and litigation support providers.” Law firms and law departments process and store a great deal of confidential information: personally-identifying client information, client communications, confidential agreements, intellectual property and the like. Due to the nature of the data they hold, these entities are prime targets for cyberattacks, and the consequences of data breach incidents are particularly severe for the firms’ reputations and for their clients.

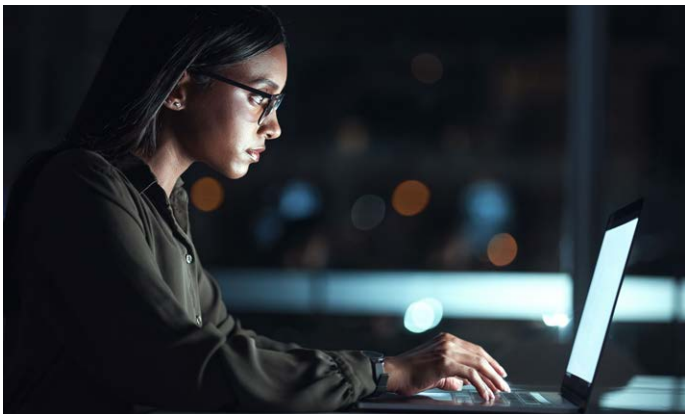
Consumers

In the consumer space, "robot lawyers," online legal services that may or may not be supervised by lawyers, are becoming increasingly common. These services provide templates or automated solutions for everything from divorce, wills and real estate purchases to setting up a small business and resolving traffic infractions. In the United States, DoNotPay recently reached a settlement with the Federal Trade Commission prohibiting the company from advertising its services as equivalent to an actual lawyer and ordering a fine of nearly $ 200,000. There are similar AI-powered online legal services in India and the UK, and they will undoubtedly spread to other jurisdictions.

These services have suffered setbacks and regulatory challenges. In particular, scaling is difficult due to the many, often subtle, differences from one jurisdiction to another, even in the same country. Due to the legal profession being tightly regulated, many legal innovators using this model have faced lawsuits from lawyers' organizations, as the Hague Institute for Innovation of Law has found. To take just one example, the online legal service Legal Zoom was sued in June 2024 by New Jersey residents for engaging in the unauthorized practice of law. The unauthorized practice of law is illegal in most jurisdictions.

Implications of legal and regulatory tech for insurers

Insurers are transforming their operations by using new legal and regulatory technology. Just about every aspect of the insurance value chain is impacted by new tools. Insureds operating in highly regulated industries that adopt new technology become better risks due to increased accuracy and lower odds of incurring regulatory expenses. Likewise, insureds that employ more advanced legal and regulatory technology may experience fewer claims and, when they do, have lower associated costs.

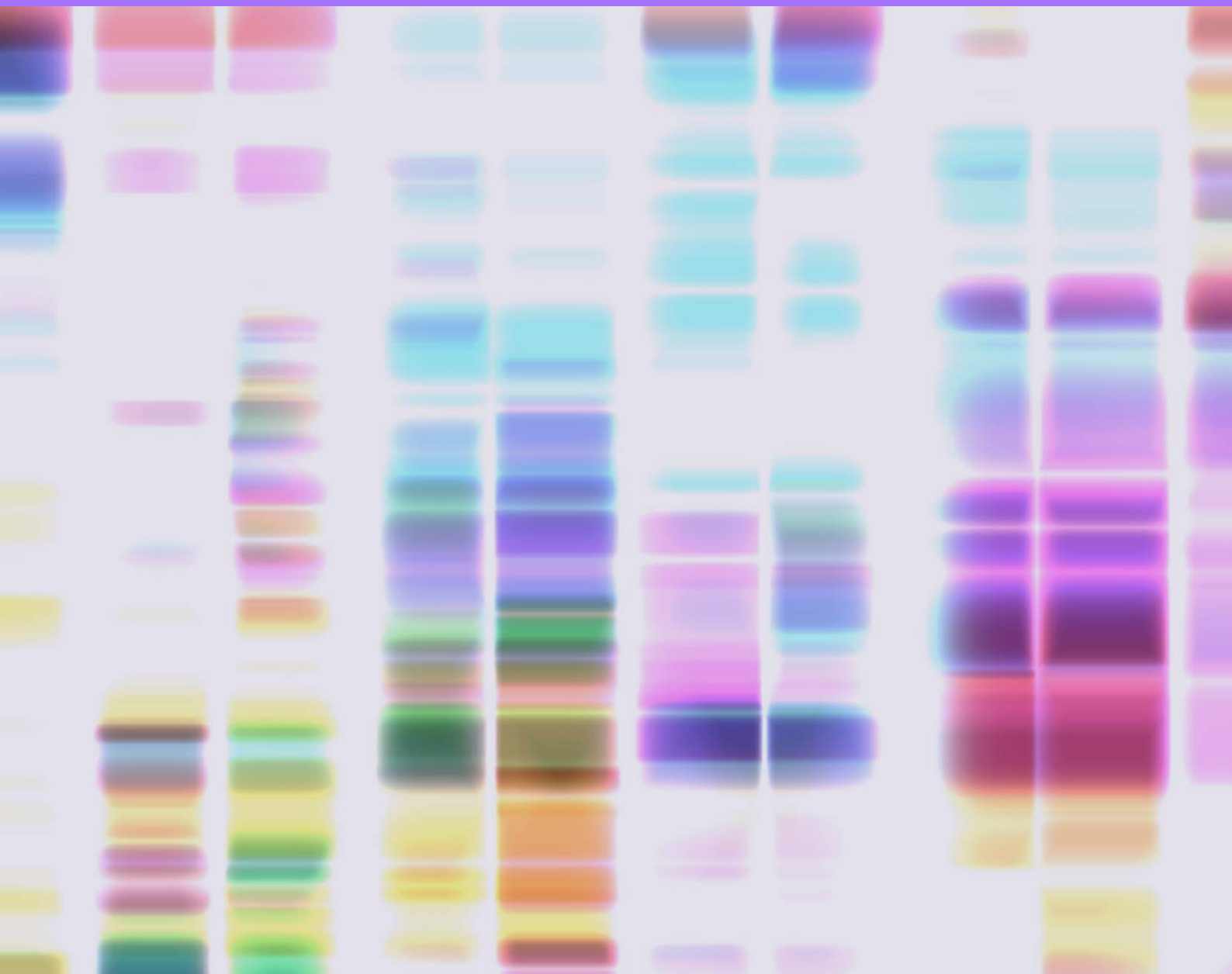


For insurers that adopt new legal and regulatory technology, their legal departments can become much more efficient, making document drafting, processing, matter management and legal research less time-consuming and human resource-intensive. By leveraging advanced e-discovery and data mining technologies, the overheads associated with litigation can reduce costs substantially. These efficiencies can increase overall profitability, while at the same time improving job satisfaction by freeing up legal staff to perform more challenging and personally rewarding tasks.

Conclusion

In 2025, moving forward, we can expect the trends in legal and regulatory technology to continue to build momentum. Commercial lawyers will avail themselves of increasingly sophisticated tools that automate many legal tasks or make them more efficient. In the consumer market, legal services will continue to proliferate, albeit facing regulatory challenges from individuals, classes and lawyer organizations. For insurers, increasing adoption of the latest advancements in legal and regulatory technologies will increase efficiencies and accuracy in many areas and improve job satisfaction for legal staff.

2 Healthy Human



Healthy Human

Unlocking opportunities through AI, data analytics, and personalized care

The healthcare landscape is rapidly evolving, driven by advances in Artificial Intelligence (AI), personalized medicine, digital healthcare and behavioral analytics. These trends are transforming the way healthcare is provided and redefining how life and health insurers can integrate these technologies into their business models.

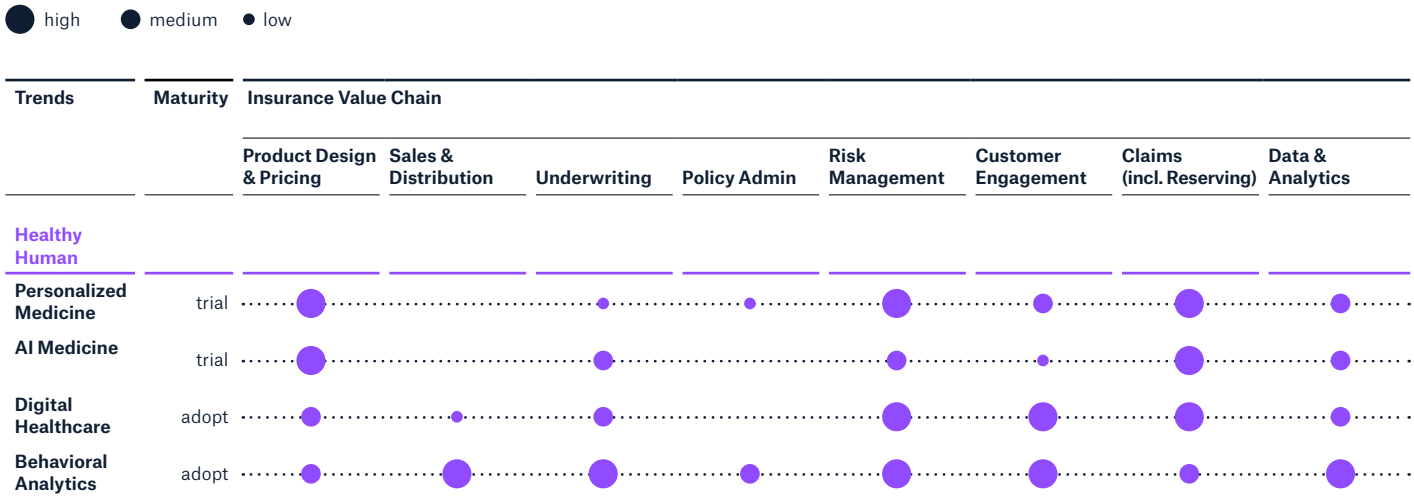
AI medicine, for instance, is improving diagnosis and treatment by identifying high-risk patients and personalizing treatment plans. Personalized medicine is another key trend, with tailored treatments based on individual genetic profiles leading to better patient outcomes and more effective prevention.

Further, digital healthcare platforms are being combined with behavioral analytics to facilitate seamless coordination between healthcare providers and patients. This convergence of technologies enables the real-time monitoring of health status, facilitates preventative care, and promotes better disease management.

In this chapter we have identified key technology trends that present significant opportunities for life and health insurers to enhance underwriting and risk management, drive business growth, and deliver more tailored products and services.

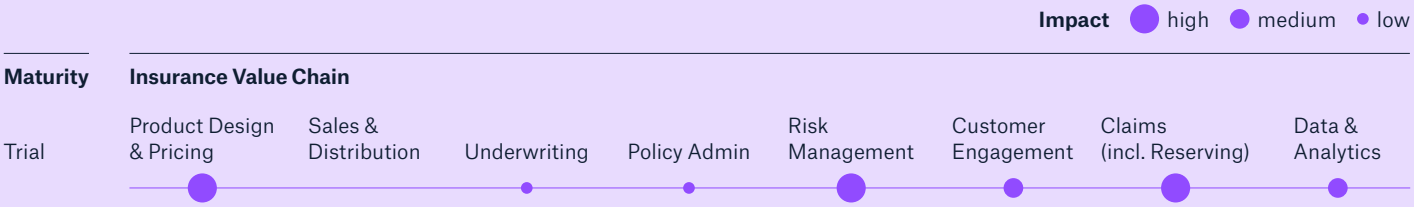
Healthy Human

Trend evolution and impact on the value chain



Healthy Human

Personalized Medicine



Opportunities

- Improved patient outcomes through tailored treatments
- Development of new treatments for individual needs
- Early disease detection and prevention
- Reduced healthcare costs through targeted treatments, reducing the need for trial-and-error treatments and minimizing the risk of adverse reactions
- Improved risk assessment for insurers and tailoring of products through improved prognostication

Risks

- High costs limiting widespread adoption
- Privacy concerns, as sensitive personal data could potentially lead to discrimination and bias
- Lack of standardization and regulation

Overview

Personalized medicine is a rapidly evolving field that holds great promise for improving patient outcomes and transforming the way healthcare is provided. By leveraging advances in genomics, epigenetics, and related technologies, personalized medicine enables healthcare providers to tailor treatments to individual patients' unique needs and characteristics. In the insurance industry, personalized medicine has significant implications for risk assessment, underwriting, and claims management.

Potential and challenges

Personalized medicine has significant implications for the insurance value chain, from risk assessment and underwriting to claims management and policyholder engagement.
It can be provided through the use of epigenetic analysis and other technologies that provide insights into an individual's health risks and characteristics. Although it may take time for personalized medicine to become integrated into mainstream medicine, it is important to consider that when it does, there will be a substantial impact on the insurance value chain. Insurers should proactively engage with industry stakeholders and regulatory authorities to address potential challenges and capitalize on opportunities. By doing so, they can ultimately improve the risk assessment process and benefit their clients.

These various technologies also have the potential to transform the way claims are managed by enabling insurers to tailor claims handling to individual policyholders' unique needs. This can be achieved through the use of advanced analytics and machine learning algorithms that analyze personalized biomarkers against claims data to identify patterns and trends, indicating where intervention could reduce claims severity or frequency. Insurers can also leverage the integration of various rehabilitation programs and interventions which can assist in reducing second and subsequent claims or facilitate earlier return to work through earlier and more precise interventions.

Furthermore, personalized medicine can improve policyholder engagement by enabling insurers to provide health and wellness programs that are tailored to individual policyholders' unique characteristics. By leveraging advanced analytics and insights, insurers can identify opportunities for engagement and intervention, and provide more targeted support to policyholders.

One of the biggest challenges lies in the costs associated with unique therapies. Further challenges to adoption of the technology relate to data protection and acceptable use of this sort of technology in insurance, which may be regulated in some markets.

Precision medicine vs. personalized medicine

Precision medicine and personalized medicine are often used interchangeably, but are not the same. Precision medicine refers to the use of advanced technologies, such as genomics and epigenetics, to develop targeted treatments that are tailored to individual patients' unique needs and characteristics. Personalized medicine, on the other hand, refers to the use of these technologies to develop treatment plans that are tailored to individual patients' profiles and requirements. This means that personalized medicine is a wider field that includes conventional therapies, too.

Key insights and recommendations for action
Insurers should develop a strategy for incorporating data that may become available from personalized tests and therapies into their risk assessment and underwriting processes, bearing in mind that regulation may be lagging in this field.

Technologies enabling personalized medicine:

Data

Genomics: The study of genes and how they function is a key enabler of personalized medicine. Genomic analysis can provide insights into an individual's health risks and characteristics, and enable healthcare providers to tailor treatments accordingly.

Epigenetics: The study of gene expression and its impact on health is another key enabler of personalized medicine. Epigenetic analysis can reveal important health information and allow for more targeted and effective treatment strategies. Liquid Biopsy and Circulating Biomarkers: Non-invasive liquid biopsies and circulating biomarkers facilitate the detection and monitoring of diseases.

Single-Cell Analysis: This technology enables the analysis of individual cells, providing insights into cellular heterogeneity and helping to identify specific cell populations that may be driving disease progression.

Imaging and Radiomics: High-resolution imaging and radiomics support the analysis of medical images to identify biomarkers and predict treatment outcomes, facilitating more accurate diagnoses and personalized treatment plans.

Electronic Health Records (EHRs) and Health Informatics: The integration of EHRs and health informatics is providing a comprehensive view of patient data, enabling healthcare providers to make more informed decisions and develop personalized treatment plans.

Analysis

Machine Learning: Machine learning algorithms are increasingly being used to analyze claims data and identify patterns and trends. This can improve claims handling and reduce costs.

Artificial Intelligence: AI is being used to analyze large datasets and identify patterns and trends in health data. This can be used to develop personalized treatment plans and improve health outcomes.

Therapies

Pharmacogenomics: The term is used primarily to describe customized pharmacotherapy that takes into account not only the specific clinical picture, but also the individual's physiological composition and gender-specific effects of medication. Personalized medicine seeks to improve the stratification and timing of healthcare by utilizing biological information and biomarkers on the level of molecular disease pathways, genetics, proteomics and metabolomics.

Synthetic Biology and Gene Editing: Advances in gene editing technologies like CRISPR/Cas9 are enabling the development of novel therapeutics and personalized treatments for genetic diseases.

3D Printing and Bioprinting: These technologies are being used to create customized implants, prosthetics, and tissue models, enabling the development of personalized treatments and therapies.

Early cancer detection is crucial

Cancer is a leading cause of death among individuals under 65 in many insurance markets, making it a pressing concern for leading insurers and Munich Re. As a result, leveraging personalized medicine technologies to enhance cancer prognosis is a key focus area. From a clinical perspective, early cancer detection is crucial for improving treatment outcomes. However, universal cancer screening is currently not feasible due to cost constraints and the potential for false positives. Developments in this field have also demonstrated to researchers that the focus should be on the molecular profiles of specific types of cancer rather than the organ of origin. This will assist in better understanding the underlying biology of the disease in order to develop more effective treatment strategies. For more information about advances in cancer outcomes, please refer to our Life Science Report.

Recent advances in liquid biopsy technology have enabled the analysis of tumor DNA, RNA, and other biomarkers in blood, urine, and saliva. The Galleri® test, developed by GRAIL, is a multi-cancer screening tool that can detect around 50 types of cancer. This test has demonstrated higher sensitivity rates for more severe cancers and specificity rates of 99.5%, delivering highly accurate identification of cancer markers.

Munich Re North America is currently collaborating with 11 carriers and two distribution partners to offer the Galleri® test to eligible policyholders on a post-issue basis. As of November 2024, more than 7,000 tests had been completed by policyholders on a voluntary basis. Notably, 73% of positive results, at an average patient age of 60, were for cancers with no current screening available, highlighting the potential of this technology to improve cancer detection and treatment outcomes. We are likely to see a short-term impact on targeted and effective treatment, which may lead to lower mortality claims in the long term. For more information, see here.

Key insights and recommendations for action
Insurers should start investing in advanced analytics and machine learning algorithms that can analyze claims data and identify patterns and trends by combining the claims data with data linked to personalized medicine technologies.

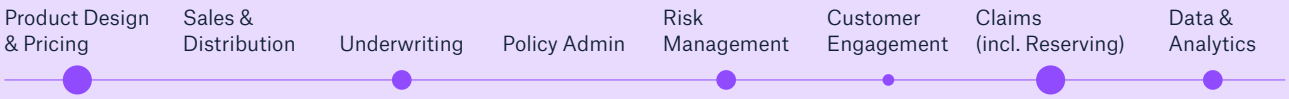
Healthy Human

AI Medicine

Impact high medium low

Maturity Trial

Insurance Value Chain



Opportunities

- High-precision patient data analysis can be used to recommend the most appropriate treatment options based on individual characteristics
- Earlier detection, earlier intervention, and better triage, leading to improved health outcomes and reduced healthcare utilization
- Automated tasks and data analysis can improve time management of HC providers
- NLP can improve outcomes for at-risks individuals
- More efficient underwriting by applying predictive analytics

Risks

- Risk of distorted results and inadvertent discrimination due to unconscious bias in AI system data
- Errors and omissions in AI-driven diagnoses and treatment may raise concerns about accountability and liability
- Over-reliance on AI systems can lead to reduced clinical skills and critical thinking skills
- Risk of data privacy breaches and system errors, which can compromise patient confidentiality
- Risk of anti-selection risk if insured individuals with rarer conditions can use this information for their benefit

Overview

Artificial Intelligence is transforming the healthcare landscape at an unprecedented pace, with significant potential to impact the insurance value chain. For insurers, healthcare professionals, and patients alike, AI holds the promise of revolutionizing every single aspect of care – from earlier diagnoses to personalized treatment options. By utilizing machine learning and Artificial Intelligence techniques to analyze medical data, AI medicine can improve diagnostic accuracy, reduce the risk of missed or incorrect diagnoses, reduce adverse effects in clinical trials, and enhance clinical outcomes. In the insurance industry, AI medicine can lead to improved mortality and morbidity, and to increased efficiency in data analysis and decision-making. To fully capitalize on these benefits, insurers need to start leveraging AI medicine insights, while also addressing potential data-asymmetry risks.

The impact of AI Medicine

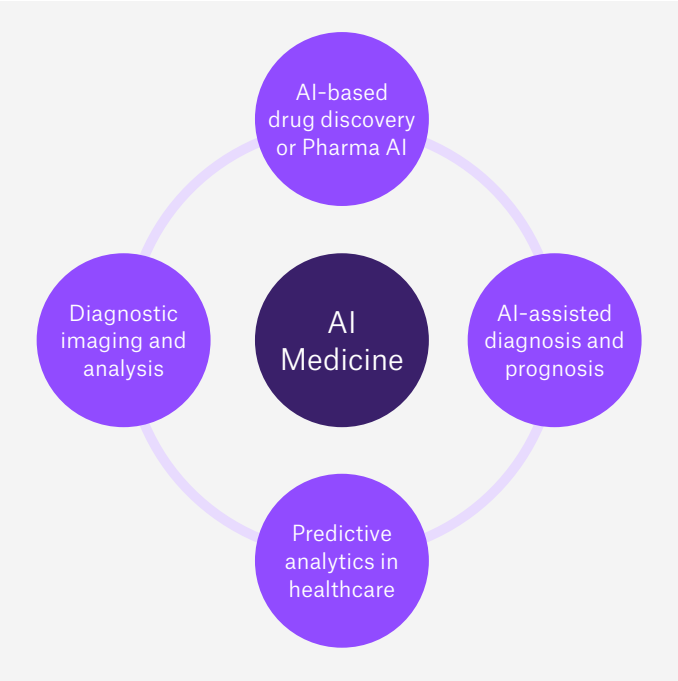
AI medicine is a field that uses Machine Learning and Artificial Intelligence techniques to analyze medical data and make recommendations or predictions about patient care or drug development. This trend is related to personalized medicine, which focuses on tailoring medical treatment to an individual's unique characteristics, such as their genetic profile, medical history, and lifestyle.

One area where AI medicine is having a significant impact is in the development of new drugs. AI can be used to analyze large amounts of data, including genomic data, data on chemical compounds, and clinical trial results, to identify potential drug candidates and predict their effectiveness. This subfield of AI medicine is referred to as Pharma AI.

Another area where AI medicine is being used is in the analysis of medical images, such as retinal scans, X-rays and magnetic resonance imaging. This can result in faster diagnoses, more efficient use of human medical resources, and the generation of large data volumes. AI can also be used to identify abnormalities and diseases, and to recommend the most appropriate treatment options. In addition, AI algorithms can be used to detect abnormalities not visible to the human eye, including rare conditions.

Key insights and recommendations for action
Invest in applying AI-powered solutions in insurance processes: Insurance companies will benefit from using affordable AI-powered technologies to reduce the costs of underwriting and claims adjudication.

Figure: The application fields of AI Medicine



Source: Munich Re

In health insurance, detailed healthcare data has been used for some time to predict healthcare utilization through predictive analytics. Insurers collect data from claims, electronic health records, pharmacies, lab results, and demographic information. However, since the "explosion" of AI technology, advanced statistical models and Machine Learning algorithms have been deployed to analyze this data to identify patterns and trends, which can help to predict an individual's likelihood of utilizing healthcare services.

