NTT DATA

NTT DATA Technology Foresight 2025

Trend 1: Enhanced humans

Imagine a future where your potential isn’t limited by time, task or knowledge.

Contents

Introduction

"Enhanced humans" describes the synergistic collaboration between humans and machines, where technologies such as artificial intelligence (AI), machine learning (ML) and automation to amplify human capabilities.

Rather than replacing humans, these technologies boost people's productivity and the quality of their outputs while empowering them to handle more complex and value-generating tasks.

Significance and impact on modern work environments

In the future, enhanced humans will revolutionize task execution in the workplace. Human–technological integration will facilitate faster decision-making, lower error rates and inspire innovation.

Specifically, it will reduce the time employees spend daily on unproductive activities.

Studies show that employees devote

20% of their workday to searching for information

28% to managing emails

14% to collaboration

Implementing an enhanced-humans strategy will drastically cut down on this time, delivering significant efficiency gains. For example, reducing the time people spend on searches by **30 minutes** daily could save an organization with **1,000 employees over 1.5 million euros annually.**

Key drivers and technologies

The integration of enhanced humans into the mainstream is driven by the rapid evolution of AI, increased availability of data, advancements in automation and growing implementation of generative AI (GenAI). Central to this are technologies like AI-enhanced software development, virtual assistants, digital avatars (which in their most realistic form evolve into digital humans) and GenAI-powered applications. Together, these technologies enable the integration of AI into daily work, creating new opportunities for employee support and business success.

However, the rise of enhanced humans comes with potential risks. Social impacts include job displacement, widening skills gaps and privacy issues. Technical challenges may include algorithmic bias, security vulnerabilities and increased energy use.

Responsible organizations are preparing themselves to address potential challenges that may arise when integrating AI into their workplaces.

Technical explanation

Enhanced humans refers to the seamless integration of AI technologies to augment human capabilities, especially in the workplace, where they support employees in various capacities:

1. Organizational enablement through AI

The strategic use of AI improves organization-wide processes and decision-making by analyzing large amounts of data. Adoption of AI by business units promotes innovation, enables new business models and creates competitive advantages, making the entire organization more efficient and adaptable.

2. AI-assisted workplace

An AI-powered workplace improves productivity, efficiency and collaboration with tools that automate routine tasks and support employees in their daily work.

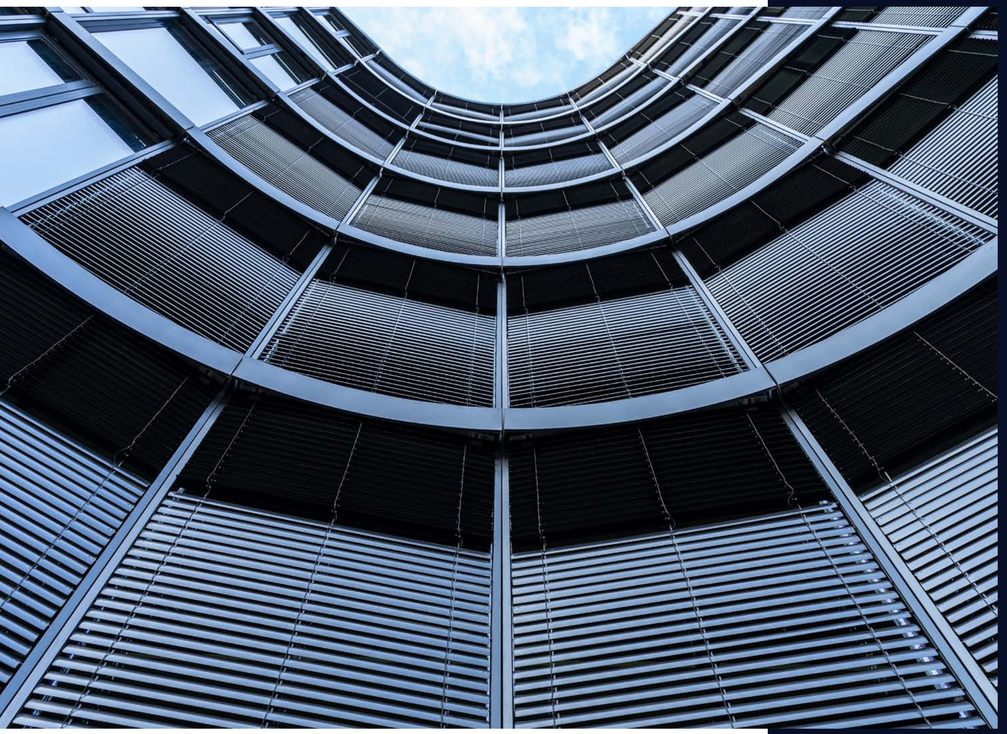
3. GenAI software development

Using GenAI in software development processes, software engineering and AI code-generation streamlines development workflows and reduces the time between concept and deployment.

4. AI safety and compliance

The integration and use of AI tools must comply with regulatory standards to ensure a secure and ethically responsible environment.

> “Ultimately, human–AI integration will create a workforce that’s not just technologically proficient but also strategically empowered to leverage AI for ongoing innovation and performance improvement.



Technology

Leading large language models (LLMs) like GPT-4, Google's Gemini and NVIDIA's Nemotron-3 are increasingly being refined and optimized for diverse applications, including real-time processing and on-device use across industries like education and customer service.

GPT-4o, the latest version of OpenAI's generative pre-trained transformer (GPT), supports multimodal inputs, real-time conversations, memory learning, and advanced translation and emotion detection capabilities.

OpenAI's o1 model, introduced in September 2024, excels in advanced reasoning for complex tasks but operates more slowly and at higher costs than GPT-4o. It has two variants: o1-preview for broad reasoning and o1-mini for coding, math and science. Unlike GPT models, o1 models are trained using reinforcement learning techniques to **"think before they answer",** and they produce long internal chains of thought.

Retrieval augmented generation (RAG) improves LLMs by retrieving relevant external information and integrating it into responses, improving accuracy, contextual understanding and cost-effectiveness. Its applications span customer support, content creation, legal research, healthcare and financial services. However, RAG comes with challenges, such as retrieval quality, and there are ethical issues to consider.

Digital humans (also called AI avatars) are advancing in realism and interactivity, with applications in customer service, entertainment and healthcare that feature capabilities like real-time facial expressions and emotion detection.

Business explanation

The enhanced-humans trend, where AI augments human abilities, signals a major shift for businesses.

Employees are able to maximize their potential and organizations can quickly adapt to a fast-changing market.

The enhanced-humans trend brings several key outcomes that can redefine organizational success:

Increased productivity

By automating routine and time-consuming tasks, employees can focus on higher-value activities.

Improved decision-making

AI-driven data analysis provides deeper insights and predictive analytics, enabling more informed and accurate decision-making.

Accelerated innovation

With AI handling and improving standard operations, organizations can allocate more resources to innovation and development.

Cost efficiency

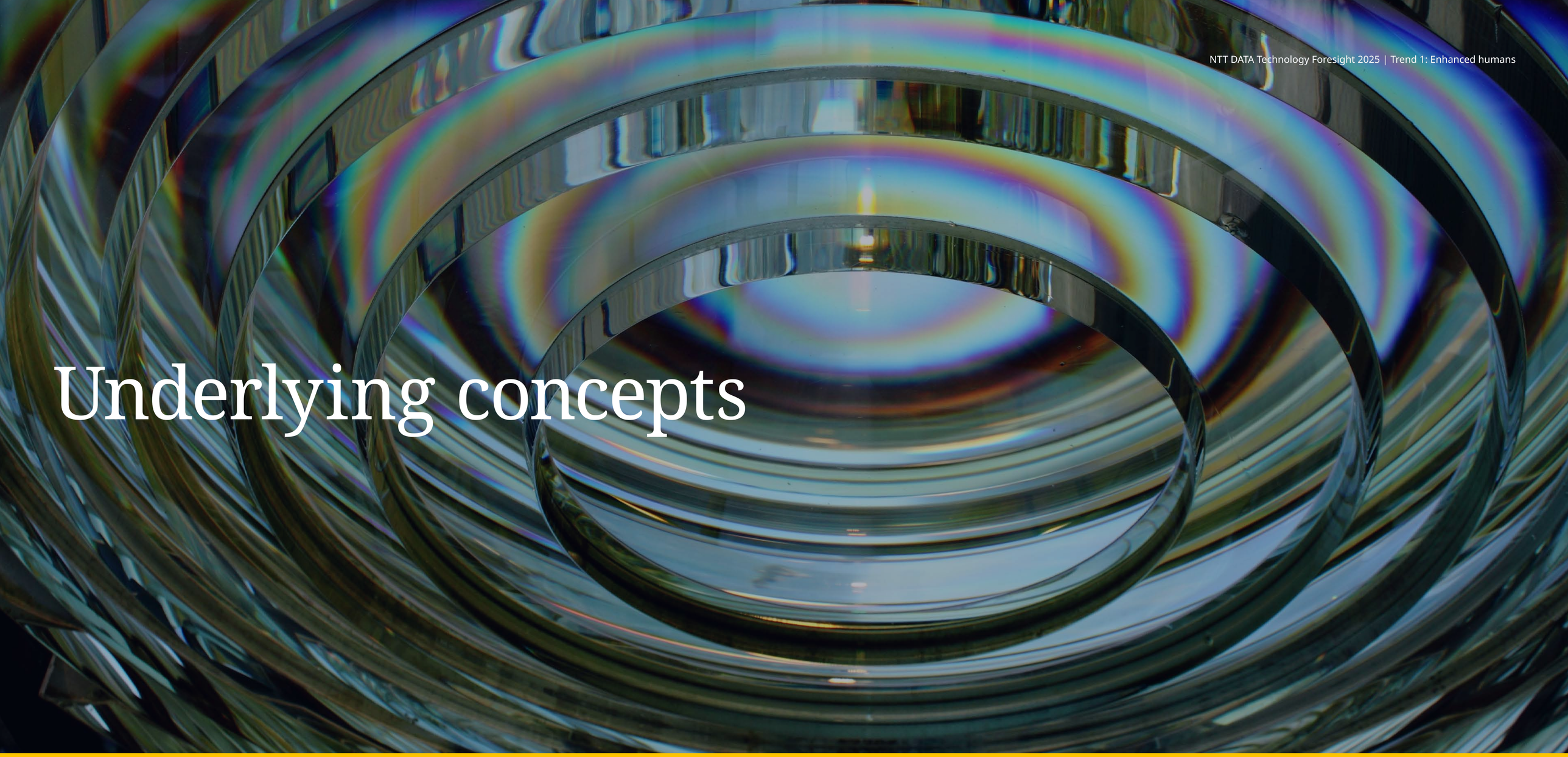
Enhanced humans can lead to significant cost savings through better resource allocation, fewer errors and less time required to complete business processes. These savings can be reinvested into other strategic areas.

Competitive advantage

Organizations that integrate AI to augment their employees' abilities will gain a competitive edge through greater agility, responsiveness and capacity to innovate.

Enhanced customer experience

AI can improve customer service by enabling faster and more personalized interactions.



