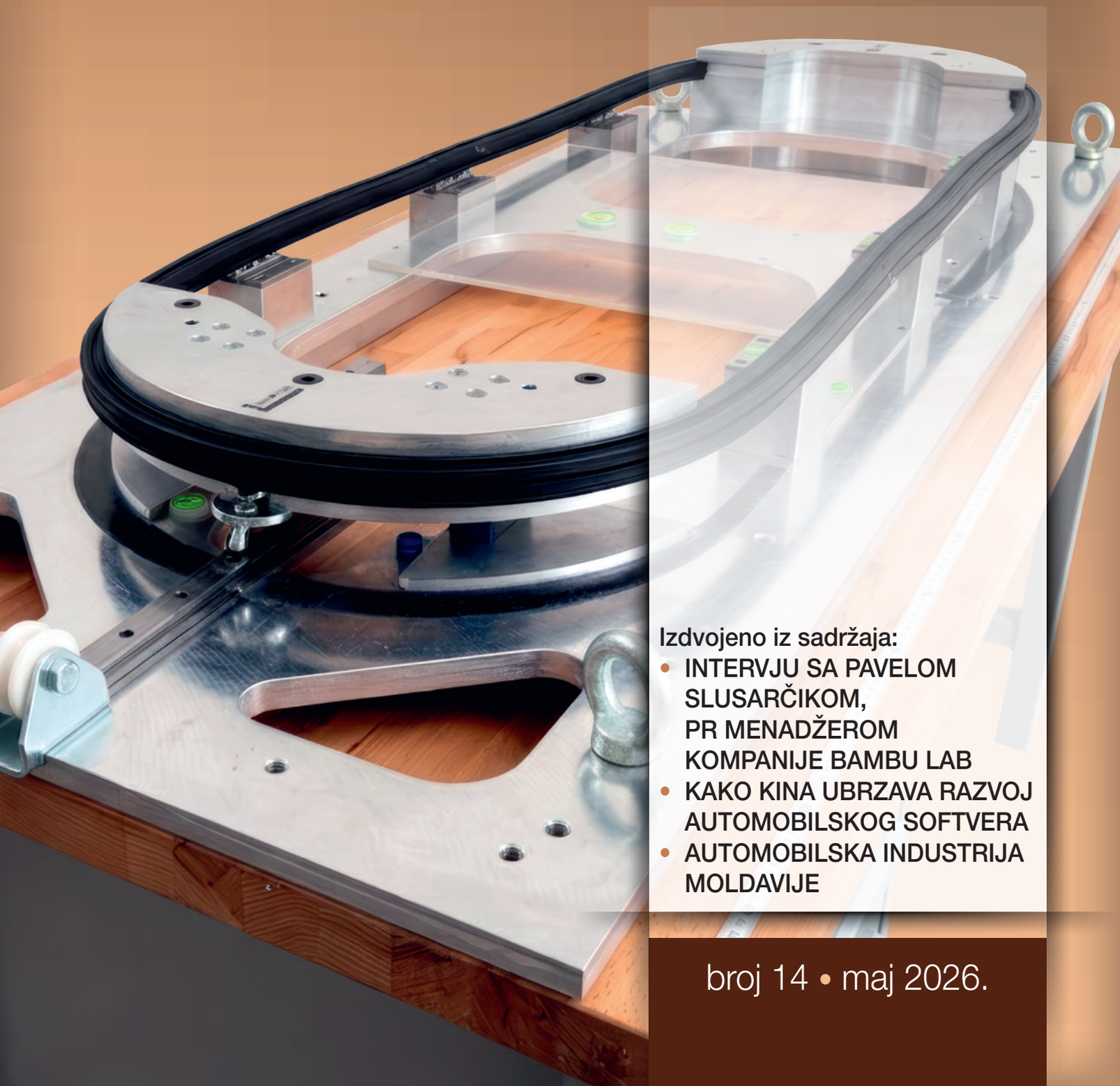
CONNECT & SUPPLY

Časopis o auto-industriji



Izdvojeno iz sadržaja:

- INTERVJU SA PAVELOM SLUSARČIKOM, PR MENADŽEROM KOMPANIJE BAMBU LAB
- KAKO KINA UBRZAVA RAZVOJ AUTOMOBILSKOG SOFTVERA
- AUTOMOBILSKA INDUSTRIJA MOLDAVIJE

broj 14 • maj 2026.

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Poštovani čitaoci,

Živimo u nestabilnom svetu gde jedna kriza sustiže drugu, poslovanje iz dana u dan postaje sve izazovnije, dok evropska automobilska industrija i dalje ne pronalazi sopstveni pravac i nema jasnu viziju budućnosti. Kako se nositi sa ovakvim izgledima? Da li rešenje nude savremene tehnologije, kao što je aditivna proizvodnja? Šta Evropa može da nauči od Kine? Da li se treba okrenuti bliskim a nedovoljno istraženim industrijama kao što je Moldavija? Ili je konačno vreme da podržimo mala i srednja preduzeća koje vode lokalni preduzetnici?

Četrnaesti broj našeg časopisa, i ovaj put u sprezi sa SEE Automotive konferencijom u Beogradu, pokušava, ako ne da da odgovore, onda bar da pokrene razgovor na sve ove teme.

Naši sagovornici i saradnici pomogli su nam da oformimo možda najinteresantniji broj do sada.

Nadamo se da ćete uživati čitajući.

Svoje tekstove, kao i sve primedbe i sugestije možete poslati direktno na mejl urednika: aleksandar.saranac@acserbia.org.rs

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urednik

Sadržaj











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4 ERAS OF ADDITIVE MANUFACTURING

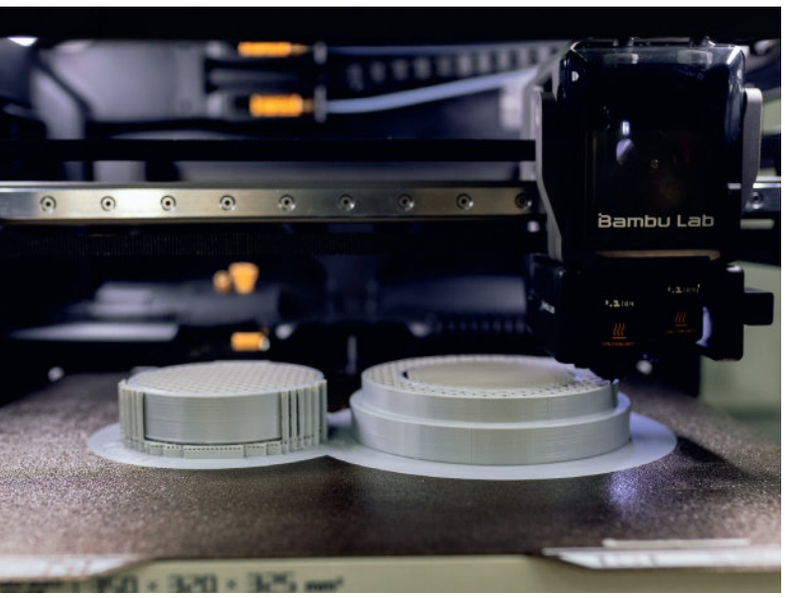
Pawel Slusarczyk, a well-known additive manufacturing influencer and Global PR Manager at Bambu Lab, recently visited Serbia to recognize one of their local redistributors. We took this opportunity to speak with him about the current state of additive manufacturing and its role in the automotive industry.

Could you tell us more about yourself—your experience as an additive manufacturing influencer, your work with Bambu Lab, and any connections you've had with the automotive industry during that time?

I began my career in January 2013 by founding Centrum Druku 3D (3D Printing Center), a blog dedicated to additive manufacturing. Although at the time it was just one of several similar blogs in Poland, within a year it became the clear market leader, evolving into a major media outlet.

At its peak, Centrum Druku 3D employed eight editors and reached several thousand monthly users - a level of traffic that is difficult to achieve today locally in such a niche segment of manufacturing.

As virtually no one in Poland was interested in 3D printing at that time, most companies established between 2013 and 2017 took their first steps through



exposure on the platform. As a result, Centrum Druku 3D became one of the foundational pillars of the additive manufacturing industry in Poland.

In addition to editorial work, I was actively involved in consulting, training (having trained over 1,000 people throughout my career), and organizing conferences and trade events.

Between 2018 and 2020, together with my team, I developed SKAFFOSYS – the first Polish commercial bioprinter. From 2021 to 2023, I led GREENFILL3D, a startup producing biodegradable 3D printing materials based on wheat bran. These materials were used to create proprietary advertising displays for the food industry, as well as a line of eco-friendly lamp shades and home décor accessories.

In 2023, I sold Centrum Druku 3D and shifted my focus to international editorial activities. I published a historical series, "On This Day in 3D Printing…", as well as newsletters including The 3D Printing Journal and 3DP War Journal. My work appeared in leading industry media such as 3DPrint.com and VoxelMatters. At the latter, I also worked as an industry analyst, contributing market reports on metal and polymer 3D printing for 2024.

I am also the creator of the Three Laws of the AM Market, which have been widely adopted and cited within the industry.

In mid-2025, Bambu Lab - the world's largest 3D printer manufacturer – approached me with a collaboration offer. I initially joined as a Customer Success Manager, responsible for developing the 3D printing market in Central Europe, and soon after also took on the role of Global PR Manager, overseeing communications and press publications.

As for the automotive sector, my direct experience is limited. My involvement has primarily been through training and consulting services for companies in this industry. In 2017–2018, I also organized two conferences in Poland titled "3D Printing in the Automotive Industry."

You often say that we live in the 4th era of additive manufacturing. Can you explain it for our readers?

The concept of the Four Eras of 3D Printing was first proposed by me in August 2025, on the occasion of the bankruptcy of Desktop Metal – a fallen unicorn of industrial metal additive manufacturing.

The collapse of Desktop Metal symbolically marked the end of the Third Era of 3D printing development. In the Fourth Era, the industry will split into two distinct tracks: consumer (mass-market) and industrial (specialized), which will never converge again.

The Era of Rapid Prototyping (1984–2010)

3D printing was born in 1984 thanks to Charles Hull, who co-founded 3D Systems two years later. During this period, alternative technologies emerged, including SLS, FDM, and binder jetting. The common denominator across all companies at the time was rapid prototyping – no one was thinking about mass production or end-use parts. Quality and ease of use fell short of today's standards, but these technologies made economic sense compared to manual prototyping. It was only in the 2000s that they began to see applications in medicine and select industrial use cases.

The Era of Consumer 3D Printing (2010–2017)

Projects such as RepRap Project (2004) and Fab@Home (2006) laid the groundwork for desktop 3D printing. After key FDM patents expired in 2009, companies like MakerBot and Bits from Bytes emerged. Driven by the charisma of Bre Pettis, the media proclaimed 3D printing as "the next big thing." In reality, however, technology failed to meet expectations - printers were unreliable, slow, and difficult to use.

Around 2015, the hype bubble burst, leading to a wave of bankruptcies. By 2017, the consumer market had begun to retreat, and former leaders pivoted toward industrial applications.

The Era of Mass Additive Manufacturing (2017–2025)

A new generation of companies - such as Markforged, Carbon, Desktop Metal, Nexa3D, and Velo3D –targeted industry from the outset, focusing not on prototypes but on end-use parts and serial production. Ric Fulop became the central figure of this era, promoting a vision of replacing traditional manufacturing with metal binder jetting.

The peak came with a wave of SPAC-driven public listings in 2020–2021 – ultimately ending in failure. The bankruptcy of Desktop Metal (preceded by the collapse of Nexa3D and the restructuring of Velo3D) marks the end of this era. As it turned out, industrial 3D printers were also not fully ready for mass production – key barriers include cost, productivity, and the lack of standards and certification.

The Fourth Era (2025–...)

Today, the market is divided. The consumer segment – dominated by Chinese companies such as Bambu Lab, Creality, and Elegoo – is thriving like never before. FFF technology is entering mainstream consumer electronics market and, within 3–5 years, may become as common as paper printers.