Predictive factors include comorbidities, disease severity, treatment adherence, lifestyle factors, and socioeconomic factors. The resulting risk score informs premium pricing, care management, and resource allocation. By leveraging predictive analytics, insurers can more effectively manage risks, reduce costs, and improve health outcomes for their policyholders.

The application of healthcare data to predict healthcare utilization has a strong parallel in how healthcare practitioners are leveraging AI to diagnose patients earlier. While the stakes are higher in healthcare, the insurance industry can also learn from this trend. As AI medicine continues to evolve, insurance companies can tap into its expanding capabilities to enhance their value chain.

One area where this convergence is especially evident is in AI-augmented life insurance underwriting. Traditionally, underwriters relied on health disclosures to assess the risk profiles of policyholders, determining standard rates or loading for additional mortality or morbidity risks. By combining health data with other data points and applying predictive analytics, the underwriting process has become significantly faster and more efficient.

"AI in medicine: A paradigm shift in preventive medicine, diagnostics and treatment. This convergence of technology and medicine promises even more significant advances in the years to come."

Dr. Pamela Chetty
Chief Medical Officer, Munich Re Africa Branch

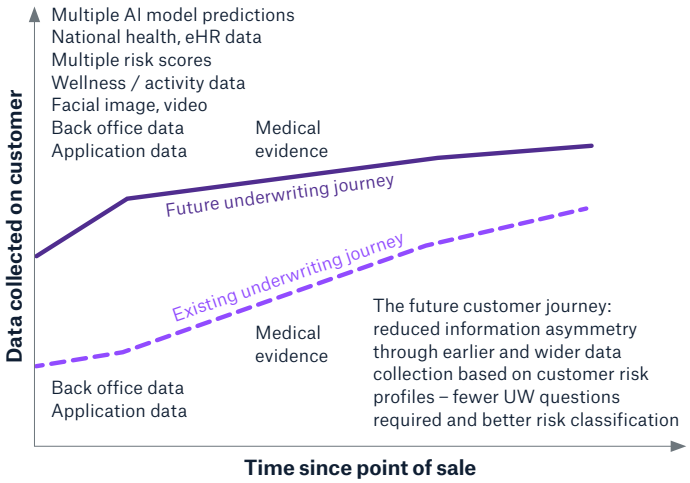
Munich Re is a pioneer in this field, having deployed AI-powered underwriting solutions in e.g. Asia, the Middle East, and Africa. These solutions have been successfully implemented and generating value for years, yielding tangible improvements in customer experience. The life and health insurance industry is now at a turning point in terms of monetizing AI, as explained in detail in our white paper on Next Generation AI-Augmented Underwriting.

Looking ahead, we can expect to see the customer journey transformed through earlier and more comprehensive data collection based on customer risk profiles. This will reduce information asymmetry, minimize the need for lengthy underwriting questions, and enable better risk classification. Munich Re's AI-augmented underwriting solution, which integrates multiple data sources, AI models and technologies, is a prime example of this transformation.

"AI retinal screening is becoming standard practice in China, and it's making the screening of eye diseases very affordable and accessible. It's not a routine requirement in insurance medical exams yet, but we have been seeing more AI retinal exams in our life insurance applications."

Dr. Hao Liu
Proposition Medical Doctor at Munich Re
South-East Asia, Middle East and Africa markets

Figure: Munich Re's AI-augmented underwriting solution uses multiple data sources, AI models and technologies to transform the underwriting journey.



Healthy Human

Digital Healthcare

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

- Increased quality, quantity and types of data available on customers to be insured, which can drive improved customer propositions
- Improved data analysis and decision-making in life & health insurance
- Simplified coordination between healthcare providers and parties in the insurance value chain
- Automated and improved processes such as underwriting

Risks

- Regulatory limitations on using personal health data
- Data security and safeguarding concerns
- Proving clinical acceptance of digital tools, which drives adoption in insurance

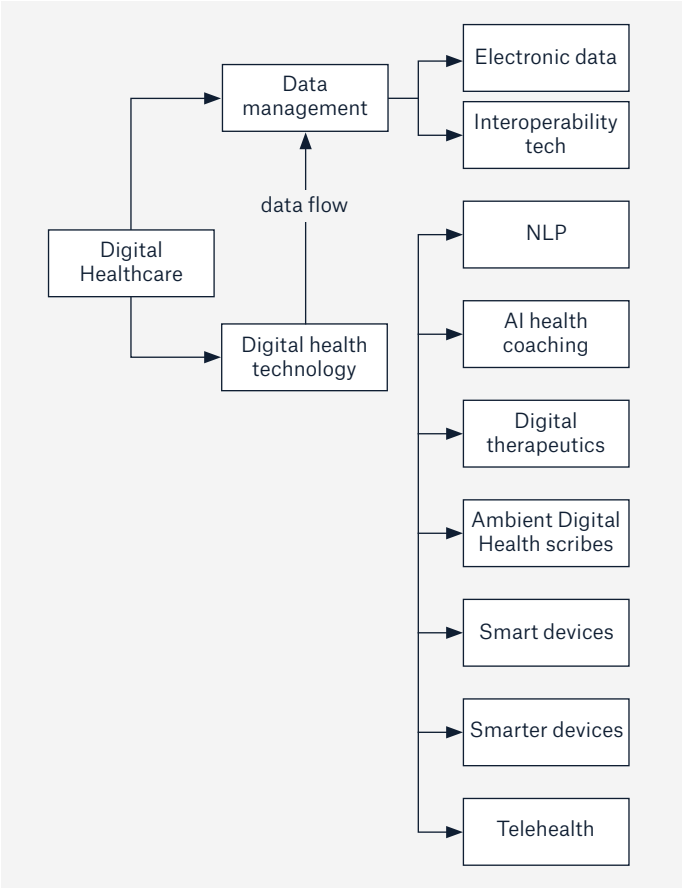
Overview

The healthcare industry is undergoing a significant transformation with the integration of digital technologies, which are revolutionizing the way patients receive care and interact with healthcare professionals. This trend, known as Digital Healthcare, is not only improving patient outcomes but also generating vast amounts of data that can be leveraged to enhance the insurance value chain. From electronic health records (EHRs) to telehealth and remote monitoring, Digital Healthcare solutions are streamlining coordination between healthcare providers, insurance companies, and patients.

Categorizing Digital Healthcare technologies

Digital Healthcare is a multifaceted trend that encompasses various components, which impact the insurance value chain to varying degrees. Dividing the trend into two categories can facilitate a better understanding of its current and future impact on insurance.

Healthcare data management refers to digital solutions for collecting, storing, and analyzing healthcare data to improve patient outcomes and operational efficiency. Examples from this category include electronic health records (EHRs) and interoperability technologies such as real-time health system (RTHS) platforms. These technological fields have a significant impact on the insurance industry, as they enable secure data sharing and provide valuable insights for healthcare providers, insurance companies, and researchers alike.



Source: Munich Re

> The transformation of underwriting via technology will accelerate this year. In the United States, electronic health records (EHRs) have reached critical thresholds of coverage and speed of return, making them essential for life insurance underwriting. The full spectrum of AI tools – machine learning, Natural Language Processing and Gen AI – will enable the industry to move beyond manual review of records to full automation of decisions.
>
> **Patrick Sullivan**
> SVP, Integrated Analytics, Munich Re Life North America

In turn, digital health technology encompasses a wide range of digital solutions that enable healthcare providers and patients to play a more active role in healthcare in various stages of the value chain. This category includes many outstanding examples, such as Natural Language Processing (NLP), ambient digital scribes, smart devices, smarter devices, telehealth, remote photoplethysmography tools, and AI health coaching.

While contributing to the insurance value chain to varying degrees, they all add to the growing pool of health data which may at some stage prove to be useful in the chain, as they are all aimed at improving health outcomes. When considering using any of these technologies, insurers need to be aware of evolving regulations, such as getting consent to share smart device information under standard personal information protection legislation, which can vary considerably from region to region and pose challenges to progress.

The impact of Digital Healthcare is significant, and it is increasingly being adopted in the insurance value chain. To show how the myriad of technologies can work together, it's worth highlighting an example from the United States that combines electronic health records (EHRs) and NLP technologies.

Munich Re has made it easier to use electronic health records for risk assessment with its Automated EHR Summarizer, a tool that analyzes and summarizes large volumes of patient data and is designed to improve the efficiency and accuracy of underwriting.

The Automated EHR Summarizer extracts relevant information from EHRs to provide a profile of an individual's health history including physical measurements, medical diagnoses, procedures, treatments, lab results, prescriptions, and tobacco use, which are essential factors for assessing risks.

We apply a range of AI solutions, Natural Language Processing (NLP) and machine learning algorithms, paired with our risk assessment expertise, to process complex and messy data quickly and accurately. Further, the EHR Summarizer supports automated underwriting by providing streamlined data for digital consumption in rules engines or scoring models, and improves the speed and efficiency of manual reviews in the light-touch underwriting and post-issue review contexts.

Munich Re's Automated EHR Summarizer is just one example of how Digital Healthcare solutions can be used to improve the efficiency and accuracy of insurance processes, while also enhancing the insurance applicant experience by minimizing friction and reducing the time to decision.

Key insights and recommendations for action
Invest in Digital Healthcare solutions: Insurance companies should invest in Digital Healthcare solutions that enable the collection, storage, and analysis of healthcare data to improve key processes in the insurance value chain like underwriting.

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

- Offers a more accurate understanding of individuals' health and lifestyle, enabling enhanced risk assessment and more informed decision-making.
- Facilitates customer segmentation, allowing insurers to craft personalized products and services that meet individual needs, driving increased sales and reduced acquisition costs.
- Helps identify undisclosed health risks, mitigating the likelihood of fraudulent claims. Reveals new opportunities for customer engagement, enabling targeted marketing campaigns and improved customer retention.

Risks

- Can perpetuate existing biases if the data or algorithm design is flawed, leading to unfair treatment of certain customer groups.
- Compliance with relevant laws and regulations is important, so as to protect customer privacy and personal data.
- Incorrect or falsified behavioral data can lead to incorrect risk or pricing assumptions, highlighting the need for robust data validation and verification processes.
- Clients may not accept the use of certain variables, such as geo-location tags.
- Justifying specific variables and outcomes can be difficult.

Overview

The insurance industry is on the cusp of significant change, driven by the increasing availability and sophistication of behavioral analytics. This technology enables the collection, monitoring, and analysis of data on individual actions and intentions from digital products, providing unprecedented insights into human behavior. 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. From risk assessment and customer segmentation to fraud prevention and personalized product offerings, the potential applications of behavioral analytics in insurance are vast and varied.

Key insights and recommendations for action

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.

Applications of behavioral analytics in the insurance value chain

The integration of behavioral analytics across the insurance value chain is transforming the way insurers operate, from product design to claims processing. By leveraging behavioral data, insurers can create personalized sales and upselling opportunities that meet their customers' unique needs. 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. Furthermore, behavioral analytics can enhance underwriting processes, enabling insurers to make more informed decisions about risk assessment and pricing.

In the area of risk management, behavioral data can help detect patterns and anomalies and detect instances of potential fraud, thereby improving claims processing efficiency. One example is analyzing clients' digital footprints as they complete online risk questionnaires. Additionally, behavioral analytics can facilitate more effective customer segmentation, allowing insurers to develop targeted marketing campaigns to improve customer retention.

The health and insurance sector has witnessed significant advances in risk assessment, driven by the increasing adoption of behavioral analytics. Munich Re is leveraging behavioral analytics to strike a balance between risk assessment and customer experience. This approach has yielded valuable insights, shedding light on the potential and limitations of behavioral data in risk assessment.

One of the primary challenges in using behavioral data for risk assessment is the lack of transparency and explainability. Behavioral scores can identify high-risk individuals, but often lack concrete evidence, making it difficult to justify underwriting decisions to clients or brokers. This issue is further complicated by potential model biases. This has been observed in many markets that Munich Re operates in, e.g. in China, where large datasets are available.

As a result, there is a growing trend towards leveraging medical data at the point of sale for risk screening, as it provides more tangible evidence and is more widely accepted by the insurance industry.

Further, data protection and privacy concerns in many countries have restricted the use of certain data points, such as phone numbers and geo-location tags for risk assessment. As a result, we have had to adapt and focus on more targeted and market-acceptable variables.

A successful example of this approach can be seen in Munich Re's development of the Dynamic Risk Calculator (DRC) model in India. By combining applicants' profile information and health declaration data, the DRC model provides a more cost-effective and market-acceptable alternative to traditional behavioral scores. This model classifies policyholders into five risk categories, enabling insurers to tailor their underwriting processes and onboarding requirements to each category.

The DRC's behavioral analytics capabilities offer a range of benefits, including policyholder behavior analysis and informed decision-making. By applying clustering algorithms, anomaly detection techniques, and classification algorithms, insurers can identify higher-risk client profiles and take proactive measures to mitigate them by applying different onboarding requirements. For instance, the DRC can predict the likelihood of policyholders filing early claims or lapsing their policies, enabling insurers to create dynamic underwriting rules and onboarding requirements.

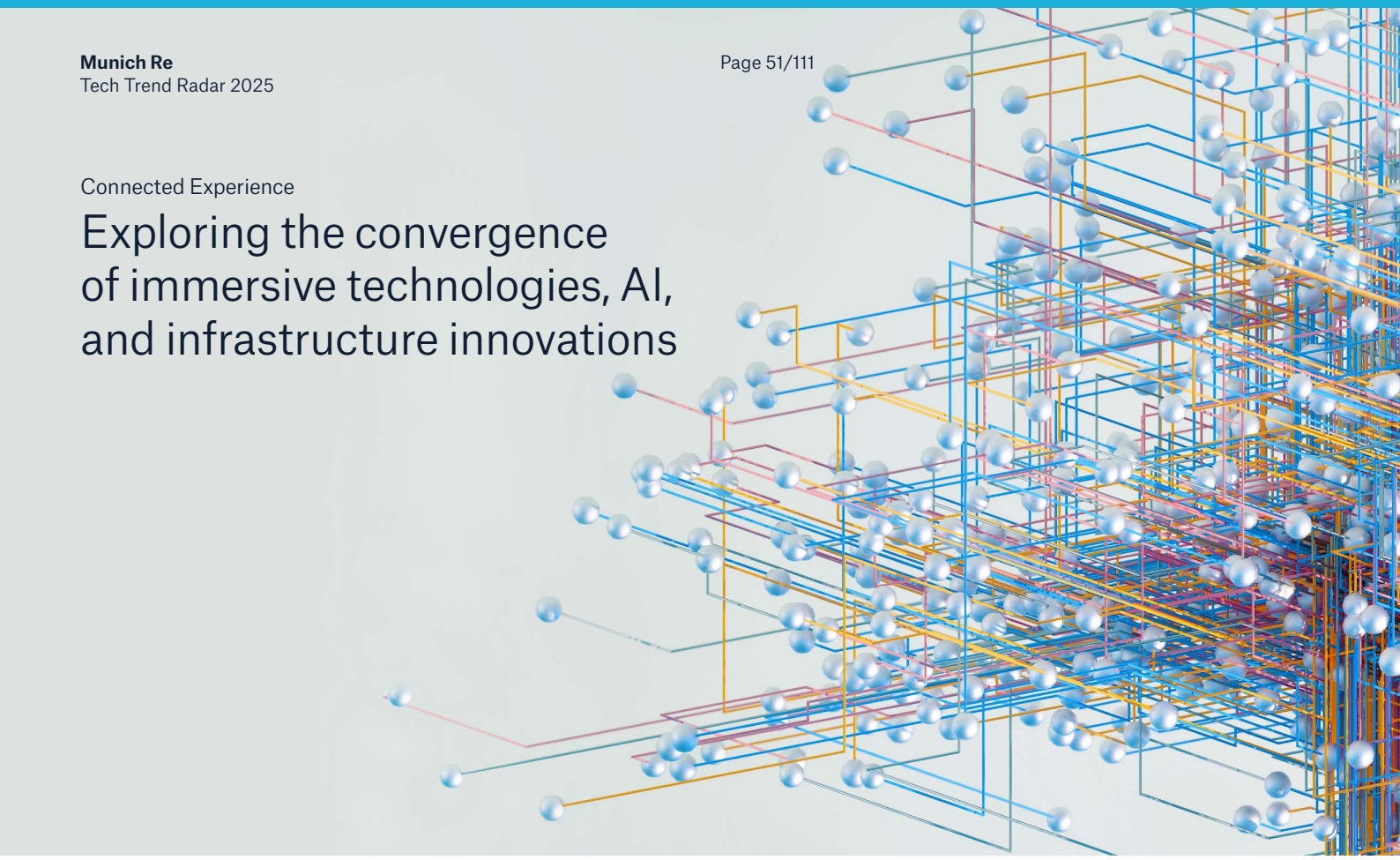
The success of the DRC model highlights the potential of behavioral analytics in terms of enhancing risk assessment in the life and health insurance sector. By leveraging targeted and market-acceptable variables, insurers can optimize their risk assessment processes, improve their overall profitability, and provide a more seamless customer experience. As the insurance industry continues to evolve, behavioral analytics will likely play an increasingly important role in shaping the future of risk assessment.

> Leveraging our joint data resources and analytical expertise, we will continue to expand our data inventories and refine the model algorithms. We look to apply what we have learned through our behavioral research and analysis to practical use for the benefit of our clients and insurance consumers in the China market.

Eric Zhao
General Manager Life & Health, Munich Re China

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

3 Connected Experience



Connected Experience

Exploring the convergence of immersive technologies, AI, and infrastructure innovations

The field of connected experience encompasses trends associated with or facilitated by networking and infrastructure technologies. This concept refers to the interactions between various systems, devices, and entities, as well as those between users or between users and machines, all of which are often enhanced by immersive technologies.

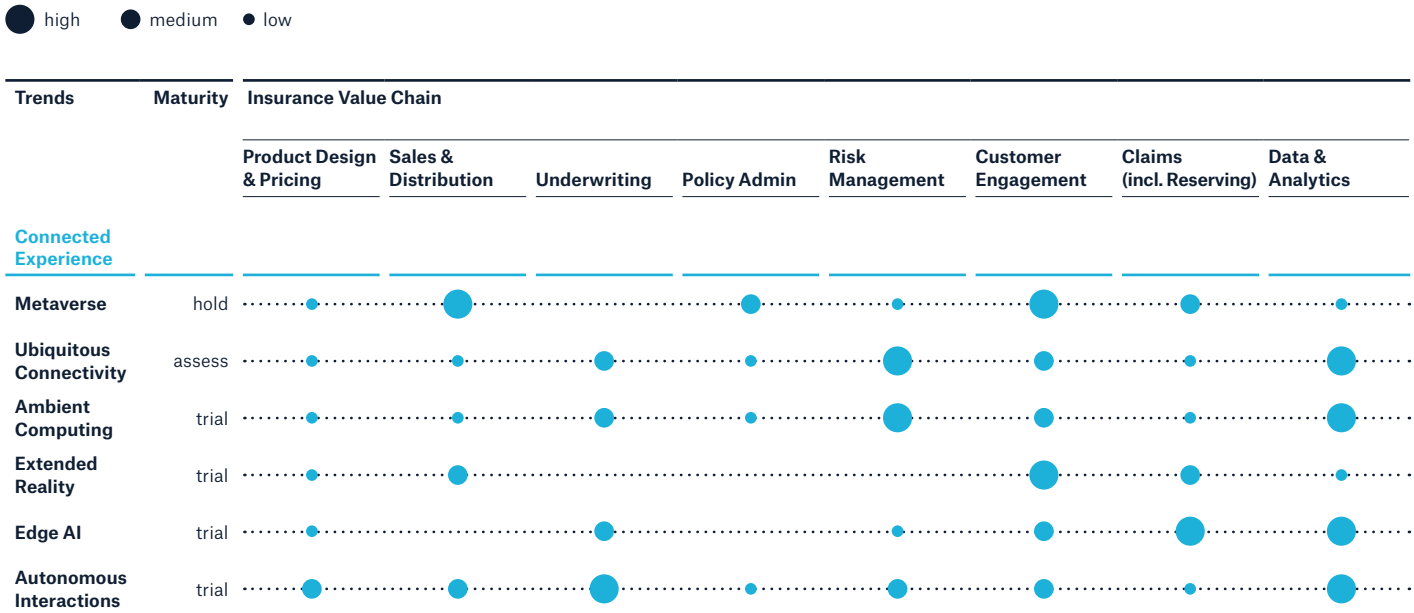
In 2025, many trends are expected to continue to mature. Extended Reality for instance will remain a significant trend, blending virtual and real environments to create more immersive experiences. The number of insurance use cases in virtual spaces will grow, although it will still take time until e.g. the Metaverse becomes a part of everyday life.

AI of course has and will continue to have a major impact on shaping connected experience technologies. Trends such as “Edge AI” and “Autonomous Interactions” highlight the possibilities that Artificial Intelligence offers. The new trend, “Autonomous Interactions” focuses on the capabilities and uses of “AI agents”, which can e.g. autonomously complete decision-making or problem-solving tasks on behalf of a user or another system.

As users, we are increasingly accustomed to continuous connectivity, interacting with digital devices and consuming digital services. In Ambient Computing, interactions are seamless, without the user even noticing them. In this regard, e.g. IoT infrastructure plays a crucial role in reducing data processing costs and increasing energy efficiency. Newly arising standards such as 6G are set to provide even better connectivity around the globe, further boosting speed and reliability.

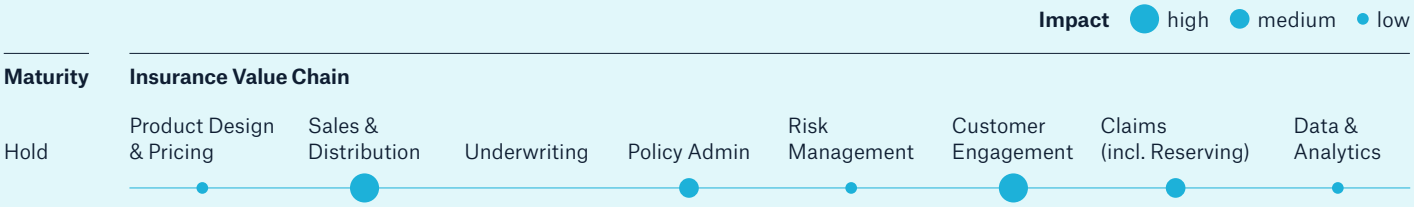
Connected Experience

Trend evolution and impact on the value chain



Connected Experience

Metaverse



Opportunities

- New products: Insurance for virtual assets, identities, and cyber risks
- Customer engagement: Immersive consultation and claims handling
- Recruiting & onboarding: Virtual hiring, training, and onboarding

Risks

- (Lack of) user-friendliness: Easy-to-use, affordable, and accessible hardware is still in development
- Interoperability: Lack of standards to ensure smooth transitions between platforms
- Infrastructure: Reliance on 5G and cloud tech for speed and power may pose challenges
- Security: Robust data protection and cybersecurity are essential

Overview

The term "Metaverse" has gained considerable attention in recent years. From tech giants to startups and media companies, billions have been invested to make the vision of an immersive digital space a reality. And it's no passing fad; rather, it's a clear direction in which technology and society will move in the coming years. The Metaverse has the potential to fundamentally change the way we live, work, and learn.

