

Everything *you wished for?*

Has Gen AI for software lived up
to the hype in automotive?

Capgemini 

When Gen AI first caught the eye of software developers, the predictions were wild. Now – a couple of years out – we can start to parse fact from fantasy. Our recent survey details the way **Gen AI is actually being used in software today**, and the profound implications across all sectors.

On November 30th, 2022, Open AI opened the floodgates. Just two months out, **100 million users** were using their new Chat GPT app, making it the fastest growing user base of all time. In our discussions with automotive leaders, the mix of excitement and caution, fascination and fear, and intense curiosity – it's like nothing we've seen.

Around the world, some of the most common questions we've heard from automotive employees include:

- Will Gen AI solve the scarcity of software development talent?
- ... and how will it evolve my role?
- Will Gen AI improve coding quality?
- ...or will it lead to unverifiable, untraceable errors?
- in fact, in light of regulatory requirements for traceability, can Gen AI be used for code creation at all?
- How are software developers using Gen AI?
- What are the risks?
- Above all, how can OEMs capitalize on this trend?

To find answers, The Capgemini Research Institute **recently interviewed** 1,000 senior executives and 1,000 software professionals from organizations with over \$1 billion in annual revenue. The results paint a picture of an industry in the first stages of a profound change.



Breaking down Gen AI

Generative AI (Gen AI) encompasses various types of models designed to create content, ranging from text and images to music and code.

Visual output is created by a type of Gen AI known as Generative Adversarial Networks (GANs). These consist of two neural networks – the generator and the discriminator – that work together to create realistic images, videos, and other media. In the automotive industry, GANs could be used to generate realistic driving scenarios for training autonomous vehicles, enhance image data for better object detection, and create synthetic sensor data to help train vehicle systems.

Variational Autoencoders (VAEs) are another form of Gen AI, used primarily for generating data that is similar to the input data, such as creating new faces based on a dataset of facial images. Transformer models are also used in natural language processing and have revolutionized tasks like translation and summarization. In the automotive industry, VAEs could be used to compress and reconstruct sensor data for efficient

storage and transmission, generate synthetic data for training autonomous driving systems, and to detect anomalies in vehicle performance.

In this report, we're primarily concerned with two types of Gen AI: Large Language Models (LLMs) and Small Language Models (SLMs). LLMs include well-known apps such as Chat GPT and Co-Pilot, which have been trained on vast amounts of text data to generate human-like text and code. Small Language Models are more compact and efficient versions of LLMs, designed to be more specialized and resource-efficient.

SLMs are particularly useful for specific, niche applications where the computational power and extensive capabilities of LLMs might be overkill. They are easier to fine-tune for particular tasks, require less computational power, and can be deployed more efficiently.



Current challenges within the automotive industry

We'll be looking at the effect of Gen AI on four primary challenges facing automotive OEMs:

Software-driven transformation

SDT has become crucial for OEMs to stay competitive, as it enables faster innovation and enables new, better customer experiences. However, it also presents challenges such as skill gaps, cybersecurity risks, and integration issues, as well as a substantial shift in mindset. (Just imagine what our roads would look like if OEMs followed a Minimum Viable Product strategy for physical automobiles!)

Advanced Driver Assistance System

ADAS promises safer roads, reduced traffic congestion, and greater mobility for those unable to drive. However, it faces significant challenges, including technical hurdles in navigating complex environments, cybersecurity risks, and ethical concerns about decision-making in critical situations.

Sustainable mobility

Sustainable mobility is essential for reducing emissions and promoting cleaner, more efficient transportation systems. New regulations and the [challenge from China](#), which has rapidly advanced in electric vehicle adoption, make this an urgent priority.