Meanwhile, industrial 3D printing will continue to complement traditional manufacturing rather than replace it. It requires better software, lower machine costs, and certified materials. We are entering a new and fundamentally different chapter in the evolution of the industry and the market.

Industry Reality vs Hype is a theme you often return to. What was promised, and what can really work for industry (especially automotive and mobility industry)?

In general, the problem over the years was that successive companies and successive founders promised more than their companies or the technologies they were developing were actually able to deliver. Let's take two of the most well-known examples: MakerBot in 2010–2014 and Desktop Metal in 2018–2023.

MakerBot introduced the first desktop 3D printer based on FFF technology to the market in 2010, which effectively initiated the entire market in this segment. The first 3D printer models were very crude, difficult to use, and unreliable. In fact, their main advantage was simply that they worked at all.

Meanwhile, the company – and especially its leader Bre Pettis – presented 3D printers as revolutionary and ready to conquer the consumer market. While the best model in the company's history, the Replicator 2, still gave some hope, the completely unreliable and failure-prone 5th generation MakerBot practically brought the company to its knees. The entire management team at the time was removed, and Bre Pettis's successor – Jonathan Jaglom – shifted the company's direction from consumer to more professional mar-

kets (which, ultimately, also ended in failure years later after his departure).

As a result, many people who believed in Pettis's vision bought 3D printers (MakerBot as well as competing brands) and were severely disappointed with their poor quality. Consequently, they turned away from 3D printing altogether for years.

It is worth noting that the 3D printers themselves did work – they were simply not capable of meeting consumer expectations. Ordinary people expected an easy-to-use product, not a complex tool for hobbyists and technology enthusiasts.

Desktop Metal did essentially the same thing, but in the manufacturing industry. It took a technology that had existed for around 20 years – binder jetting – packaged it into an attractive machine with revolutionary marketing slogans, and tried to sell it to all major manufacturing companies.

Here as well, the company's founder and leader – Ric Fulop – claimed that their solutions would revolutionize the industry and that 3D printing with metal powders would replace traditional manufacturing methods. This, unfortunately, also ended in failure.

The metal binder jetting technology itself is not bad – it is simply not suitable for serial production at the scale expected by industry. Additionally, it involves complex post-processing, including sintering printed parts in a furnace, during which they shrink by around 20%. This is a major complication and limitation.

Again, as in the case of MakerBot, the technology that was itself reasonably good was not suitable for the applications it was being forced into.

As for the automotive sector, every additive manufacturing technology does have its place – just not in the way it was presented between 2010 and 2023. The automotive industry is actually one of the biggest beneficiaries of 3D printing, but in very specific areas.

3D printing entire cars is a fantasy. 3D printing specific car components or tools used in their production is reality.

Where do you see real, economically viable use cases of AM in automotive today?

The number of areas where 3D printing is a game-changer for automotive is enormous. One of the most interesting is so-called giga casting, where sand 3D printers from companies like voxeljet or ExOne (now merged into one company) are used to produce molds. Tesla began basing its body production on giga casting, and other companies have followed.

Anywhere where special vehicles or sports cars are produced (including Formula 1), low-volume part production is practically reserved for 3D printing.

Spare parts production for car models that are no longer manufactured, or for vehicle restoration. Also tuning and all kinds of modifications.

In fact, today it is difficult to find an area in the automotive sector where 3D printing has no application at all.

In the era of strong pressure on the mobility industry to reduce CO_2 footprint, can additive manufacturing help, or is it also just part of the hype?

The answer here is more complex, as it needs to be assessed on a case-by-case basis. In general, production using 3D printers is more environmentally friendly in terms of material and energy consumption – but not always.

When we talk about unit production, there is no more environmentally friendly method than 3D printing. However, as production scale increases, we enter a gray area of "it depends."

It should be remembered that scalability in 3D printing essentially comes down to increasing the number of machines. And individual studies are required to determine what is more environmentally friendly – a single injection molding line or a farm of 300 desktop 3D printers producing the same output.

Do you think that automotive professionals (especially in Europe) are aware of the real strengths of additive manufacturing and are they using it properly? Is additional training and awareness needed, and what is the best way to achieve it?

I'll put it this way: if they are not aware of it yet, they deserve to fail.

Automotive companies have been using 3D printers since the 1990s and were among the very early adopters of this technology.

Of course, one must distinguish between different production plants within a given automotive company. BMW, which has been using 3D printing since 1990, may have facilities where 3D printing is not needed. But that does not mean the company does not use 3D printing, right?

Do you expect that small FDM 3D printers will soon become a standard part of R&D offices in the automotive industry, just like laser printers are today?

I'll repeat what I said earlier – if an R&D department does not have a 3D printer, it is something to be ashamed of. Every serious, self-respecting company should have a 3D printer, at least "just in case."

Unless we are talking about a company that sends orders by fax and calls employees on pagers. In that case, the lack of a 3D printer is justified.

THE ”SMARTPHONE ON WHEELS“ IS HERE: HOW CHINA IS ACCELERATING THE SOFTWARE-DEFINED FUTURE

Introduction: The Tipping Point Has Arrived

Three years ago, at IAA Mobility 2023, conversations about Software-Defined Vehicles (SDV) were still largely theoretical – full of promise but short on production reality. Fast forward to IAA Mobility 2025, and the picture has fundamentally changed. European OEMs are now rolling out their first production-ready SDV models, with BMW's Neue Klasse series exemplifying this shift.

Yet beneath this European progress lies a more profound transformation: Chinese automakers and suppliers are not just participating in the SDV revolution – they are increasingly setting its pace. With China's automotive market reaching 34.5 million vehicles sold in 2025–16.5 million of which were NEVs – and domestic brands commanding nearly 70% market share, China has become the world's most advanced laboratory for software-defined mobility. The penetration of L2-level ADAS now exceeds 64%, while AI-powered intelligent cockpits approach 80% of new vehicles.

This article explores how Chinese companies are driving the SDV revolution through real-world cases, and what this means for Serbian and Southeast European suppliers seeking to participate in this new ecosystem.

Part I: The ”China Speed“ Advantage – From Technology Importer to Value Exporter

A landmark development in early 2026 illustrates China's evolving role in the global automotive supply chain. According to industry reports, in February 2026, FAW-Volkswagen's Qingdao plant began exporting battery systems to Germany – a historic ”reverse export“ of core components to Europe.

What makes this case significant is not just the direction of trade, but the complexity involved. The exported high-voltage battery system assembly is not a single component but a precision assembly integrating 17 different parts, including the battery pack, DC-DC converter, and high/low voltage wiring harnesses. These systems will be installed in hybrid vehicles produced in Germany and the Czech Republic for the Volkswagen Group's global factories.

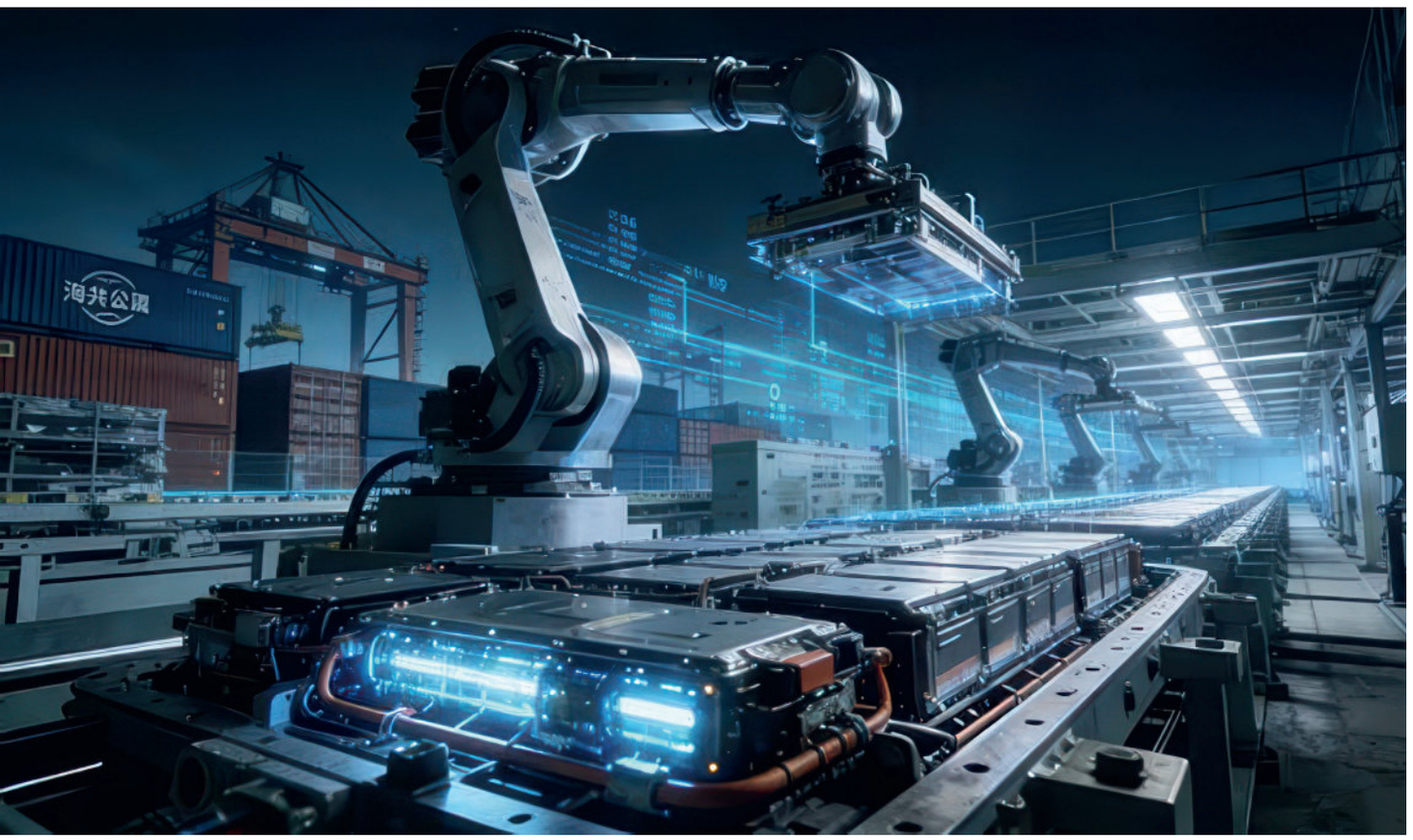
“We used to be the OEM that sourced components from the Group to assemble vehicles, ”explained Long You, a planning engineer at FAW-Volkswagen Qingdao. ”Now, we've become the Group's supplier, manufacturing customized battery systems for Volkswagen Germany. The fundamental driver behind this is China's globally recognized leadership in battery technology cost and performance.“

The project team achieved small-batch delivery in just 14 weeks – a timeline that would be challenging even for established suppliers. This ”China speed“ was enabled by close coordination with local government, which helped navigate complex export certification processes, international safety standards, and customs procedures.

This export milestone aligns with Volkswagen Group's broader China strategy. In January 2026, the Group announced that its China Electrical Architecture (CEA) – developed jointly with VCTC, CARIAD China, and XPeng – had entered production, cutting ECU count by 30% and reducing development costs by up to 50% . FAW-Volkswagen will launch 11 new models starting in 2026 under this architecture, including six BEVs.

This case offers three critical insights for European suppliers:

1. China is no longer just a market – it's becoming a source of advanced components
2. The ability to compress development cycles while meeting global OEM standards is a distinct competitive advantage
3. Government-industry collaboration can significantly accelerate export readiness



Part II: Collaborative Innovation – Chinese Software Meets Global Hardware

The SDV revolution requires deep integration of software and hardware – an area where Chinese companies are increasingly partnering with global Tier 1 suppliers. A compelling example emerged in January 2026, when Schaeffler and Neusoft Reach signed a strategic cooperation framework agreement to jointly develop SDV solutions for both Chinese and global markets.