The Metaverse from the perspective of the insurance industry

The Metaverse refers to an expansive digital space created through the convergence of Augmented Reality (AR), Virtual Reality (VR), Blockchain, and Artificial Intelligence (AI). In this space, the boundaries between physical and digital realities blur. It enables users to engage in interactive and immersive environments as avatars, whether for social encounters, business collaborations, or creative projects. These interoperable platforms aim to facilitate interaction across various digital ecosystems and provide a seamless user experience. In recent years, companies and organizations have begun exploring the versatile possibilities of the Metaverse for e.g. medical training, social interactions, shopping, and in the manufacturing industry.

But a number of challenges still need to be addressed, e.g. user-friendliness and interoperability. Easy-to-use, affordable, and accessible hardware is still in development. Also, the lack of standards can hinder seamless transitions between different platforms, making it difficult for users to navigate the Metaverse efficiently. Infrastructure also poses challenges, as the reliance on 5G and cloud technology for speed and power can differ and create disparities in user experiences depending on their geographic location.
Also, security and data protection are paramount to offer users a trusted environment.

Although the Metaverse is still under development, its potential is undeniable. Companies, governments and institutions are already investing heavily in this future technology, and we are on the cusp of a new era where digital and physical realities will merge, creating countless opportunities for innovation and growth. In the insurance industry in particular, it holds enormous potential.

1. New insurance models
The Metaverse opens up numerous new opportunities for the insurance industry, both in terms of product development and customer interaction. Digital assets like NFTs, virtual real estate, and in-game goods are gaining in importance, increasing the demand for specialized insurance for digital risks. Insurance companies can offer policies that protect virtual goods against hacking, data loss or manipulation. However, traditional underwriting models must first be adapted to the specific risks of virtual environments.

2. Customer experience and sales
The possibility of creating immersive and interactive customer experiences is particularly lucrative for insurance companies, allowing them to set up virtual branches or consulting areas where customers can receive personalized advice from avatars. This could not only increase efficiency, but also appeal to younger, tech-savvy target groups. For example, insurers could use simulations in the Metaverse to visualize risks, such as the effects of natural disasters, to better explain their policies.

3. Prevention and claims management
Further, the Metaverse offers insurers significant opportunities with regard to prevention and claims management. With the help of virtual reality, for example, training courses can be held to optimize behavior in risk situations. For companies, this could mean preparing their employees for workplace accidents or cyber-attacks through immersive training. Augmented Reality technologies could also help loss assessors to evaluate physical damage more efficiently by providing additional data through virtual tools.

4. AI, Blockchain, and data analysis
The technological infrastructure of the Metaverse is dominated by AI and Blockchain. Insurers can use AI to assess risks in real-time by analyzing data from the virtual environment, while Blockchain can be used to secure transactions and proof of ownership in the metaverse, making the insurance process more efficient and transparent. For example, insurance contracts can be integrated directly into smart contracts that automatically settle claims as soon as certain conditions are met.

> The Metaverse offers us as an insurer new possibilities for customer communication.

Matthias Nawrocki
Head of Metaverse, ERGO Group AG

Connected Experience

Ubiquitous Connectivity

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

- Enhanced service delivery: Improved connectivity empowers insurance companies to deliver innovative and enhanced user experiences through smarter, interconnected systems and AI-powered platforms
- Streamlined operations: Insurance organizations can optimize risk modelling, decision-making and processes by leveraging real-time data exchanges across networks of interconnected devices

Risks

- Security vulnerabilities: The growing use of connected devices increases the risk of cyber-attacks, data breaches and disruptions, posing significant challenges for individuals, businesses and governments alike
- Privacy concerns: With more extensive data collection, concerns about protecting personal and corporate information throughout insurance processes have become even more important, requiring advanced cybersecurity measures

Overview

The ability to stay connected online from virtually anywhere has become an essential aspect of modern life. Ubiquitous Connectivity ensures that devices can continuously generate, share and process data without interruptions, even under adverse conditions.

Ultimately, Ubiquitous Connectivity is transforming the way societies work, while also promoting new ways of living, working and engaging on both the technological and social level.

> Broadband technologies such as fiber-optic and 5G, which help 'future-proof' networks, continue to grow rapidly to meet the increasing demand for high-quality, affordable and ubiquitous connectivity (...).

Source: OECD, 2024

Our ability to go online from almost anywhere is crucial for many tasks

The concept of Ubiquitous Connectivity integrates devices seamlessly across diverse locations and service providers. This approach not only accelerates the adoption of advanced technologies in underserved and remote regions – leveraging advances like Low Earth Orbit (LEO) satellites – but also incorporates capabilities for edge computing and hybrid cloud systems. Ubiquitous Connectivity enables real-time data processing like instant insurance claim validation and analytics closer to the source, which can reduce latency, improve reliability, and enhance overall system efficiency. Businesses can leverage this constant data flow to optimize operations, enhance user experiences, and deliver smarter services. Thanks to connected device infrastructures, insurers can monitor homes and assets proactively and offer alerting services that prevent losses before they occur.

One of the perennial challenges for IoT networks concerns limitations in wireless data transfer speeds and network coverage gaps. However, recent advances, including the rollout of 5G, Wi-Fi 6E, Low-Power Wide-Area Networks (LPWAN), and next-generation satellite networks, are addressing these constraints. These technologies, combined with developments in edge computing, AI and advanced IoT sensors, are making solutions like autonomous systems, wearable devices, and smart homes increasingly viable and efficient.

Keyfact

A new world record in wireless transmission has been set by transferring data at a speed of 938 Gigabits per second.

Source: University College London, 2024

Connected Experience

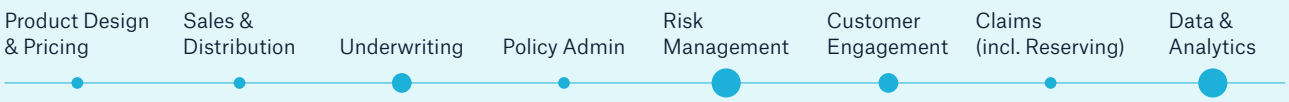
Ambient Computing

Impact high medium low

Maturity

Trial

Insurance Value Chain



Opportunities

- Enhanced risk management through improved access to wider-ranging real-time data points, e.g. real-time underwriting models
- Smart resource management and predictive maintenance help conserve resources and reduce the costs of losses
- Operational efficiency: IoT-powered ambient computing minimizes the need for manual inspections

Risks

- Lack of standardization limits device interoperability and has slowed adoption
- Widespread data collection raises ethical and legal questions about user privacy and data ownership, also in insurance use cases
- Connectivity challenges and limited bandwidth can disrupt real-time data exchanges

Overview

Expanding on the concepts of smart homes and the Internet of Things (IoT), Ambient Computing defines a world where computers and the internet seamlessly interact in our daily lives – without the need to consciously use them. To make this vision a reality, a strong network of smart, connected devices is called for. Sensors and devices must be ubiquitous, interoperable, and capable of processing large and complex data feeds.

> As enabling technologies mature, Ambient Computing has the potential to revolutionize our interactions with the digital world – bringing us closer to a future where technology effortlessly aligns with human behavior.

Norman Thoms
VP IoT Technologies, HSB

The benefits of computers and the internet without consciously using them

The use of smart devices in homes, businesses, and public spaces has surged over the past decade, but when it comes to seamlessly working together in our daily lives, the reality has often fallen short. Though individual smart technologies are very good at specific tasks, creating a seamless and user-friendly experience has proven extremely difficult.

Ambient computing seeks to bridge the gap. This approach uses technologies that can predict needs in advance – when a person's gaze, movements, and behaviors are enough to predict their needs and deliver highly personalized services without any conscious input on their part.

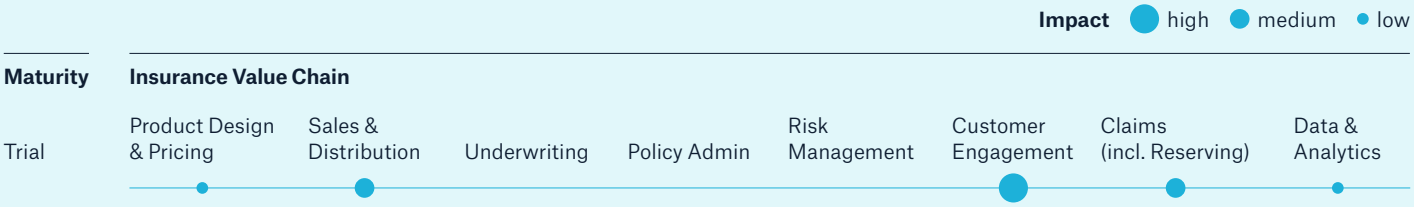
The ultimate goal is to create an environment where technology remains in the background but still operates correctly and intelligently to enhance an individual's experience.

With regard to e.g. Usage-Based Insurance (UBI), Ambient Computing data can update highly personalized insurance products like pay-as-you-go home, health, or property insurance on the basis of the client's actual usage and risk exposure.

Recent advances give hope that this ambient future will be here soon, driven by innovations in Artificial Intelligence (AI), specifically Natural Language Processing (NLP), Large Language Models (LLMs), and communication standards like 5G and Wi-Fi 6E.

Connected Experience

Extended Reality (XR)



Opportunities

- Extended Reality (XR) enables virtual risk demonstrations for customers, explaining complex insurance coverages
- AR-enabled devices can provide data overlays in asset inspections and claims surveys, e.g. risk categories
- XR can be used for remote recruitment processes and immersive training, e.g. for sales agents

Risks

- Malicious applications could result in data leakage, such as providing unintentional insights into a user's communication, field of view or location
- XR devices may create a public perception of surveillance, leading to reputational risk for early adopters

Overview

Extended Reality (XR) encompasses Virtual Reality (VR) – computer-generated artificial 3D environments, Augmented Reality (AR) – the real environment enhanced with digital overlays, and Mixed Reality (MR) – where the virtual and real environment are merged. Currently used in niche use cases, XR is gaining wider adoption as end-user devices become increasingly available and affordable.

Extended Reality is reaching the mainstream

Meta was the surprise winner in the market for Extended Reality devices in 2024. While Apple's Vision Pro delivered the highest quality at a premium price point in a somewhat clunky package, Meta produced a stylish and more affordable product in cooperation with popular glasses brand Ray-Ban. These market dynamics underline that the technology is mature and ready for various private and commercial use cases.

XR will be combined with increasing AI capabilities in recognizing and classifying real-world objects, providing even richer overlays in AR and more realistic simulations in VR.

Virtual customer interactions in the sales process can become immersive, e.g. enabling insurance agents to give tangible demonstrations of risks. In the context of global workforces, the next generation of virtual meetings in XR will be more engaging, allowing a wider range of expression than flat video streams. The Meta glasses already show how XR may find its way into daily life. With increased adoption, the social awkwardness of constant video recording may subside.

Keyfact
More than 1 million Meta Ray-Ban glasses were sold in 2024.

Source: Counterpoint Research

Keyfact
The B2C market revenue of AR/VR hardware is projected to grow to US$ 62bn by 2029.

Source: Statista

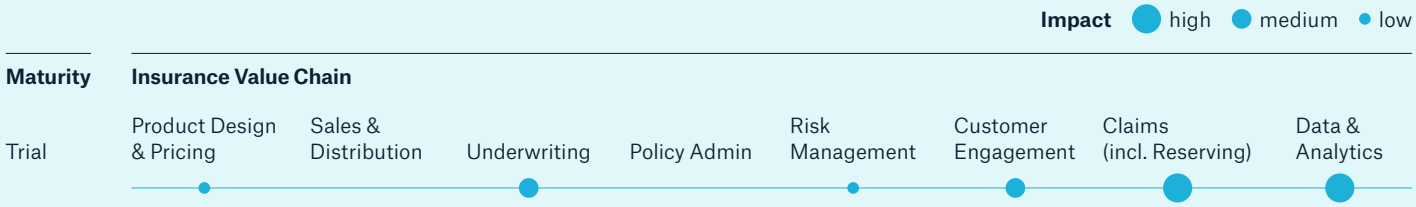
AR technology is starting to be used in underwriting processes in insurance. Digital overlays on smartphone camera feeds are being used to guide SME customers to provide details of their property.

Underwriters may soon get digital overlays during inspections, in the same way as claims adjusters during surveys, to speed up the risk categorization and impact assessment processes. Ever-increasing data collection through cameras and other sensors can endanger privacy and confidentiality. It may extend insurers' exposure to fraud risks, as social profiling, impersonation and fishing become more accurate and believable with more data points.

Socially, VR/MR poses a risk of isolation if virtual alternative realities allow an all-too-easy escape from real-world challenges. See Tech Trend Radar 2024 for more details on Extended Reality (XR).

Connected Experience

Edge AI



Opportunities

- Fast and intelligent decision-making that supports, for example, claims processes or preventive measures
- Reduced costs due to less data traffic
- Local processing enables a better response to local security requirements or regulations

Risks

- Local computing power is more limited than in a cloud approach, so deployable AI models on the edge are usually less complex
- Maintenance and updates might be challenging on spread edge devices

Overview

Edge computing technologies have been around for several years, allowing data to be collected and processed as close to its source as possible, at the edge of networks.

With the rise and growing maturity of AI, edge architecture is often enhanced by local AI applications on edge devices such as IoT devices, smartphones, and other hardware, minimizing the need for extensive cloud resources. This enables improved intelligent decision-making capabilities in real time, along with reduced latency, enhanced data privacy and lower bandwidth usage.

Insurers can benefit from emerging Edge AI solutions

The rise of Edge AI is driven by the increasing need for faster decision-making and processing in various applications. With the proliferation of IoT devices, such as wearables in healthcare or industrial edge devices in general, along with the overall increase in data volume generated, Edge AI provides a solution to the challenges associated with traditional cloud computing models.

By leveraging local processing power, organizations and users can achieve quicker insights and responses, which is especially crucial in industries that require immediate actions based on real-time data analysis, for example where IoT is used for damage detection or damage prevention.

In the same way, insurers can benefit from emerging Edge AI solutions in B2B and B2C business. Use cases in the insurance industry exist, for example, in motor insurance, where built-in AI-based smart systems can not only offer driving assistance but also deliver analytic data, e.g. in the event of an accident. Wearables with AI applications support customers in a healthier lifestyle, and IoT devices with intelligent decision capabilities can be used in an industrial or private home context to reduce the risk of damage, e.g. through leakage surveillance or early warnings of device failures based on analysed data that deviates from normal patterns. See Tech Trend Radar 2024 for more details on Edge computing.

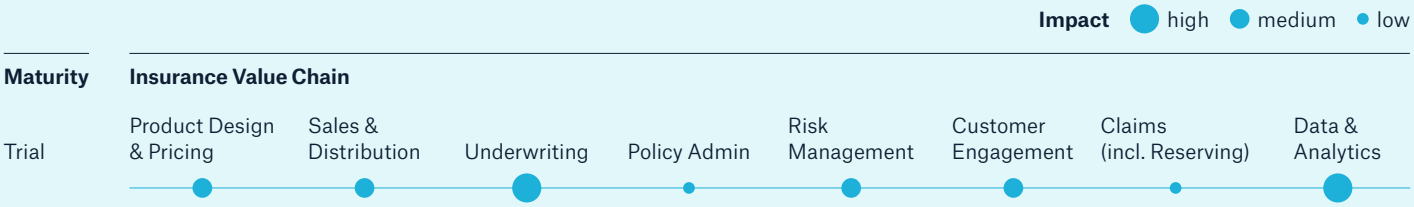
Keyfact

The Edge AI software market is projected to grow at a CAGR of 24.7% starting from US$ 1.92bn in 2024 to US$ 7.19bn by 2030.

Source: marketsandmarkets.com

Connected Experience

Autonomous Interactions



Opportunities

- Autonomous Interactions and Machine Customers can automate tasks, optimize processes and reduce the need for manual labor, leading to cost savings and higher operational efficiency
- They enable highly tailored experiences for customers. For example, autonomous systems can provide customers with customized insurance solutions
- Machine Customers can facilitate real-time transactions and automate decision-making, making financial interactions faster and more efficient

Risks

- AI relies on complex systems and data, which can sometimes lead to errors or inaccurate outputs, potentially causing harm, creating liabilities, or leading to other kinds of financial loss
- AI systems can perpetuate biases and discrimination, leading to unfair outcomes or treatment of certain groups
- AI systems can increase the risk of business interruption (BI) due to cyber-attacks or technical errors, which can lead to significant financial losses and reputational damage

Overview

Autonomous Interactions refer to AI systems that engage directly with customers. AI-driven chatbots are one example. Machine Customers are AI agents that interact autonomously with businesses to complete tasks traditionally managed by people. These systems make decisions based on data analysis and real-time insights, performing functions such as buying products.

The use of Machine Customers comes hand-in-hand with new risks. These AI systems can be used to contract with other parties or perform tasks autonomously. If the AI system makes mistakes, it can give rise to liabilities – which is why some insurers have already incorporated AI exclusions in their products. This could leave companies unprotected as the "age of AI agents" advances. Understanding the capabilities and limitations of Machine Customers, Autonomous Interactions and AI agents is crucial for harnessing their full potential, understanding the risks and, finally, insuring them.

> Human-in-the-Loop (HITL) processes are still seen as a critical component in various scenarios involving AI agents, although the effectiveness of human involvement to mitigate these agents' errors is questionable.

Michael von Gablenz
Head of AI Insurance

AI adoption grew significantly in 2024

AI is being used by more and more companies to automate processes and decision-making. Autonomous Interactions, for example, leverage Artificial Intelligence to perform actions, make decisions, or respond dynamically to changing conditions. Machine Customers and Autonomous Interactions represent specific use cases for AI Agents.

McKinsey & Company's 2024 Global Survey on AI, for example, shows 72% of respondents using AI for at least one function. Generative AI is being used by 65% of respondents.

The use of AI comes with increased awareness about AI risks. For example, AI and Generative AI were ranked as the #1 concern in the "Emerging Technologies" category across five distinct target segments in Munich Re's RiskScan 2024 report. The growing adoption of, and investment in, AI has led to a breakthrough in "AI Agents." AI Agents can be understood as systems or programs capable of performing tasks autonomously on behalf of a user or another system. These agentic systems are the foundation of Machine Customers and Autonomous Interactions.

How do AI agents work?

The decision-making abilities of AI agents vary widely. Rule-based systems rely on fixed logic and are effective for certain tasks but lack the flexibility to adapt to new circumstances. In contrast, learning agents leverage AI algorithms to process data, identify patterns and refine their behavior over time. These agents are well-suited for dynamic environments where adaptability is critical. Probabilistic and utility-based agents which optimize actions based on calculated likelihoods or goals further enhance decision-making. Even advanced agents, however, are constrained by the quality of their training data and the boundaries of their programming.

Human-in-the-Loop (HITL) processes are still viewed as a critical component in scenarios involving AI agents, although the impact of human involvement on mitigating their errors is uncertain. For example, in their paper "The Allocation of Decision Authority to Human and Artificial Intelligence," Athey et al. find that in cases involving well-functioning AI systems, humans in the loop will pay less attention and miss errors produced by AI systems, rendering HITL processes ineffective. As such, it might be preferable for organizations to build less powerful AI Agents if humans are to pay attention and HITL processes are to be used as important risk-mitigating tools.

Risks and opportunities

While Machine Customers and Autonomous Interactions can reduce costs and increase revenues while making economic interactions faster, they also introduce new risks, including errors in AI model outputs, bias and discrimination. To name but a few implications, BI exposure increases under cyber coverage and negligent supervision exposures increase, alongside the risks that are most commonly considered, namely data privacy and governance, reliability, security, transparency and fairness (AI Index Report 2024 – Artificial Intelligence Index).

For instance, an AI agent system could automate the entire process of forecasting supply and demand, managing inventory, and placing orders as a Machine Customer. Once the system has analyzed vast amounts of data – such as historical sales trends, weather forecasts and market conditions – it can predict the future demand for products like winter coats. Based on this prediction and the available supply stock, the Machine Customer triggers an order with suppliers autonomously through a connected e-commerce platform, such as an automated procurement system. The system might place the order directly with manufacturers, negotiating terms and quantities based on predefined rules and real-time pricing data. It then makes the necessary logistics arrangements to ensure the inventory is replenished on time, interacting with warehouse management systems to maintain appropriate stock levels.

	Human-in-the-Loop	Human-out-of-Loop
Fixed	**Assisted Intelligence** Systems assist humans in tasks and/or decision making. They do not learn or adapt.	**Automated Intelligence** Systems automatically execute simple or routine tasks. They do not learn or adapt.
Adaptive	**Augmented Intelligence** Systems assist humans in tasks and/or decision making. They make precise recommendations and learn to improve accuracy over time.	**Autonomous Intelligence** Systems act on their own to complete complex tasks and make decisions. They learn to improve accuracy over time.

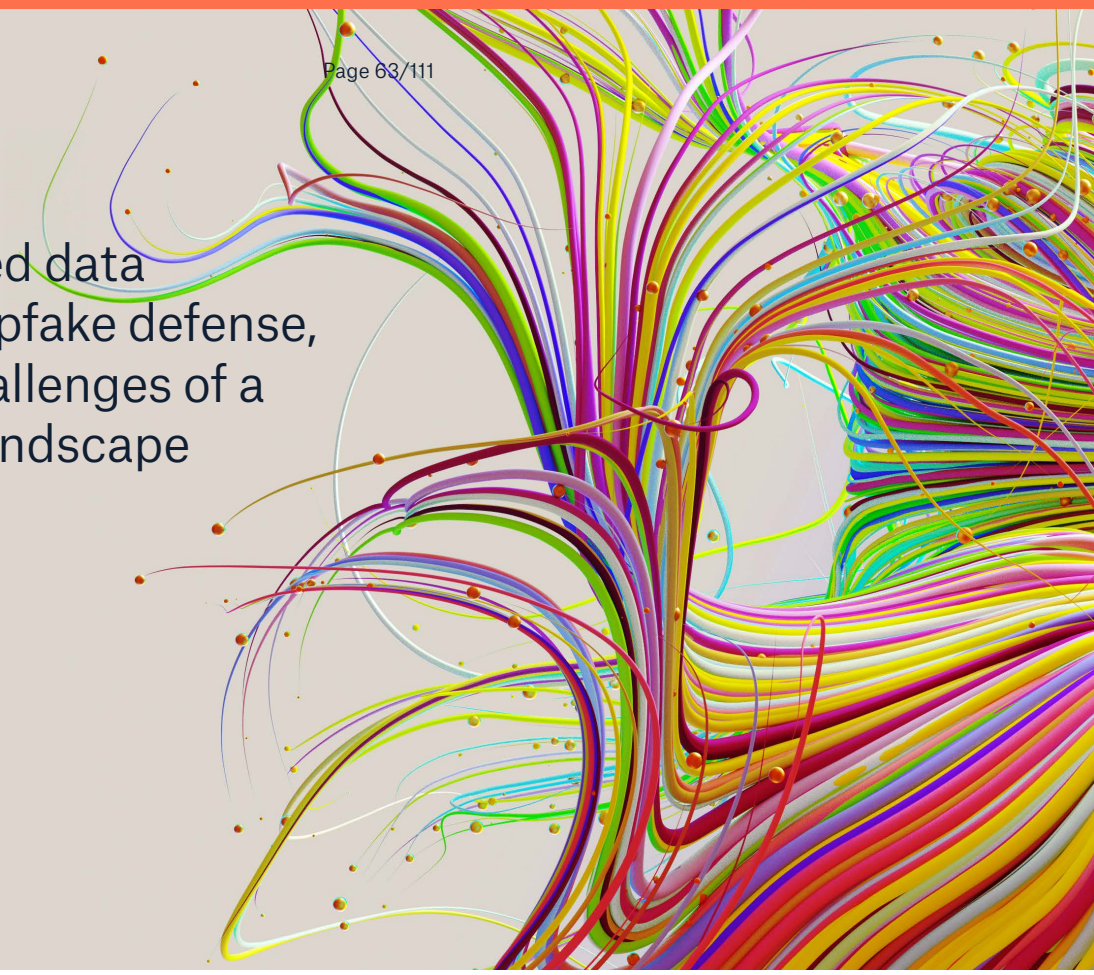
Source: Based on Rao, Dr. A.S., Verweij, G. (2017). Sizing the prize - What's the real value of AI for your business and how can you capitalise? [online]. Available at https://www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf

This process gives rise to several risks. If the AI relies on biased or outdated data, it might place an excessive order, resulting in overstocking and higher costs. The lack of transparency in AI decision-making processes could also make it challenging to assess why certain decisions were made which then result in financial loss. aiSure™, the flagship product from Munich Re's Insure AI team, offers a mechanism for risk transfer to the model provider in the form of a model performance guarantee, enabling confidence and certainty regarding the financial benefits of AI adoption.