Underlying concepts

Underlying concepts

The transformative trend of enhanced humans is underpinned by several underlying concepts that must be considered to ensure its successful implementation and widespread adoption. Safety, compliance, organizational enablement and technological advancements are the bedrock on which enhanced human capabilities are built. Understanding and mastering these underlying concepts is key to unlocking the full potential of enhanced humans in an organization.

Enhanced humans

AI safety and compliance

- Ethical considerations
- Security gaps and threats
- Explainability and transparency
- Bias detection and reduction
- Technical safety measurements
- Compliance with regulatory requirements

Organizational enablement through AI

- Technological infrastructure and integration
- Data management and governance
- Scaling of AI applications
- Change management and training
- Optimization of business processes
- Strategic decision-making

AI-assisted workplace

- Human–machine collaboration
- Optimization of work processes
- Improved employee support
- Efficient data analysis and decision-making
- Productivity increase

AI-assisted software development

- Automation of software development
- Improved collaboration in the dev team
- Scaling the maintenance of software projects
- Adaption to individual requirements
- Reduction of errors and security gaps
- Compliance with regulatory requirements

Figure 1: Enhanced humans — underlying concepts and supporting trends

Underlying concepts

AI safety and compliance

AI safety and compliance will be decisive success factors for organizations seeking to expand their use of AI technologies. Organizations must ensure their systems are not only efficient and “fair”, but also legally compliant. Protection against cyberthreats, avoiding bias and discrimination and complying with increasing global data protection laws such as GDPR will all be essential.

Technical measures such as differential privacy, federated learning and bias detection tools will help to minimize these risks. Explainable AI approaches such as SHapley Additive exPlanations (SHAP) and Local Interpretable Model-agnostic Explanations (LIME) will ensure transparent decisions while also providing safeguards against cyberattacks.

> “Organizations that invest in AI safety will protect their reputation, minimize legal risks, promote trust in their AI applications and secure long-term competitiveness.

Ethical considerations

- Looking ahead, responsible AI practices will increasingly integrate ethical principles such as fairness and transparency into AI strategies. This is crucial for both legal compliance and public trust.
- Organizations will need to implement mechanisms that allow for the traceability and algorithmic accountability of their AI systems.

Security gaps and threats

- Adversarial examples are manipulated inputs intended to deceive AI models and will continue to represent a growing security risk. Organizations must take protective measures to prevent these attacks, for example, by cross-checking results with techniques from the field of explainable AI.
- Model drift detection will require regular monitoring for models in operation, helping detect deviations in model performance at an early stage.

Explainability and transparency

- Explainable AI will deliver understandable explanations for AI decisions, improving the acceptance and comprehensibility of AI solutions.
- Tools like SHAP (a game-theory-inspired approach to model explanation) and LIME (a model-agnostic approach to explaining and interpreting AI models) will provide standardized and widely applicable approaches for explainable AI.
- Future AI services will be required to provide explanations at the same speed and quality as the results themselves.

Bias detection and reduction

- Fairness-aware machine learning techniques like bias mitigation algorithms will increasingly prevent systems from making discriminatory decisions. This is crucial for compliance with ethical and legal standards and the acceptance of broader AI adoption.
- Model cards will provide standardized documentation tools and increase the transparency of models by revealing model behavior, including potential biases and the quality of predictions.

Technical safety measures

- Differential privacy techniques anonymize personal data during processing by AI models. This will significantly reduce the risk of data leakage and boost user and customer acceptance for advanced AI functions.
- Adversarial training will increase the resistance of models to manipulation attempts aimed at causing malfunctions in automated processes and decision-making.

Compliance with regulatory requirements

- The EU AI Act defines strict requirements for managing high-risk AI applications, including regular audits.
- Organizations will need to intensify their efforts to ensure their AI solutions comply with these requirements, or risk facing grave legal consequences.
- The National Institute of Standards and Technology (NIST) AI Risk Management Framework guides organizations in identifying, assessing and managing risks associated with AI. This is important for safety and compliance.
- Organizations will also find increasing support for regulatory compliance in the RegTech startup ecosystem.

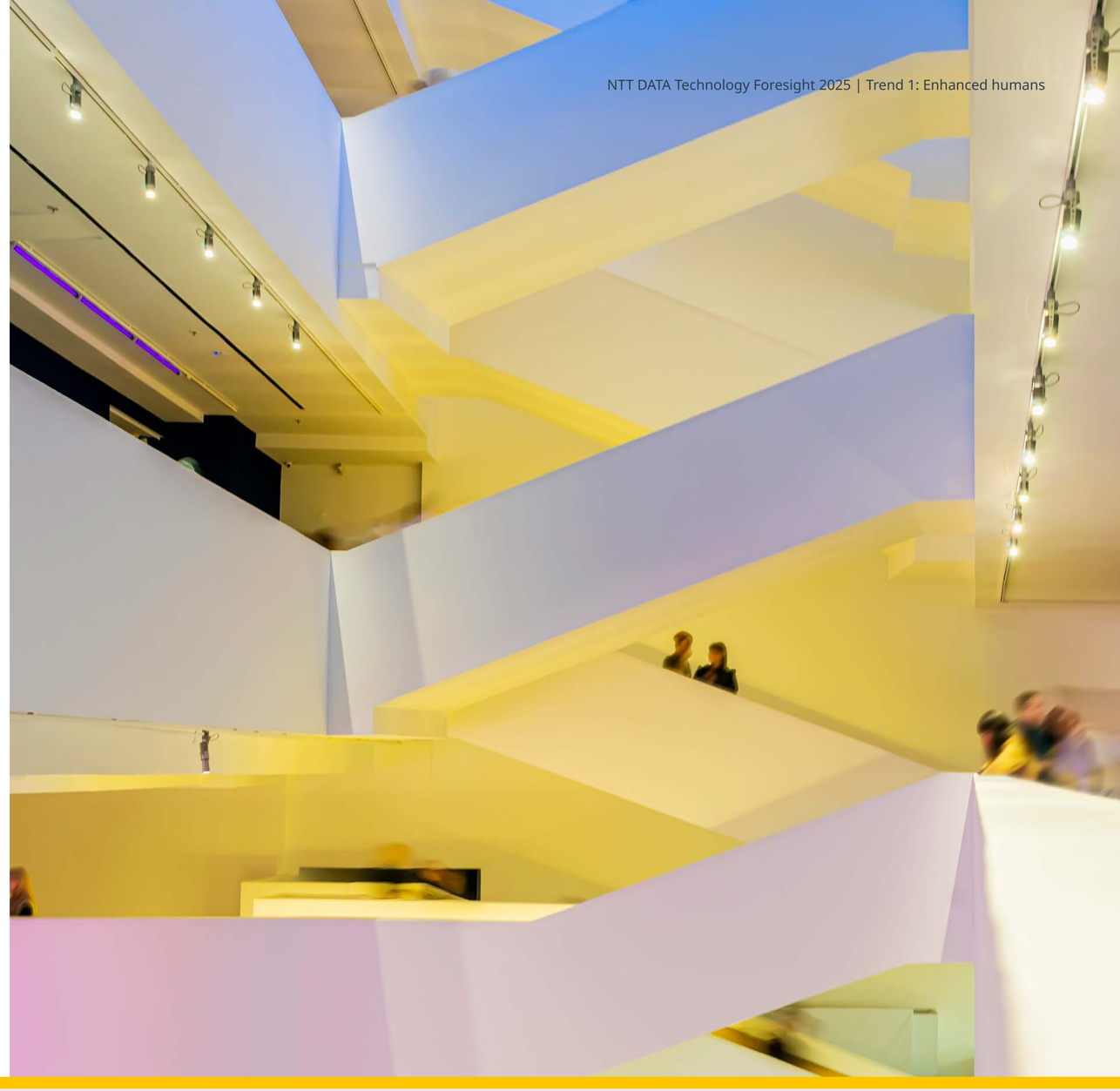
Underlying concepts

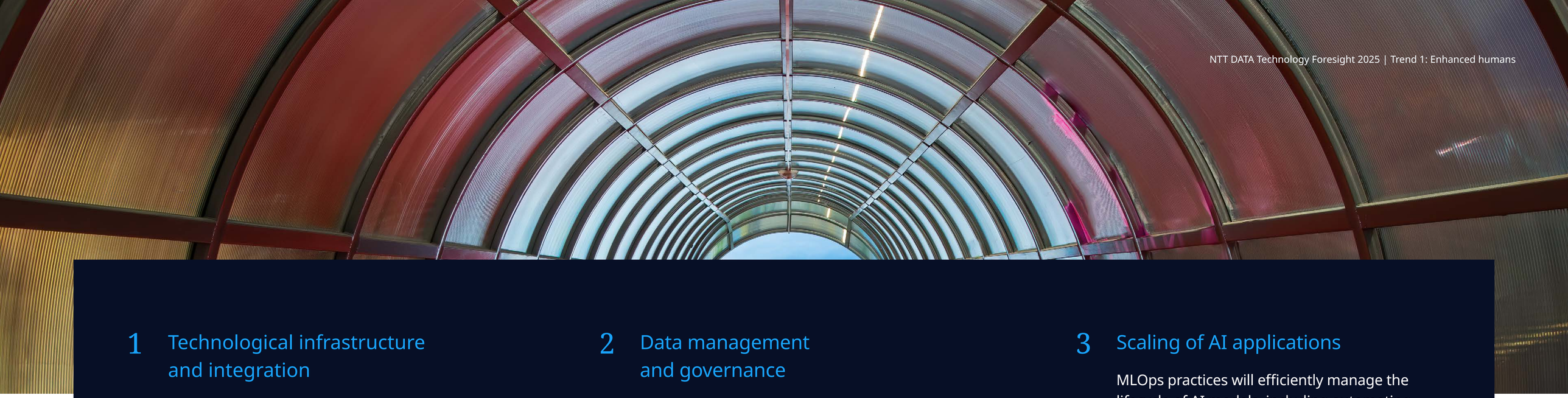
Organizational enablement through AI

Organizational enablement through AI refers to the strategic use of AI to transform culture, people and processes, and hence improve efficiency and inspire innovation. Increasingly, we'll see organizations integrating AI into areas such as human resources, supply chain, financial planning and decision-making processes to create a competitive advantage.

Cooperation and collaboration between humans and machines will be crucial to fully exploiting the potential of AI. This will require effective change management and training to enable employees to work with AI systems.

> "Equally, data management and governance will play a central role in ensuring the quality, privacy and security of data and enabling reliable, data-driven decisions.





1 Technological infrastructure and integration

GenAI will require scalable cloud environments with specialized hardware to process large amounts of data and perform complex model calculations in real time.

A seamless connection to internal data sources, application programming interfaces (APIs) and other systems will be crucial for providing relevant data for training models and integrating GenAI into existing processes and systems.

2 Data management and governance

Data meshes will support the efficient storage and analysis of large amounts of data and create a basis for data-driven decisions and AI projects. The decentralized architecture of data meshes will enable technical and organizational scalability.

Data governance strategies will need to ensure that data quality, privacy and security measures meet legal and regulatory requirements.

3 Scaling of AI applications

MLOps practices will efficiently manage the lifecycle of AI models, including automating training, deployment, monitoring, maintenance and retraining.