Schaeffler, a German motion technology company with over 25 years of experience in automotive electronics, brings hardware advantages including domain controllers, zonal controllers, vehicle motion controllers, and central computing units. Neusoft Reach, a leading Chinese automotive software company, contributes mature capabilities in foundational software, middleware, and AI development platforms.

What makes this partnership significant is its focus on "China speed and innovation DNA" to accelerate SDV solution commercialization. The collaboration spans joint R&D in foundational software, middleware, and AI platforms, creating fully validated, flexibly deliverable solutions for automakers.

Du Qiang, President and CTO of Neusoft Reach, emphasized: "Software-defined vehicles represent not just technological evolution but a profound transformation in how the industry collaborates. This strategic partnership with Schaeffler builds on our long-term technical exchange and joint engineering practice. Together, we will leverage 'China speed' and innovation DNA to advance the mature implementation of SDV solutions."

Neusoft Reach's software leadership extends beyond this partnership. At CES 2026, the company announced a collaboration with NXP to develop next-generation Agentic AI solutions based on the S32N7 processor, supporting the industry's transition from Software-Defined Vehicles (SDV) toward AI-Defined Vehicles (AIDV). This demonstrates that Chinese software companies are no longer just following global trends – they are helping define them.

This case demonstrates a new model of "deeply rooted in the Chinese market, going global with Chinese solutions." The traditional approach of developing products independently and then seeking customers is being replaced by co-creation with Chinese partners who understand both local market dynamics and global requirements.

Part III: Chinese Investment in Serbia – A Thriving Ecosystem for SDV Collaboration

For Serbian readers, the most compelling development is the rapidly expanding presence of Chinese automotive suppliers in Serbia itself, creating a genuine ecosystem that spans from established pioneers to new entrants.

Chinese automotive suppliers are not newcomers to Serbia. Yanfeng, one of the world's largest automotive interior suppliers, has been operating in Serbia for several years, manufacturing cockpit components and interior systems for European OEMs including BMW and Mercedes-Benz. The company's Serbian operations have grown steadily, demonstrating the viability of Serbia as a manufacturing base for Chinese Tier 1 suppliers.

MINTH, a leading global supplier of body structural parts and trims, has also established a significant presence in Serbia as part of its European expansion strategy. The company's investment in the "Sky City" industrial complex represents a long-term commitment to the Serbian market, creating hundreds of local jobs and integrating into the European automotive supply chain.

These pioneers have done more than just establish factories – they have validated Serbia's value proposition for Chinese manufacturers, navigating local regulations, building supplier relationships, and demonstrating that Serbian operations can meet the highest European quality standards.

For Serbian suppliers, the question is no longer whether to engage with Chinese automotive companies, but how to position themselves within this rapidly growing ecosystem. The foundation has been laid; the cluster is forming; the window of opportunity is open – but it won't stay open forever.

Part IV: Building the Platform – The Technical Foundation

While the cases above focus on manufacturing and collaboration, the technical foundation of SDV is equally important. Chinese OEMs are developing sophisticated platforms that enable software-defined capabilities across their vehicle portfolios.

In January 2026, Great Wall Motor (GWM) released its Guiyuan Platform, a native AI all-power platform compatible with PHEV, HEV, BEV, FCEV, and ICE powertrains. Inspired by the ancient Chinese invention of movable type printing, the platform modularizes hardware into 49 core modules and 329 shared components, while software capabilities are atomized into over 2,000 standardized services that AI can understand and orchestrate.

This approach addresses a fundamental challenge of SDV: how to deliver rich software experiences across vehicles at different price points. As QNX's Niko Boeker observed at IAA 2025: "The real challenge is not stacking a complex luxury software stack but building a scalable unified platform. Can an affordable electric vehicle run the same platform capabilities efficiently? Only by improving code efficiency, fully leveraging limited computing power, and building a modular system that can cover an entire product line can we truly unlock the value of software-defined vehicles."

In February 2026, Great Wall Motor's Wey brand CEO Zhao Yongpo made a striking statement: "The era of Software-Defined Vehicles is nearing its end; the age of AI-Defined Vehicles has arrived. "The newly unveiled Wey V9X, built on the Guiyuan S platform, demonstrates this shift. It features an on-board AI agent that learns from driver behavior – automatically adjusting climate control based on time of day, proactively finding charging stations on weekend trips, and even detecting driver stress through biometric signals. Unlike traditional SDV approaches that simply add AI features to existing architectures, GWM has rebuilt the foundation: hardware interfaces are unified, software functions are atomized, and AI is embedded at the system level.

This platform approach offers a clear message: understanding modular architecture and standardized interfaces is essential. Components must be designed not as standalone products but as parts of integrated systems that can be configured across vehicle lines.

Part V: What This Means for Serbian and SEE Suppliers – A Practical Guide

Drawing from these Chinese cases, here are actionable insights for Serbian and Southeast European suppliers:

1. Embrace "China Speed" Mindset

The FAW-Volkswagen case demonstrates that 14-week development-to-delivery cycles are possible. Serbian suppliers should evaluate their own development processes and identify opportunities to compress timelines without compromising quality.

2. Seek Collaborative Partnerships

The Schaeffler-Neusoft model shows that co-creation with Chinese partners can accelerate capability building. Serbian suppliers should explore partnerships with Chinese companies – not just as customers, but as development partners.

3. Leverage Local Presence

SHAC and Times New Material's investments in Serbia create immediate opportunities. Serbian suppliers should proactively engage with Chinese companies operating locally, understanding their needs and positioning themselves as reliable second-tier partners.

4. Understand Platform Architecture

GWM's Guiyuan platform illustrates the importance of modular thinking. Serbian suppliers should ensure their products are designed with standardized interfaces that can integrate with diverse vehicle platforms.

5. Prepare for Software Integration

The trend toward intelligent chassis means even traditional mechanical components must now communicate with vehicle motion control software. Serbian suppliers should invest in understanding software requirements and developing integration capabilities.

6. Leverage Serbia's Strategic Position

As Chinese suppliers establish European footholds in Serbia, local suppliers gain a geographic advantage. The ability to offer just-in-time delivery, local service, and rapid response becomes a competitive differentiator.

Conclusion: The Window of Opportunity

The cases presented in this article reveal a fundamental shift: China is no longer just the world's largest automotive market – it is becoming a source of innovation, technology, and components for the global industry. The SDV revolution, far from being a theoretical concept, is being realized today through tangible investments, collaborations, and exports.

For Serbian and Southeast European suppliers, this presents a limited window of opportunity. Chinese OEMs and Tier 1s expanding into Europe need local partners who understand both worlds – those who can meet global quality standards while adapting to Chinese working practices. Suppliers who invest now in understanding SDV requirements, building software capabilities, and forging relationships with Chinese companies will be positioned to thrive in the coming decade.

With 11 new VW models, GWM's AI-powered platforms, and multiple Chinese suppliers establishing Serbian footholds all converging in 2026, the window of opportunity is open – but it won't stay open forever.

The "smartphone on wheels" is already on European roads. The question for Serbian suppliers is not whether to join the SDV revolution, but how quickly they can get on board.

Richy Qiu is Founder & CEO of GNSGO and the Official China Promotion Partner of the Serbian Automotive and Mobility Cluster (AC Serbia). With 18 years of experience in China's automotive industry, he helps European buyers connect with qualified Chinese suppliers.

MOLDOVA'S AUTOMOTIVE INDUSTRY: MANUFACTURING, ELECTRONICS AND ADVANCED MOBILITY

From Cost Efficiency to Higher-Value Capabilities

The automotive and mobility industry in the Republic of Moldova is undergoing its most ambitious transformation since the establishment of the first industrial platforms. The shift is no longer about scale alone but reflects a rapid move toward higher-value activities. The industry is transitioning from labor-intensive production to embedded software development, design, power electronics for electric vehicles, and complex electronic systems.

Amid global supply chain restructuring, Moldova is benefiting from the nearshoring trend. Delivery times of under three days to any EU destination, combined with an attractive tax system and access to a vast market of over 870 million consumers through Moldova's Free Trade Agreements (EFTA, DCFTA, CIS, CEFTA, GUAM, UK, and Republic of Türkiye), position the country as a strategic location for investors seeking proximity and operational stability.

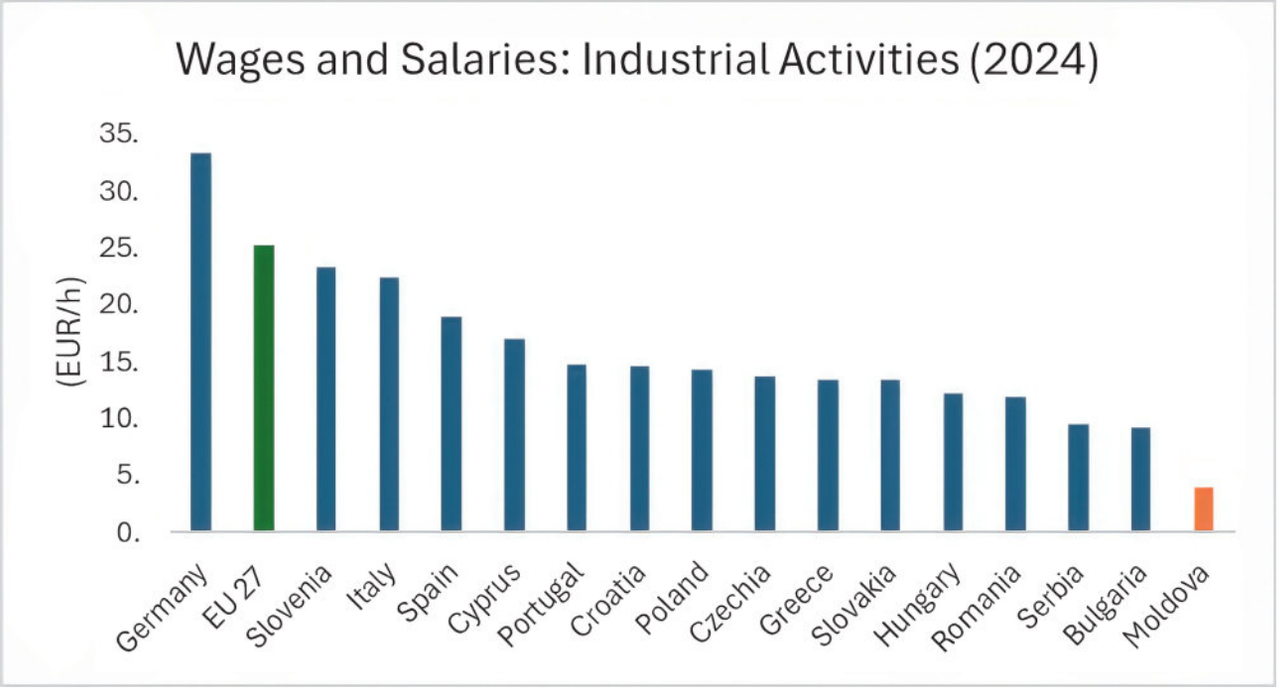
This structural shift is already visible in the sector's performance indicators.

Export Performance and Industrial Foundations

Recent data confirms that the automotive sector is central to Moldova's industrial exports. In 2024, exports of electrical machinery and equipment reached USD 579 million. Wiring products remain dominant, generating USD 508 million, yet value added per unit continues to rise.

These components feed directly into assembly lines of major OEMs such as BMW, Mercedes-Benz, Volkswagen in Germany, Romania, and the Czech Republic, reinforcing Moldova's integration into European industrial value chains. This performance is supported by several structural advantages:

- A growing network of industrial parks and specialized production platforms supporting manufacturing and logistics
- Geographic proximity that reduces transport risks and inventory costs
- A competitive labor market with average monthly costs for the automotive industry of around EUR 735.