Conclusion

Machine Customers and Autonomous Interactions through AI agents offer transformative opportunities across diverse sectors, but require thoughtful implementation to balance their autonomy with human oversight. Addressing risks through transparency, robust testing, ethical frameworks, and risk transfer mechanisms is essential for their responsible deployment.

4 Cyber & Crypto



Cyber & Crypto

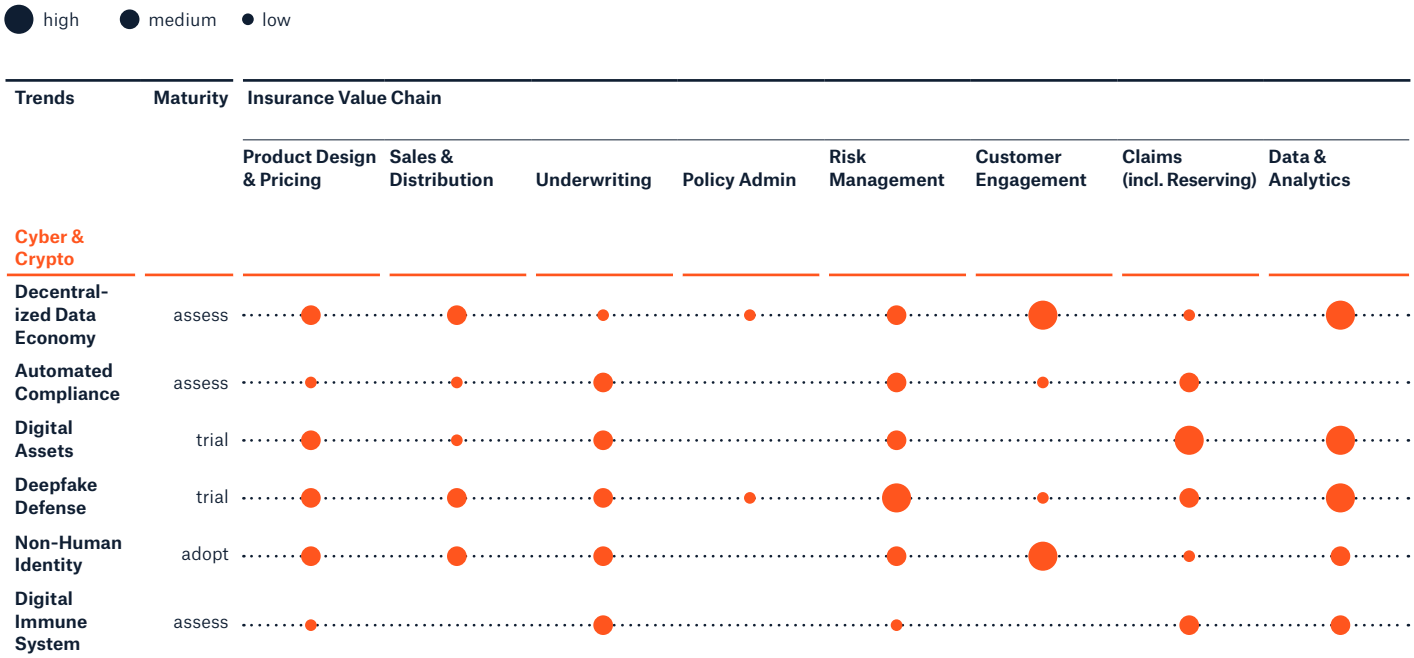
From decentralized data economies to deepfake defense, navigating the challenges of a rapidly evolving landscape

Of all technological trends, Crypto and Cyber consistently surprise us with new opportunities and risks. Every day brings a new development in this area, challenging us all to identify and weigh up the opportunities and risks, even if they are not readily discernible when evaluating the nascent technologies. This year, several trends have captured our attention.

The Decentralized Data Economy, which relies on cryptocurrencies using blockchain and Ethereum technologies, experienced tremendous growth and remains on a trajectory toward greater adoption and utility in business. Facilitating cheaper, faster transactions that provide an immutable audit trail attracts consumers and investors alike. But the Decentralized Data Economy brings with it a number of risks, including lack of regulatory oversight and a history of facilitating nefarious activity. Automated Compliance that incorporates artificial intelligence is revolutionizing what was recently a labor-intensive, largely manual task. As in other areas, automation allows practitioners to concentrate efforts on identifying previously unnoticed risks and mapping more effective strategies. The rising threat of mis- and disinformation, one of the big global risks, has heightened the need for effective Deepfake Defense mechanisms. Deepfake tech can be used to create convincing but false content that can have serious consequences. The evolution of AI is driving Non-Human Identity (NHI), which connects millions of systems and devices. As NHI is more ubiquitous, the need for security and privacy standards is critical. AI is also central to developing the Digital Immune System – a concept derived from human immunity, whereby entire systems are engineered with a holistic approach to maintaining the confidentiality, integrity and availability of information. The rapid convergence of emerging technologies in the cyber landscape has the potential to increase exposures and, as a result, widen the gap between the potential total economic loss from cyber risks and the covered risks by insurance. Insurers are offering solutions to close this gap continuously. The overall ambition is to strengthen resilience to cyber risks, because they are the flip side of digitalised relationships, processes and products. Munich Re shares analyses of the cyber risk landscape annually in its report “Cyber Insurance: Risks and Trends 2025”. Munich Re is committed to investing in collaborations to improve underlying data, further develop sophisticated cyber modelling and innovate solutions.

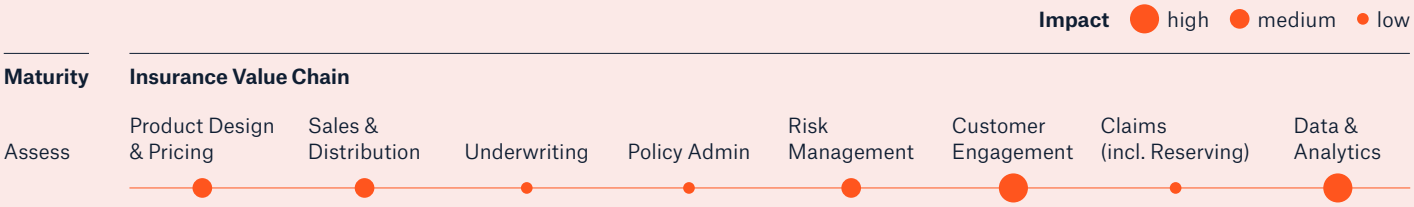
Cyber & Crypto

Trend evolution and impact on the value chain



Cyber & Crypto

Decentralized Data Economy



Opportunities

- Monetization of standardized data-sharing interfaces
- Integration of insurance products into broader (financial, health) services; enhanced risk assessment; personalized insurance offers based on individual customer profiles

Risks

- Data protection as a challenge
- Security and robustness of APIs in data transfers
- Data strategies need to be redesigned

Overview

Insurance companies are increasingly being encouraged to enhance their data storage, quality, and interfaces. By doing so, they can ensure they remain more than just providers of risk capital and maintain strong customer interactions. Opening up to third parties through standardized application programming interfaces (APIs), with customer consent, can provide access to relevant insurance data and create more collaborative opportunities. Potential examples include tax-relevant insurance information for providers of tax return software. As Blockchain approaches are still in the experimental stage and have not yet had any groundbreaking successes in the insurance industry, this year's focus is on innovative forms of data sharing that go beyond B2B for more customer-centricity.

Open data ecosystems: unlocking value through secure data sharing

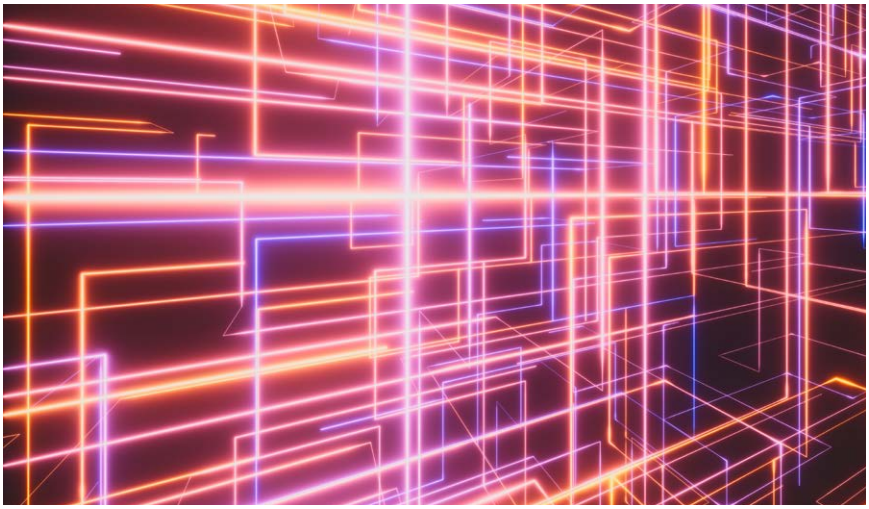
The concept of a Decentralized Data Economy is fundamentally reshaping the way organizations and individuals interact with data. The aim is to enable organizations to share data securely without fear of losing it, while giving individuals the opportunity to distribute their data according to their preferences and exchange it for benefits. At the core of this is the data ecosystem – an evolution from digital ecosystems – , which forms the backbone of innovative products and services driven by seamless data transfers and interoperability.

Data ecosystems allow previously isolated insurance products to evolve into holistic, customer-centric risk management solutions. For instance, by leveraging property geodata, insurers could automatically incorporate building components like solar panels into coverage plans. Large Asian insurers have demonstrated the potential of these ecosystems, especially in health insurance.

Advances in technologies like AI, Blockchain, and cloud computing support real-time data integration, which allows health insurers to integrate data from wearable devices to track physical activity, paving the way for dynamic premium adjustments or wellness incentives.

This reflects the growing importance of data ecosystems in achieving unprecedented levels of data sharing and interoperability between stakeholders across the entire insurance value chain.

The drive for interoperability is already underway. Initial approaches to the interoperable use of data can be seen in institutional (B2B) data transfers between insurers and their partners. While these interfaces initially served insurers, their true potential lies in unlocking value for customers. With the customer's consent, their insurance-related data can be linked to third-party systems via an API – while the provision and use of the API can also be monetized. Standardized data interfaces facilitate smoother data transfers, paving the way for insurers to monetize their data assets while delivering enhanced outcomes to their customers.



In Singapore, customers can already get a holistic view of their overall financial situation by participating in the Singapore Financial Data Exchange. The regulatory landscape is evolving to support this shift toward data ecosystems. One major milestone is the Framework for Financial Data Access (FIDA). Introduced by the European Commission in June 2023, this initiative establishes a regulated environment for customer-centric data sharing. Supported by regulatory initiatives, insurers have a unique opportunity to lead the way in creating a Decentralized Data Economy where trust, innovation, and customer sovereignty form the basis of future growth.

Cyber & Crypto

Automated Compliance

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

- Improved efficiency, accuracy, and client experience
- Reduced costs of compliance
- Improved risk profile
- Increased employee satisfaction
- Improved customer satisfaction and loyalty

Risks

- Requires supervision and maintenance to ensure accuracy and reliability
- Mistakes can be very costly and incur greater cost to remediate
- New laws challenge developers to roll out updates continuously

Overview

Automated Compliance systems take the old processes of tracking frameworks to spreadsheets, and spreadsheets to manual confirmation, to the next level. They write reports and generate logs. They identify anomalies and prioritize remediations. While regulatory compliance was once tedious and labor-intensive, automated systems streamline the process. Automated regulatory compliance has experienced rapid growth with the advancements in artificial intelligence. Adoption of automation can greatly reduce the cost of compliance.

Potentials and benefits of Automated Compliance

For the financial sector, the cost of compliance is soaring due to a continuously evolving regulatory landscape and greater globalization, demanding compliance with what are often complex and conflicting rules. For insurers, using AI systems to continuously monitor transactions for suspicious activity and flag potential compliance issues in real time could support insurance fraud investigations and lower claims costs.

Automating the management of proliferating state, national and global data privacy and cyber security mandates, and generating automated audit trails to document compliance activities, can result in unprecedented efficiencies. This can free up human resources to focus on more complex and rewarding tasks. Eliminating, or at least minimizing, mundane activities can improve employee satisfaction and increase retention of valued personnel.

Automated compliance has a vast range of applications. Financial institutions can use automated systems to monitor transactions, detect fraud, and ensure compliance with regulations such as Know Your Customer (KYC) and Anti-Money Laundering (AML).

Several countries have adopted expansive privacy laws. Within countries, states and municipalities have adopted their own privacy laws. All of these laws have their own, often unique, sometimes complementary or overlapping requirements. Compliance automation can include tools that automate data subject requests, data mapping, and consent management, ensuring that organizations meet data privacy requirements.

"Automating legal compliance can simplify the underwriting process. Software helps enhance consistency and reduce errors."

Tim Zeilman
Vice President, Global Cyber
Product Owner, HSB

Automated systems can help organizations assess security vulnerabilities, implement security controls, and monitor network activity to comply with cybersecurity regulations. Compliance automation can help organizations track and manage supplier compliance with regulations related to environmental, social, and governance (ESG) standards.

While automated compliance holds great promise, it is not the kind of technology that we can set and forget. Automated systems require human supervision and maintenance. While less regulated industries can accept higher rates of error, the financial services, healthcare, critical infrastructure and other highly regulated industries require much lower error rates.

At this time, while error rates of automated compliance software have improved since they were initially introduced, they still require evaluation and continued supervision by humans prior to, during and following implementation.

Cyber & Crypto

Digital Assets

Impact high medium low

Maturity Trial

Insurance Value Chain

Opportunities

- Enhanced liquidity: Fractional ownership and ETFs boost market access and depth.
- Efficiency: Smart contracts cut costs by automating key processes.
- Faster settlement: Atomic settlement ensures quick, error-free transactions.
- Fewer errors: Single-transaction settlements minimize counterparty risks and failures.
- Rising insurance demand: Growth in digital assets drives demand for tailored coverage.

Risks

- Cybersecurity: Digital assets vulnerable to hacks and smart contract flaws.
- Legal uncertainty: Despite regulatory efforts such as the EU's MiCAR, questions surrounding ownership and governance persist.
- Operational risk: Failures in digital asset platforms, custody services, or technology providers can disrupt services - strong resilience is key.
- Regulatory complexity: Global regulatory fragmentation complicates compliance.
- Lack of standards: Missing global standards and interoperability hinder adoption

Overview

Digital assets, such as cryptocurrencies, tokenized assets, and NFTs, have further cemented their existence in the financial industry. The record-breaking launch, in terms of growth, of Bitcoin and Ether ETFs in the course of 2024 demonstrated the resilience and maturity of this asset class. Compared to traditional investments such as gold, digital assets offer more flexibility, transparency, and accessibility, leading the way for innovation in the financial industry. Within the digital asset space, two emerging trends in particular, Decentralized Physical Infrastructure Networks ("DePIN") and Real-World Asset ("RWA") Tokenization, are currently showing promising additional use cases for blockchain technology. In order to generate new opportunities in this expanding asset class, it is important for insurers to keep up with developments in the digital asset ecosystem.

Adoption is accelerating

The growing importance of digital assets Bitcoin ETFs have been paving the way for broader institutional adoption, helping to establish digital assets as a potential alternative to traditional investments. In 2024, the approval of Ether ETFs further cemented Ether's position as the second-largest cryptocurrency. According to on-chain data, U.S.-listed Bitcoin ETFs amassed $109 billion in assets within just eleven months – a figure nearing the $121 billion that U.S.-listed gold ETFs took nearly two decades to achieve.

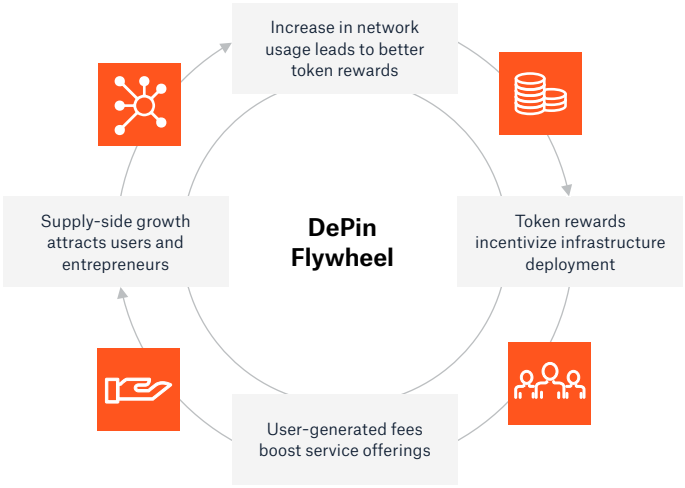
Adoption is accelerating globally, with financial institutions, banks, and asset managers actively entering the market. Major players such as Fidelity, JPMorgan, and Deutsche Bank are developing digital asset products, adding custody solutions and staking services into their offering. This wave of institutional participation underscores the mainstream attention that digital assets are attracting, reinforcing their maturity and scalability.

At the same time, tokenized assets are transforming access to traditionally illiquid markets, including, but not limited to, real estate and fine art. By enabling fractional ownership, tokenization democratizes high-value investments, allowing everyday investors to participate in markets that were once out of reach.

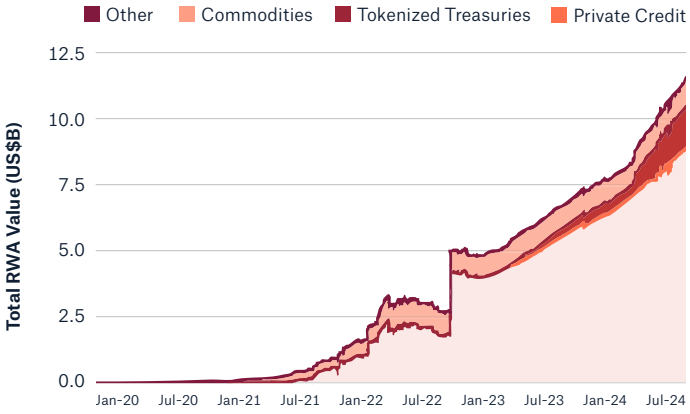
Key trends in the Digital Asset ecosystem

Decentralized Physical Infrastructure Networks (DePIN) integrate blockchain technology with physical infrastructure, such as telecommunications and decentralized storage, fostering community-driven business models. By leveraging blockchain for secure, transparent coordination and incentive mechanisms, DePIN ensures trustless participation and verifiable transactions. For example, Helium, a company Munich Re Ventures invested in in 2016, uses blockchain-based token rewards to incentivize users to build and maintain decentralized wireless networks. This strategy not only lowers operational costs but also redistributes ownership to individuals, promoting a more inclusive system. Industry experts highlight DePIN's transformative potential in industries like IoT and telecommunications, enabling decentralized coordination, security, and monetization at scale.

Tokenization is transforming how assets – both tangible, like property and commodities, and intangible, such as intellectual property and digital content – are bought, sold, and owned. It allows for fractional ownership, making these assets more liquid and accessible to a broader range of investors. For example, BlackRock's tokenized fund "BUIDL" provides access to infrastructure investments through blockchain, enabling greater transparency and flexibility for investors. Similarly, in 2024, Siemens issued a € 300 million blockchain-based bond, leveraging tokenization to streamline issuance processes, bypass traditional intermediaries, and reduce transaction costs. In total, tokenization of real-world assets (excl. stablecoins, which are a cryptocurrency pegged to fiat currency to maintain a stable value) have grown to more than US$ 12bn (as of October 2024, source).



Source: Datsenko, A. (2023). Decentralized Physical Infrastructure (DePIN) Explained [online]. Available at https://ideasoft.io/blog/what-are-decentralized-physical-infrastructure-networks-depin/



Source: Sharma, S., Tan, C. (2024). RWAs: A Safe Haven for On-Chain Yields? [online]. Binance. Available at: https://www.binance.com/en/research/analysis/rwas-a-safe-haven-for-onchain-yields

> Tokenization represents a fundamental shift in how we understand asset ownership, creating immense opportunities for liquidity and accessibility. However, it also introduces unique risks – particularly around smart contract vulnerabilities and challenges posed by regulatory developments. As insurers, our role is to bridge this gap, providing confidence and protection to stakeholders by addressing insurable risks in this evolving landscape.

Dr. Andre Knoerchen
Head of New Tech Underwriting

Central to tokenization are smart contracts, which automate the issuance, transfer, and enforcement of tokenized assets. These programs or algorithms on the blockchain reduce the need for intermediaries, ensure real-time execution of transactions, and minimize the risk of human error. For example, a smart contract could automatically distribute revenue from a tokenized property to its fractional owners, ensuring transparency and accuracy. By providing tamper-proof execution, smart contracts enhance trust and efficiency, making tokenized assets an attractive option for investors and businesses alike.

However, reliance on smart contracts also introduces risks. Vulnerabilities in their code can be exploited, potentially leading to financial loss or unauthorized access to assets. Recent research conducted by SolidityScan revealed that around 10% of audited smart contracts contained critical flaws, emphasizing the need for rigorous testing and continuous monitoring. Additionally, legal disputes may arise if the terms of a smart contract conflict with traditional regulatory frameworks or are ambiguously coded. As tokenization becomes more widespread, mitigating these risks will be essential to ensure its long-term success.

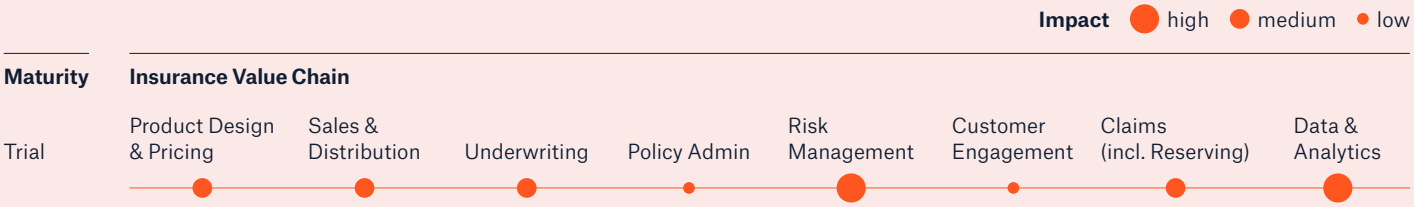
Beyond these challenges, tokenization offers transformative benefits for industries beyond finance. By way of example, real estate investments become more accessible through fractional ownership, while supply chain management can utilize tokenized commodities for enhanced traceability. Even intellectual property, such as music rights or patents, can be tokenized, unlocking new revenue streams and improving ownership transparency.