Modular AI architectures will enable organizations to expand and adapt their AI applications flexibly and cost-effectively and increase the speed of adoption of AI.

4 Change management and training

Corporate culture will have to embrace collaboration with AI. Change management, supported by clear communication and employee engagement, will smooth the integration of AI into work processes.

Training initiatives will be essential for preparing employees to work with AI systems, strengthening their digital competence and promoting acceptance.

In this way, AI will become a trusted team member and companion.

5 Optimization of business processes

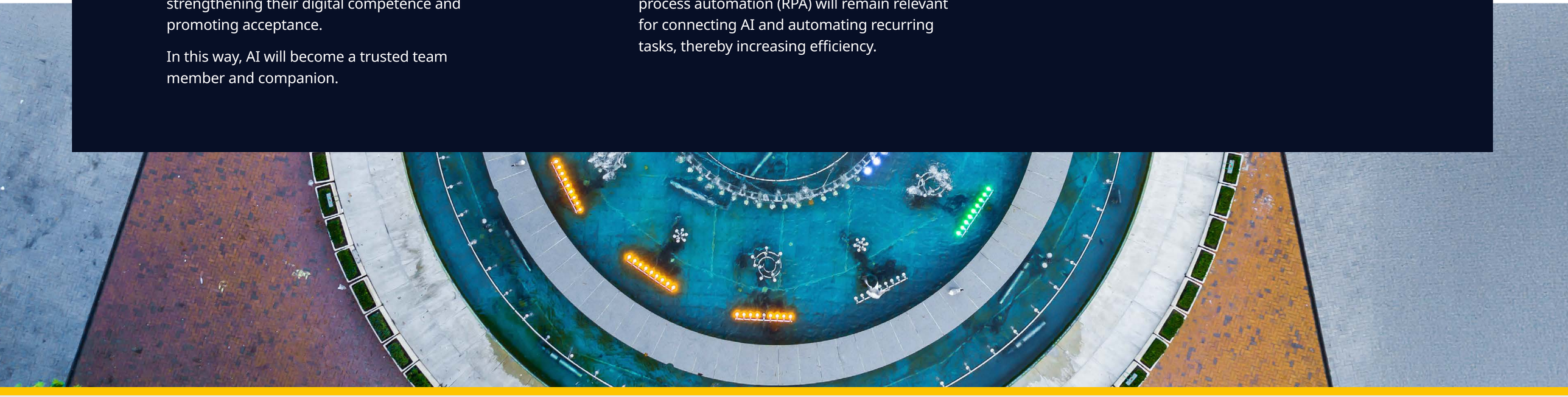
AI will observe and optimize complex business processes based on information automatically retrieved from systems and workplaces. This will shorten processing times and improve overall business performance.

AI will have to be connected to operational systems and processes. Classic tools like robotic process automation (RPA) will remain relevant for connecting AI and automating recurring tasks, thereby increasing efficiency.

6 Strategic decision-making

Predictive analytics will anticipate future trends and customer needs, leading to proactive and informed business decisions.

Data-driven business strategies based on AI will give organizations a competitive advantage and enable innovative business models.



Underlying concepts

AI-assisted workplace

AI-powered workplaces will integrate advanced technologies such as GenAI-powered chatbots and services, predictive analytics and RPA to increase productivity and efficiency. These tools will automate routine tasks such as data and document processing and reporting so employees can spend more time on value-adding activities like face-to-face customer service.

GenAI assistants will play a central role in this by analyzing large data sets, summarizing complex information and generating personalized content. Through natural language interaction, they'll improve access to data and support decision-making.

> These technologies will also promote human–machine teamwork by supporting employees in their daily work and improving collaboration, for example, by automatically generating meeting summaries and offering suggestions on task prioritization.

Productivity increase

- Automated task management with virtual assistants and chatbots will coordinate routine tasks such as scheduling, email management and data analysis.
- Work environments will adapt to employees' individual needs and preferences by providing recommendations for task prioritization and time management.
- Personalized recommendations will help employees make informed decisions faster and more accurately. Decisions will be better documented and grounded in facts.

Efficient data analysis and decision-making

- Large amounts of data will be analyzed in real time to provide relevant insights that lead to faster and more informed decisions.
- GenAI-powered understanding and processing of natural language will make it easier for employees to access data and analyses, regardless of their technical expertise.
- Data from different sources can be combined without the need for engineers to design new interfaces and data flows.

Improved employee support

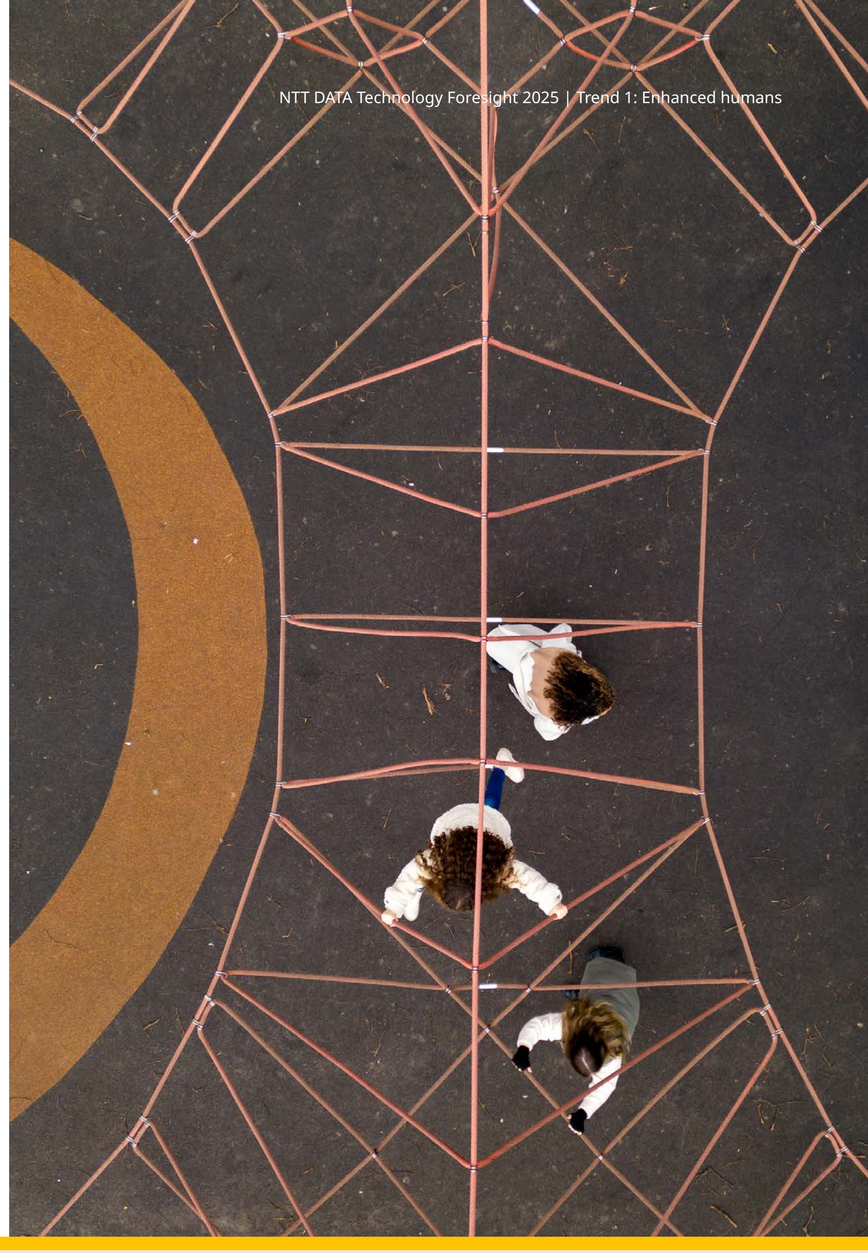
- Support chatbots and digital assistants will provide instant support to employees by answering frequently asked questions and helping solve problems, increasing employee efficiency and satisfaction.
- Learning platforms will automatically create personalized training and development programs that augment employees' skills and address specific needs, based on individuals' current skills and knowledge.
- The collection and consolidation of information from different data sources, based on natural language semantics, will expedite the creation and adoption of effective knowledge-management tools.

Optimization of work processes

- Workflows will be automated and optimized by AI services that autonomously identify and automate repetitive tasks, thus reducing cycle times and increasing overall productivity.
- Intelligent document processing will reach a new level with GenAI: documents can be automatically classified, analyzed and processed, reducing the manual effort involved in training classical AI.
- Creative approaches, concepts and layouts will be generated by drawing insights from large amounts of information, providing inspiration and helping people to overcome creative blocks.

Human–machine collaboration

- Advanced teamwork will emerge from tighter collaboration between humans and machines.
- The computing power and precision of machines will complement human creativity and problem-solving skills. Trusted AI services will provide unbiased and private feedback on team dynamics, boosting team productivity.
- Improved communication systems will analyze and optimize communication patterns, resulting in more efficient meetings, clearer instructions and better information flow within teams.



Underlying concepts

AI-assisted software development

GenAI is revolutionizing software development by automating creative processes and supporting developers in the creation of code, designs and applications. GenAI models will enable organizations to develop software faster and more cost-effectively. Tools such as AI-assisted integrated development environments (IDEs) will provide developers with real-time code suggestions.

Techniques such as transfer learning and reinforcement learning will improve the quality of the generated software components. In addition, GenAI will automate DevOps processes such as continuous integration/continuous deployment (CI/CD) and increase security through AI-driven code analysis and security checks.

> “Collectively, these capabilities will allow organizations to work in a more agile and innovative way.

Automation of software development

- Differential privacy techniques anonymize personal data during processing by AI models. This will significantly reduce the risk of data leakage and boost user and customer acceptance for advanced AI functions.
- Adversarial training will increase the resistance of models to manipulation attempts aimed at causing malfunctions in automated processes and decision-making.

Improved collaboration in the development team

- Intelligent pair-programming assistants will enable seamless collaboration among developers and machines by acting as partners in pair programming and continuously making suggestions for code improvement.
- Collaborative coding platforms will promote collaboration across distributed teams by providing real-time ssuggestions for and corrections to the work of multiple developers. This will maximize consistency in software development efforts.

Scaling and maintenance of software projects

- Automatic refactoring will improve compliance with architecture models and ease the software maintenance burden. It will also reduce technical debt, which is vital when scaling software projects in terms of functionality and team size.
- CI/CD pipelines will be generated based on application code, and integrate intelligent inspection and testing services. This will optimize automated tests and deployments, enabling fast and secure software delivery.

Adaptation to individual requirements

- Models will be trained for discrete industries or use cases, allowing developers to create software solutions tailored to address domain-specific challenges like efficiency, safety and compliance.
- Customizable AI frameworks will allow developers to create software applications that meet specific business needs by easily integrating and customizing existing models and tools.

Reduction of errors and security gaps

- Automated security checks will independently detect and fix security vulnerabilities in code, reducing the risk of cyberattacks and data breaches.
- Models for predictive error detection will anticipate where errors might occur and make suggestions for avoiding bugs, increasing the reliability and stability of software applications.