The scale of the IT landscape

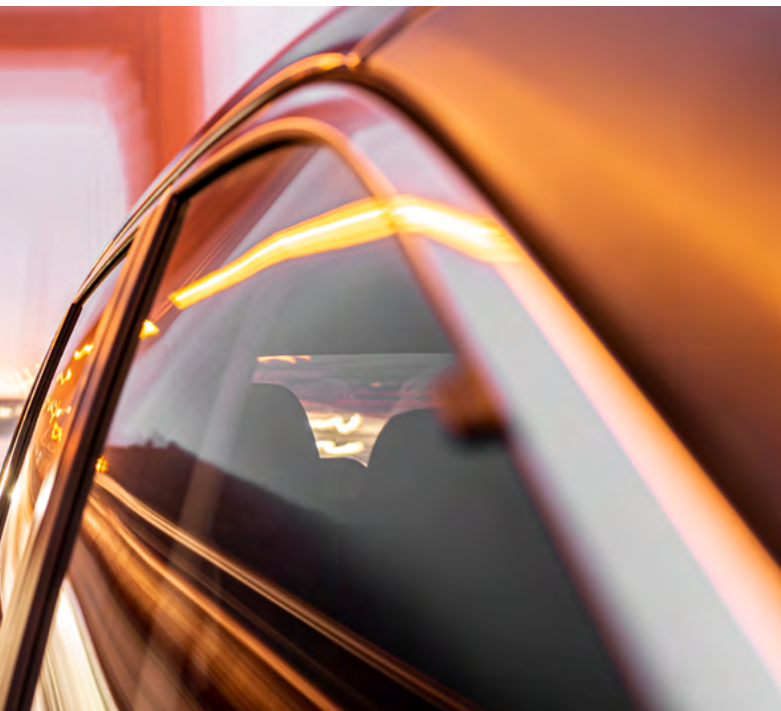
Groundbreaking new software tends to capture our attention. But OEMs also need to maintain vast amounts of legacy software to keep earlier models running in top shape. Many OEMs – especially brands with a long heritage – desperately need to modernize their IT ecosystems, but the scale of the undertaking makes that a daunting project. In the meantime, resources are spread thin, and the opportunity costs of operating on a legacy platform keep growing.

With these challenges in mind, let's now turn to the results of our survey.

How much time is Gen AI saving?

One of the most common predictions for Gen AI regards speed, with estimates of up to 50% faster code development. According to our survey, Gen AI is creating efficiencies, but they amount to a more moderate 7 – 18% increase in productivity. Unsurprisingly, some tasks are more prone to time reduction. Coding assistance is on the higher end, boasting an average of 9% efficiency gains, all the way up to 34% in some cases.

On its own, this result probably isn't enough to upset the automotive industry. But it is enough to change it. For one thing, anyone who's been around for a while knows the power of incremental improvement over time, and efficiency gains on the scale of 7 to 18% dwarf most improvements. (Plus, experience would indicate that these efficiencies are likely to increase, for the same reason.)



Is Gen AI replacing people?

So if the average software development tasks can be finished 7 – 18% faster, does that mean companies are laying off 7 – 18% of their workforces? We're happy to report that no: only 4% of organizations plan to use Gen AI to reduce their headcount. (In fact, this was the lowest response to any question in the entire survey.) What generative AI is doing

is precisely what many optimists dared hope for – it's helping to close the talent gap. At a time when many OEMs are forced to choose which projects are given all the resources they need, and which will have to make do with less; when the development of new features may come at the cost of stabilization and basic operations, Gen AI's shrinking of the talent gap is very good news. Backlogs which for years have been growing, are finally starting to recede.

And still, it's not the best news in our research. In fact, one of the most promising findings was in an area that none of us predicted.

Generative AI bridges the gaps between teams

One of the top benefits of Gen AI in software development came out of nowhere: 78% of software professionals expect generative AI to improve collaboration between business and technology teams. How exactly might it do that?

We talked with Lech Dulian, a web development lead at Capgemini, to get his perspective. He gave the example of an update to an app: "By the time a release is ready, it can be hard to draw a straight line between the initial requests – the patches, the user stories, etc. – and the release. That can be hard to put into words. When questions come up, you need to figure out how much context to give, what parts need explanation. LLMs can be very effective at extracting the most important parts, removing technical jargon, and translating code into language that is easy to understand for non-technical stakeholders."