Conclusion: The future of Digital Assets

The leading Digital Assets are no longer speculative novelties – they have become essential to the financial ecosystem. The adoption of Bitcoin and Ether ETFs highlights their growing legitimacy and potential. At the same time, trends like DePIN and tokenization are expanding blockchain's applications beyond finance, touching industries like infrastructure and real estate. For insurers and other stakeholders, staying ahead of these developments is important to capturing new business opportunities, managing emerging risks, and driving innovation. Digital assets, such as Bitcoin, Ether, stablecoins and tokenized RWAs are not just a passing trend – they represent a profound shift in how value is created, transferred, and insured.

Cyber & Crypto

Deepfake Defense



Opportunities

- Development of AI tools for detecting and mitigating synthetic media.
- Educational campaigns to raise awareness about deepfake risks and recognition.
- Cross-industry partnerships to establish standards and strengthen defenses against misinformation.

Risks

- Detection must be nearly flawless to maintain trust and credibility.
- Rapid advances in deepfake technology challenge current defenses.
- Missteps or lack of transparency could erode public confidence.

Overview

Deepfake and disinformation defense involves identifying, mitigating, and preventing the spread of manipulated media and false information. By leveraging advanced AI tools, organizations can detect artificial content, authenticate media, and safeguard against the misuse of deepfakes in scams, misinformation campaigns, and reputational attacks. This defense strategy is critical for maintaining trust, protecting sensitive information, and ensuring the integrity of communication channels. As deepfake technology evolves, proactive measures, including robust detection systems and public awareness, are essential to counter these sophisticated threats effectively.

Combating digital deception

In an era dominated by digital transformation, deepfakes and disinformation have emerged as formidable threats to information integrity. Deepfakes, a product of Generative AI, can convincingly fabricate audio, video, and images. While these technologies demonstrate impressive advances, their misuse enables identity theft, fraud, and erodes trust in digital content. Similarly, disinformation – the deliberate spread of false information – undermines societal cohesion and democratic processes, making it one of the most pressing challenges of the digital age.

Deepfake technology is evolving rapidly, making it increasingly difficult to distinguish authentic media from fabricated content. Cybercriminals exploit these tools for personal gain, from impersonating executives in corporate scams to disseminating fake political statements aimed at manipulating public opinion. The consequences extend beyond the immediate targets, undermining trust in media and institutions globally.

In a quest to undermine the truth and trust, disinformation campaigns leverage false or misleading content to disrupt societies and influence decision-making. Social media platforms amplify the reach of such campaigns, spreading disinformation at unprecedented speeds. This creates echo chambers that reinforce false narratives, making it harder to combat their influence. Governments, organizations, and individuals alike are grappling with the far-reaching implications of this digital deception.

Despite the risks, opportunities exist to address deepfake and disinformation threats effectively:

- **Advancing detection technologies**
  AI-powered detection tools can analyze content authenticity and identify deepfake media. These solutions can integrate with social platforms and news outlets to flag suspicious material, restoring public trust in digital ecosystems.

- **Strengthening public-private collaboration**
  Partnerships between governments, tech companies, and researchers can lead to unified strategies for combating digital deception. By pooling resources and expertise, stakeholders can create global standards and share best practices to enhance defense mechanisms.

- **Enhancing media literacy**
  Public education campaigns focused on media literacy can empower individuals to critically evaluate digital content, reducing the impact of misinformation. These programs play a vital role in creating a digitally resilient society.

- **Increasing regulatory scrutiny**
  A number of countries and regions have laws that regulate deepfakes, including the European Union, China, South Korea and individual states within the United States. In the US, a number of jurisdictions have laws that govern the development and use of deepfakes. These laws range from criminalizing the unauthorized mimicking of a voice or depiction of an identifiable individual or the use of a minor's image, to requiring disclosure when deepfakes are used.

Risks and challenges

Detection systems face the critical challenge of achieving near-perfect accuracy, as even minor errors can significantly erode confidence in their effectiveness. However, this risk can be mitigated by combining automated detection tools with human oversight to enhance reliability and trust. Recent advances in machine learning and media-modality fusion techniques have shown promise in improving detection rates by analyzing multiple features simultaneously, such as facial expressions and audio signals.

Another pressing issue is the rapid evolution of deepfake technology. As detection tools improve, so do the methods used to create more sophisticated and convincing deepfakes. Techniques like adversarial training and multi-modal data integration are emerging as vital tools in this ongoing technological arms race, which demands continuous innovation to stay ahead of malicious actors (Gupta et al.). The widespread proliferation of deepfakes and disinformation has already weakened public trust in digital media. Without transparent and effective solutions, this erosion of trust could intensify, impacting businesses, institutions, and individuals who rely on the credibility of digital information.

Building a proactive defense

To counter these challenges, organizations must take proactive measures. Investing in robust detection systems, establishing transparent policies, and fostering cross-industry collaboration are critical steps toward mitigating digital deception. Additionally, public awareness initiatives play a vital role in educating individuals on how to identify fake content and comprehend the broader implications of disinformation. By addressing these challenges with urgency and precision, we can work toward to create a safer and more trustworthy digital ecosystem where the integrity of information remains uncompromised.

Deepfakes and insurance

The proliferation of deepfakes has vast and uncertain implications for insurance, from underwriting through to claims, all implicating fraud. For example, deepfakes can be used in applications for insurance to misrepresent the security of a computer system or to enhance the appearance of a property. In claims, deepfakes can be used to make a fraudulent claim or could be the basis of a claim. For example, deepfakes are increasingly used in social engineering to impersonate clients, vendors or internal executives in attempts to gain unauthorized access to systems or to persuade someone with authority to make a fraudulent funds transfer or misdirect shipments of inventory. This means that detection of deepfakes is, and will remain, critically important in order to mitigate insurance risks.

Defending reality

The rise of deepfakes and disinformation presents one of the most pressing challenges of the digital age, demanding immediate and sustained action. While the technology behind these threats is impressive, its misuse has far-reaching implications for trust, security, and societal cohesion. Combating digital deception is not just a technological endeavor; it's a collective responsibility involving governments, industries, and individuals.

As we develop advanced detection tools, foster cross-industry collaboration, and enhance public awareness, the question remains: Are these efforts living up to the hype? The answer depends on our ability to stay ahead of evolving threats and turn defensive strategies into proactive solutions.

Key Findings
According to a McAfee survey, 70% of respondents stated they are not confident in distinguishing between real and cloned voices. This highlights the growing sophistication of AI voice cloning technology and its potential to exploit vulnerabilities in human trust.

Cyber & Crypto

Non-Human Identity

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

- NHI enables secured systems to communicate and share information without human interaction. This promotes efficiency and enhances security.
- When properly configured and monitored, NHI reduces unauthorized access.
- Facilitates compliance with industry standards.

Risks

- NHIs increasingly targeted in cyber attacks.
- Many NHIs are not monitored and are poorly secured.
- The current market for NHI is highly fragmented.

Overview

Identity Access Management (IAM) is a core component of cybersecurity. IAM refers to how users can access digital resources and what they can do with them. Non-Human Identity (NHI) – also sometimes referred to as Machine Identity – is a component of IAM and is increasingly important within information technology and cybersecurity. NHI includes all methods of managing access to digital resources that do not involve humans. For example, a password is a conventional IAM method whereas an automated method enabling one system to access another is an NHI method of access. NHIs include service accounts, APIs, IoT devices, and bots (see figure below).

NHIs can make systems more efficient, secure and compliant but suffer from vulnerabilities

NHI is being used increasingly in many businesses. Re/insurance is an ideal application. For example, Application Programming Interfaces (APIs) enable reinsurers and cedents to share data and services, creating a seamless experience for insureds. But NHI is about much more than one system connecting to another. In many cases, multiple systems are connected. NHIs enable IoT, OT equipment, AI Large Language Models, Databases, Robotic Process Automation and a large number of other tools.

While many businesses and industries have deployed NHI, the technologies suffer from several weaknesses. NHIs tend to be insecure, often using security credentials that are static, and have excessive privileges and weak encryption. They are increasingly being targeted in cyberattacks. According to the NHI Management Group, 80% of identity breaches involved NHIs. Compromised NHIs frequently lead to successful cyberattacks. The lack of NHI security has led to recent government initiatives to provide guidance and to publish best practices.

Key Findings

NHI use is proliferating rapidly but suffers from security vulnerabilities. Government guidance and standards are pushing industry to improve security so that the technology can advance safely.

With the exponential growth of Non-Human Identities (NHI), enterprises must adopt comprehensive platforms that move beyond traditional username-and-password models to ensure robust IAM programs.

Sidra Ahmed Lefort
Munich Re Ventures

The Australian Signals Directorate's Australian Cyber Security Centre (ASD's ACSC) in collaboration with national cyber security authorities of the United States, United Kingdom, Canada, New Zealand, Germany, Netherlands, Japan, and the Republic of Korea, has published "Principles of Operational Technology (OT) Cyber Security". The document provides best practices to help organizations design, implement, and manage secure OT environments, ensuring business continuity for critical services.

Also in October of 2024, CISA issued "Internet of Things Security Acquisition Guidance" and the United States National Institute of Standards and Technology (NIST) has been developing and maintaining its "Cybersecurity for IOT Program" since at least 2017. While the security of NHIs is a challenge, the proliferation of guidance and standards, as well as the extensive coordination among nations to develop and maintain them, is encouraging for the future security and utilization of NHIs.

Non-Human Identities (NHIs)

NHI Mgmt Group

Types of NHIs

API Keys	Tokens	Service Accounts	Secrets	Technical Accounts	Certificates	Admin Accounts	System Accounts

Where Are They Found

Machines / Devices

- Servers
- Mobiles
- Desktops
- Internet of Things (IOT)
- Operational Tech (OT) Equipment
- Tech Equipment used in Industry

Software Workloads

- Containers, Microservices
- Virtual Machines (VMs), Databases
- Applications, Services, Scripts
- API Processes/Services
- Robotic Process Automation (RPA)
- AI LLMs, Chatbots

Source: Non-Human Identity Management Group (2025). The Ultimate Guide To Non-Human Identities [online].
Available at: https://nhimg.org/the-ultimate-guide-to-non-human-identities

Cyber & Crypto

Digital Immune System

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

- 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, influence the rapid development and deployment of digital immune system (DIS) capabilities. A DIS is a holistic approach to an entity's entire IT infrastructure aimed at optimizing the user experience and reducing system failures. As this technology is expanded a nd improved, all components of the insurance value chain can benefit from greater security, resilience and enhanced user experience.

For re/insurers, entities employing proven DIS are likely to be easier to underwrite. These systems offer increased security, transparency, and an improved user experience overall, leading to fewer claims and greater profitability.

A holistic approach

Originally conceived by Gartner, the digital immune system is a collection of practices and technologies used in software design, development, operations and analytics aimed at mitigating risks, and improving cyber security 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 worth an estimated USD 32.50bn in 2024, will grow to USD 36.70bn in 2025, and is projected to reach around USD 109.36bn by 2034.

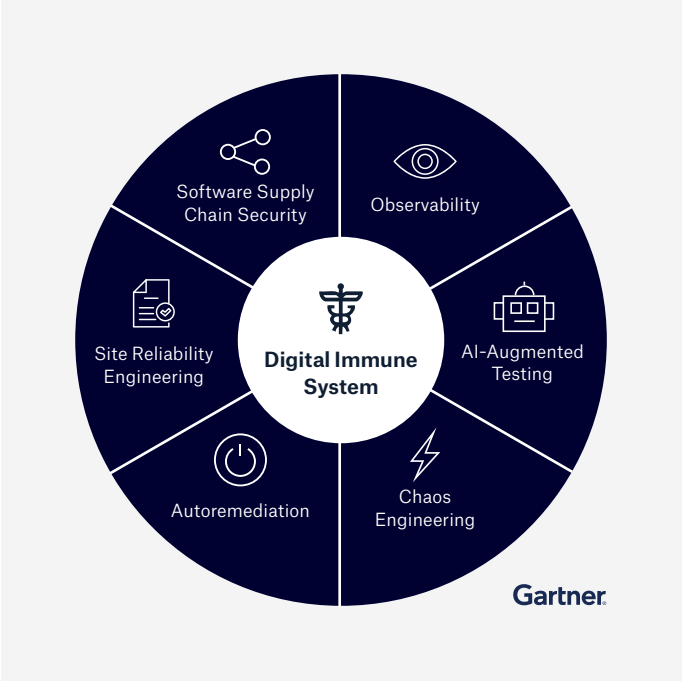
Most of the major advances in the DIS can be attributed to advances in generative AI. Working in tandem with existing technologies and practices, generative AI allows for more efficient and accurate autonomous testing, simplifies chaos engineering, documents observations, and provides automated remediation and continuous validation. As these technologies and processes improve, it is essential for humans to supervise, maintain, document and contribute to the continuous development of the DIS. Due to the challenges presented by the increasing level of sophistication of ever evolving threats, the systems also have to evolve to reflect and outpace the threat landscape.

According to The Business Research Company, 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 the need for, the sort of coordinated approach that the digital immune system can provide.

Insurance implications

As adoption of the DIS increases and technology harmonization is improved, insurance will benefit in several ways. Cyber insurance, in particular, will see fewer and less severe claims related to cyber attacks. Data breaches, particularly due to cyber attacks, will also become less frequent. Business interruption, perhaps the most costly component of cyber remediation, will also likely be reduced, as the DIS provides a documented system roadmap that can reduce recovery time.

Figure: Six Elements of a Digital Immune System



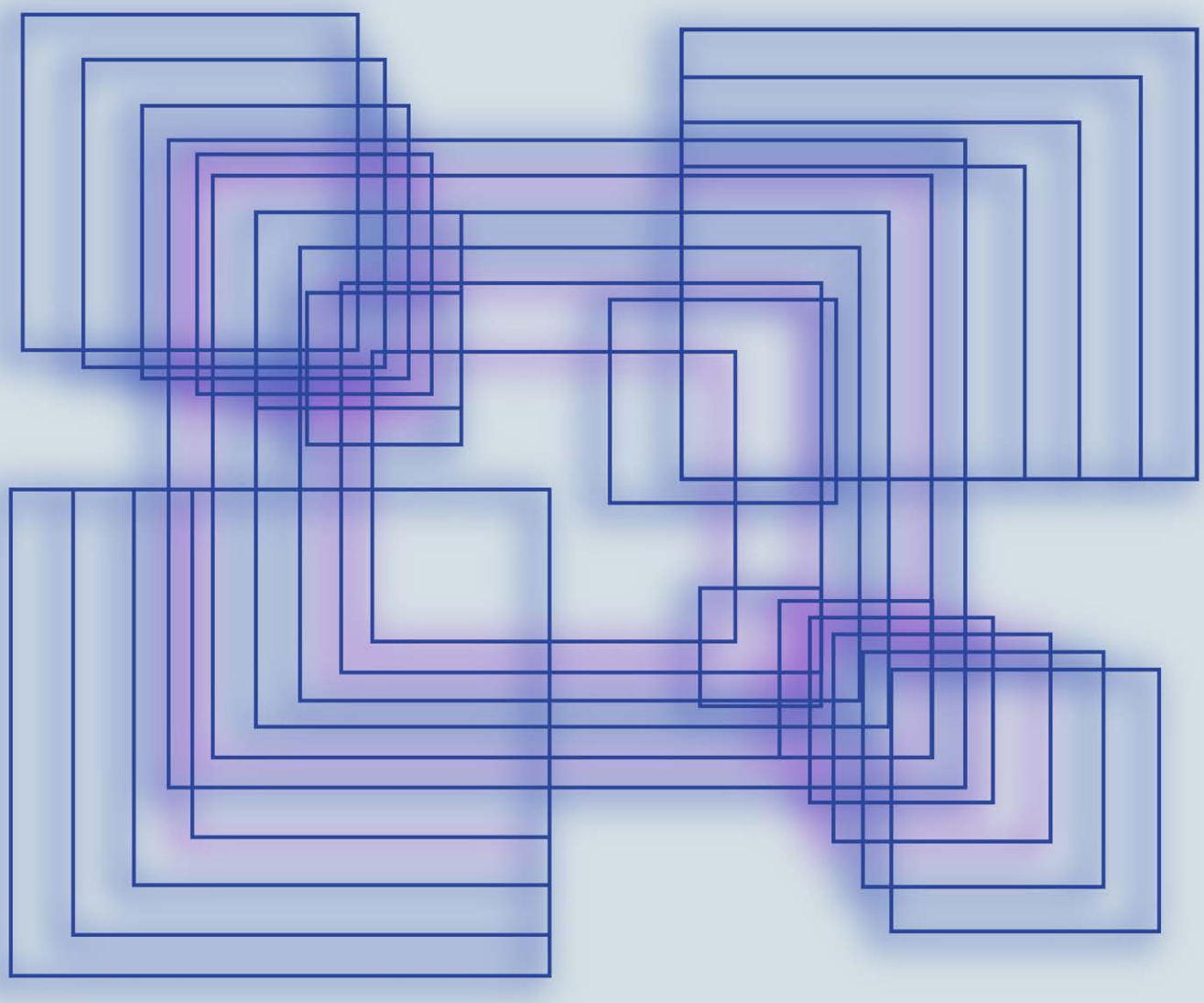
Source: Gartner®, Improve Software Quality by Building Digital Immunity, 17 October 2022, figure 2. GARTNER is a registered trademark and service mark of Gartner, Inc. and/or its affiliates in the U.S. and internationally and is used herein with permission. All rights reserved.

Conclusion

The digital immune system will make further advancements over the coming years. The advent of generative artificial intelligence, together with rapid developments in quantum computing, will undoubtedly assist us in gaining an advantage over bad actors and facilitate new gains in risk mitigation and management.

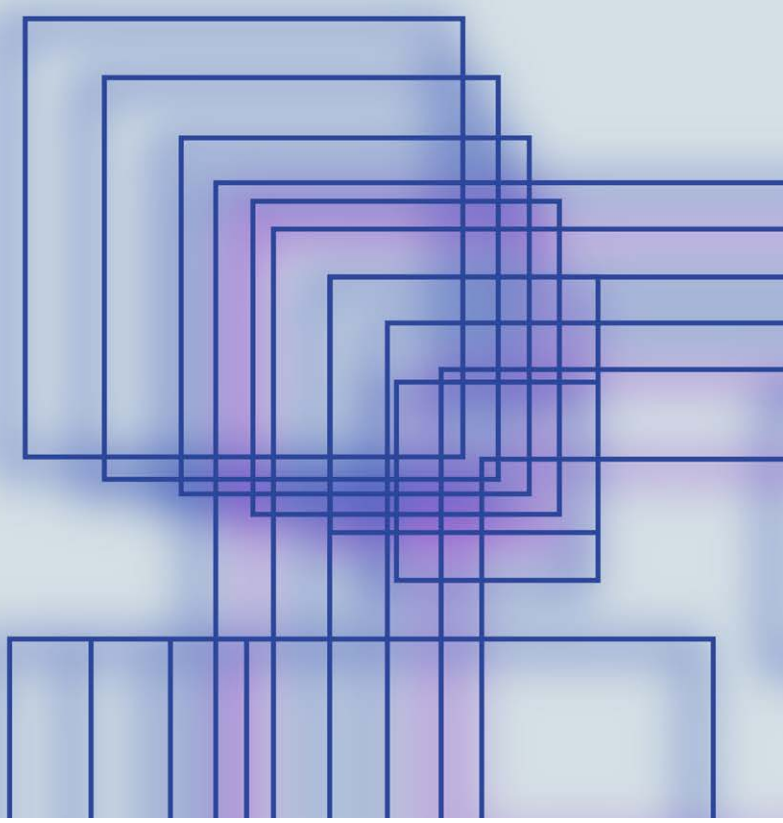
Key Findings
The digital immune system market is poised to grow at a CAGR of 12.9% between 2024 and 2034.

5 Redefining Industries



Redefining Industries

Remote sensing, renewable energy, EVs, and climate resilience: navigating the changing risk landscape

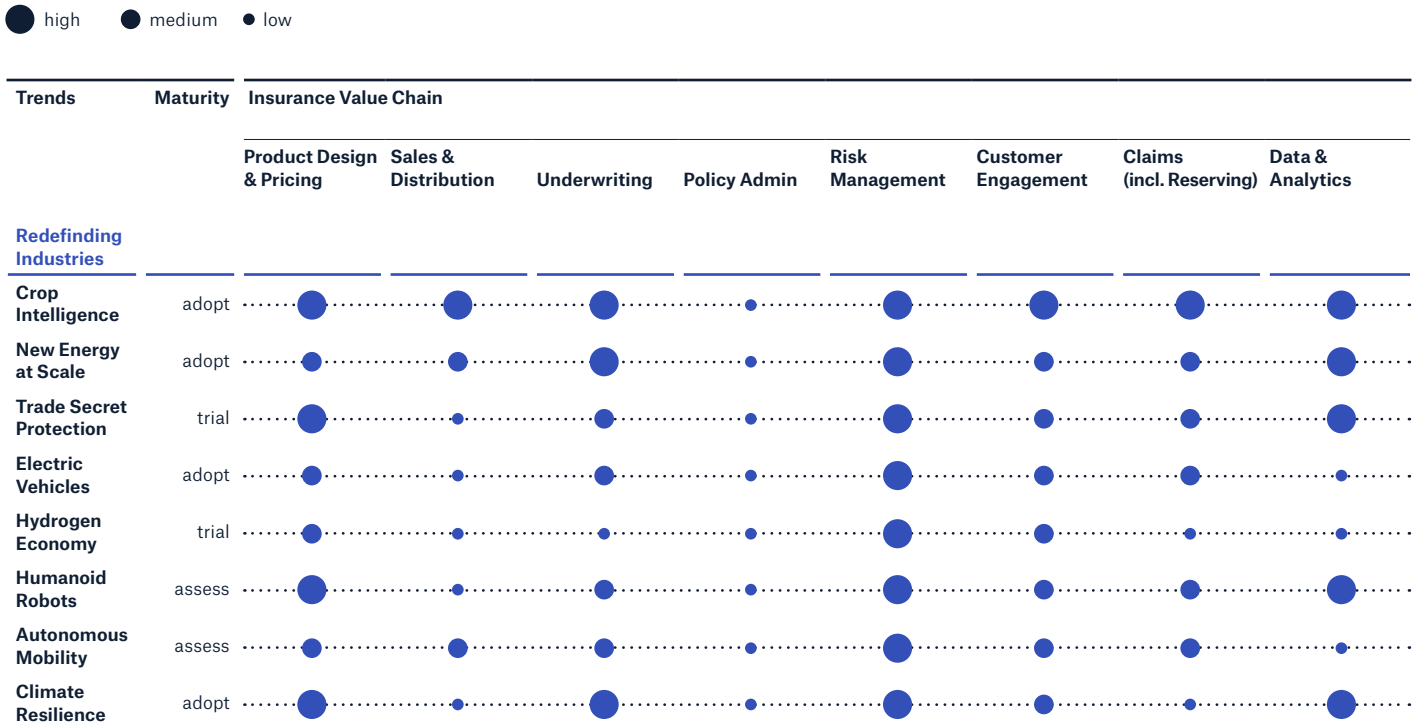


The convergence of technological advancements and changing market conditions is redefining traditional industries, with far-reaching implications for the insurance sector.