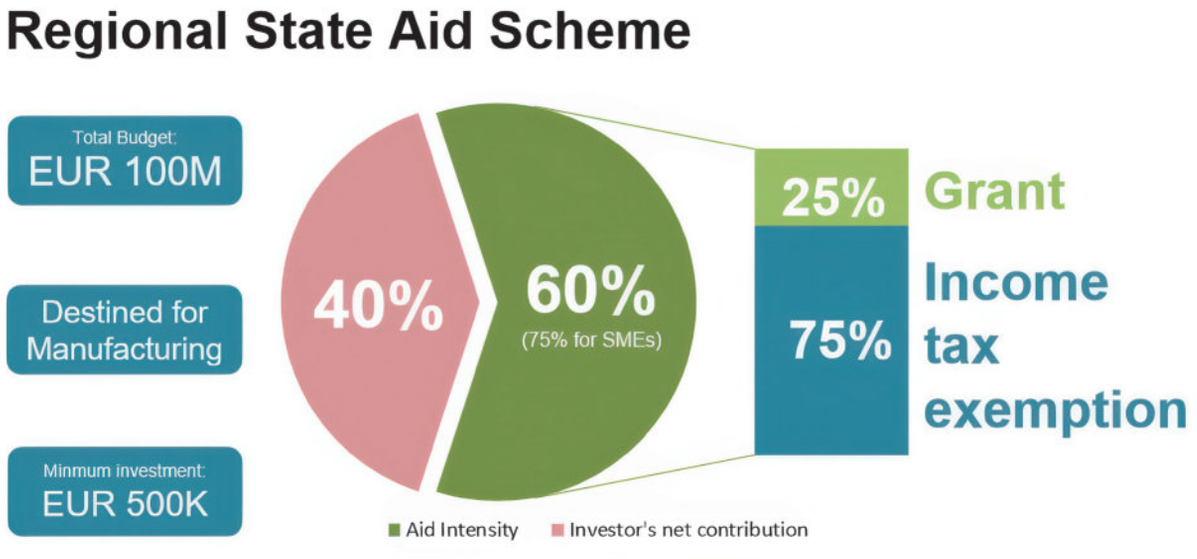
** Source: Eurostat (lc_lci_lev); NBS.*

Policy Direction and Investment Framework

At the macro and legislative level, both countries Moldova and Serbia are advancing through the process of European integration, with Moldova progressing at a particularly strong pace. As of March 2026, all six negotiation clusters have been opened, marking full coverage of the 33 thematic chapters of EU legislation and contributing to greater policy predictability for long-term investments.

The Moldovan government plays an active role in shaping the sector and supports businesses through targeted policy measures:

- Zero import duties on EVs to sustain domestic demand
- 13 industrial parks located across the country
- A regional state aid scheme launched in January 2025, with a USD 100 million budget and capital reimbursement rates of 60 to 75 percent for investments in manufacturing capabilities.



A key role in facilitating these investments is played by *Invest Moldova Agency*, a public institution founded by the Government of the Republic of Moldova under the Prime Minister's Office, created and mandated to attract strategic investments in the Republic of Moldova, contribute to export growth, promote the country's image and develop the economic diplomacy dimension.

Acting as a single point of contact for investors, Invest Moldova provides end-to-end support through its One-Stop Shop service, offering tailored advisory, facilitation of administrative procedures, and connection to local partners and suppliers. Through both strategic and operational assistance, it helps international companies navigate market entry, access state support mechanisms, and integrate into Moldova's industrial ecosystem.

Beyond domestic policy, regional dynamics further shape the sector's development.

Regional Integration and Industrial Synergies with Serbia

Moldova's specialization creates opportunities for cooperation with Serbia, whose automotive sector generates around EUR 9 billion annually and employs over 100,000 people.

Both markets continue to expand across multiple segments of the automotive value chain, creating a strong foundation for deeper collaboration. Serbia has developed significant capabilities in large-scale manufacturing, including vehicle assembly, tire production, and battery development, while Moldova has been strengthening its position in embedded software, control systems, high-precision wiring, and selected areas of power electronics and battery-related systems.

This combination supports closer regional integration. Capabilities developed in both markets can be combined across different stages of the value chain, while overlapping areas of activity also create opportunities for partnerships, joint development, and supply chain coordination, contributing to a more competitive and interconnected offering for the European automotive market.

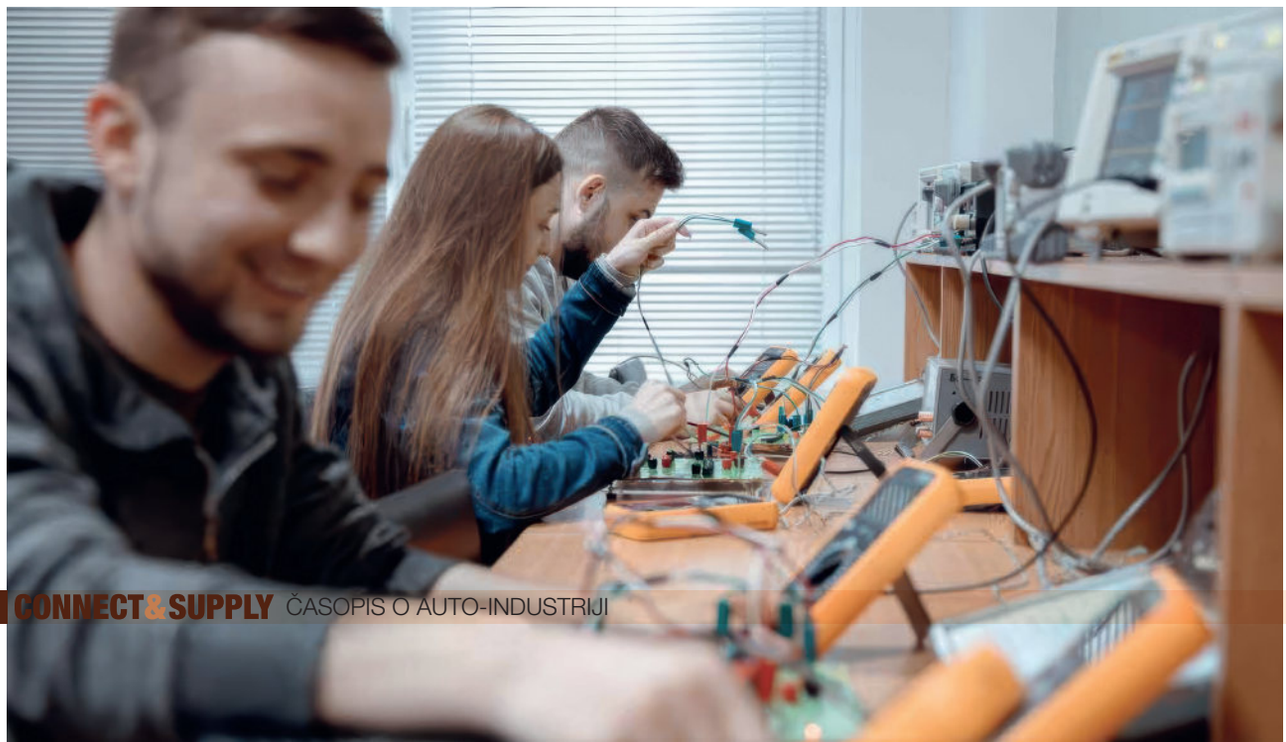
The ability to support this transition depends not only on industrial capacity, but also on the availability of skilled talent.

Human Capital and Talent Development

Workforce adaptability remains a key strength. Educational institutions, particularly the Technical University of Moldova, are expanding programs aligned with industry demand in embedded systems and electronics.

The dual vocational education system operates across 45 schools in partnership with over 200 companies. Additional initiatives such as Embedded School provide applied training for engineers. The government supports talent retention through a monthly bonus of 3,000 MDL for young professionals entering the workforce.

This evolving skills base is already reflected in the emergence of new innovation-driven companies.



Emerging Innovation Leaders

Established companies such as Dräxlmaier (4 plants in Moldova), Sumitomo Electric Bordnetze SE (2 plants), Gebauer & Griller (2 plants), Lear Corporation (2 plants), Magnetec, and Cornelius Electronics, which recently invested EUR 5 million in a new facility, provide scale and employment. At the same time, a few R&D-focused firms are shaping the next phase of development:

- Inform Business LLC (local company) develops battery management systems and inverters, with deployments in over 170 cities worldwide. The company is investing EUR 5 million in a new facility next to Chisinau.
- Dräxlmaier's Product Development Office in Chisinau drives engineering innovation for next-generation vehicles, leveraging local talent from its partnerships with the Technical University of Moldova.
- IT companies are advancing embedded software for automotive applications, from body control modules and infotainment systems to radar and electric drivetrains.

Moldova's Role in the Evolving European Automotive Ecosystem

Moldova has moved beyond a cost-based manufacturing model and is integrating into higher-value segments of the European automotive ecosystem. This evolution reflects a broader shift from cost-driven production toward participation in more complex and innovation-intensive value chains.

Supported by logistics, EU policy alignment, and targeted investment incentives, the country is strengthening its position within the regional industrial landscape. The transition to e-mobility presents both constraints and opportunities, and Moldova's approach focuses on building capabilities in software, electronics, and specialized components while leveraging regional partnerships.

This combination supports a gradual but consistent shift toward a more innovation-driven industrial base.

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AUTOMOTIVE B2B INTEGRATION 2026 IN SOUTHEASTERN EUROPE – THE SHIFT FROM STATIC DOCUMENT EXCHANGE TO AGILE DATA INTEGRATION

By 2026, B2B integration has become a core business capability for automotive companies rather than a pure IT topic. This shift is particularly visible in Southeastern Europe, where production sites in Serbia, Romania, Bulgaria, and neighboring countries are tightly embedded in global OEM and Tier-1 supply chains.

OEMs now expect transparency, speed, and reliability far beyond basic document exchange, driven by initiatives such as Catena-X. Suppliers must meet these expectations while operating in highly cost-sensitive environments and often with limited local IT resources. Established integration providers like SEEBURGER support automotive manufacturers in maintaining production stability while gradually introducing new data-driven capabilities.

Production growth meets operational reality

Over the past decade, Southeastern Europe – and Serbia in particular – has evolved into a strategically important automotive production region. Serbian plants supply global OEM programs from locations in Kragujevac, Novi Sad, Niš and the wider Vojvodina region, often acting as critical Tier-1 or Tier-2 nodes within European supply chains.

At the same time, IT landscapes in many South-Eastern European plants are lean, pragmatic, and historically grown. ERP systems are often centrally governed by corporate IT, while local teams focus on operative topics with production and logistics. Integration is therefore not fancy luxury, but mission critical for delivery.

By 2026, this tension has increased. OEMs expect:

- higher process transparency to meet new regulations,
- faster reaction times to minimize supply chain interruption,
- connectivity to data ecosystems such as Catena-X.

For engineers in Serbia and the wider South-Eastern European region, the challenge is clear: Continue the good work and expect changes on the fly, or – in a more sophisticated language: Operate proven integration processes with near zero tolerance for disruption while absorbing new requirements in parallel.