Innovation and prototyping

- The rapid creation of software prototypes, for example from simple paper sketches, will expedite the innovation process and shorten time to market for new products.
- With AI-powered innovation, developers will be able to create novel features and products that embrace natural interaction and unstructured data, strengthening the organization's competitive advantage.

> AI is reshaping software development, accelerating innovation, enhancing collaboration and tackling complex challenges effectively.

Tech radar

Tech radar for mainstream adoption

In the constantly changing tech landscape, keeping up with the latest developments is essential, not just advantageous.

Continually analyzing technology trends and tracking their evolution will help you anticipate changes and prepare yourself for upcoming shifts.

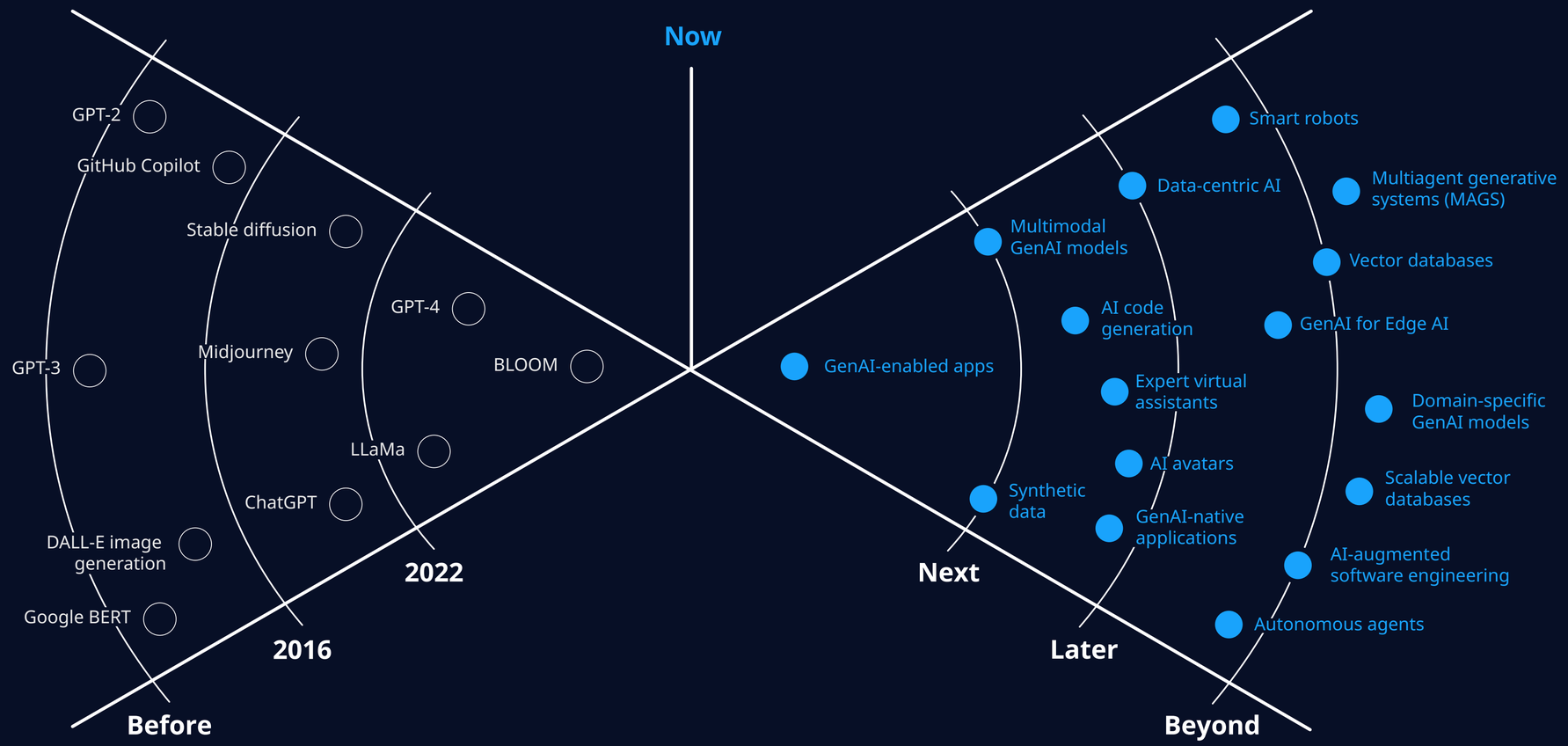


Figure 2: Tech radar — past and future technology

Future tech: now, next and later

A **GenAI-enabled apps**
GenAI-enabled applications enhance the user experience and assist with tasks like generating text, code and images, and enabling autonomous workflows.

B **Multimodal GenAI models**
Multimodal GenAI models process multiple types of inputs and outputs, such as images, text and audio, enabling models to interact across different modalities.

C **Synthetic data**
Synthetic data is artificially generated data used to train AI models, offering solutions in areas such as data scarcity, privacy concerns and regulatory compliance while mimicking real-world data patterns.

D **AI code generation**
AI code generation uses LLMs to generate code based on user prompts, primarily through AI code assistants that are integrated into development environments and support various programming languages.

E **Expert virtual assistants (VAs)**
Expert VAs go beyond traditional VAs by using AI technologies to provide accurate solutions in specialized fields like healthcare and legal, while offering proactive intelligence and multimodal interactions.

F **GenAI-native applications**
GenAI-native applications are built using generative AI technology, designed for specific business capabilities or industries and are often offered as software-as-a-service (SaaS) solutions.

G **AI avatars**
AI avatars are humanlike digital personas created with AI technologies like computer-generated imagery (CGI) rendering, natural language processing (NLP) and emotion AI. They facilitate more immersive and interactive experiences in metaverse and virtual environments.

H **Data-centric AI**
Data-centric AI focuses on improving training data to enhance AI outcomes, emphasizing data quality, privacy and scalability, as opposed to model-centric approaches, which prioritize the development and optimization of AI models.

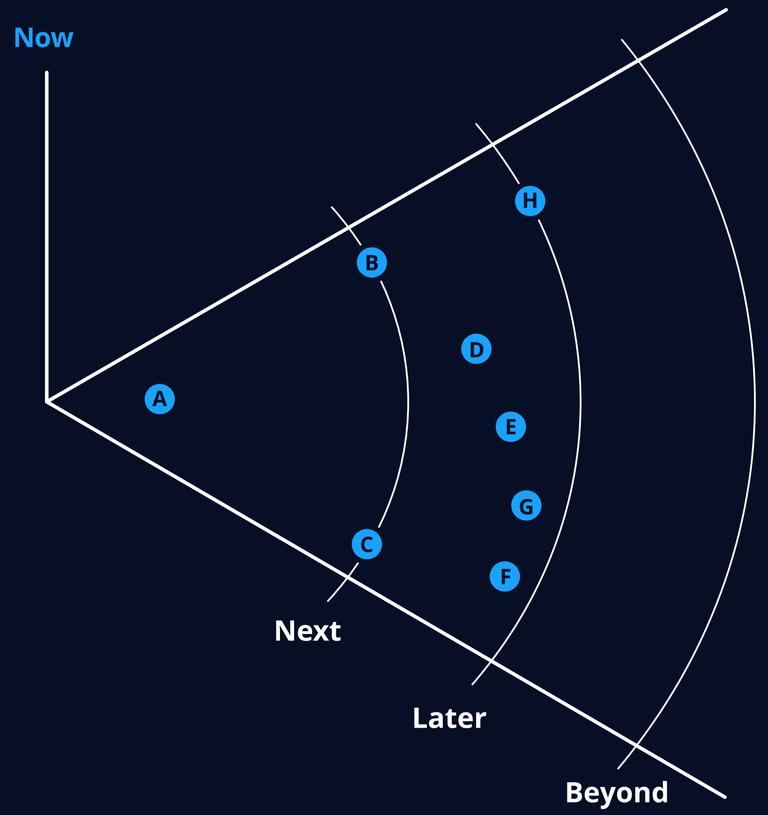


Figure 3a: Tech radar — future technology

Future tech: later and beyond

I **Smart robots**
Smart robots, including unmanned aerial vehicles (UAVs), automated guided vehicles (AGVs) and autonomous mobile robots (AMRs), are AI-powered machines that autonomously perform personal, logistical and industrial tasks.

J **GenAI for edge AI**
GenAI at the edge enables content generation, strategy development and automation based on large data repositories, impacting areas like content creation and employee experience.

K **Autonomous agents**
Autonomous agents are AI-driven systems that independently achieve defined goals by learning from their environment and making decisions without human intervention.

L **Vector databases**
Vector databases store numerical data representations. They are often used in machine learning to search for and compare data points with low latency based on vector similarity.

M **Multiagent generative systems (MAGS)**
MAGS combine software agents and LLMs to simulate behaviors and generate emergent dynamics within multiagent environments.

N **AI-augmented software engineering (AIASE)**
AIASE uses AI technologies like ML and NLP to help software teams create applications faster, with less effort and at a higher standard of quality.

O **Domain-specific GenAI models**
Domain-specific models are GenAI models tailored to specific industries or tasks. They improve performance and reduce prompt engineering needs compared to general-purpose models.

P **Scalable vector databases**
Vector databases enable semantic search by storing embeddings generated by LLMs, allowing for the efficient retrieval and ranking of data in conjunction with custom enterprise information.

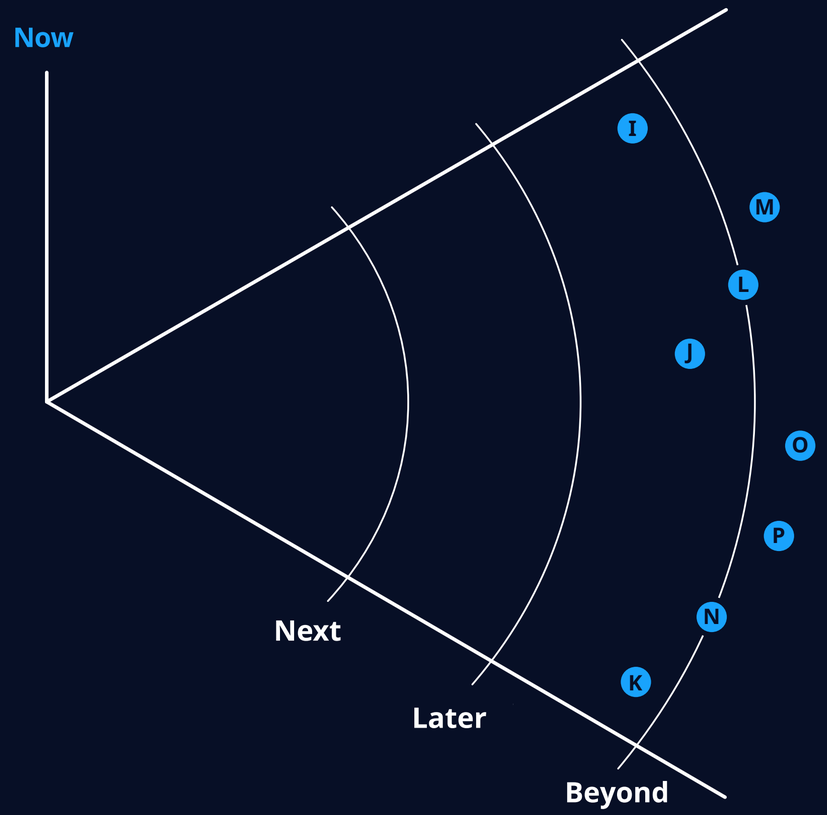


Figure 3b: Tech radar — future technology

R&D highlight

R&D highlight

"tsuzumi"