The use of remote sensing technologies, such as satellite imagery and drones, is revolutionizing agricultural insurance through improved crop monitoring and risk assessment. The transition to renewable energy sources, including solar, wind, and hydro, is creating new opportunities and risks for the insurance industry, from investment in transmission and distribution systems to the development of insurance solutions. The rise of Electric Vehicles (EVs) is also driving change, with insurers needing to adapt to new risks and opportunities, from higher repair costs to cyber threats. Climate Resilience is becoming increasingly important, with businesses seeking to improve their understanding and management of climate-related risks. Meanwhile, the protection of trade secrets is taking on newfound importance in a globalized, digitalized economy, with robust risk solutions and collaboration between insurers and businesses crucial for safeguarding valuable information assets. Other trends, such as the Hydrogen Economy, the Humanoid Robotics, and Autonomous Mobility, are also poised to have a profound impact on the insurance sector, from enhancing operational efficiency to creating new products and services. Ultimately, these trends will collectively reshape the insurance industry, requiring insurers to innovate, adapt, and respond to emerging risks and opportunities.

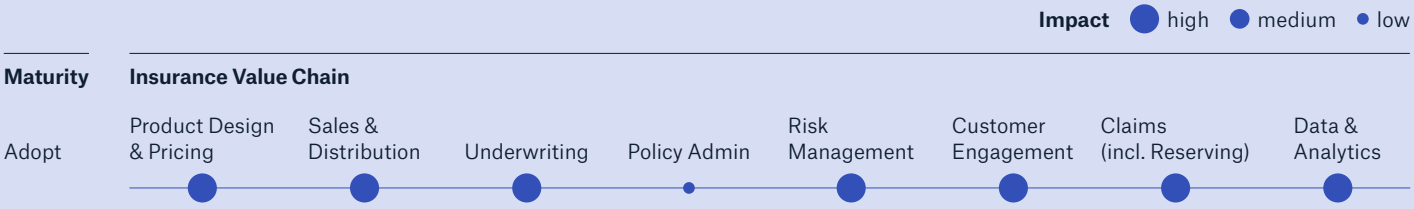
Redefining Industries

Trend evolution and impact on the value chain



Redefining Industries

Crop Intelligence



Opportunities

- Expansion of crop insurance in the food production chain
- Continuous crop monitoring
- Faster and more accurate claims settlement

Risks

- Technical and accuracy-related limitations
- Legal and privacy risks

Overview

Remote sensing, one of the main trends in the crop insurance market, refers to the use of technologies to capture, process and interpret information about crops and rural areas without the need to be physically present. It makes particular use of satellite image processing to assess risks, monitor crops and help speed up the claims adjustment process. In this context, it plays a leading role in helping insurance companies offer customized products for their clients, promoting greater adherence to insurance and a better experience for their policyholders. Despite the progress made in recent years, it is important to note that there is still a significant protection gap, leaving around 60% of global agricultural production vulnerable, which represents an impressive US$ 113bn. Remote sensing is key to helping the market tackle this problem.

Remote sensing and crop insurance: Transforming risk management

Agriculture is inherently vulnerable to climatic risks, biological agents and environmental variations that can compromise production and mean significant losses for farmers. In this context, agricultural insurance plays a fundamental role in mitigating these risks, guaranteeing financial protection for farmers. However, the accuracy and efficiency of risk analysis processes, crop monitoring, and the settlement of potential claims are constant challenges for insurance companies.

In recent years, remote sensing has emerged as a revolutionary tool in this sector, enabling precise and automated crop monitoring. The use of satellite images, drones and IoT (Internet of Things) sensors has transformed the way insurance companies assess agricultural risks and determine insurance premiums, while also allowing them to process claims more quickly and reliably.

Remote sensing and the underwriting process

Policy underwriting, the stage of risk assessment and pricing, requires a thorough analysis of the risks associated with a particular crop and region. Traditionally, this process has relied on face-to-face visits by experts and limited historical data. With remote sensing, insurers can access detailed information on vegetation health, climatic conditions and historical production performance through indices like the NDVI (Normalized Difference Vegetation Index) and the EVI (Enhanced Vegetation Index).

Because data is captured cycle after cycle, insurers now have access to a vast pool. By gaining a more in-depth understanding of the reality and performance pattern of the area in question, they can offer customized products adapted to the specific needs of each farmer. This customization not only offers insurers more security when accepting/pricing risks. It also helps to boost sales, reducing anti-selection and contributing to the territorial dispersion of portfolios, which is essential for volatile lines such as Agro.

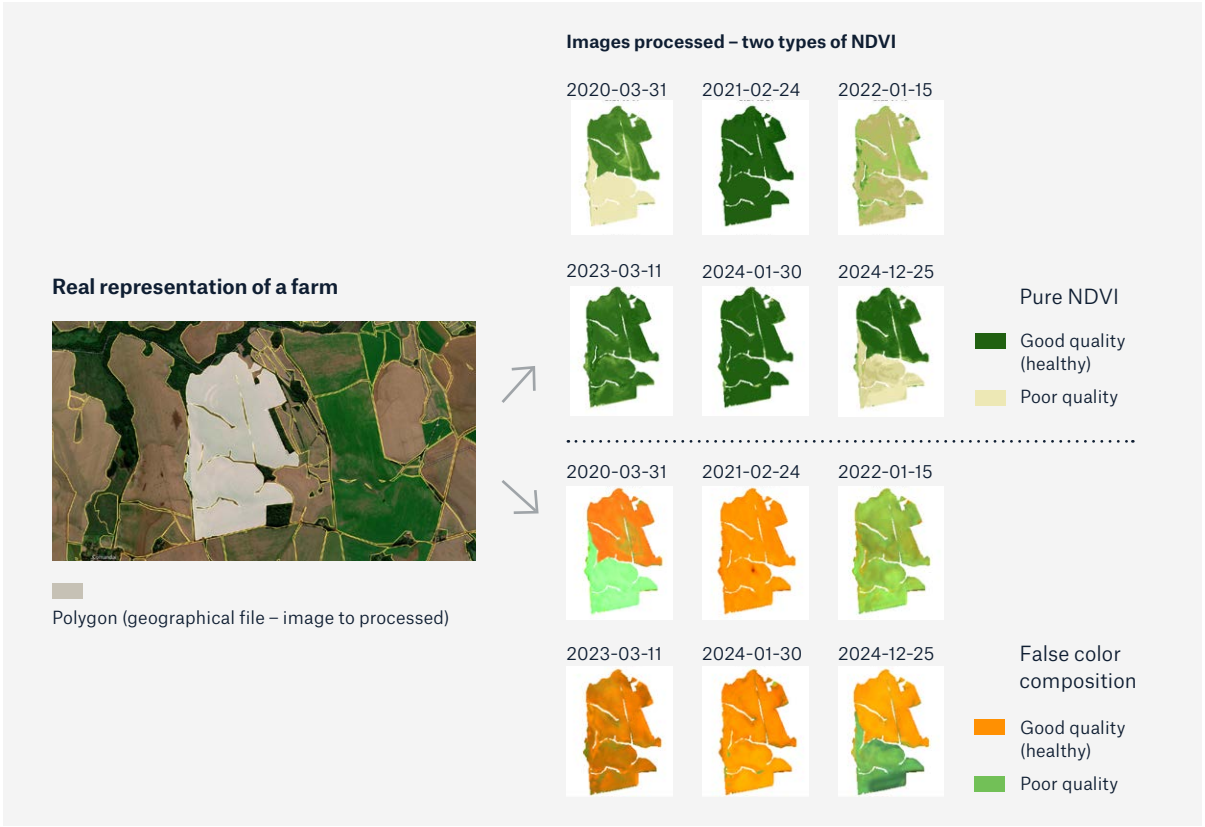
Continuous crop monitoring and risk mitigation

Once a policy has been issued, remote sensing allows insurers to monitor crop conditions on an ongoing basis, generating data that makes it possible to identify water stress patterns, possible management errors, and damage caused by adverse weather events. This sort of monitoring is crucial for taking swift and assertive action – be it by excluding risks associated with management from the policy, meaning that these are not covered, or by anticipating the occurrence and impact of claims on crops. In addition to managing their portfolios more effectively, insurers become part of the production process with farmers, providing timely service with the quality and agility they need. Data can also be shared with farmers, allowing them to contribute to decision-making and improve the efficiency of agricultural operations in the field.

Faster and more accurate claims settlement

The moment when a claim occurs is the key point in the farmer's experience with their insurer, as this is when they realize the true value of their policy. Although this phase still requires field inspections, the use of remote sensing has dramatically accelerated this process. In practical cases in the United States, remote sensing is used to assess damage after hailstorms, for example, significantly reducing the time it takes to analyze claims and sometimes eliminating the need for an in-person inspection. Once crops are monitored remotely, it is possible to assess and prove the occurrence of events (in addition to hail, these include drought, frost, excessive rainfall, etc.) and determine the extent and severity of the damage caused. This data generates reports that help to settle claims more quickly and decisively.

Figure: Example of image processing using remote sensing capabilities. Turning images into information.



Source: Munich Re Agro Digital Suite

"Reducing anti-selection, exploiting the potential of each crop and region, excluding areas not suitable for planting, and pricing those that are suitable fairly, based on the reality of each risk, is one of the main applications of remote sensing in crop insurance."

Luiz Leonardo
Agro Underwriterl

Challenges and final considerations

Despite numerous advances, the use of remote sensing in agricultural insurance still faces challenges. Image accuracy can be compromised by cloud cover, and data interpretation requires investments in training and technology. What is more, regulatory and privacy issues must be considered when using geospatial information.

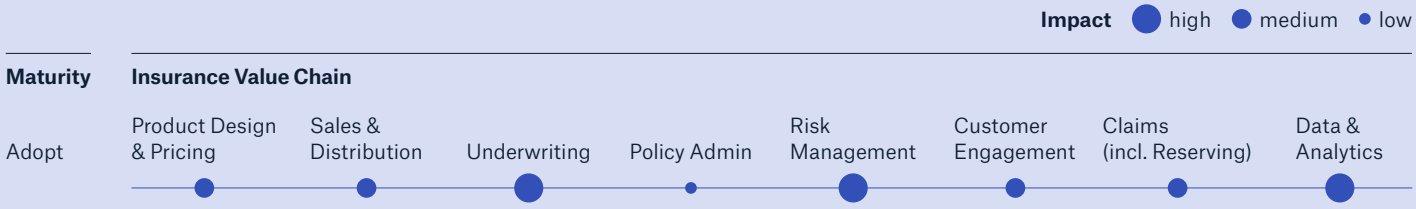
As technologies evolve and become more accessible, however, it is undeniable that remote sensing is becoming an essential tool for innovation in agricultural insurance. Its use not only improves the accuracy of risk and claims analysis, but also enables more efficient and transparent management for insurers and farmers.

The future of agricultural insurance is increasingly digital, and remote sensing will play a key role in building a more resilient and technological sector.

With this in mind, and with the aim of helping our clients to tackle the main challenges related to agricultural insurance in Brazil, Munich Re currently offers a set of tools known as the Agro Digital Suite (ADS). Broadly speaking, it includes (i) a platform that enables the insurer to distribute insurance, (ii) a mechanism for analyzing risk at plot level based on remote sensing, and (iii) an active portfolio management module.

Redefining Industries

New Energy at Scale



Opportunities

- Considerable growth potential throughout the renewable/ low-emission energy sector
- New concepts of performance guarantees for producing assets and power market participants
- Changes in power market design require new risk transfer solutions

Risks

- Rapid technological development with unproven technologies and resulting new risks
- Increasing risk of natural perils to renewable energy facilities
- Increasing complexity throughout the value chain
- Increasing weather dependency of the entire power system

Overview

Ongoing electrification requires renewable energy sources like solar, wind (on-/offshore), hydro power and other technologies to produce electricity with low or zero CO2 emissions. Furthermore, to match energy supply and demand and to effectively integrate large quantities of volatile energy generation into the power system, significant investments in the transmission and distribution system, storage facilities and the digitalization of the power system are required.

Low-emission energy sources

In 2024, the global average temperature exceeded the pre-industrial level by 1.5°C for the first time, making it the warmest year on record (Source: Copernicus Climate Change Service). To limit the temperature increase to at least well below 2°C, net-zero emission commitments have been implemented by a majority of nations. The installed capacity of renewable energies, however, still has to increase tremendously between now and 2030.

Major growth is expected primarily in solar photovoltaics (PV) and wind (on- and offshore) installations over the next few years. Significant cost reductions for PV modules are accelerating this trend. Specifically, PV or solar thermal assets are highly vulnerable to natural perils like hail, storms or flash floods. To a lesser extent, this applies to onshore wind farms as well. However, with increasing turbine ratings and heights, the risk of lightning strikes increases. Advanced lightning protection systems are being developed to mitigate this risk. Since a significant share of new offshore wind farm development zones are located in areas at a high risk of tropical cyclones, design standards for offshore turbines must be adapted to withstand local hazards.

Compared to the growth in solar PV and wind power, new hydro and nuclear power installations look comparatively small. In absolute terms, however, these technologies remain relevant for providing base load power during times with low production from renewable sources. Nuclear power might see a renaissance in the more distant future with small modular reactors and new technologies like fusion reactors.

Power grid

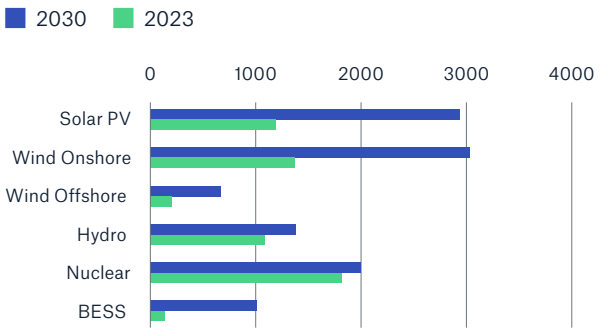
Since the majority of large-scale renewable production facilities is distant to load centers, the expansion and reinforcement of transmission systems is a key prerequisite for the success of the energy transition.

Furthermore, a higher number of interconnectors is required to facilitate the exchange of electricity between regions and countries. This infrastructure is crucial for utilizing geographical smoothing effects, which can help balance out fluctuations in power supply and demand. Additionally, a more extensive network of interconnectors can advance the integration of power markets, allowing for more efficient and coordinated energy distribution. By increasing the number of interconnectors, we can also create opportunities for further flexibilization of the power system, enabling it to adapt more easily to changing energy needs and conditions.

A significant fraction of these transmission systems will be offshore, connecting offshore wind farms or linking island systems to the onshore grid. These projects pose significant challenges as they need to respond (partly) to new needs to withstand harsh offshore conditions while increasing transmission capacity.

The distribution system also requires large-scale investment to enable the transition from a purely consumer towards a prosumer (producer-consumer) driven system. Digitalized grids and measuring devices (e.g. smart meters) need to be introduced to enable prosumers to participate in power markets and to allow the Distribution System Operator (DSO) to steer prosumer production and consumption. According to the World Energy Outlook 2024 of the International Energy Agency, total annual investment in transmission and distribution grids will have risen to US$ 690bn in 2030.

Figure: Estimated Global asset value (bnUSD)



Source: Munich RE (2025). Estimated Global asset value [bnUSD]. Based on 1) Data by International Energy Agency (2024). World Energy Outlook 2024. [online]. Available at https://www.iea.org/reports/world-energy-outlook-2024, [original data]. Licence: CC BY 4.0 All rights reserved IEA. And based on 2) Data by Global Wind Energy Council (2024). Global Wind Report 2024. [online] Available at https://www.gwec.net/reports/globalwindreport/2024

Storage

The underlying production volatility of wind turbines and solar PV remains a challenge for the stability of the power system. Currently, grid stability is secured through backup power plants and demand-side management, providing balancing power or reducing system demand as the case may be.

Large-scale Battery Energy Storage Systems (BESS) are becoming increasingly important, as surplus energy can be stored and fed back into the grid during times of scarce production from renewable energy sources. The rapid decline in battery costs make the technology more competitive for short-term storage than conventional backup power plants. As a result, BESS will play a pivotal role in the energy transition.

However, this technology is not without risk: recent fires in BESS projects around the world demonstrate the associated risk and the need for protection systems. Improved monitoring and early warning systems need to be in place to prevent fires from starting in these installations. Also, stringent rules for separation between neighboring units and surrounding property need to be adhered to in order to limit fires to single compartments.

Power markets

The increasing share of renewable energy sources along with the associated production volatility require new approaches regarding system stability and production security. Despite the typical “energy only” markets in which power producers receive compensation per generated MWh, so called “capacity markets” are becoming increasingly important in providing back-up power in times of low production from solar and wind. In these markets, producers are paid for their available production capacity. This results in increasingly volatile power prices, which pose a relevant risk to industrial offtakers and power producers. Back-up power providers are heavily penalized in the event that a given reliability level is not met. Munich Re has developed new insurance solutions to transfer some of these risks.

Munich Re provides risk transfer solutions for projects in construction and operation for all of the aforementioned technologies. Beyond that, we offer tailored solutions, e.g. performance guarantees as well as power market risks.

Redefining Industries

Trade Secret Protection

Opportunities

- Despite the large insurance capacity required, the first product providers will be able to capture a large market share
- Advantageous contractual terms, as the protection of trade secrets applies for as long as secrecy is maintained
- As there is no specific insurance cover for trade secrets, a first mover approach in this field could be lucrative. The insurance industry could develop a risk solution jointly

Risks

- Pricing requires interdisciplinary expertise (IT, Cyber, Legal)
- Software solutions can compromise security and privacy due to comprehensive monitoring
- Valuation of trade secrets is complex

Overview

A trade secret is an information asset (piece of intellectual property) with an inherent economic value. Trade secrets encompass proprietary formulas, algorithms, strategies, and processes that give businesses their unique edge. Unlike patents or trademarks, trade secrets derive their value from confidentiality. However, this very secrecy makes them particularly susceptible to risks such as cyber attacks, insider threats, and corporate espionage. Hence, protection against the loss, manipulation or damage of trade secrets is crucial.

Trade Secret Protection: A strategic imperative

In a globalized, digitalized economy, the risk of losing trade secrets has never been greater. Software developed in-house, code, formulas, and the algorithms that form the core of AI systems are trade secrets that call for appropriate risk solution concepts.

Large industry clients, CIOs and Heads of Intellectual Property are increasingly interested in protection concepts for trade secrets. The need for robust trade secret protection is not just a legal or operational concern – it is a strategic imperative. According to recent statistics, the annual global loss targeting intellectual property amounts to about $60 billion. With roughly 80% of today's S&P 500 companies chiefly relying on intangible assets, developing risk solutions for competition-relevant trade secrets is vital.

While international frameworks like the Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement, EU Directive 2016/943, and national laws advise trade secret owners to take appropriate technical, organizational and/or legal measures, the actual implementation of these measures is inconsistent. This is mainly because the legislator only defines a minimum level of protection and refrains from explicitly protecting trade secrets, instead placing that responsibility with the trade secret holder.

For insurance companies, this constitutes a market potential. According to an internal evaluation, there is currently a significant protection gap, with only ~15% of information asset losses insured, compared to ~60% of property assets. The development of risk solutions is still in its infancy, with hybrid risk solutions being tested. An example would be a business interruption insurance with compensation for financial losses from interruptions caused by cyber theft of trade secrets. For hybrid solutions to be effective, collaboration between insurers and business is essential. Before calculating premiums, insurers will have to insist that appropriate precautions are taken to preserve the confidentiality of the trade secret.

Businessclients should comply with certain verifiable standards such as ISO 27001 certification (ISMS) before insurance cover can take effect. Potential liability ceilings will likely be based on the amount of the inherent economic value of a trade secret and take into account existing safeguards. In general, insurers should agree on a minimum set of measures that are used to protect valuable information in digital form. These could include data encryption, security protocols for system access, employee nondisclosure agreements, and various physical security methods. Software solutions that offer data classification, monitoring, and alerting functionas should also be considered when designing insurance cover.

> The market has recognized the danger of losses due to the disclosure of trade secrets without any specific insurance coverage.

Tim Klein
Executive Assistant, ERGO Group

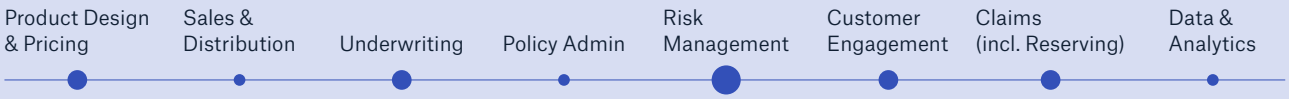
Redefining Industries

Electric Vehicles

Impact high medium low

Maturity Adopt

Insurance Value Chain



Opportunities

- New customers' needs and fears
  - Common fears, e.g. range anxiety, residual value, fire risks
  - Motor insurance and affinity business address EV fears
- Enhanced data collection to support pricing and underwriting
- EV claims handling processes as general lever to improve overall process
- Partnerships across the entire insurance value chain – from new players to bigger players

Risks

- Shift in underlying risk drivers impacting
  - frequency through change in driving behaviour, 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

The ongoing shift from Internal Combustion Engine (ICE) Vehicles to Electric Vehicles (EV) is directly impacting the (re) insurance industry and the performance of motor books. Customer needs are changing, as is the risk typology.

Insurers are well advised to apply a proactive approach when it comes to EV adoption in their respective markets to stay ahead of the curve across the entire insurance value chain. This starts with defining the right products and services, followed by new pricing techniques, and ends with adapted EV claims management and new partnerships.