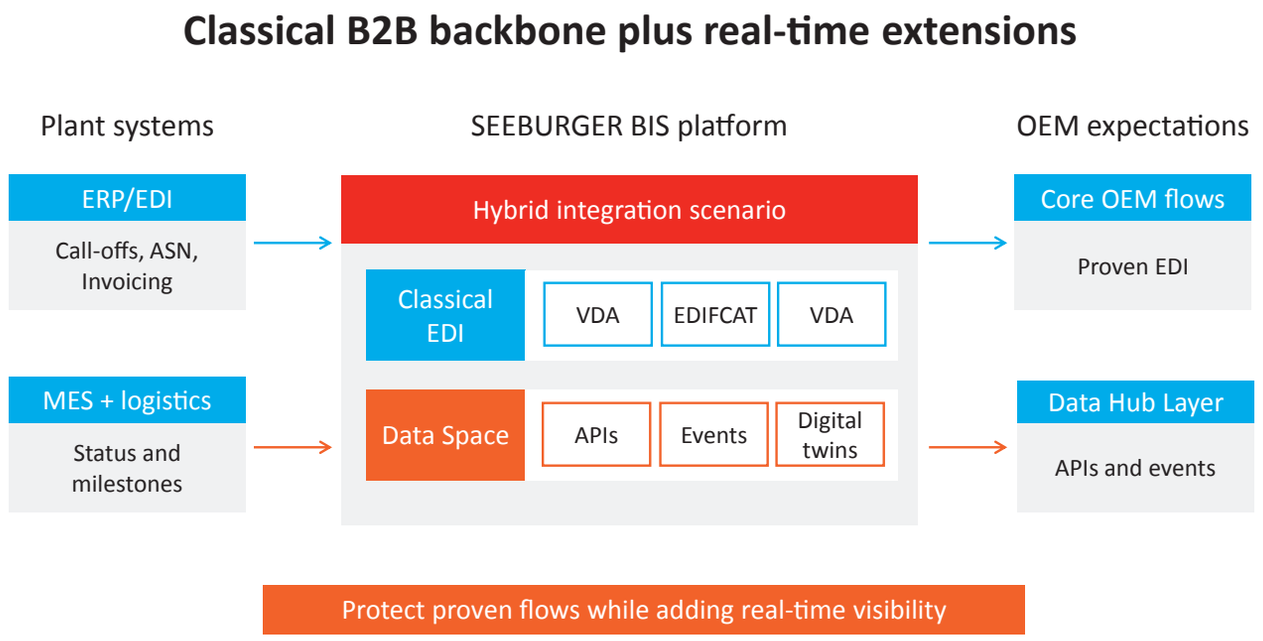


Figure 1: classical B2B backbone plus API/event-based extensions

Master the standards, be ready for new challenges

Industry standards such as VDA and EDIFACT remain the must-have for production critical processes such as delivery schedules, shipping notices and (e-)invoicing. These processes are typically highly automated and monitored, as any interruption has an immediate impact on production output and vendor performance ratings, resulting in losing money. Most suppliers have experienced penalties for wrong or late ASNs, so you know what I am talking about.

The real complexity does not lie in the standards themselves, but in the simultaneous servicing of multiple OEM supply chains, every single one with slightly different requirements. One Serbian production site may support several OEMs or Tier-1 customers in parallel, each with slightly different message formats and logistic processes. This cannot be done efficiently with a simple in-house converter software. A highly capable B2B integration platform is needed to provide fail-safe existing integrations and have all the tools for new integrations, be it new processes or new customers and suppliers. Not to mention the security aspects to protect your own and customer data from attacks, ransoms, or a simple system crash.

Transparency is a requirement, not optional

By 2026, OEMs increasingly demand near real-time visibility into logistic and even manufacturing processes. While core transactions continue to run through established integration channels (VDA over OFTP2 for example), reliable real-time status information is requested via APIs and event-based interfaces extend the B2B-Integration to digital twins of products and processes.

Hybrid integration models have therefore become the new must-have. Stable ”classic“ EDI backbone processes remain the standard and must be extended through new data-integration patterns. This approach mirrors scenarios seen at global Tier1 suppliers, where SEEBURGER must support the synchronization of classic EDI transaction flows with modern interfaces like APIs and new dataspace interactions.

Real life use case Catena-X: A Practical Challenge for South-Eastern Europe

The Automotive Dataspace Catena-X is gaining relevance for Serbian and Western Balkan suppliers, driven primarily by OEMs like BMW, Ford, Mercedes Benz, VW. Catena-X requires completely new data sets (compared to the classic "EDI" documents) that are generated not only in the ERP (MES, logistics) but also on new normalized data hubs, where data from engineering to the production line at the shop-floor level is aggregated. These data sets include serial numbers, product master data, lots / batches, and lifecycle data for digital twins in addition to the classic Delfor, Deljit or ASN data used as of today, often used as a trigger foundation. Another difference is the provision of the data. While classic EDI data is provided with the ERP-centric business process (e.g., shipment), the future is not that simple. In the future, partners will request specific data on demand within the dataspace which requires new patterns for secure and sovereign data exchange. Digital Twin Data becomes a Business Data Entity, serving as an API Catalog for complex data chains. An example: BMW requests all serial numbers as digital twin references from its supplier. By that, they are able to gain further insights when demanding specific production information through the data space. First use cases address capacities and stock items for that part and structured quality data reports. That makes it easier for BMW to initialize quality investigations. Usually, this data is already available on the production site and needs to be provided in a regulated manner.

The key insight is that B2B integration is evolving. Modern B2B covers new automation initiatives in classic EDI but also takes new data chains into account: CO_2 data, traceability information and digital product passports must be embedded into existing business relations.

Catena-X cannot be treated as a standalone IT project; it is an evolution of the existing classic B2B ecosystem. Modern integration platforms allow this to be handled alongside established transaction flows while enforcing access rights and usage policies without introducing parallel system landscapes.

Catena-X operating model

How Catena-X connects requests, data hubs and governed exchange

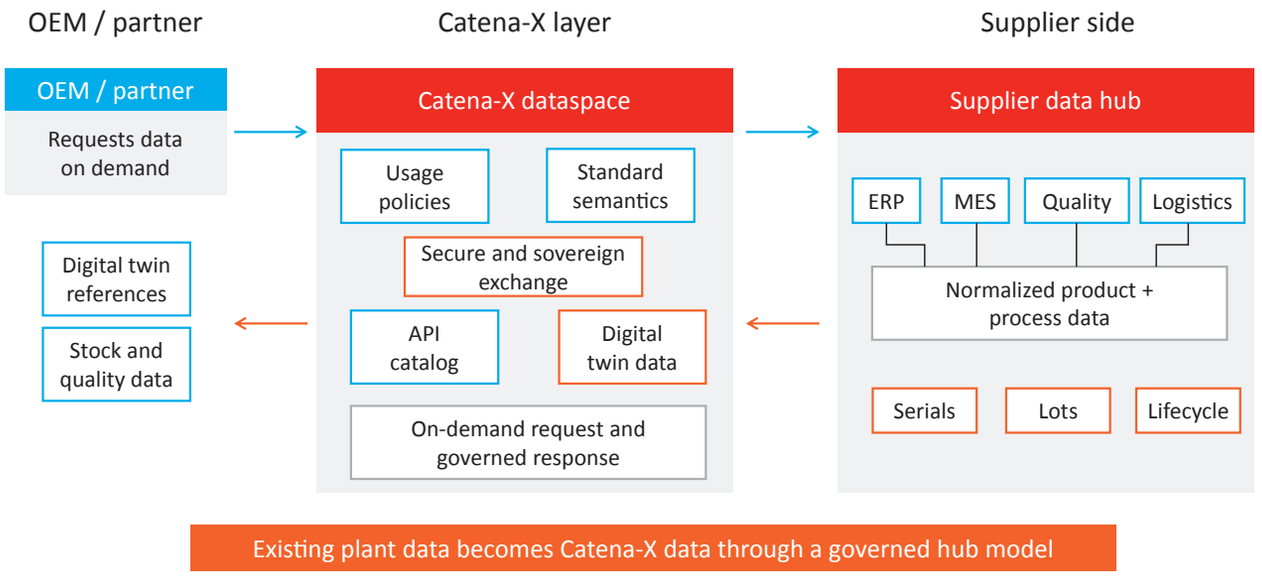


Figure 2: How Catena-X works: requests, data hubs and governed exchange

Watch your suppliers

Supplier enablement remains one of the most underestimated success factors in the supply chain visibility. While large South-Eastern European production sites operate highly automated environments, many Tier-2 and Tier-3 partners still rely on manual or semi-automated processes.

OEM requirements, however, apply equally to all suppliers. Web-based integration, standardized mappings and centrally managed onboarding processes are therefore essential to maintain overall supply chain stability and OEM ratings as well for new patterns like API and Catena-X. SEEBURGER customers use these mechanisms to integrate smaller regional suppliers efficiently to fulfill their supply chain certifications and ratings.

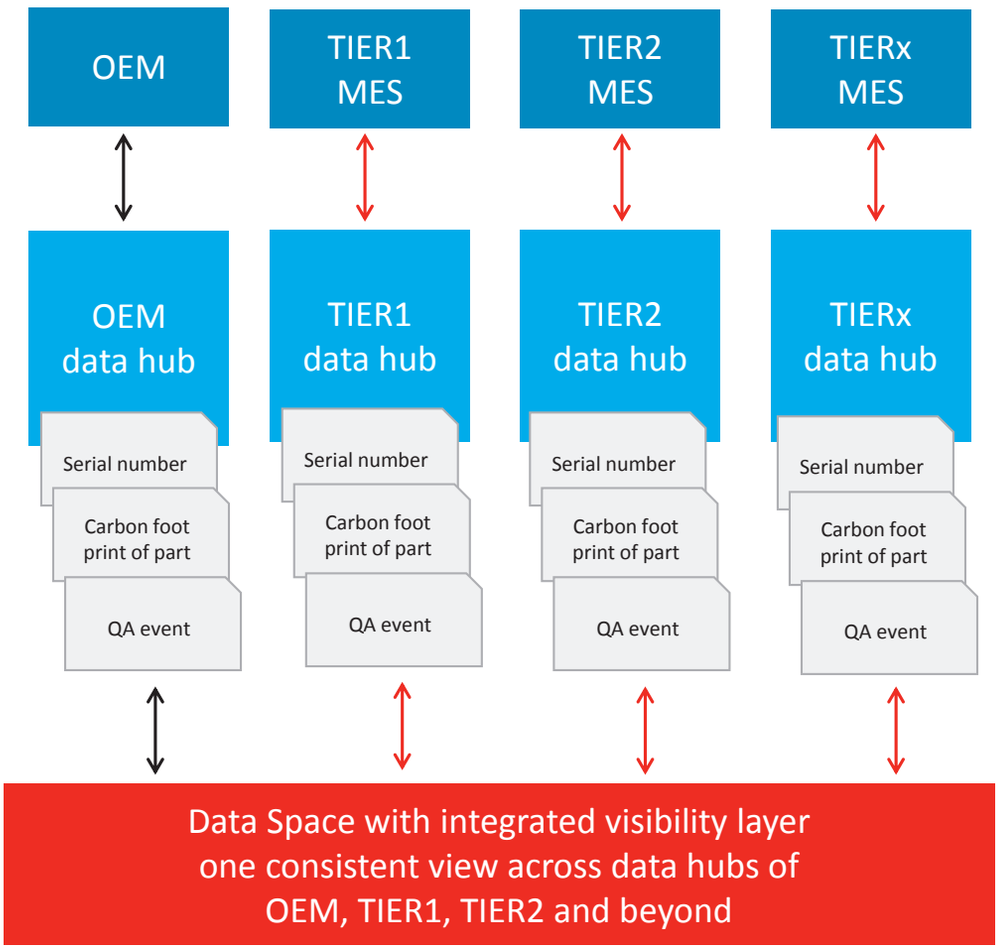


Figure 3: Continuous track-and-trace visibility across OEM and multi-tier suppliers

Conclusion: To keep your success, you need your B2B integration platform to be flexible, fast, cheap, secure, reliable, user- friendly, scalable, … (and much more)

If one of these features is missing in your current environment, you will run into problems sooner or later.

The SEEBURGER Business Integration Suite addresses all these challenges while being the market leader in automotive B2B integration for over 40 years. With its new iPaaS (Integration Platform as a Service) capabilities and BIS Hub Services, it enables companies of any size to respond to new requirements without major investments or lengthy projects.