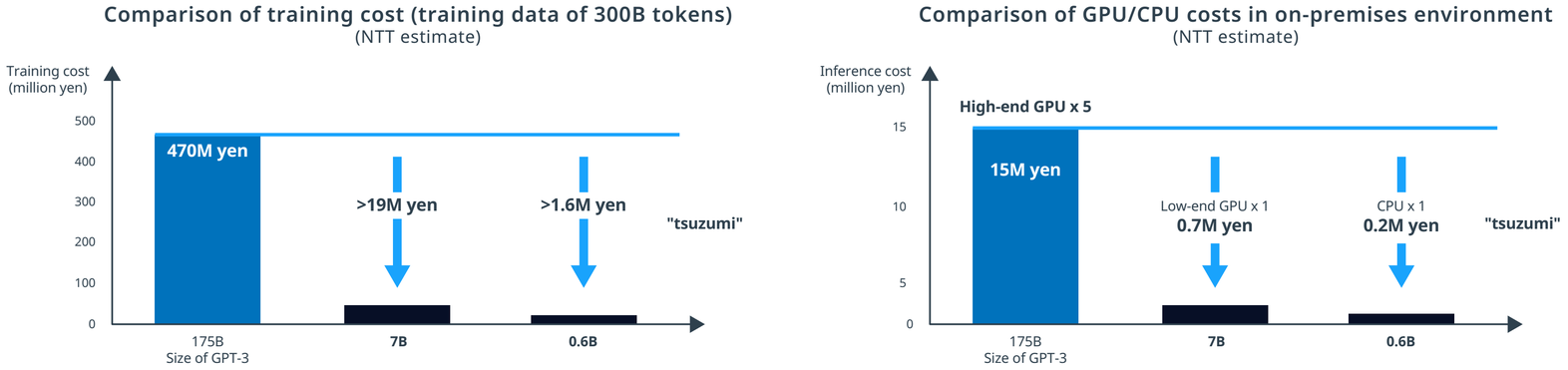
NTT's "tsuzumi" LLM, launched in March 2024, is an efficient and performance-driven solution for sustainable AI.

It has two versions: an ultra-lightweight model with 600 million parameters and a lightweight one with 7 billion parameters, designed to lower computational costs. Unlike larger models like OpenAI's GPT-3, "tsuzumi" allows high-speed inference on a single graphics processing unit (GPU) or even a central processing unit (CPU) for the ultra-lightweight version, making it suitable for businesses needing advanced AI without heavy resource demands.

"tsuzumi" is highly adaptable, allowing precise customizations through adapters for industry-specific needs without extensive retraining. This feature supports fine-tuning for specialized language in sectors like healthcare and finance, reducing computational costs further.

Additionally, “tsuzumi” features multimodal capabilities to process text, audio and visual data, making it versatile for complex tasks like interpreting documents with graphical elements and analyzing medical imaging alongside patient records. Its ability to discern voice nuances is valuable in customer service and counseling, enhancing empathetic responses.

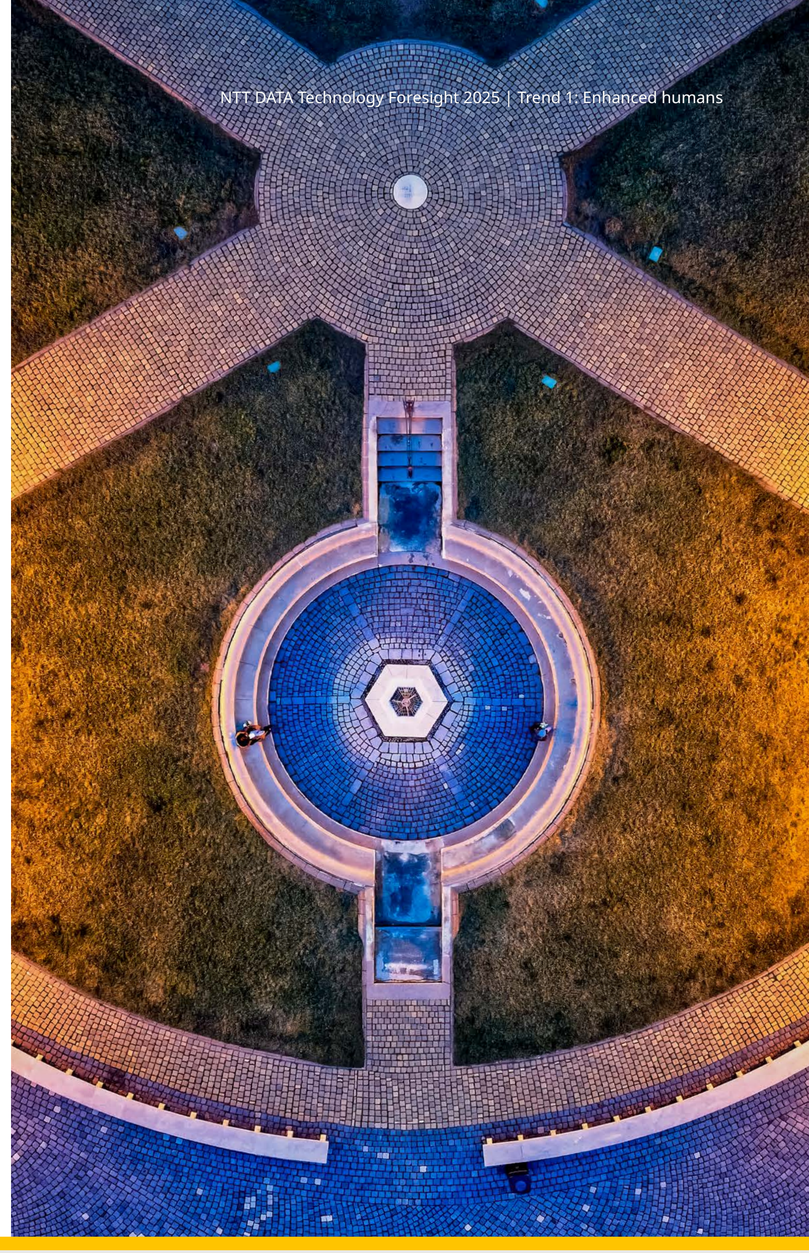
NTT’s research has led to “tsuzumi" being a powerful alternative to larger models, with the benefits of customization and lower operational costs. It represents a significant advancement in AI technology, making high-performance LLMs more accessible while reducing energy consumption and costs.



CPU: central processing unit
GPU: graphics processing unit

Figure 4: “tsuzumi” comparison for training and inferencing

Adapted from: *NTT Technical Review* Vol. 22, No. 8, pp. 19–25, Aug. 2024



Quantification

Relevant financials

GenAI in software development

Market size, 2024:

$49.8 billion

Market size growth, 2023–2024 (YoY):

+21.46%

Forecast CAGR, 2024–2033:

21.5%

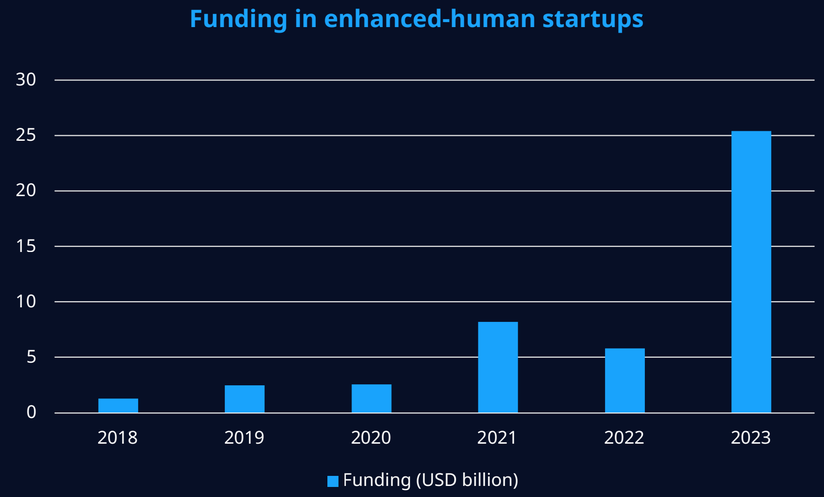


Figure 5: Funding in enhanced-human startups

> 43% of technology leaders are allocating significant budgets to GenAI initiatives.

GenAI adoption rates and benefits

75%
Organizations adopting GenAI

25%
Cost savings (efficiency)

45%
Developers using GenAI tools

40%
Reduction in coding errors

25%
Improvement in software quality

GenAI research and development

15,000*
Patents registered 2023

34,000*
Research papers published 2023

*Approximate figures

Top companies by patent count in GenAI

1. **Tencent**
   2,074 patents
2. **Ping An Insurance Group**
   1,564 patents
3. **Baidu**
   1,234 patents
4. **IBM**
   601 patents
5. **Alibaba**
   571 patents

Use cases

AI companion @Metaverse Garage

Industry: **Automotive**

The AI companion ecosystem transforms automotive experiences by evolving digital assistants into personal concierges who offer timely, data-driven services. This enhances vehicle value, integrates service providers and strategically positions original equipment manufacturers (OEMs) to deliver a seamless, personalized customer journey.

Business value

1. Enable more personalized experiences and added-value services
2. Enhance cross-selling and upselling potential
3. Improve customer loyalty

> “AI companions deliver seamless, personalized services, elevating customer experiences and loyalty.

Shopfloor assistant

Industry: **Industry and services**

Shopfloor assistants optimize production processes through real-time instructions, troubleshooting and automated process improvements. This increases efficiency and quality and provides employees with automatic planning and quality assurance.

Business value

1. Cost reduction through process automation
2. Increased productivity through real-time troubleshooting and optimized workflows

Energy trading copilot

Industry: **Automotive**

This solution optimizes energy trading through real-time data analysis, automated transactions and risk management. It improves decision-making, maximizes profits and minimizes risks while automatically monitoring and complying with regulatory requirements.

Business value

1. Optimized earnings through data-driven trading decisions
2. Lower risk and ability to respond faster with automated processes

> “The network engineering copilot streamlines network management with intelligent automation, improving efficiency, reducing disruptions and enhancing resilience.

Network engineering copilot

Industry: **Telecommunications, media and technology**

This copilot optimizes networks through a range of automated functions, including design, real-time troubleshooting, load optimization and security management. It improves operational efficiency, minimizes disruption and strengthens network security by providing intelligent solutions for network issues and optimization.

Business value

1. Cost reduction through more efficient network infrastructure and automated troubleshooting
2. Increased network stability and reliability

GenAI for fraud prevention

Industry: **Financial services**

A GenAI fraud-prevention tool provides real-time anomaly detection, dynamic risk modeling, secure authentication and automated fraud verification. By reducing fraud, minimizing losses and increasing customer security through proactive and accurate fraud detection, it's an essential element of a robust and effective risk management strategy.