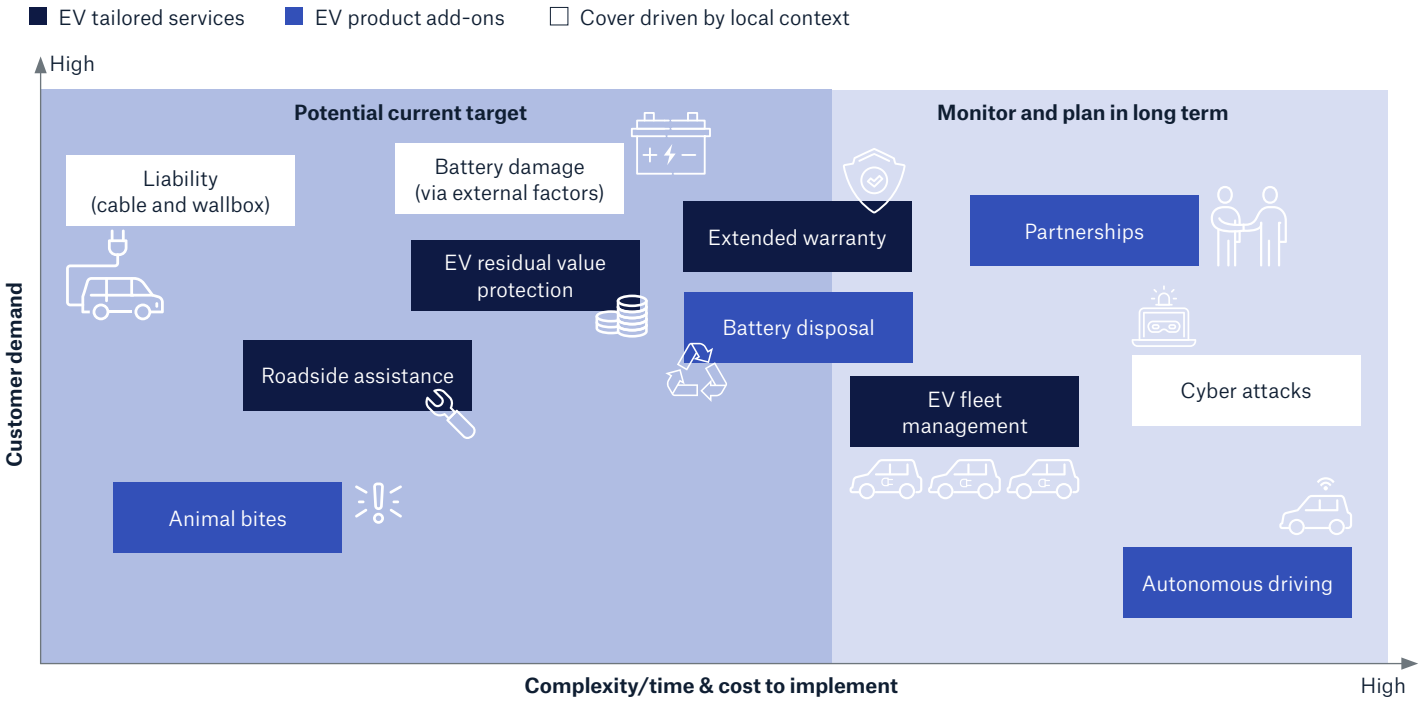
Introduction

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.

Opportunities

EVs sales uptake also brings a variety of opportunities within the insurance space. One of the most important ones is taking customer fears and demand seriously and providing the right insurance products based on these fears. The more fact-based the concerns, the better (e.g. see fire risk below). The insurance industry as a whole might need to rethink its offering within the service landscape. For example, roadside assistance services for EVs require dedicated services when vehicles are having battery problems or are even catching fire. This calls for much more intense customer interactions as before – people don't automatically know what to do.

The residual value of EVs is now another big topic. It is currently seen as a threat for private individuals when buying new or used EVs. Insurance products aimed at protecting the residual value based on the right estimates and calculations can be seen as an opportunity within the market, provided the right knowledge is readily available. Customer needs related to EV also differ from one market to the other. Flooding and marten bite risks or battery disposal regulations are different. But in most markets, these customer needs are currently being taken into account in product development.



Source: Munich Re

Affinity business is also creating new opportunities for insurers. Demand for Extended Warranty and GAP insurance for electric vehicles is rising rapidly. OEMs are exploring ways to offer these products to their EV customers through digital channels or at dealerships. This can help maintain customer relationships and support dealership operations. As electric vehicles require less maintenance, resulting in fewer customer interactions, offering these products can be mutually beneficial.

Enhanced data collection and new types of pricing and underwriting can also bring new opportunities. EV data is currently still a rare commodity, as most insurers are trying to collect their own data and learn from it. But EVs also provide plenty of new data points which can be used to make underwriting and pricing work more accurate and tailored to EV drivers. In response to this need, Munich Re has been working to develop a deeper understanding of the risks associated with EVs, and to help insurers assess the level of risk associated with newly launched EV models, even in the absence of historical data.

New EV claims handling processes are currently being developed at dealerships (e.g. special local regulations to improve safety when working on damaged EVs). Processes need to be understood at insurance companies and a more digitalized approach to claims handling is required – especially when working with new market entrants from Asia. This can present an opportunity to improve the overall claims handling process and also make it future-proof – not only for EV business.

Lastly, EV business is no longer a pure OEM business. Lots of new partnerships spanning the whole EV ecosystem are already visible and growing. This also includes new potential for insurers – be it with new market entrants (manufacturer) or within the entire service offering to EV customers, which can be offered within the world of insurance as well. The graphic provides an overview of the main current opportunities within a special ranking system.

Risks

While the underlying risks associated with motor insurance remain the same for electric vehicles as for internal combustion engines, there are differences in terms of risk levels and the underlying drivers associated with them.

Munich Re studies have, for example, shown that, all things being equal, accident frequency tends to be higher for EV than for ICE. A few key drivers have been identified to explain this increase:

- Most buyers of EV are purchasing this type of vehicle for the first time. Several studies show that it takes some time to adapt to a new type of vehicle. This applies in particular to EV, whose acceleration capabilities are significantly higher
- The geographical spread of EV is skewed towards urban areas, more prone to frequent traffic collisions
- The breakdown of EV drivers by age is also skewed towards younger, less experienced drivers compared to ICE drivers, i.e. drivers that are more prone to accidents
- Several cases of fraudulent commercial usage (ride-hailing, food delivery, etc.) have been identified in various geographies, as the lower cost of usage of EV can incentivize insured persons to use their vehicles commercially.

The global consensus is that the average cost of claims for EV is higher than for ICE. Studies have shown that, besides EV-specific parts (battery, high-voltage cabinet, etc.), non-EV specific parts (such as a bumper or a light) are usually more expensive for EV than for ICE. This, combined with the need for specialized training for the workforce and the additional complexity of some repairs, contributes to an overall increase in the cost of claims.

"As Electric Vehicles transform the automotive industry, insurers must accelerate their own transformation to stay relevant and deliver value in a rapidly changing world."

Falk Albers
Senior Executive Partner,
Global Leader Mobility,
Insurance Consulting

We have seen a lot of media coverage about EV fires, creating the impression that EV are more prone to fire than ICE. However, a global consensus is emerging that EV do not pose an increased fire risk compared to ICE, and statistics actually tend to show a lower fire risk for EV compared to ICE.

Still, EV fires are much more complicated to extinguish due to their intrinsic nature and the huge amount of energy stored in the battery. Specific procedures and additional resources are required to properly extinguish an EV fire and prevent its reignition.

The rise of EV is also directly connected with an increase in the level of vehicle connectiveness and the importance of onboard software. As a result, vehicles are exposed to new cyber risks and are vulnerable to attacks.

This aspect is still being investigated across the (re)insurance industry given the limited current number of observations. Nevertheless, the exponential rise in what are now being called software-defined vehicles will push further studies in this direction and drive the development of adequate risk assessment.

Redefining Industries

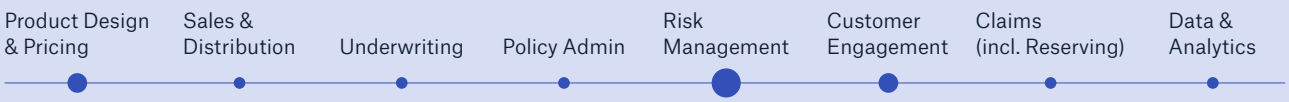
Hydrogen Economy

Impact high medium low

Maturity

Trial

Insurance Value Chain



Opportunities

- Hydrogen has the potential to redefine and decarbonize the energy system.
- Rapid growth in production capacities is required to meet the projected demand.
- Innovative risk transfer solutions can help facilitate the transition.

Risks

- Hydrogen infrastructure and storage capacities are essential for widespread adoption.
- Diverse risks and uncertainties, coupled with political and regulatory challenges, are hindering hydrogen bankability, the growth of clean hydrogen production, and systematic deployment.

Overview

The energy sector is seen as a major contributor to global emissions, with ever-increasing efforts to transition toward lower emission intensity. Alongside renewable energies and direct electrification approaches, sustainable energy carriers are expected to play a vital role. Among them, hydrogen is a versatile option that can be produced with high efficiency and power for a wide range of applications, combining different sectors as part of an envisioned Hydrogen Economy. However, leveraging the Hydrogen Economy's decarbonization potential will require overcoming significant hurdles to the deployment of clean hydrogen projects.

Hydrogen and its potential for the energy transition

The need to adopt measures to limit the severity of climate change has reached an unprecedented level. At the same time, political developments are strengthening the desire for local energy security and less reliance on fossil fuels. In this context, it is commonly accepted that hydrogen represents an important pillar for a successful energy transition.

The Hydrogen Economy refers to an industrial and economic system design in which hydrogen serves as one of the main energy carriers for various sectors. With its multiple applications – direct use, combustion, re-electrification in fuel cells or long-term storage – hydrogen has the potential to power carbon-intensive industries, buildings and heavy-duty transportation, as well as to balance out seasonal fluctuations in renewable electricity production.

Furthermore, hydrogen is essential to the production of various chemicals and fuels, and can even be employed to decarbonize steel and cement production. Importantly, however, in order for a Hydrogen Economy to comply with the 2050 emission targets, hydrogen must be produced via a very low emission-intensity pathway.

Clean hydrogen is primarily produced from renewable electricity such as solar or wind power using an electrochemical process called electrolysis. The resulting "green hydrogen" originates from water, thus contributing to a decreased reliance on fossil fuels.

"Sustainable energy carriers associated with low emission intensity are vital for a successful energy transition. In this context, hydrogen produced from renewables will play a key role, but its deployment is currently hampered by a variety of uncertainty factors. Well-thought-out risk mitigation and transfer solutions can pave the way for investment security and a rapid upscaling of green hydrogen technologies."

Dr. Kathrin Ebner
Technology Lead Hydrogen & E-Mobility

Another pathway to low-emission-intensity hydrogen production involves integrating carbon capture utilization and storage (CCUS) technologies into the Steam Methane Reforming (SMR) process for extracting hydrogen from natural gas ("blue hydrogen"). This aims at preventing the release of the CO^2 emissions produced when the methane molecule is split into the atmosphere. So, while still of fossil origin, blue hydrogen's carbon footprint is favorable when compared to the direct use of fossil methane as a fuel. With that in mind, it is often referred to as a "bridging technology." As a product of hydrogen use, only water and heat are formed, eliminating the release of the harmful by-products of combusting carbon-based energy carriers (carbon dioxide, soot, etc.). To leverage the resulting overall emission reduction potential of clean hydrogen, its production would have to be rapidly upscaled alongside corresponding infrastructure. To put that into numbers, in 2023 global hydrogen demand reached 97 Mt, mostly derived from methane without any carbon capture ("gray hydrogen"). By 2050, hydrogen production is expected to reach 500 Mt, with clean hydrogen production accounting for the vast majority.

Key Findings
For hydrogen to fulfill its planned role as a major contributor to global emission reduction, rapid deployment of production capacities and upscaling of infrastructure are required.

Currently, however, clean hydrogen deployment is facing many challenges. On the one hand, market volatility, regulatory changes and geopolitical uncertainties affect the feasibility of hydrogen projects. On the other, there is a limited understanding of the technical risks associated with the technologies due to limited long-term experience and data availability.

Uncertainties regarding component failure and underperformance, unexpected maintenance and repair costs or system downtime, contribute to hesitant capital investments and limited bankability of electrolysis plants. Accelerating the energy transition will require enormous amounts of capital – the International Energy Agency (IEA) estimates that annual global investment in the clean energy industry in the period leading up to 2030 to achieve net-zero targets by 2050 will need to be at around US$ 4 trillion.

A combination of financial, institutional and regulatory instruments will be needed to de-risk hydrogen projects, including suitable policy frameworks to reduce uncertainty and encourage investment. In the context of de-risking, the insurance industry is a key stakeholder offering a variety of risk transfer solutions. This allows even less fully understood technical risks to be addressed, helping to overcome the reluctance towards less mature technological approaches like electrolytic production.

2 Questions for Patrick Hinze

How will the Hydrogen Economy change over the next year?

The Hydrogen Economy is set for significant growth over the next 12 months. Key drivers include increasing low-carbon hydrogen projects, technological advances in electrolyzers, and increased global investment. Europe is leading the way with strong initiatives, while US policy uncertainty could slow progress. Production costs are expected to drop, making hydrogen more competitive. Infrastructure development, such as the Hamburg Green Hydrogen Hub, is crucial. Despite challenges like cost and policy hurdles, hydrogen remains central to global energy transition efforts and corporate strategies.

Why is insurance so important to boosting hydrogen production?

Adequate risk management is vital for hydrogen projects, as it mitigates the financial volatility associated with technology underperformance. It insures investors and stakeholders against potential losses, enhancing project bankability. By providing confidence in the reliability of hydrogen technologies and operations, performance insurance attracts capital, accelerates development, and supports the scaling of this emerging energy sector.

Patrick Hinze
Head of Emerging Green Technologies

Redefining Industries

Humanoid Robots

Opportunities

- Increase in operational efficiencies and quality
- Improved underwriting and casualty risks
- New market for robot insurance products
- Reduction in claims costs
- Autonomous handling of repetitive tasks or tasks that are dangerous for humans

Risks

- Modelling risks
- Product and service offering uncertainty
- Cyber security and privacy concerns
- Safety implications
- Ethical dilemmas

Overview

The robotics revolution is here, reshaping industries at an unprecedented pace, and the insurance industry is no exception. Robots, automation, and artificial intelligence are not only redefining traditional processes but also creating entirely new paradigms of risk, coverage, and customer interaction. Equipped with advanced AI and sensors, humanoid robots will enhance efficiency, reduce costs, and provide real-time data for better decision-making, leading to higher process efficiency and more personalized services. Yet insurers will face new challenges, namely identifying what kind of robotic technologies will make a difference with regard to risk and the required coverage offerings.

A new era of human and machine

In the not-so-distant past, the term “robotics” conjured up images of manufacturing floors and assembly lines. Today, the field of robotics has transcended its industrial roots, transforming into a ubiquitous presence that touches nearly every aspect of our daily lives. While robots have become an integral part of our lives, their capabilities and applications have expanded exponentially in recent years, promising to revolutionize the way we live, work, and interact with each other.

Driving forces of the robotic revolution

The robotic revolution is being driven by the convergence of several key technologies, including advancements in increasingly sophisticated sensors, actuators, power systems and artificial intelligence, amplifying their potential for multifunctional capabilities and collaboration with humans. The intersection of humans and robotics is a hallmark, with distinctions between the physical and digital realms rapidly disappearing across industrial domains from healthcare to services and agriculture.

The emergence of household robots and disruptive breakthroughs in humanoids

Once considered as purpose-oriented niche luxury items, household robots have transitioned to become household staples, fundamentally reshaping people’s everyday lives. From AI-enabled personal virtual assistants to automated laundry-folding robots, they are operating in hyper-connected, automated ecosystems, for example to optimize energy use, monitor properties and automate repetitive tasks.

While the "ChatGPT" moment for robots was expected years ago, tectonic shifts may appear in 2025, transitioning the purpose-bound robotics we are familiar with to general-purpose robots, with recent breakthroughs in Generative AI to emerge in Humanoids.

A combination of factors has made Humanoid robots smarter, cheaper and more human. The cost of components and production has decreased, with Unitree, for example, readying its Humanoid "G1" for mass production with a tag of $16.000. Developments in neural networks and machine learning algorithms have empowered Humanoids to learn and adapt to new situations, and achieve heightened performance and efficiency as they interact with their environments in a manner that simulates human-like intelligence. Breakthroughs in computer vision have expanded robotic capabilities in areas such as object recognition, tracking, and manipulation.

They mirror the human form and functionality and can integrate seamlessly into our physical and social environments. The evolution of humanoid robots has traversed a significant spectrum, from rudimentary mechanical prototypes to sophisticated, autonomous entities. Moreover, these AI-driven systems enable humanoid robots to decipher and respond to human gestures and emotions with precision, effectively bridging the divide between humans and machines. Pioneering companies including Tesla (Optimus), Boston Dynamics (Atlas), NVIDIA (GR00T), 1X (Neo), and Figure (Figure 02), as well as Chinese manufacturers like Unitree (G1), are at the forefront of harnessing the transformative potential of humanoid robots, which promises to redefine the very fabric of industry ecosystems and imbue machines with new levels of autonomy and human-like intelligence.

Surge in collaborative robots ("Cobots")

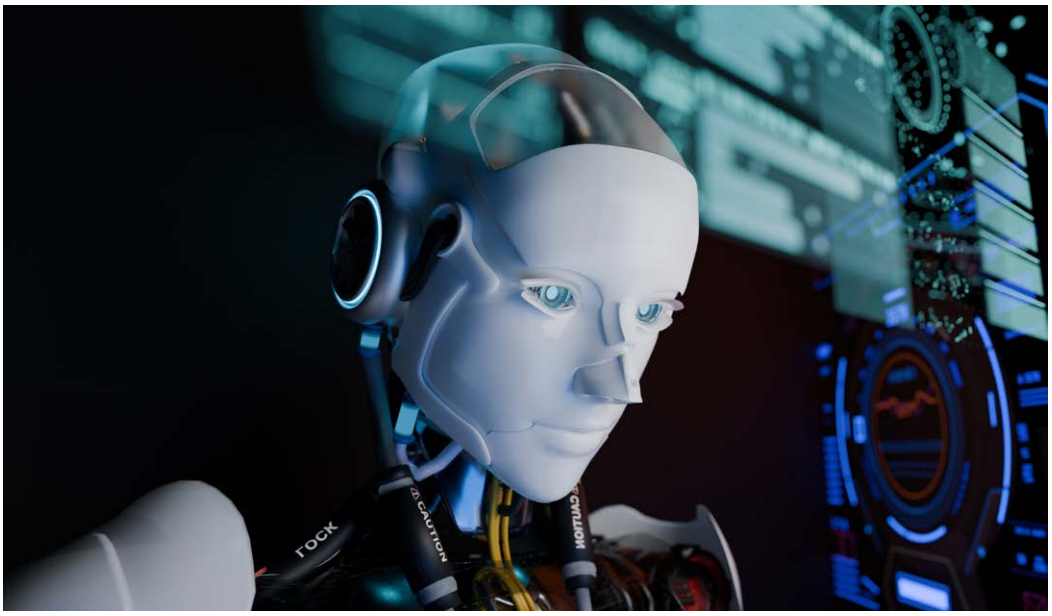
"Cobots" are increasingly becoming an integral part of the modern workplace. Unlike traditional industrial robots, which operate in isolated zones, cobots are designed specifically to work alongside humans, augmenting productivity while ensuring enhanced safety. Industries like manufacturing, retail, and healthcare are integrating cobots to streamline operations. For example in logistics, cobots expedite the sorting of goods while minimizing errors. In healthcare, robotic systems enable surgeons to perform high-precision procedures, and support eldercare by enhancing mobility and monitoring capabilities.

Expansion of autonomous vehicles and drones

Autonomous technologies powered by advanced neural networks and machine learning algorithms continue to evolve, with autonomous vehicles, autonomous mobile robots (AMRs) and drones achieving greater efficiency and reliability. Drones and AMRs are being deployed for last-mile and warehouse logistics, while autonomous trucks enable cost reductions and address labor shortages. These technologies bring unique risks that insurers need to consider. For example, cybersecurity threats loom large, with the potential for hackers to disrupt or control autonomous systems. Cyber and product liabilities, as well as vehicle coverage can become a focus.

In today's robotics era, the most critical factor for organizational success is not the adoption of new technologies, but the development of new capabilities, skills, and mindsets.

Andreas Schumacher
Project Manager Artificial Intelligence



Robotics in healthcare

Robots are playing an increasingly crucial role in healthcare, encompassing services such as diagnostics, surgical assistance, and patient care. This can influence underwriting, as medical malpractice must adapt to include potential failures of robotic systems. If robotic healthcare solutions are proven to reduce human errors and improve outcomes, long-term healthcare costs may decrease.

Technological shifts in agriculture

The agricultural sector is experiencing a seismic shift with the emergence of robotics, as autonomous tractors, drone crop monitors, and robotic harvesters reshape the farming landscape, making it more efficient and environmentally friendly. Farmers can optimize resources, reduce waste, and increase yields. As these innovations amplify productivity, they also usher in a new wave of risks, including mechanical breakdowns, programming glitches, and dependence on GPS and connectivity, which agricultural insurers must adapt to by developing novel products and policy bundles.

Impacts of the robotic revolution for insurers

Robots blur traditional definitions of liability. If a robot injures someone or causes damage, determining fault is increasingly complex. Insurers must design products that address shared liability among manufacturers, software developers, and operators. Connected robots in homes, healthcare, and industrial workplaces are vulnerable to hacking. Cyberattacks could lead to physical harm, financial losses, or data breaches. Insurers need to expand physical cyber coverage to protect against these risks. Robots generate vast amounts of real-time operational data. Insurers can leverage this data to refine risk models, enabling dynamic pricing. They can leverage data analytics and AI to predict risks and offer personalized insurance solutions.

Conclusion

By 2025, humanoid physical robots will be revolutionizing the insurance industry. Their use in claims assessments, risk management, customer service, and fraud detection will significantly increase operational efficiency, reduce costs, and enhance the customer experience. Insurance companies that embrace these technologies early on will gain a competitive edge by offering faster, more personalized services and improving their data-driven decision-making processes.

Key Findings

"More than 250,000 humanoid robots are anticipated to be shipped worldwide by the end of 2030."

Source: Goldman Sachs

Redefining Industries

Autonomous Mobility

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

- AVs have the potential to significantly reduce accidents by eliminating human error.
- The emergence of AVs creates opportunities for insurers to develop new products and services tailored to the unique risks associated with this technology.

Risks

- Liability may shift from drivers to manufacturers, potentially disrupting the traditional personal auto insurance model.
- The timeline for mass adoption of Level 5 AVs remains uncertain, making it challenging for insurers to accurately predict the impact on their business.

Overview

The automotive industry is undergoing a profound transformation with the emergence of Level 5 Autonomous Vehicles (AVs), often called driverless cars. AVs promise numerous benefits, such as reduced traffic congestion, increased safety, energy conservation, and independent mobility for those unable to drive themselves. In short, AVs have the potential to revolutionize not only how we travel but also various industries. As we explore the potential impact of Level 5 AVs on the insurance landscape, we examine projected market penetration, develop hypotheses about their effects, and analyze how insurance models might adapt to this disruptive technology.

Levels of autonomous driving

To understand the impact of Level 5 AVs, it is essential to grasp the different levels of autonomous driving defined by the Society of Automotive Engineers (SAE). These levels range 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 under all conditions without any human intervention.

Projected market penetration of Level 5 Autonomous Vehicles

Considering the emerging landscape of Level 5 Autonomous Vehicles (AVs), the precise timeline for mass adoption remains uncertain. However, projections suggest that Level 5 autonomy is unlikely to be broadly available before 2035, according to S&P Global Mobility, a leading automotive research firm. However, the transition to Level 5 autonomy is expected to be gradual, with increasing levels of automation becoming more prevalent in the coming years.