3D SKENERI ZA VELIKE OBJEKTE: PRECIZNA MJERENJA U PUNOM MJERILU

Velike objekte poput automobila, industrijske opreme ili složenih mehaničkih sklopova, često je teško digitalizirati klasičnim 3D skenerima. 3D skener za velike objekte mora imati veliki domet, mogućnost snimanja velikog volumena, te visoku točnost i rezoluciju. Današnji sustavi kombiniraju pouzdanu tehnologiju, fleksibilnost ručnog rada i brzo procesiranje podataka, kako bi omogućili detaljne 3D modele i kod vrlo velikih dijelova.

U ovom vodiču saznat ćete koje uvjete mora zadovoljiti 3D skener za velike objekte, gdje se najčešće koristi, te koja rješenja za skeniranje i obradu podataka nudi i preporučuje TOPOMATIKA, tvrtka koja se više od dvadeset godina bavi preciznim industrijskim 3D mjeriteljstvom.

Što mora imati 3D skener za velike objekte?

Za pouzdanu digitalizaciju velikih dijelova nije dovoljna samo napredna tehnologija. Sustav se mora uklopiti u postojeće radne procese, pri čemu treba uzeti u obzir 5 ključnih čimbenika:

1. Mjerno polje i volumen skeniranja: veliki mjerni volumen ključan je za obuhvat cijelog objekta, dok manji volumen omogućuje veću razlučivost detalja – zato je važno uskladiti pokrivenost i razinu preciznosti prema zahtjevima zadatka.
2. Točnost i rezolucija na većim udaljenostima: i pri većoj udaljenosti od objekta skener mora zadržati visoku preciznost i jasnoću detalja.
3. Površina i radno okruženje: tamne ili reflektirajuće površine, te promjenjivi uvjeti osvjetljenja predstavljaju izazov. Moderni sustavi to kompenziraju inteligentnim algoritmima.
4. Brzina skeniranja i tijek rada: kod velikih objekata brzina prikupljanja i obrade podataka presudna je za produktivnost.
5. Integracija softvera: potrebna su snažna softverska rješenja za obradu velikih oblaka točaka i njihovo povezivanje s CAD ili CAE sustavima.

Primjene 3D skenera za velike objekte

Kontrola kvalitete velikih struktura

U automobilskoj, zrakoplovnoj i strojarskoj industriji ključno je brzo i pouzdano usporediti stvarno stanje s CAD modelom, čak i na velikim udaljenostima i velikim površinama. Skener mora zadržati točnost kroz cijeli volumen mjerenja.

Obrnuto inženjerstvo velikih komponenti

Kod masivnih ili složenih dijelova važno je obuhvatiti kompletan geometrijski oblik bez gubitka detalja, uz stabilno spajanje podataka i minimalne prekide u radu.

Validacija dizajna i veliki prototipovi

Kod velikih prototipova presudna je kombinacija mobilnosti, brzine i rezolucije. Ručni sustavi poput ZEISS T-SCAN hawk 2 omogućuju skeniranje velikih objekata na terenu, uz visoku preciznost i učinkovitu obradu podataka.

Odabir pravog uređaja

Kvalitetan 3D skener za velike objekte mora objediniti veliki raspon , visoku rezoluciju i brzinu skeniranja uz naprednu softversku podršku. Zbog toga TOPOMATIKA, službeni regionalni zastupnik ZEISS tehnologija, koristi i preporučuje ZEISS T-SCAN hawk 2.

Zašto?

ZEISS T-SCAN hawk 2 je svestrani ručni 3D skener namijenjen mobilnim mjerenjima velikih objekata. Kompaktan dizajn i intuitivno rukovanje čine ga idealnim za terenski rad. I kod velikih struktura ili većih udaljenosti od objekta omogućuje iznimnu točnost i hvatanje finih detalja.

Nova verzija ZEISS INSPECT dodatno optimizira rad sa skenerom ZEISS T-SCAN hawk 2, posebno kod velikih i složenih objekata, donoseći:

- Kontinuirani Satellite Mode – osigurava stalno snimanje referentnih točaka bez prekida, što rješava problem gubitka praćenja i nestabilnog spajanja podataka kod velikih dijelova.
- Prošireni mjerni volumen – omogućuje skeniranje većih površina s veće udaljenosti uz manje referentnih točaka, čime se skraćuje priprema i ubrzava cijeli proces.
- Adaptivna rezolucija – automatski prilagođava razinu detalja geometriji dijela, pa nema potrebe za ručnim podešavanjem između velikih ploha i finih elemenata.
- Unaprijeđena poligonizacija – brže i stabilnije pretvara sken u kompletnu mrežu, čime se smanjuje vrijeme od skeniranja do analize.

U praksi to znači brže i jednostavnije skeniranje velikih objekata, uz manje pripreme, stabilnije podatke i učinkovit prijelaz u kontrolu ili daljnju obradu.

Odabir pravog partnera - više od samog hardvera

Odabir pravog rješenja za 3D skeniranje i mjerenje nije samo pitanje tehnologije, već i pouzdanog partnera koji razumije cijeli proces – od mjerenja do interpretacije podataka. TOPOMATIKA se već više od 20 godina bavi preciznim industrijskim 3D mjeriteljstvom, s više od 300 instaliranih sustava i preko 600 korisnika usluga u regiji.

Naši klijenti nas biraju zbog stručnosti, edukacije i podrške, odnosno zbog cjelovitih rješenja koja obuhvaćaju više od samog hardvera.

Uz ručne laserske skenere, u našoj ponudi nalaze se i iznimno precizni optički 3D skeneri iz ATOS serije, industrijski CT sustavi za unutarnju inspekciju, industrijski mikroskopi, sustavi za mjerenje pomaka i deformacija te oprema za mehaničko ispitivanje materijala, uključujući kidalice i tvrdomjere.

Zahvaljujući takvom portfelju i iskustvu, TOPOMATIKA je pouzdan partner za sve izazove u području industrijskog mjerenja – od malih detalja do velikih, kompleksnih sustava.

Želite provjeriti kako to izgleda na vašim dijelovima? Kontaktirajte nas za besplatno mjerenje vaših dijelova i proizvoda na info@topomatika.hr ili nas posjetite na Međunarodnom sajmu tehnike u Beogradu od 19. do 22. 5. 2026.

KAKO JE SUBARU UBRZAO PROIZVODNJU ALATA ZA 50% UZ 3D PRINT – JEDNOSTAVNIJA I UČINKOVITIJA PROIZVODNJA

„Brzina je život“ – mantra koju prihvaćaju brojne industrije. Bilo da pilotirate zrakoplov, pokrećete start up ili proizvodite proizvode, brže djelovanje uz preciznost donosi stvarne prednosti. U proizvodnji, brzina u kombinaciji s točnošću omogućuje konkurentsku prednost i brži odgovor na zahtjeve tržišta.

Matt Daroff, voditelj projekta u Subaru of America, Inc., i njegov tim razvijaju široki katalog originalnih Subaru dodataka za sva vozila koja se prodaju u SAD-u. Alati i pomagala potrebni za preciznu ugradnju dodataka tradicionalno su se izrađivali konvencionalnim metodama – strojnom obradom metalnih i plastičnih dijelova i njihovim spajanjem – što je bio spor i skup proces, posebno tijekom validacije i iteracija prototipova. Subaru je prepoznao potencijal aditivne proizvodnje da ubrza izradu alata i tako je započelo njihovo putovanje u 3D printanje.

Jasno opravdana investicija

Kao i kod svake veće investicije, kupnja 3D printera morala je biti ekonomski i operativno opravdana. U ovom slučaju to nije predstavljalo problem, s obzirom na visoke troškove tradicionalne izrade alata. Prelaskom na 3D printanje, Subaru APD tim mogao je opravdati ulaganje u Stratasys F770™ 3D printer velikog formata, čime je izradu alata prebacio unutar vlastite organizacije. Time su značajno smanjeni troškovi vanjskih dobavljača, a dodatna ulaganja svela su se uglavnom na samu investiciju u uređaj.

„Razvijamo specijalizirane alate i pomagala za preciznu ugradnju naših proizvoda. Trošak izrade jednog takvog alata bio je toliko visok da je bilo lako opravdati kupnju F770 3D printera. Korištenje ovog stroja za prototipiranje i proizvodnju alata za taj projekt samo po sebi **smanjilo je troškove za otprilike 70% i omogućilo povrat investicije za otprilike dvije godine**“, kaže Daroff, napominjući da se F770 od tada koristi za prototipiranje i izradu alata za više proizvodnih linija i različitih vozila u razvoju.

Najveći utjecaj aditivne proizvodnje bio je na proces razvoja alata. Prema Subaru iskustvu, prelazak na AM potpuno je transformirao radni tijek tima, osobito kod prototipiranja i razvoja alata.

„Iteracija prototipova alata trajala je tjednima kod konvencionalne proizvodnje. Aditivna proizvodnja smanjila je to na nekoliko dana. To nam je omogućilo smanjenje vremena razvoja alata za ovu liniju proizvoda za više od 50%“, kaže Daroff.

Izazov s 3D printom velikih dijelova i kako su to riješili

F770 printer koristi FDM® filament tehnologiju i ima dovoljno velik prostor za 3D ispis velikih pomagala potrebnih za ugradnju dodataka. Ako neki alati premaše duljinu printnog stola od 100 cm, Subaru dizajneri alata ih dijele, printaju u nekoliko dijelova i spajaju. Kombinacija velikih dijelova i tipične brzine ekstrudiranja znači da printanje može trajati duže.

Prema Subaru timu, to nije iznenađenje, ali proizvodni plan morao je pratiti tempo printanja alata. Iako je 3D print smanjio troškove u odnosu na konvencionalnu proizvodnju, **pitanje je bilo kako dodatno uštedjeti vrijeme kroz ubrzanje printanja**.

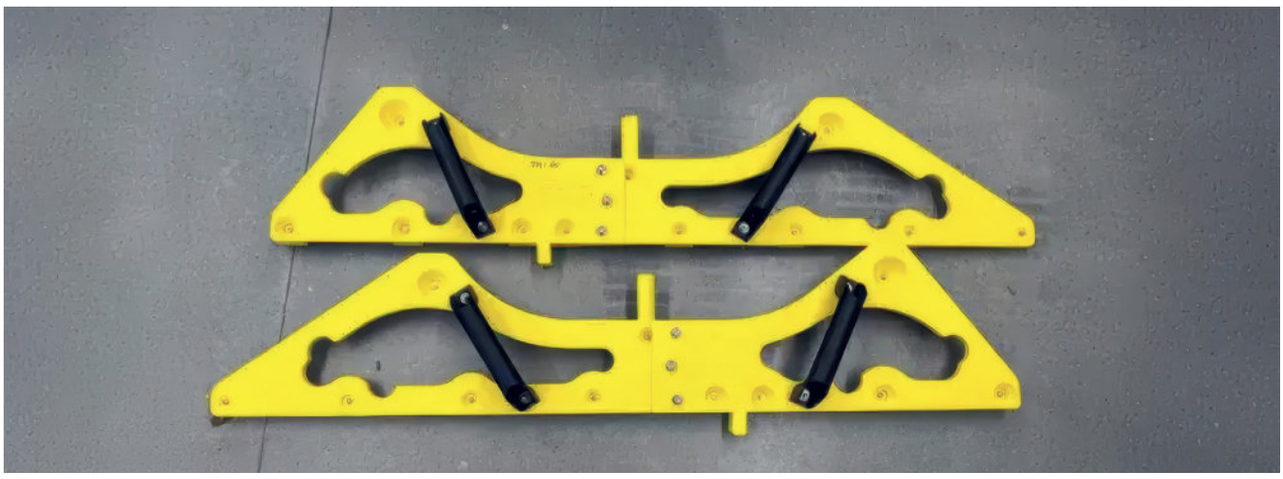
Rješenje je bio beta test nove glave za printanje T25, dizajnirane za povećanje brzine F770 printera za barem 1,5x. Nova T25 glava omogućuje bržu ekstrudiranje materijala i ima veći otvor mlaznice, čime se smanjuje vrijeme printanja.

T25 glava printa s istom visinom sloja od 0,33 mm kao standardna T14 glava, što osigurava sličnu završnu obradu.