Business value

1. Reduction of fraud through proactive detection and prevention
2. Increased customer security and trust through effective risk management

> "GenAI for fraud prevention transforms risk management by enabling real-time insights and dynamic fraud responses.

AI-assisted requirement engineering

Industry: **Cross-industry**

This tool improves efficiency, productivity and quality by gathering, classifying and aligning stakeholder input. It checks consistency, improves accuracy and supports documentation with suggestions and standardization, streamlining the entire requirements management process.

Business value

1. Increased productivity
2. Higher quality of requirements

Datenschutz-Grundverordnung (DSGVO)/General Data Protection Regulation (GDPR) assistant

Industry: **Cross-industry**

This assistant supports the design and implementation of a customizable GDPR companion for employees. It can answer GDPR/DSGVO-related questions based on an understanding of European and German legislation and organization-specific knowledge databases.

Business value

1. Streamlines queries, improving operational and cost efficiency
2. Offers tailored legal assistance

> The GDPR assistant empowers employees with instant, context-aware guidance that bridges organizational and legal expertise.

Use cases

Success case

DACH | Automotive

Business need

Our client sought to quickly and fully exploit the potential of GenAI for GDPR compliance, while alsomanaging risks such as safety, security, compliance, ethics and trustworthiness. The envisaged solution also needed to act as a competent contact for necessary classifications and questions regarding GDPR.

Additional design considerations included adapting the AI model to accommodate different business units' internal processes, a lack of internal AI experts, integration of the solution into the wider internal IT environment and scalability to keep up with the fast pace of innovation.

The goal was to create a stable digital GDPR assistant prototype to present at a customer's trade fair. In addition, an integration and expansion concept was required to show how the prototype could be integrated into an existing IT environment.

Solution

1. **Analysis and conception for the implementation of a GDPR application that uses an AI-based search**

   We analyzed the database provided (documents, transcripts and website content) and designed the technical target image as a basis for a task breakdown for the subsequent implementation phase.

2. **Implementation of the GDPR application based on GenAI**

   We implemented of the GDPR application in the form of a stable prototype.

3. **Development of an integration and extension concept**

   We developed a concept for integrating the solution into corporate IT, identified opportunities to scale and optimize costs, and proposed improvements to language models along with other functional enhancements.

Outcomes

In the future, the client will have a digital GDPR assistant that's expandable, scalable and can be integrated into their existing IT environment. Corresponding concepts were also delivered as part of the project scope.

Technologies

Azure Cloud, Docker, Python

Partner products

Microsoft Azure

Startups

Startup radar

In this section, we review a selection of startups relevant to the enhanced-humans trend, based on our observations, partnerships and investments.

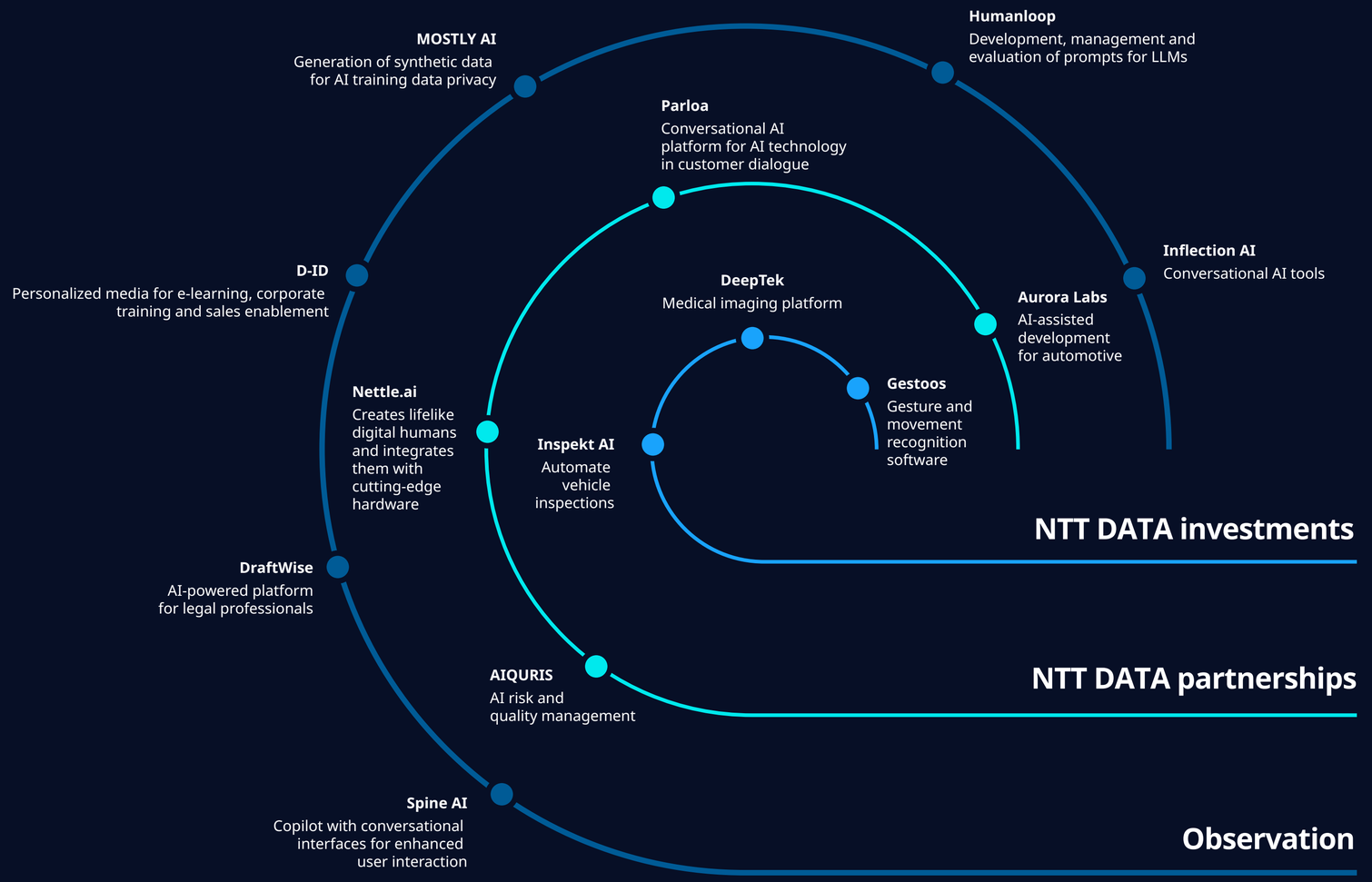


Figure 6: Investment in enhanced-human startups

Startups

Observation

Inflection AI

Founded in 2022 by former leaders of LinkedIn and DeepMind, Inflection AI focuses on developing conversational AI tools. Its flagship product API is designed to augment human–computer interaction through NLP, offering a more intuitive and accessible way to integrate AI into daily tasks.

Stage
Venture-capital backed

Funding
$1.5 billion

Valuation
$4 billion

Industry
Cross-industry

MOSTLY AI

Founded in 2017, MOSTLY AI specializes in synthetic-data generation, critical for AI training and data privacy. Its platform is particularly well suited to industries like banking and telecommunications, where it helps in developing AI models without compromising sensitive information.

Stage
Series B

Funding
$31.1 million

Valuation
Not disclosed

Industry
Financial services; telecommunications, media and technology

DraftWise

Founded in 2020, DraftWise has developed a knowledge management and intelligence platform that supports organizations' technology and compliance requirements. The platform helps law firms draft contracts faster by giving lawyers instant access to their firm's collective knowledge base and existing contracts. Firms can also customize the security architecture according to their requirements.

Stage
Series A

Funding
$28 million

Valuation
$92.93 million

Industry
B2B legal services

D-ID

Founded in 2017, D-ID has developed a platform that uses AI to create highly personalized media, specifically for e-learning, corporate training and sales enablement. The solution allows businesses to create AI-powered conversational agents and AI-generated videos for a more natural and engaging user experience.

Stage
Series B

Funding
$48 million

Valuation
Not disclosed

Industry
Cross-industry

Humanloop

Founded in 2023, Humanloop has developed a platform that trains AI models using less labeled data, allowing engineers and data scientists to move from idea to deployed AI faster, manage prompt development better and improve the evaluation of LLM applications.

Stage
Seed

Funding
$2.7 million

Valuation
Not disclosed

Industry
Cross-industry

Spine AI

Founded in 2023, Spine AI is the developer of an AI copilot with a conversational interface that seamlessly integrates with an organization's existing APIs. It offers robust, stable and hassle-free deployment and integration.

Stage
Seed

Funding
$500,000

Valuation
Not disclosed

Industry
Cross-industry

Startups

NTT DATA partnerships

Aurora Labs

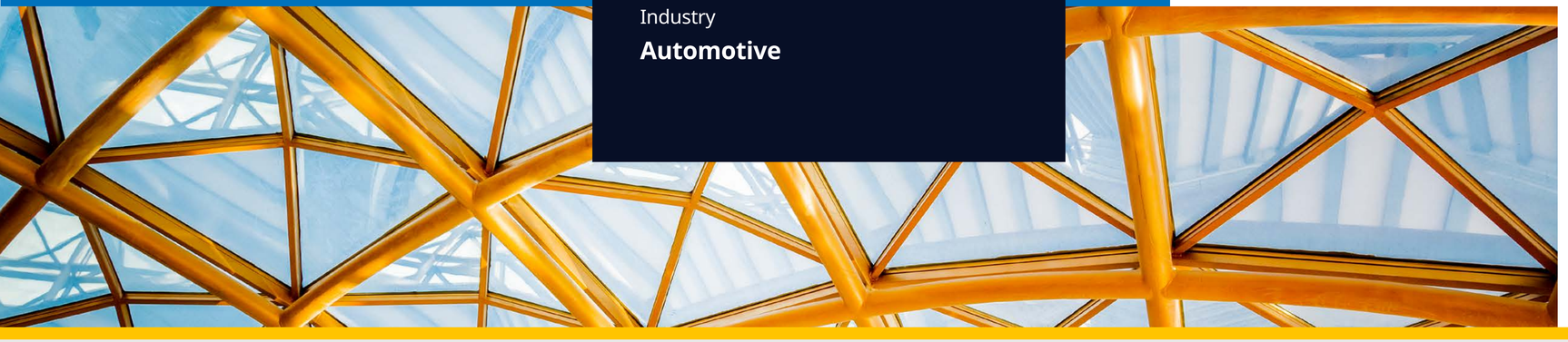
Founded in 2016, Aurora Labs brings AI-based vehicle software intelligence to the entire vehicle lifecycle, from development to testing, integration, quality control, continuous certification and on-the-road over-the-air software updates. Aurora Labs focuses on the embedded systems key to the development of software-defined vehicles. Its solutions enable automotive manufacturers to more efficiently manage software costs and the resources required to develop and manage new vehicle features and mobility services.

Stage
Series C

Funding
$97.1 million

Valuation
Not disclosed

Industry
Automotive



Parloa

Founded in 2018, Parloa has created a conversational AI customer dialogue platform designed to meet increased customer expectations for service quality across more channels. The platform captures and analyzes customer calls and service requests within seconds and automates repetitive tasks. By breaking down data silos and applying unified data training, it allows customers to use multiple service channels simultaneously.