One app, two points of view

How Gen AI helped build a (hypothetical) customer-facing mobile app

A product owner (let's call her Kim) has been tasked with leading the development of an app for customers. She begins to think about the user interface – something smooth and visually appealing to enhance customer satisfaction and brand perception. “Seamless navigation, quick access to key functions – that’s the priority,” Kim thinks. She finds some examples of existing apps that demonstrates exactly what she wants.

So why won't Mark, her software development lead, do what she's asking?

Mark refuses to get started until Kim agrees to discuss data streams. He's telling her something about “write and read” operations and usability – all useful, no doubt, but miles away from where Kim wants the conversation to be. When she presses him to explain why he's focusing his energy on these details, Mark just drills down deeper. Their emails back and forth become strained. Patience is running thin on both sides, and they haven't even started yet.

Finally, Kim takes one of Mark's emails and feeds it into an AI app. “This is what my lead developer wrote,” she prompts, “why is it important? Big picture, please.” Her eyes grow large.

What Mark had realized is that the current databases they're using will not be able to handle the volume of data produced by the car's sensors. The app would freeze up. Furthermore, this is a problem that will be far more difficult to solve down the road. Mark is looking at the big picture – just from a different perspective.

As Kim and Mark move further into the project, Gen AI continues its role as translator. Mark needs Kim's sign-off on a complex algorithm – Gen AI translates it into a (relatively) simple decision tree that she can understand. Kim wants better branding in the visuals – Gen AI breaks that down into specific requirements that Mark can act on.

Kim's and Mark's emails back and forth are now always patient and polite. Each knows why, and they're happy with it. With Gen AI, both sides are on the same page.



Gen AI is complementing employees

One of the key findings of this report is that, far from being replaced by Gen AI, developers are doing the replacing: they're taking the initiative to outsource parts of their own work to Gen AI, thus creating time to focus on the tasks they want.

This helps explain why 69% of senior software professionals report high levels of satisfaction from using generative AI for software development. Gen AI excels at painstaking tasks. Earlier we looked at which tasks are most prone to time saving. Number one on that list was creating documentation – a task with little room for creativity. Some developers are now using Gen AI to help track changing requirements and validate requirements documentation by analyzing it for completeness and clarity.

Another challenge that developers face is ensuring comprehensive code coverage during automated testing. Gen AI helps identify gaps in test coverage and suggests improvements, leading to higher quality in the ultimate services and applications. This not only streamlines the testing process but also ensures that the final product is more reliable. And for the developers, any time saved in validating or testing is time they can use for tasks which bring higher value and greater personal fulfillment.

The right tool at the right time

Let's look again at the leading challenges facing the automotive industry, this time through the lens of Gen AI.

Software-driven transformation

One clear theme is the link between software and hardware, and – just as crucially – the need for software engineers and physical engineers to collaborate seamlessly. If ever there was a need for a “translator” to keep everyone informed and aligned, that time is now!

Advanced Driver Assistance System

On a similar note, generative AI also enhances consistency, horizontally across teams and vertically throughout processes. This is particularly beneficial in embedded development, where the V-model approach often presents challenges. With the help of Gen AI, developers can reduce development costs and improve quality by testing code that has been generated or adapted based on the initial, still available requirements. The result is a leaner development process and a more predictable final product.

Sustainable mobility

Superior software development is also key to achieving more sustainable vehicles, particularly in the advanced algorithms that optimize energy consumption in electric vehicles (EVs) and hybrid cars. Software manages battery usage, optimizes regenerative braking systems, and controls energy distribution between different vehicle components to maximize range and efficiency. Software supports vehicle sustainability at every

step, from modeling at the design stage, all the way through predictive maintenance post sale. The ability to quickly create high-quality code provides a clear competitive advantage. In the future, if the GANs and VAEs pan out as simulation training tools, that will also provide a more sustainable option.