Interna testiranja Stratasysa pokazala su **povećanje brzine printanja između 1,86 i 2,27 puta** u odnosu na standardnu glavu. U slučaju Subaru tima, 3D printanje alata duljine 91,5cm postiglo je povećanje brzine od 1,96x. **To je gotovo dvostruko kraće vrijeme printanja.**

Prije uvođenja T25 glave, tim je koristio dva printera za ispunjenje proizvodnih potreba. Nova glava omogućila je veći kapacitet na jednom F770 printeru, oslobađajući drugi za hitne zadatke.

„Kad nam se pružila prilika da povećamo brzinu F770 printera, bili smo oduševljeni. Sada možemo sav kapacitet dobiti s jednim printerom. To odmah čini operaciju fleksibilnijom i oslobađa drugi uređaj za druge zadatke“, kaže Daroff.



Šira poslovna vrijednost

Internom proizvodnjom 3D printanih alata, Subaru je skratio vrijeme izrade i smanjio troškove uzrokovane zastojima i kašnjenjima. Ključnu ulogu imala je odluka za *Stratasys* industrijski sustav, koji se tijekom testiranja istaknuo kvalitetom ispisa i pouzdanošću, čime je opravdao veću početnu investiciju.

Ne dešava se svakog dana da proizvođač automobila poboljša učinkovitost procesa gotovo 100% s jednostavnom nadogradnjom printera. Ali to je Subaru postigao s T25 glavom na F770 printeru, skraćujući izradu alata s nekoliko dana na jedan dan ili čak nekoliko sati.

Za Subaru, brzina nije samo printanje – radi se o bržem otkrivanju problema, smanjenju otpada i sigurnijem plasmanu dodataka na tržište. F770 s T25 glavom omogućio je upravo to.

PRECIZNA METROLOGIJA I NAMENSKI KONTROLNICI: STUBOVI KVALITETA U SAVREMENOJ AUTO-INDUSTRIJI - KVALITET KOJI STVARA POVERENJE

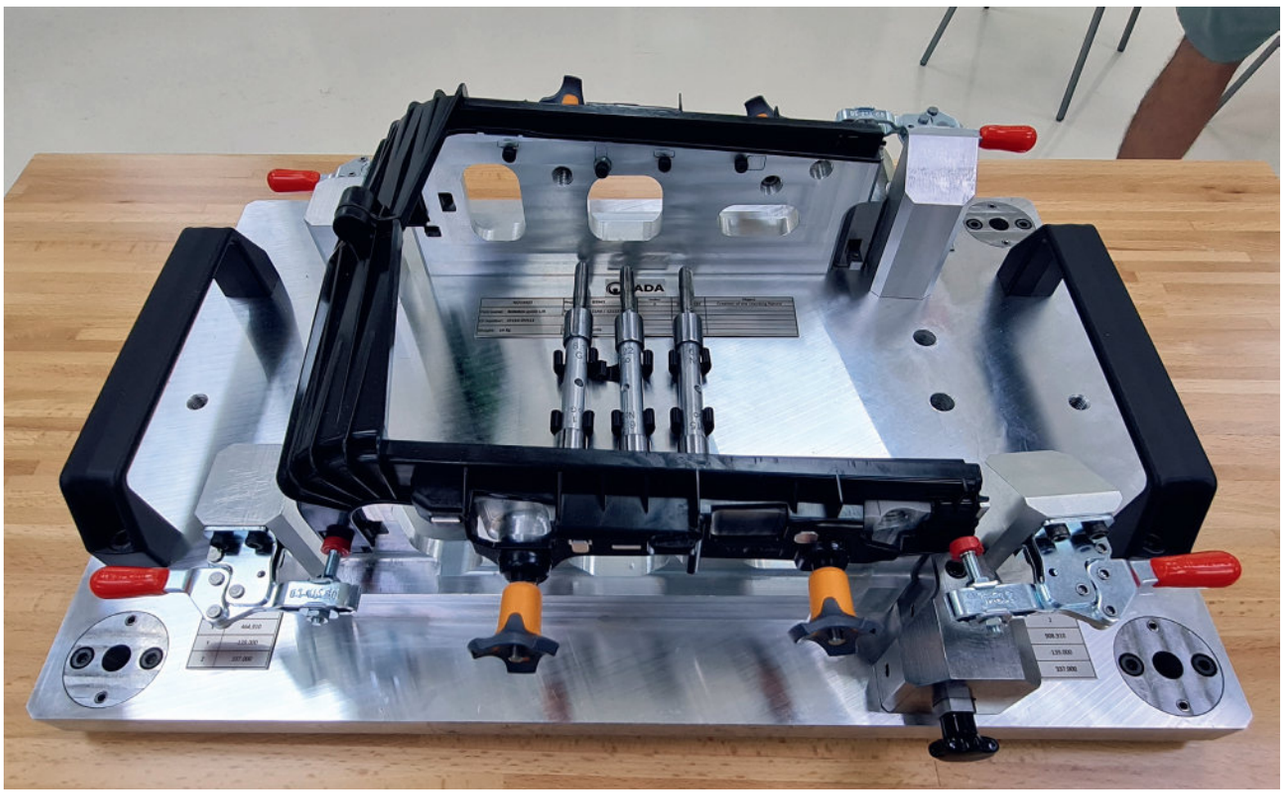
U dinamičnom okruženju automobilske industrije, gde se standardi poput IATF 16949 podrazumevaju, preciznost je jedini univerzalni jezik. Kompanija Madjor iz Kragujevca osnovana je 2018. godine sa ciljem da popuni prazninu na domaćem tržištu u visokospecijalizovanim mernim rešenjima. Danas, sa inženjerskim timom koji nosi preko 20 godina iskustva, Madjor ponosno stoji iza projekata za lidere kao što su Continental, Jaguar, Thule, Novares… Celokupan proces dizajna i izrade kontrolnika sertifikovan je prema standardu ISO 9001:2015, što klijentima garantuje sledljivost i vrhunski nivo pouzdanosti.

Kontrolnici kao garant efikasnosti

Merna kontrola na liniji fronta proizvodnje ne sme biti usko grlo. Dok su fiksne CMM mašine nezamenljive u laboratorijskim uslovima, brzina serijske proizvodnje zahteva trenutnu informaciju. Namenski kontrolnici (gejdževi) omogućavaju *Go/No-Go* verifikaciju u realnom vremenu, čime se drastično smanjuje procenat škarta i optimizuje proces kontrole.

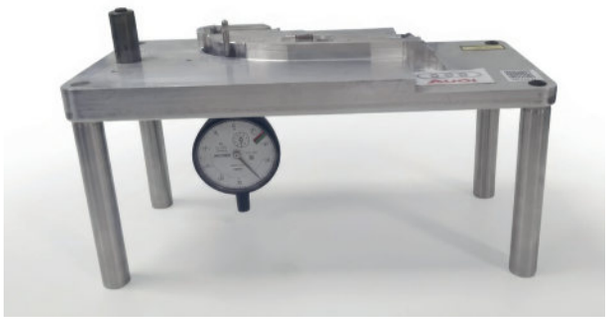
U kompaniji Madjor, razvoj svakog kontrolnika počinje dubinskom analizom geometrije dela i zahteva klijenta. Kao strateški partneri za prodaju i podršku Siemens industrijskog softvera (*NX, Teamcenter*), koristimo najnaprednije alate za 3D modeliranje. Konstrukcija u NX okruženju omogućava nam da kreiramo kompleksne merne sisteme koji ne samo da proveravaju dimenzije, već simuliraju realno uklapanje komponente u finalni sklop automobila.

U zavisnosti od zahteva procesa, projektujemo i izrađujemo dve ključne vrste rešenja: atributivne (*Go/No-Go*) kontrolnike za brzu potvrdu funkcionalnosti i varijabilne uređaje opremljene mernim satovima ili senzorima, koji omogućavaju očitavanje tačnih vrednosti odstupanja radi statističke kontrole procesa (SPC). Poseban fokus u našem inženjeringu stavljamo na *Poka-Yoke* principe, gde dizajn kontrolnika fizički onemogućava pogrešno pozicioniranje dela tokom provere. Kombinovanjem laganih aluminijumskih legura za tela gejdževa i visokootpornih kaljenih čelika za merne elemente, postižemo idealan balans između ergonomije i dugovečnosti. Svaki naš kontrolnik isporučuje se sa kompletnom dokumentacijom i mernim protokolom, čime direktno podržavamo klijente u ispunjavanju strogih zahteva IATF 16949 standarda.



Reverzibilni inženjering i digitalizacija

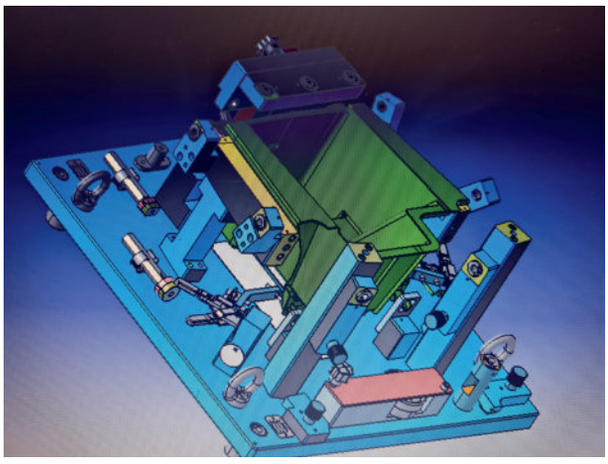
Jedan od ključnih segmenata našeg rada je reverzibilni inženjering. Često se u praksi javlja potreba za digitalizacijom alata ili delova za koje ne postoji inicijalna CAD dokumentacija. Koristeći visokoprecizne skenere, vršimo transformaciju fizičkih objekata u digitalne modele sa mikronskom tačnošću. Ovaj proces nije samo puko kopiranje; on omogućava optimizaciju dizajna, analizu habanja i kreiranje baze podataka za buduće modifikacije.



3D skeniranje i mobilnost

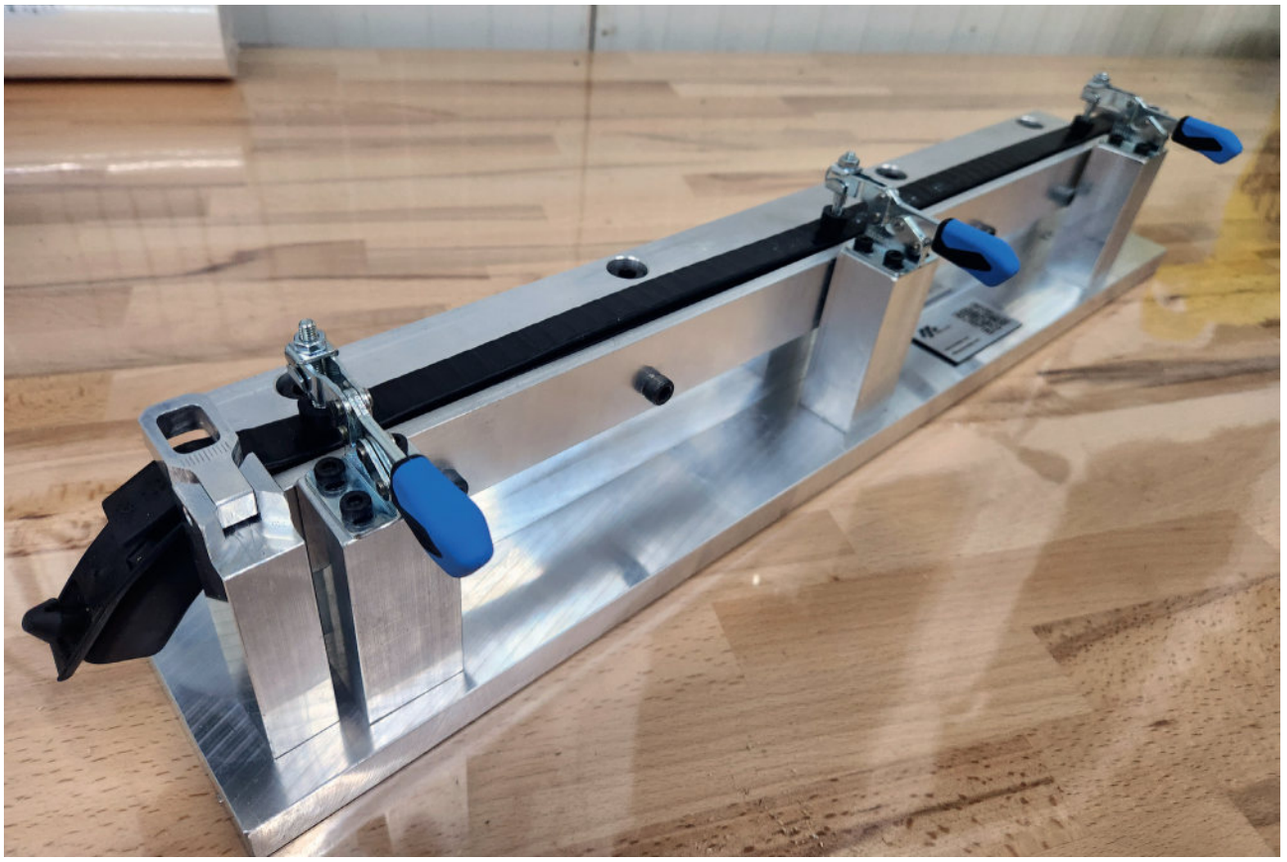
Razumemo da transport kabastih delova ili alata nije uvek opcija. Zbog toga smo razvili snažan sektor za usluge merenja na lokaciji klijenta. Naši merni timovi opremljeni su najsavremenijom prenosnom opremom, spremni da izvrše mernu kontrolu, analizu odstupanja u odnosu na CAD model ili digitalizaciju direktno u vašem pogonu.