Stage
Series B

Funding
$85.7 million

Valuation
Not disclosed

Industry
Cross-industry

Nettle.ai

Founded in 2018, Nettle.ai creates lifelike digital humans and integrates them with cutting-edge hardware like holographic projectors. These digital humans are customized to represent brands and offer interactive, intelligent conversations powered by advanced NLP. The platform delivers immersive, "phygital" experiences, blending physical and digital realities to engage audiences without the need for additional wearables.

Stage
Seed

Funding
$1.19 million

Valuation
$4 million

Industry
Cross-industry

AIQURIS

Founded by Dr Andreas Hauser and Dr Martin Saerbeck, AIQURIS specializes in AI risk management, compliance and governance, helping businesses safely adopt AI technologies while ensuring regulatory compliance and efficiency for sustainable growth and innovation across industries.

Stage
Series A

Funding
Captive cross

Valuation
Not disclosed

Industry
Cross-industry

Startups

NTT DATA investments

Gestoos

Founded in 2016, Gestoos develops AI-enabled gesture control and behavior recognition applications and ML-enabled gesture recognition solutions for the automotive, consumer electronics and digital space industries. Based in Barcelona, Spain, Gestoos was acquired by PreAct in January 2023.

Stage
Formerly venture-capital backed

Funding
$2.6 million

Valuation
Not disclosed

Industry
Cross-industry

Inspekt Labs

Founded in 2019, Inspekt Labs is the developer of an AI-based inspection platform that automates inspections of physical items using photos and videos. The platform performs quick and consistent inspections of items like cars, bikes, mobile phones, property and more, enabling users to easily conduct damage assessments, asset valuations, claims assessments and fraud detection.

Stage
Seed

Funding
$720,000

Valuation
Not disclosed

Industry
Insurance; logistics

Deeptek

Founded in 2017, Deeptek has developed an AI system that provides decision support for the radiology industry. The system offers services like teleradiology services, radiology optimization platforms and community outreach programs, enabling radiologists to reduce their workload and expedite the diagnosis process.

Stage
Series A

Funding
$10 million

Valuation
Not disclosed

Industry
Healthcare

> “Startups in AI are not just disrupting industries; they are blending innovation with scalability to redefine how we work and live.

Future scenarios

As industries transform, new value chains emerge and technological advancements grow exponentially, companies must navigate complex, evolving landscapes.

Future scenarios and GenAI-powered personas allow organizations to explore possible futures by simulating realistic business environments, and minimize risk through scenario-based planning.

Uncertainties represent what we cannot know, but identifying them can reduce the risks of blind spots down the road.

Future scenarios

Uncertainty: regulatory response

The regulatory lag

What if regulation struggles to match the pace of AI development?

As AI fuels the enhanced-human initiative, it will create a vibrant environment for breakthrough innovations and spur growth and opportunities across various sectors. However, regulatory frameworks governing AI's responsible use may not be updated at the same speed. Advancements in augmenting human capabilities could continue unchecked until regulations eventually catch up to provide the necessary safeguards.

Islands of oversight

What if the regulatory spotlight shines brightest on finance and healthcare?

Given the higher levels of regulatory attention on finance and healthcare, these sectors could lead the way in safely integrating AI and set exemplary standards for enhanced-human technologies. This concentration of oversight will ensure that AI enhancements in these critical areas maximize benefits like improved patient care and financial security, establishing models for other sectors to follow.

However, because other sectors don't initially receive the same level of oversight, the application and benefits of AI in enhancing human abilities may be uneven across different industries.

Future scenarios

Uncertainty: impact on employment

The upskilling divide

What if the upskilling race creates champions and stragglers in society?

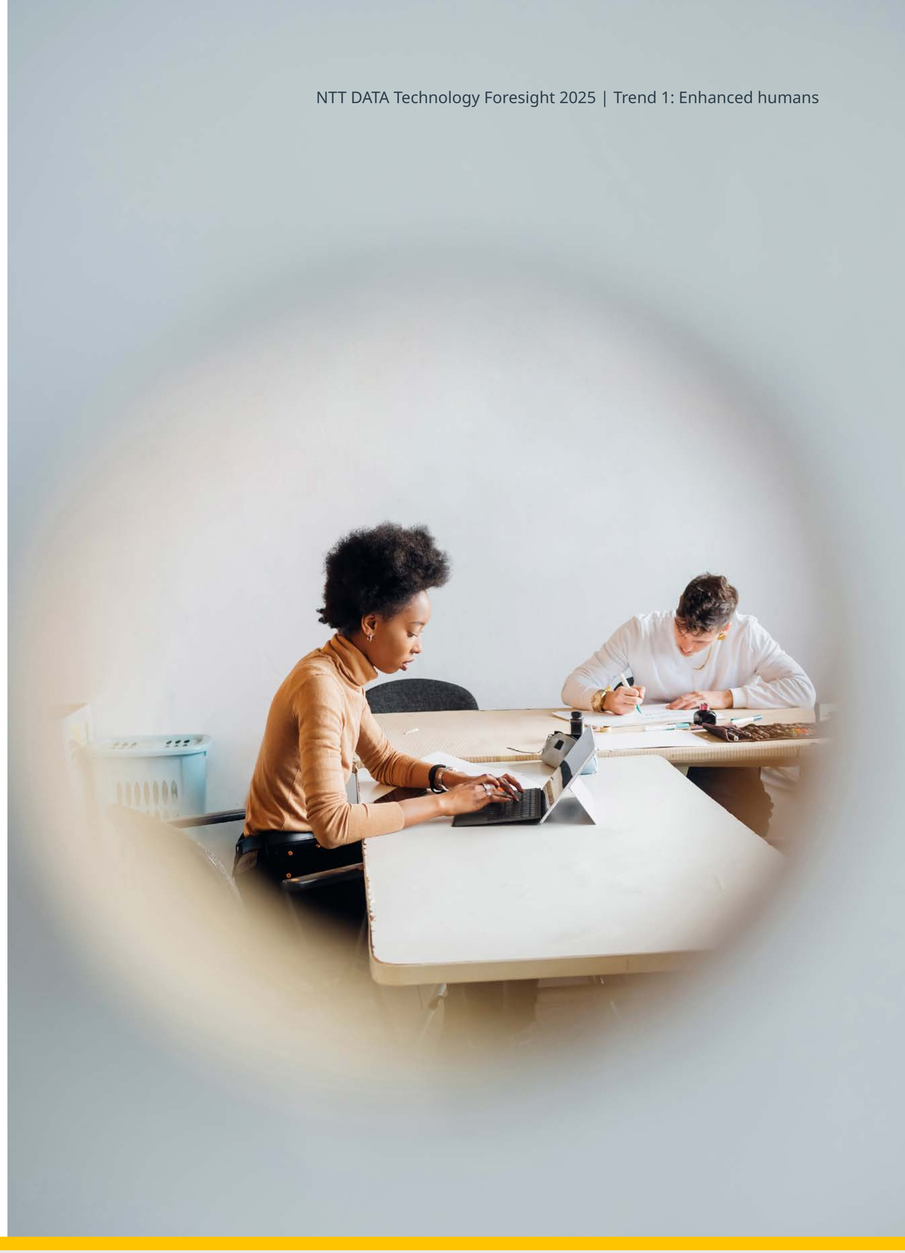
As industries integrate AI, the divide between those who are given the opportunity to enhance their skills and those who aren't could deepen, impacting social equity. This challenge highlights the need for comprehensive, accessible training programs that ensure all members of society can benefit from enhanced-human technologies, not just those already at an advantage. It also underscores the importance of fostering an inclusive environment where every individual has the potential to thrive in an AI-augmented future.

Elastic instability

What if GenAI fuels a booming yet precarious gig economy?

While the expansion of the gig economy through AI may introduce challenges to job security, it will also introduce opportunities for greater flexibility and diversity that support personal and professional growth. This new landscape will require a rethink of traditional employment models and the introduction of innovative work structures that balance flexibility with stability to benefit a broad range of workers.

> Exploring scenarios like regulatory lag or the upskilling divide highlights the pivotal choices ahead.



Conclusion and next steps

Conclusion and next steps

Think about this

Given the rapid pace of AI advancements, staying ahead will require constant adaptation and the integration of the latest tools and techniques.

How do you keep up with the speed of AI innovation? What is your GenAI ecosystem?

As concerns regarding AI ethics and bias increase, organizations must ensure they have transparent and explainable AI systems and comply with new regulations governing the use of these systems.

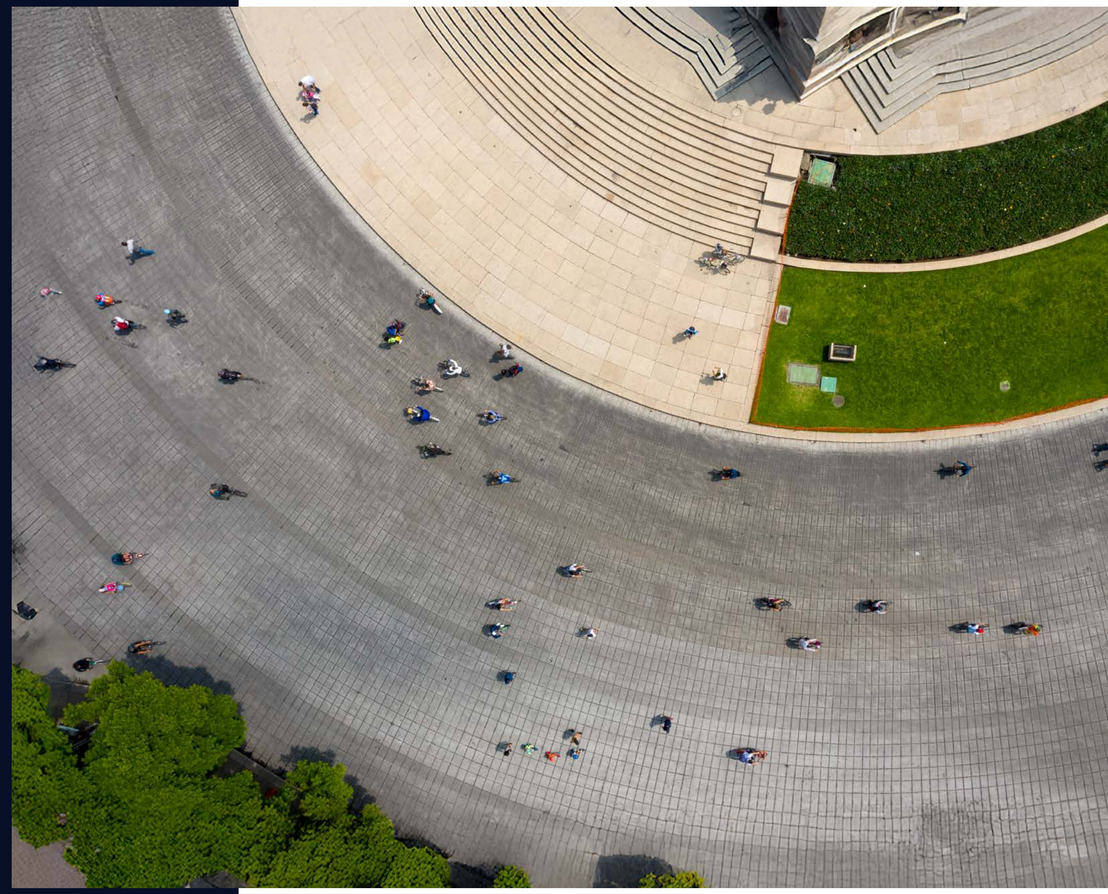
How do you bring transparency to your AI systems?