Hypotheses on the impact of Level 5 AVs on the insurance Industry

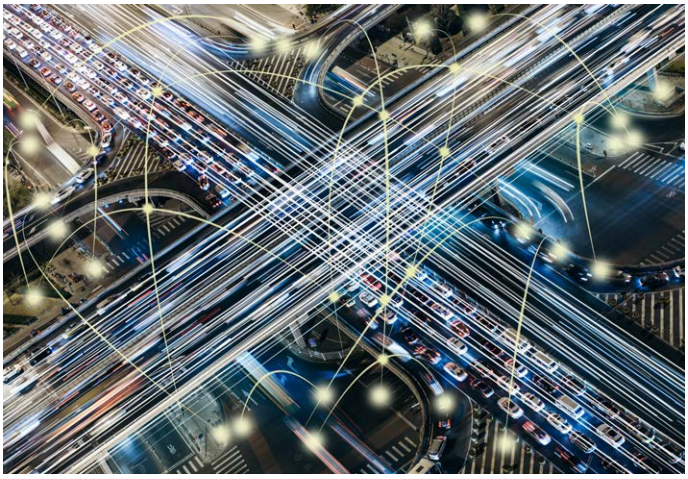
There are certain commonly held beliefs when it comes to the impact of AVs on the insurance industry. We propose three hypotheses to explore:

Hypothesis 1: Decreased accident frequency
This hypothesis is based upon the assumption that widespread adoption of AVs has the potential to significantly reduce accidents by eliminating human error, a major contributing factor to crashes. Some calculations suggest that accident rates for AVs could be 50 times lower than for conventional cars. However, it is important to acknowledge that the data is still limited and is based primarily on controlled testing environments. As the technology continues to evolve and more self-driving cars hit the road, there is still a need for continuous monitoring and improvements to maintain this low accident rate.

Hypothesis 2: Shift in insurance liability
This hypothesis is supported by the notion that liability will shift from drivers to manufacturers as Level 5 AVs emerge. Widespread AV adoption will likely result in car insurance being replaced by product liability insurance, ultimately borne by auto manufacturers. This is because Level 5 AVs are designed to operate without human intervention, making the manufacturer responsible for the vehicle's actions.

Hypothesis 3: Emergence of new insurance products
This hypothesis is supported by observations of the evolving insurance landscape and anticipation of new risks associated with AVs. There will likely be a need for new product development to address emerging autonomy risks which may include coverage for cybersecurity threats, software malfunctions, and product liability.

These hypotheses were chosen because they address key areas of potential disruption in the insurance industry related to the introduction of Level 5 AVs. Understanding the potential changes in accident frequency, liability, and the types of insurance products needed will be crucial for insurers to adapt and thrive in this evolving landscape.



Conclusion

Level 5 Autonomous Vehicles are poised to revolutionize the automotive industry and bring about significant changes in the insurance landscape. While mass adoption may still be some years away, the transition to higher levels of automation is already underway. The insurance industry is well advised to proactively adapt to this technological shift by developing new risk assessment models, tailoring insurance products, and collaborating with stakeholders in the AV ecosystem. By embracing innovation and addressing the unique challenges and opportunities presented by Level 5 AVs, the insurance industry can contribute to the safe and responsible integration of this transformative technology into society.

Redefining Industries

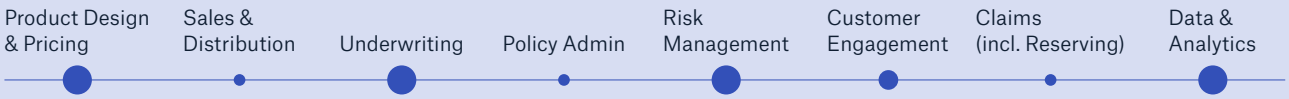
Climate Resilience

Impact high medium low

Maturity

Adopt

Insurance Value Chain



Opportunities

- Prepare for climate impacts, reduce potential losses and safeguard long-term resilience
- Comply with emerging regulations such as EIOPA and PRA guidelines
- Drive innovation by identifying new products, services, or business models for climate change

Risks

- Complexity of climate models, data gaps and scope of analysis can be challenging
- Identifying climate hazards without estimating financial materiality can be ineffectual
- Failing to take appropriate action to mitigate or adapt to identified risks could result in long-term harm

Overview

In 2024, natural disasters resulted in US$ 320 billion in losses, underscoring the growing impact of climate risk on lives, economies and assets. To address these challenges, organizations, governments and communities must assess vulnerabilities and prepare for rising threats, including extreme weather events and chronic stressors like sea-level rise. Climate risk assessments involve three steps: understanding exposure, measuring financial impacts, and managing material risks. Sectors like finance, real estate, energy, and government are increasingly adopting these assessments. Conducting holistic and consistent climate risk assessments is crucial to maintaining long-term resilience.

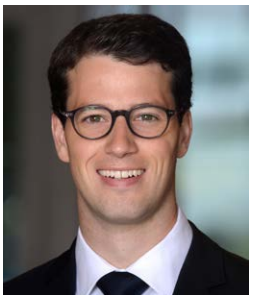
Key Findings
The increasing financial impacts of climate risks underscore the urgent need for climate risk assessments and resilience strategies.

Assessing physical climate risks for a resilient future

In 2024, natural disasters caused overall losses of US$ 320 billion, with a clear upward trend in recent years, in particular for insured losses. As climate threats intensify, organizations, governments and communities must address mounting risks to lives, assets and economies. The growing frequency and intensity of extreme weather and chronic stressors like rising sea levels highlight the need to assess vulnerabilities and prepare effectively. Tools like Munich RE's Location Risk Intelligence platform offer vital insights into physical risks and future scenarios, enabling proactive measures to build resilience.

Climate risk refers to the potential adverse effects of climate change on natural and human systems. Physical risks arise from direct climate phenomena, such as hurricanes, floods, droughts, heatwaves, and rising sea levels. These hazards can damage production sites and infrastructure, disrupt supply chains, and threaten ecosystems and communities. Physical risks are often location-specific, requiring detailed analysis to identify and manage exposures.

Conducting a climate risk assessment involves three steps: understanding, measuring, and managing. The "understand" step consists of analyzing the exposure of different areas or assets to various climate-related risks and how the risk changes over time in different climate scenarios. This can already give an indication as to which risks, geographies, or assets are at low, medium or high risk today and in the future – and provide guidance on how to refine the next steps in the assessment process.



"Climate risk and resilience will be a key topic for the insurance industry going forward – not only for adequate pricing and risk management but also to develop new products and superior data & analytics."

David Fischer
Senior Product Manager,
Climate Risk

The second step ("measure") then involves estimating the potential financial impact of relevant risks in terms of a loss metric by taking into account the vulnerability of exposed systems. This helps to determine whether a risk affecting a given asset or concentration of assets poses a financially material risk to a business or community. Munich Re's Location Risk Intelligence platform can provide comprehensive support throughout both of these steps.

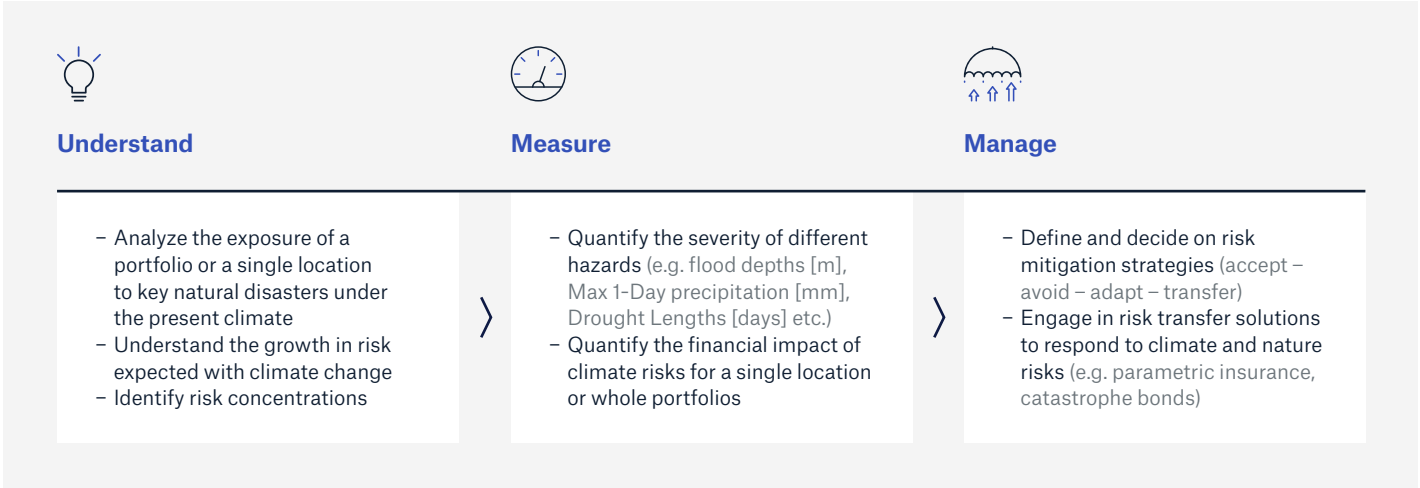
The third step ("manage") in a comprehensive approach to climate risk involves the definition of, and decision on, the management of financially material climate risks. The results of the first two steps provide a foundation for a range of actions aimed at reducing exposure and building resilience. Developing a risk mitigation strategy and adaptation measures is among the most critical responses. These measures can include investments in resilient infrastructure, such as flood barriers and heat-resistant buildings.

Restoring ecosystems also provides natural buffers against climate impacts. In addition to physical adaptations, operational changes, such as modifying supply chain logistics or adjusting agricultural practices, can help organizations align with emerging climate realities. Risk transfer strategies can also help manage the financial impacts of climate events through products like parametric insurance and catastrophe bonds.

Certain sectors are particularly proactive in conducting climate risk assessments due to their operational needs and exposure to climate impacts. These include:

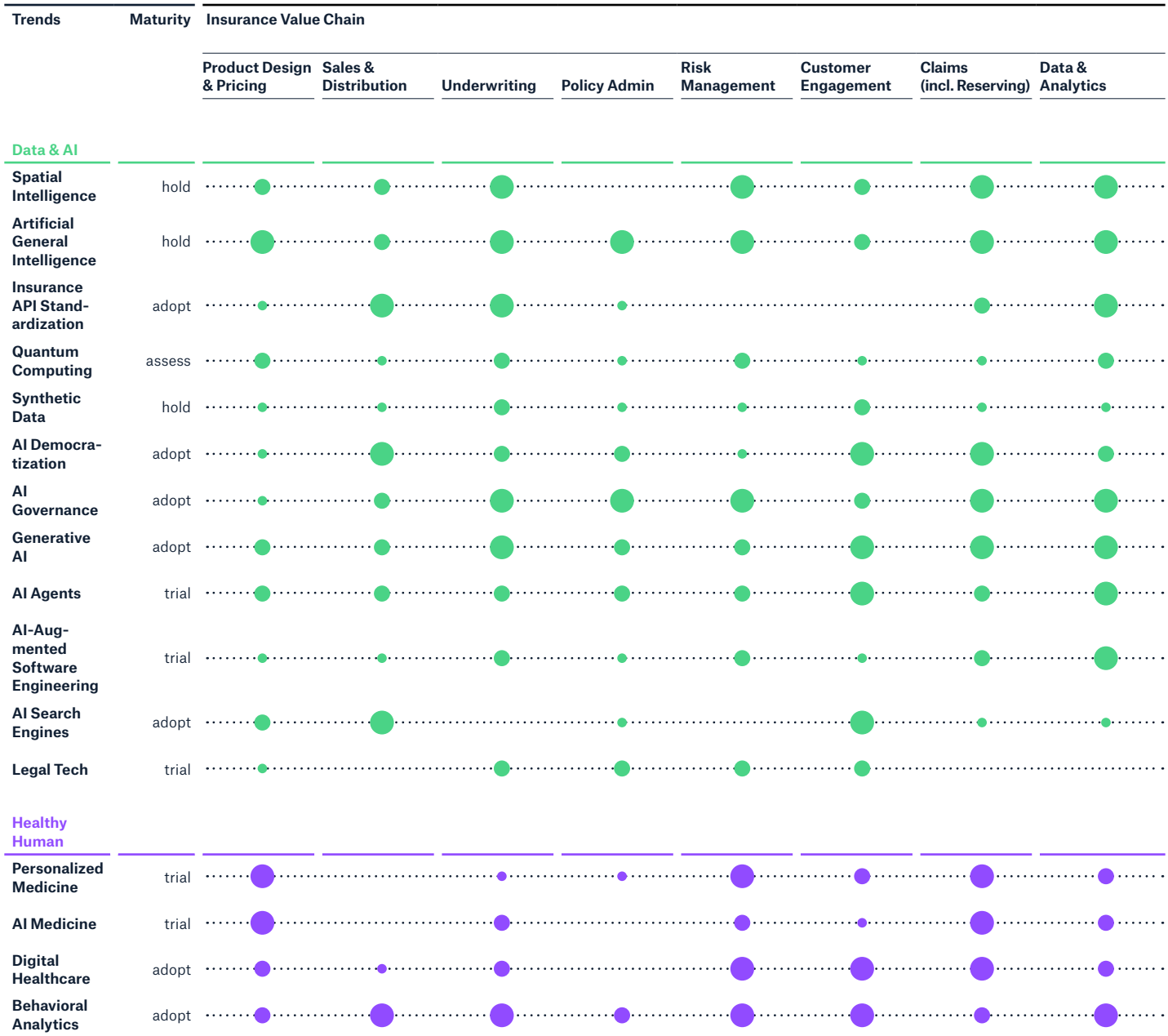
- **Financial sector:** Banks, insurers, and asset managers use risk assessments to evaluate investment and underwriting vulnerabilities and opportunities, and to comply with disclosure mandates.
- **Real estate:** Developers and property managers analyze location risks to ensure the durability and long-term value of their properties.
- **Agriculture:** Farmers and agribusinesses assess climate patterns to protect crop yields and adapt farming practices to changing weather conditions.
- **Energy:** Power and industrial companies evaluate risks to critical infrastructure, such as power grids and renewable energy systems, to maintain reliable energy supplies.
- **Government:** Authorities and planners use risk assessments to inform disaster preparedness, infrastructure development, and resilient urban design.
- **Logistics and supply chain:** Companies analyze transportation networks and supplier locations to mitigate disruptions.

Across all these sectors, tools like Location Risk Intelligence provide accurate physical risk assessments, scenario modelling, and data-driven insights, enabling stakeholders to make informed decisions and bolster their resilience.



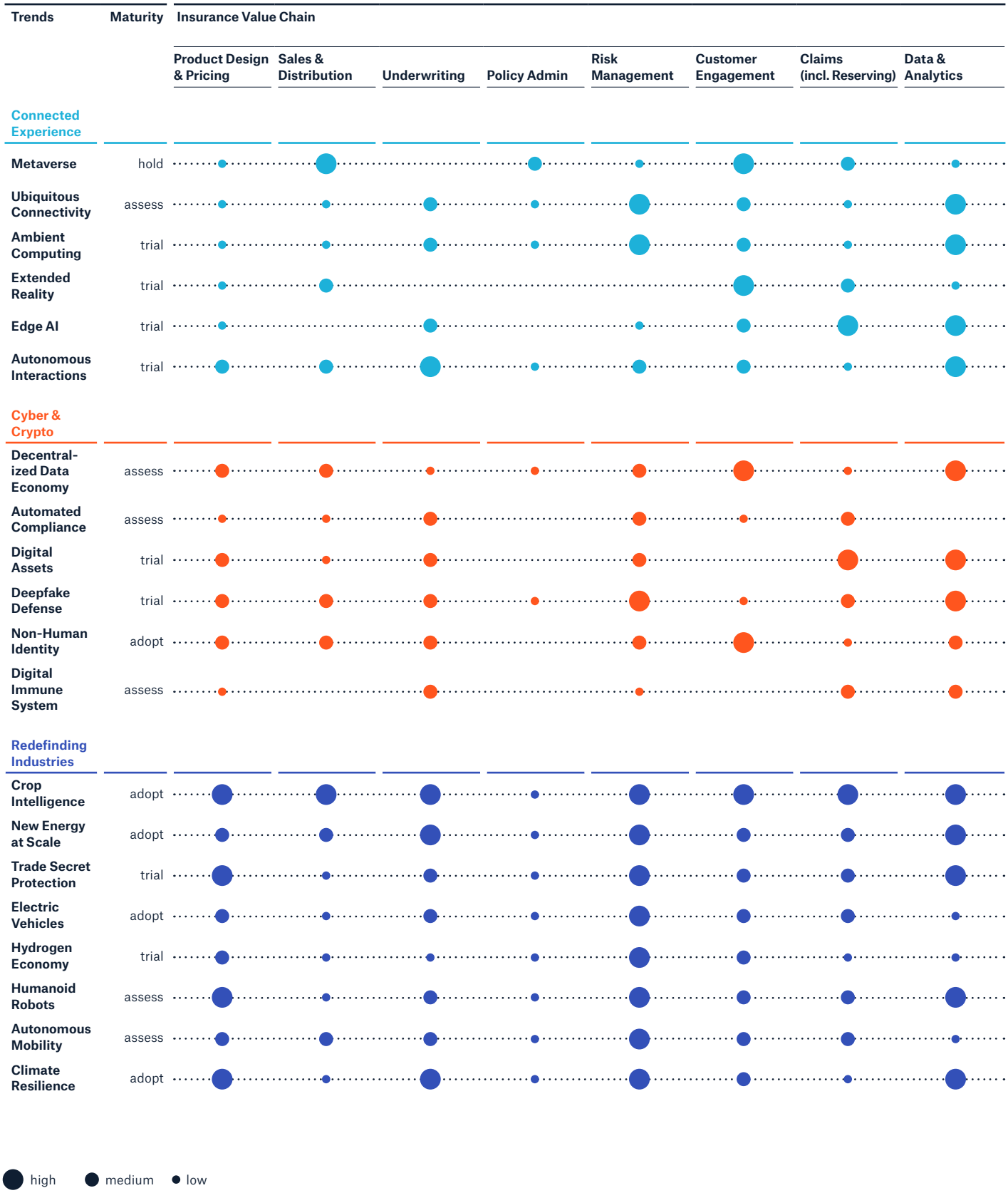
Impact on value chain (1/2)

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

Location Risk Intelligence

Location Risk Intelligence Platform is a modular SaaS platform that enables our 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.

The solution for the insurance industry

UW Monitoring Tool

The Portfolio Monitoring Tool sets a new standard for informed decision-making, providing our clients with a comprehensive view of their portfolio. Offering truly customizable, in-depth analyses that go beyond conventional financial reporting, the tool delivers actionable insights through features like cohort retention and rate change analyses. By seamlessly integrating Munich Re's data assets and GenAI capabilities, clients can enhance the quality and business value of their own data.

Reinsurance Property/Casualty

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

Automated EHR Summarizer

The automated EHR Summarizer simplifies access to the EHR data needed for life insurance underwriting. By normalizing EHR data directly from the source, it highlights core data points identified as essential by underwriters and provides triage guidance.

Automated EHR Summarizer

Clareto

Clareto offers life insurance carriers and distributors access to the largest interoperability network for risk assessment. This network includes fully implemented, expertly managed, and continuously optimized connections to electronic health records (EHRs), health information exchanges (HIEs), and other digital health data sources - covering over 70% of the U.S. population.

Clareto

ALLFINANZ SPARK/NOVA

Our 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

iRisk

Our 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

CLARA plus

Our 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

MIRA PoS

Our 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

Our 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

Our solutions

Healthy Human

Next Generation AI-Augmented Underwriting

Our latest underwriting solution for life and health insurers 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 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

Connected Experience

Automated Underwriting Platform for facultative & corporate business

Munich Re F&C´s Automated Underwriting Platform 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. Currently, cert2go is available for all property lines of business.

cert2go

IoT Sensor Solutions

Insurance companies are looking for new ways to use technology, such as Internet of Things (IoT) sensors, to improve their operations, elevate their customer experience, and create new coverage opportunities. Munich Re's Sensor Solutions by HSB® is an IoT solution that helps insurers implement sensor-based IoT programs to address common risks like water, fire, and equipment failure for commercial and personal lines insurers, along with their policyholders.

Internet of Things (IoT)

REALYTIX ZERO

REALYTIX ZERO is a cloud-based, automated underwriting platform which helps launch, distribute, and scale new or existing insurance products. With REALYTIX ZERO, you can digitize, automate, and launch any insurance product in a matter of days and adjust it in real time using our no-code/low-code approach and API integration. Our new embedded Python capabilities now enable us to seamlessly integrate even complex pricing logic in a remarkably short time frame.

REALYTIX ZERO

Our solutions

Cyber & Crypto

In today's rapidly changing cyber landscape, effective risk management is more crucial than ever for our clients. By bringing together expert knowledge from insurance, reinsurance, and external partners, we can provide robust risk assessments and accumulation modelling that help make cyber risks insurable. This enables us to support our clients in mitigating the consequences of cyberattacks and protecting their businesses from potential harm. With a deep understanding of cyber risks and a disciplined approach to market growth, guided by a clearly defined risk appetite, we strive to deliver tailored solutions that meet the unique needs of our clients. Please also refer to our newly published report Cyber Insurance: Risk and Trends 2025, which provides an outlook on the cyber risk landscape and the surrounding dynamics affecting cyber insurance and market demand. The report presents insights, facts and figures which we want to share with our clients.

Digital Asset Protection

As the blockchain ecosystem continues to evolve, new risks and challenges are emerging for businesses and investors operating in the crypto economy. The rise of digital assets and decentralized applications has created a growing need for specialized insurance solutions that can provide security, reliability, and stability. Our Digital Asset Protection Solutions aim to address these risks, leveraging Munich Re's expertise in risk management and insurance to help safeguard digital assets and provide confidence for companies and investors to operate effectively in this innovative space.

Digital Asset 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

Home Cyber Protection HSB

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 cyber crimes, providing them with the necessary knowledge and support to protect themselves in a rapidly evolving digital landscape.

HSB Home Cyber Protection

Our solutions

Redefining Industries

Epidemic and Pandemic Risk Solutions

Epidemic and Pandemic Risk Solutions 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.

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 guarantee 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 (Login required)

Electric Vehicles Analytics (EVA)

Electric Vehicles Analytics (EVA) leverages advanced machine learning techniques to provide comprehensive risk assessment and pricing solutions for electric vehicles. EVA enables insurers to more accurately estimate risks, define risk appetite, and confidently underwrite emerging exposures. It includes detailed statistical analysis to identify and classify EVs based on technical specifications, helping insurers to optimize profitability and reduce anti-selection. EVA supports insurers in adapting to market standards and local regulations, ensuring robust risk management and competitive pricing.

Insurance Solutions for Electric Vehicles

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

Our solutions

Redefining Industries

HySure

HySure is a risk transfer solution designed to support the low-carbon hydrogen industry. It provides product and performance guarantees for electrolyzer manufacturers, helping to mitigate financial risks and enhance investor confidence. HySure covers high repair costs, underperformance, and availability issues, helping to manage financial risks and increase confidence in the market.

Securing the Power of Green Hydrogen

Insight

Insight is an analytics tool designed to optimize the automation process and underwriting performance. It provides detailed insights into underwriter workloads, average underwriting duration, trends, and rules impacting referrals. By leveraging this data, insurers can enhance efficiency, reduce costs, and improve decision-making processes.

Underwriting analytics

Talaria

Talaria is an embedded finance solution designed to streamline trade finance for small and medium-sized enterprises (SMEs). It integrates seamlessly into B2B platforms, offering invoice-to-cash solutions that enhance liquidity and cash flow management. Talaria leverages Munich Re's expertise in data analytics and machine learning to provide risk-intelligent pricing and credit underwriting. This solution simplifies the administrative burden of trade finance, making it more accessible and efficient for SMEs.

Talaria Solutions

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