The scale of the IT landscape

This may be where generative AI generates the most benefit. We believe that soon, vast amounts of legacy tasks will be managed more efficiently thanks to generative AI. Enormous amounts of data can be simplified, and many legacy processes will either be automated, or slimmed down. Currently, it's a challenge to simply maintain the software of early models. Gen AI may provide the boost necessary to start improving it. Most promising of all, the process of simplifying these legacy landscapes could be a strong first step in the direction of a complete modernization overhaul.

Generative AI is also driving app modernization in the automotive industry by enhancing both vehicle functionality and operational efficiency. Automakers are using Gen AI to update legacy systems, enabling real-time data processing for predictive maintenance, reducing downtime and repair costs. In-car systems benefit from AI-driven personalization, optimizing infotainment, route navigation, and voice interactions. In manufacturing, Gen AI improves supply chain management by predicting demand and optimizing inventory, while also streamlining design through AI-generated simulations. These innovations help automotive companies boost efficiency and remain competitive in a connected, data-driven market.

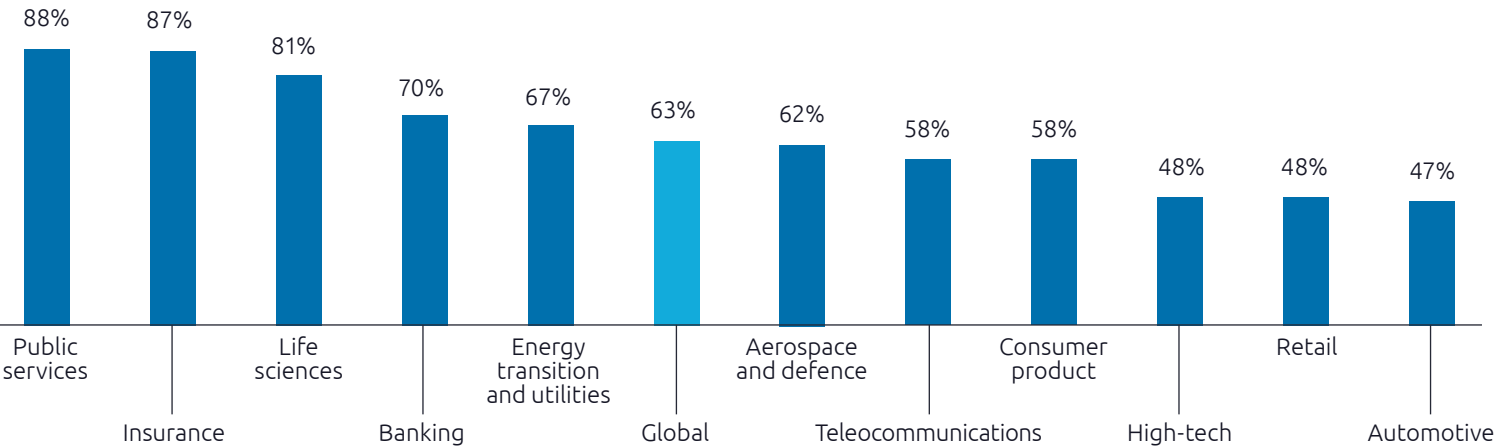
Finally, to say that OEMs' goals today are challenging is an understatement. What they're working on are among the great engineering breakthroughs of all time. Achievements such as these require top minds – software designers and architects who have their pick of employers. To attract and keep such



talent, the employee experience is crucial. Top software engineers who have grown accustomed to using Gen AI in their work will choose employers that facilitate that choice. And as our research shows, the time for employers to define their Gen AI policy is past due.

“Top software engineers who have grown accustomed to using Gen AI in their work will choose employers that facilitate that choice.”

Percentage of workforce using unofficial and unsupported generative AI solutions and tools, by industry



The risk of generative AI in software development...

This leads to one of the most important discoveries in our research: a stunning 43% of software professionals in the automotive industry are using generative AI tools not officially authorized and supported by their companies. Even more incredible – of all the industries we surveyed, this was the lowest rate. For that, automakers deserve praise. But there’s still a long road ahead.

These results point to a level of risk that cannot be ignored – there’s a reason why engineers don’t bring their tools from home. Unknown and unauthorized use of Gen AI tools could bring serious legal, functional, and security consequences.