Enhanced-human technologies do not replace people but enhance their abilities. Critical thinking and targeted questioning will remain essential.

How do you train juniors if there are no easy or routine tasks?

Ownership of AI models and the distribution of value from AI services raise critical questions about control and equity in the evolving digital landscape.

Who owns AI models, and how do we share the value generated by AI services?



Conclusion and next steps

Do this next

5 minutes

Prioritize key workflow bottlenecks

Identify the top three processes or workflows that frequently reduce the speed of operations (for example, manual data entry, lengthy approvals). These areas are ideal for immediate, targeted AI enhancements.

5 days

Deploy a GenAI chatbot for internal queries

Set up a GenAI chatbot prototype that assists employees with routine internal queries, such as accessing data or policy information. This will immediately reduce the time people spend searching for information, and lay a firm foundation for broader AI adoption.

5 months

Launch a cross-departmental AI-enablement program

Initiate a program to train a small group of employees from different departments on how they can use AI tools in their specific roles. Focus on creating AI “champions” who can encourage the adoption of the technology among their colleagues and help refine use cases. This will set the stage for the scalable integration of AI throughout the organization.

Contact information

Experts | Enhanced humans (Data and intelligence)

Andrew Wells
Global Portfolio Lead
Andrew.Wells@nttdata.com

David Pereira
Distinguished expert
David.Pereira.Paz@nttdata.com

About the research

Contributors

Name	Surname	Country
Valentina	Contini	Germany
Johannes	Reim	Germany
Diana	Hauser	Germany
Oliver	Koeth	Germany
Iris	Pfeifer	Germany
Thorsten	Harth	Germany
Leska	Reuster	Germany
Alberto	Acuto	Italy
Christian	Koch	Germany
Moshe	Karako	Israel
Thomas	Plass	Germany
Leticia	Lastra	UK
Nick	Mc Fetrich	UK
Markus Alexander	Hessler	Germany
César	Zayas	UK
Marta	Garayoa	Spain
Yumiko	Goshima	Japan
Ryoto	Ando	Japan
Yuya	Kawamata	Japan
Hiroshi	Furukawa	Japan
Tom	Winstanley	UK

Name	Surname	Country
Maria del Pilar	Quiros Gascon	Spain
Maria Mercedes	Medina Mora	Spain
Lucia	Ciordia Navarro	Spain
Sara	Alvarellos Navarro	Spain
Jose Carlos	Chavez Peinado	Spain
Martina	Palmucci	Italy
Filippo	Capocasale	Italy
Krasimir	Dzhigovechki	Germany
Nathan	Quadrio	Germany
Fabian	Warthenpfuhl	Germany
Volker	Ganz	Germany
Florian	Soelch	Germany
Dennis	Tischer	Germany
Markus	Lunz	Germany
Enno	Kätelhöhn	Germany
Daniel	Miner	Germany
Maria Vittoria	Trussoni	Italy
Bernhard	Stay	Germany
Takashi	Okada	Japan
David	Pereira	Spain
Global Content Hub		Global

References and sources

Trend 1: Enhanced humans

- Cheung, G., Fabbri, F. and O'Niell, C. BCG. IT spending pulse: as GenAI investment grows, other IT projects get squeezed.
- Crunchbase data.
- NTT. tsuzumi speaks human: the future of AI communication.
- Shimizu, K., Nishida, K. and Nishida, K. R&D and commercialization of NTT's large language model "tsuzumi".
- Shinde, Y. Market.us Scoop. Generative AI in software development market to hit USD 287.4 bn by 2033.
- World Intellectual Property Organization (WIPO). Key findings and insights. Patent Landscape Report – Generative Artificial Intelligence (GenAI).
- World Intellectual Property Organization (WIPO). 3 patent trends in GenAI models. Patent Landscape Report – Generative Artificial Intelligence (GenAI).

Glossary of key terms

Enhanced humans
People and machines are collaborating to shape a future where human potential isn't limited by time, task or knowledge.

Ambient intelligent experiences
Technologies like AI, spatial computing and automation are fundamentally changing how organizations connect with their audiences across different touchpoints.

Digital sustainability for economic resilience
A new business strategy is emerging where organizations integrate environmental stewardship with economic growth and assign individual and collective responsibility.

Cognitive cloud convergence
By integrating advanced cloud computing technologies with AI and human cognitive abilities, organizations can improve operations, enhance decision-making and understand their data in real time.

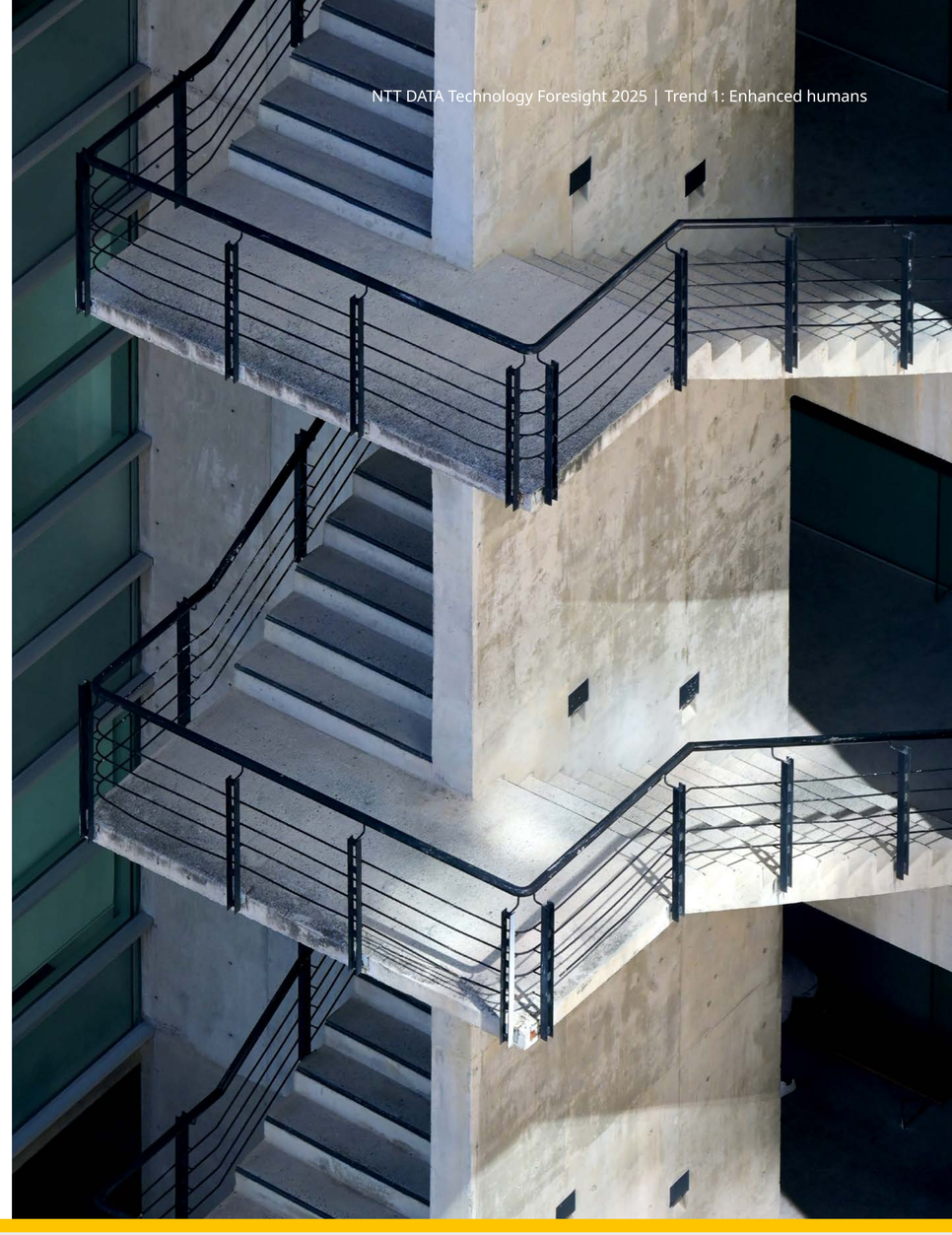
Accelerated security fusion
A new business strategy is emerging where organizations integrate automated incident response and AI-driven threat detection to adapt dynamically to emerging threats and build cyber resilience.

List of abbreviations

ADR	attack detection and response
AGV	automated guided vehicles
AI	artificial intelligence
AIASE	AI-augmented software engineering
AIOps	AI for IT operations
AMR	autonomous mobile robots
API	application programming interface
AR	augmented reality
ASIC	application-specific integrated circuit
AutoML	automated machine learning
AWS	Amazon Web Services
BAS	breach and attack simulation
CDN	content delivery network
CERT	computed emergency response team
CGI	computer-generated imagery
CGM	continuous glucose monitor
CI/CD	continuous integration and continuous delivery or deployment
CNAPP	cloud-native application protection platform
CPS	cyber-physical systems
CPU	central processing unit
CRQ	cyber risk quantification
CSIRT	computer security response team
CSPM	cloud security posture management
CX	customer experience
CVE	common vulnerabilities and exposure
DevSecOps	development, security and operations
DDoS	distributed-denial-of-service
DoT	deep learning of things
DSP	data security platform
EMS	energy management systems
ESG	environmental, social and governance
eVTOL	electric vertical takeoff and landing
FPGA	field programmable gate array
GenAI	generative AI
GPU	graphics processing units
GPT	generative pretrained transformer
IAM	identity and access management
IDE	integrated development environment
IOWN	Innovative Optical and Wireless Network
IPA	intelligent personal assistant
IRM	integrated risk management

List of abbreviations

ITRM	IT risk management
ITSM	IT service management
IoT	Internet of Things
LIME	Local Interpretable Model-Agnostic Explanations
LLM	large language model
MAG	multiagent generative system
MDR	managed detection and response
MFA	multifactor authentication
MLOps	machine learning operations
ML	machine learning
MR	mixed reality
NLP	natural language processing
OEM	original equipment manufacturer
OT	operational technology
PaaS	platform-as-a-service
PET	privacy-enhancing technology
PDE	provider data extractor
PQE	post-quantum encryption
PRM	proactive risk management
RAG	retrieval-augmented generation
RemOps	remediation operations
RPA	robotic process automation
RFID	radio frequency identification
SaaS	software-as-a-service
SHAP	Shapley Additive exPlanations
SSL	secure sockets layer
STEM	science, technology, engineering and math
TPU	tensor processing unit
UAV	unmanned aerial vehicle
VA	virtual assistant
MLOps	machine learning operations
VoC	voice of the customer
VR	virtual reality
XIoT	extended IoT
XOps	cross-functional operations



NTT DATA