A year and a half ago, we found that 15% of all software in the automotive industry was already being created with the help of Gen AI. That percent is no doubt far higher today. With numbers like this, even low-probability risks start becoming likely. How did we get here, and how should we solve it?

...and how to resolve it

In the early 2010s, an up-and-coming engineer needed software to complete his automotive vision, but what he wanted didn’t yet exist on the market. So [he built it](#), and revolutionized the automotive industry. Tesla’s holistic software platform was the response to a specific need, and it’s given them a head start that they’re still benefiting from.

Automotive leaders today are similarly situated. [65% believe](#) that software will enable a new phase of disruption and innovation larger than the digital/ internet era of the 2000s. And among the leaders we’ve spoken with, every one of them has a vision for Gen AI. But they also see very real obstacles ahead. Let’s look at these hurdles, and how to clear them.



Hurdle		Solution	
Intellectual property			
The early Copilots and GPTs of the world worked by loading your full codebase to the cloud. There was no guarantee of what might happen to your intellectual property. In many cases it was used for further training of their LLMs; in other cases, the use was unknown.		Today, that risk is solvable. Companies willing to make the investment can purchase their own proprietary Gen AI and maintain control over their IP. The RAG approach, using selected documents stored on your local vector database, can also be beneficial.	
Traceability			
Foundational to multiple regulations is the traceability of any automotive innovation, including software. When code is written by a machine, is it still traceable?		There's no precise legal precedent here, but we do see a consensus emerging: code can be written by a Gen AI, as long as that code is signed off on by a human. Thus, even if Gen AI generated the code, the developer is the owner and responsible for correctness and quality. The model is essentially the same as working with a junior coder.	
Unions and works councils			
Fears of massive redundancies have led many unions and workers councils to call for caution. In Germany, works councils have challenged the use of Gen AI by OEMs, impeding its adoption.		There's no one answer here. Long term, open communication throughout the company is crucial. Companies that find ways to ensure that Gen AI furthers the interests of their employees will likely achieve greater employee buy-in in the long run. The tide is beginning to turn. Mercedes-Benz, for example, has succeeded in reaching an agreement that enables the use of CoPilot (including for vendors).	

The future of Gen AI in the software development branch of the automotive industry appears to be proprietary tools, specialized for the needs of the company, with rules guaranteeing human oversight. With those basics in place, OEMs can start systematically reaping the value of Gen AI.

What comes next? Software developers have already demonstrated ample ability to adopt Gen AI into their work. (If anything, some of them have jumped the gun a bit!) Their early experimentation is already paying dividends on a small scale. For OEMs to start seriously capitalizing on this technology, they'll need a framework that filters out the best ideas, shares them and scales them. They'll want to ensure that their proprietary Gen AI is continuously optimized. And all along the way, they'll want to ensure that employees are sharing the benefits.

Gen AI will change the way you work. When it changes the way your company works – that's when the chapter of Gen AI in the automotive industry truly begins.

Let's drive

What would software development look like in your department if every employee were given access to specialized Gen AI tools – not just approved by your company, but created by it? What would that do to the quality of your software, the experience of designing it, and the long-term success of your brand?

For all its benefits, Gen AI usage is still in its infancy; various tools support a variety of tasks, with no coordination or information sharing. How much more powerful will Gen AI be as a tool once the puzzle pieces are put together into overarching work companions? When highly contextualized data combines with LLMs that can access solutions online (a best-of-both-worlds arrangement, where you have access to the world's data, while your data stays safe)?

Our survey makes it clear: generative AI has found a home in software development. It has the potential to complement and enhance software development across the automotive industry. This is the time for leadership and organization, aligned to the needs of your company and your partners. This is a time for drivers.

Read our original research on the state of [Gen AI and software development](#).



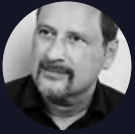


Our Gen AI for automotive solutions

Automakers today must progress on multiple fronts simultaneously. Our generative AI-powered software engineering solutions are designed to do just that. Built exclusively for the automotive sector, our solutions help you accelerate the shift to Software-Defined Vehicles (SDVs), to ACES (Autonomous Driving, Connected Vehicles, Electrification, Shared Mobility), and support a software-centric transformation that caters to evolving customer demands.

As the automotive software market heads toward an \$84 billion value by 2030, our AI-enabled, end-to-end services provide OEMs with platforms that efficiently manage and innovate digital products, from ADAS to connected mobility. Our expertise in software architecture, V&V, and regulatory compliance help you deploy adaptable, standards-based platforms that future-proof your operations, reduce development complexity, and enable scalable, resilient digital ecosystems. Take the lead in Gen AI. Contact us below.

Authors



Stephane Girard

CTO, Global Cloud & Custom Applications
stephane.girard@capgemini.com

Stéphane is currently a Global C&CA – CTO and Head of Industrialization Design Authority. Stephane holds a robust skillset that includes SOA, Enterprise Architecture, J2EE, Open Source, Solution Architecture and more.



Shailesh Agaskar

C&CA India CTO and
Industrialization Design Authority (IDA) Lead
shailesh.agaskar@capgemini.com

Shailesh has 25+ years of experience in driving Transformation through Innovative Enterprise Technology solutions enabling business growth. Shailesh is a seasoned Enterprise Architect with hands-on technology experience, driving journeys moving to Cloud, Application Modernization and Technology driven business transformation. He specializes in Microservices and similar other Architecture and Design styles underpinned by DevSecOps, Cloud Native, Data Strategy, AI/ML, IoT and related technologies. He is the Architecture Practice Lead and has special interests in Data and AI Domain and now focusing on Generative AI area for Software Engineering and Business Domains.



Jayashree Ravichandran

VP, Industry Platform Software - Automotive
jayashree.ravichandran@capgemini.com

Jayashree works with automotive clients to accelerate software transformation, developing on-vehicle and off board solutions and integration from the car to the cloud. A certified architect by training, Jayashree is a trusted advisor to internal and customer teams at all levels.



Lorna Neville

Global Marketing & Communications Director, Global Application Business Line – Cloud & Custom Applications
lorna.neville@capgemini.com

Lorna is a marketing strategy professional with over 20 years of experience. She has a range of international experience for private and public sector organizations. She currently leads the global marketing for Capgemini's Cloud & Custom Applications (C&CA) Global Applications Business Line.



Toni Sullivan

Global Senior M&C manager, Software
toni.sullivan@capgemini.com

Toni is a results-driven marketing professional with over 15 years of experience, known for a strategic approach to problem-solving and commitment to proving measurable impact. With expertise in product, service, and partner marketing globally, Toni currently leads global marketing efforts for Capgemini's Software Engineering practice under Capgemini Engineering.



Ruth-Anne Peters

Vice President | Global Automotive Marketing Lead
ruth.peters@capgemini.com

With over twenty years of experience in multiple alliance partners and industries, Ruth brings expertise in MarComms, software-defined transformation in Automotive, ADAS and more. She's dedicated to furthering safe, sustainable, satisfying mobility experiences and championing the role of women in industry.



Michael Tenschert

Global Automotive Industry Lead, C&CA
michael.tenschert@capgemini.com

As Global Automotive Industry Lead, Michael Tenschert creates the IT backbone for various important automotive projects. He is also a stream-lead within the Intelligent Industry initiative – responsible for bringing together Capgemini Engineering expertise with the classical Capgemini world



About Capgemini

Capgemini is a global business and technology transformation partner, helping organizations to accelerate their dual transition to a digital and sustainable world, while creating tangible impact for enterprises and society. It is a responsible and diverse group of 340,000 team members in more than 50 countries. With its strong over 55-year heritage, Capgemini is trusted by its clients to unlock the value of technology to address the entire breadth of their business needs. It delivers end-to-end services and solutions leveraging strengths from strategy and design to engineering, all fueled by its market leading capabilities in AI, cloud and data, combined with its deep industry expertise and partner ecosystem. The Group reported 2023 global revenues of €22.5 billion.

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