Pored usluga, Madjor je i zvanični zastupnik za *Scantech* 3D skenere. Ovi uređaji su postali standard u svetskoj metrologiji zbog svoje brzine i preciznosti u radu sa kompleksnim površinama. Za kompanije koje imaju periodične potrebe za ovakvom tehnologijom, nudimo i opciju iznajmljivanja mernih ruku i 3D skenera, uz obezbeđenu stručnu podršku i obuku.



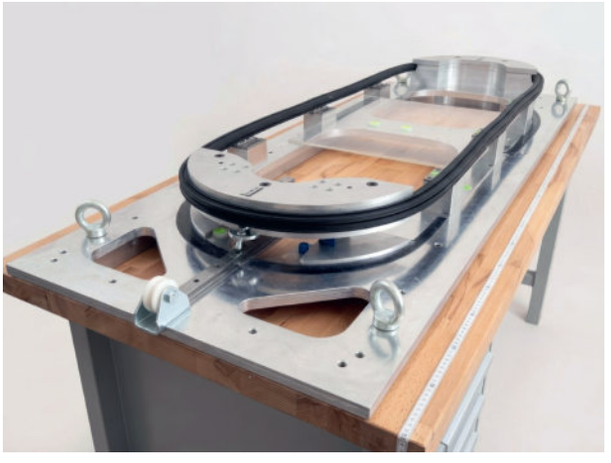
Simbioza hardvera i softvera

Ono što nas izdvaja na tržištu je sposobnost da zatvorimo kompletan krug. Mi klijentu ne prodajemo samo fizički alat; mi nudimo tehnologiju. Bilo da se radi o prodaji *Scantech* skenera, implementaciji *Siemens* NX softvera ili izradi kompleksnog kontrolnika sa mernim listom, naš cilj je da unapredimo merni proces klijenta.



Investicija u preciznost

Složeni merni sistemi koje projektujemo i izrađujemo u Kragujevcu danas su integralni deo proizvodnih linija širom Evrope. Naša misija je jasna – spojiti decenijsko iskustvo sa najsavremenijim digitalnim alatima kako bismo stvorili merna rešenja na koja se inženjeri mogu osloniti bez zadrške. U kompaniji Madjor verujemo da je precizno urađen kontrolnik ili profesionalna merna usluga investicija koja se isplaćuje kroz svaku ispravno proizvedenu seriju i zadovoljstvo krajnjeg korisnika.



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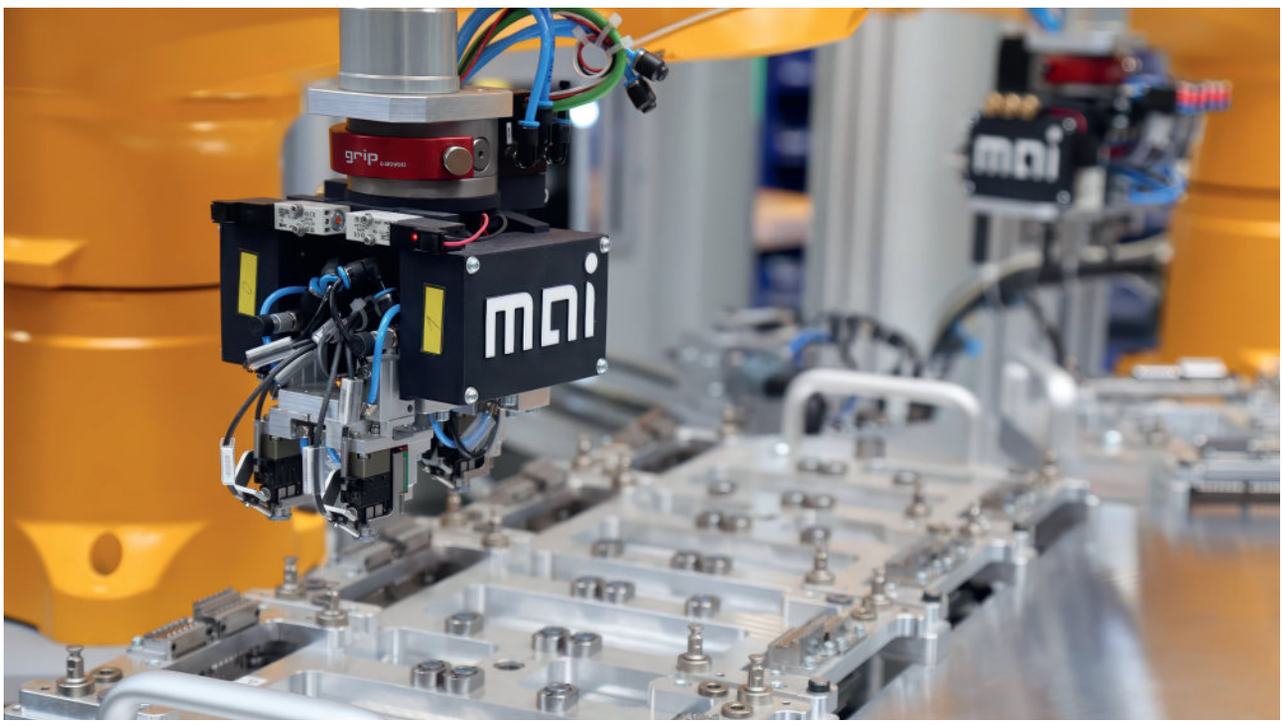
M.A.I GMBH & CO. KG – GLOBALNA EKSPERTIZA U AUTOMATIZACIJI SA LOKALNOM PODRŠKOM U SRBIJI



U savremenoj automobilskoj industriji, gde su brzina, pouzdanost i preciznost ključni, izbor pravog partnera za automatizaciju i podršku proizvodnji ima strateški značaj. Upravo na toj tački se pozicionira kompanija *M.A. i. Automation DOO* iz Kragujevca, kao deo šire međunarodne priče koju gradi nemačka kompanija *M.A. i GmbH & Co. KG*.

Matična firma, *M.A.i GmbH & Co. KG,* iz Nemačke, spada među svetski priznate proizvođače specijalizovanih mašina i automatizovanih proizvodnih linija za automobilsku industriju. Sa više od 35 godina iskustva, kompanija je izgradila reputaciju pouzdanog partnera vodećih OEM proizvođača i dobavljača u ovom sektoru. Njihova rešenja obuhvataju kompleksne sisteme koji integrišu mehaniku, robotiku i napredne upravljačke tehnologije, uz fokus na stabilnost procesa, visok kvalitet i dugoročnu eksploataciju opreme.

Pored sedišta u Nemačkoj, *M.A.i GmbH & Co. KG* je tokom godina razvila i snažnu međunarodnu prisutnost, sa kompanijama i timovima u Kini, Maleziji, Meksiku i Mađarskoj. Ovakva organizacija omogućava blizinu ključnim tržištima automobilske industrije i efikasnu podršku globalnim klijentima, uz zadržavanje visokih inženjerskih standarda.

Upravo iz potrebe da se klijentima obezbedi brza i efikasna podrška na terenu, nastala je kompanija *M.A. i. Automation DOO* u Kragujevcu. Kao lokalni partner, ona predstavlja produženu ruku nemačkog tima, ali i mnogo više od toga.

Lokalna podrška sa međunarodnim standardima

Osnovna uloga tima iz Kragujevca jeste da pruži sveobuhvatnu podršku klijentima koji koriste opremu i linije koje dolaze iz *M.A.i. GmbH*. To podrazumeva širok spektar aktivnosti – od puštanja u rad, optimizacije procesa i isporuke rezervnih delova do redovnog održavanja i rešavanja problema u radu sistema.

U praksi, to znači da korisnici u regionu ne moraju da čekaju dolazak inženjera iz inostranstva, već dobijaju brzu reakciju lokalnog tima koji poznaje i tehnologiju i specifičnosti proizvodnog okruženja. Ovakav pristup značajno smanjuje zastoje u proizvodnji i doprinosi većoj efikasnosti.

Pored klasičnog servisa i *aftersales* podrške, *M.A.i. Automation DOO* aktivno učestvuje i u unapređenju postojećih sistema. Kroz analizu rada linija i komunikaciju sa operaterima i menadžmentom, tim identifikuje potencijalne tačke za optimizaciju – bilo da je reč o softverskim izmenama, unapređenju upravljačkih algoritama ili boljoj integraciji sa drugim sistemima u fabrici.

Razvoj sopstvenih rešenja – od podrške ka inovaciji

Iako je inicijalno fokus bio na podršci i servisu, kompanija iz Kragujevca je vremenom razvila i sopstvena softverska rešenja koja odgovaraju konkretnim potrebama proizvodnih pogona.

Jedan od ključnih projekata je sistem za nadzor proizvodnje i praćenje potrošnje energije. Reč je o rešenju koje omogućava prikupljanje i analizu podataka direktno sa proizvodnih linija, sa ciljem da se proces učini transparentnijim i efikasnijim.

Sistem obezbeđuje uvid u stanje mašina u realnom vremenu – da li su u radu, zastoju ili pripremi, kao i osnovne proizvodne parametre. Ove informacije su dostupne kako operaterima, tako i menadžmentu, što omogućava brže donošenje odluka i pravovremenu reakciju u slučaju problema.

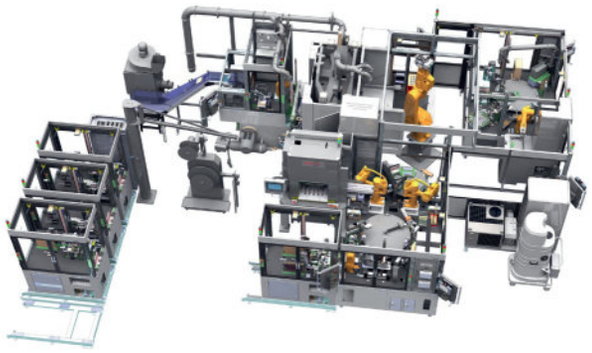
Poseban segment predstavlja praćenje potrošnje energije. U uslovima sve većeg pritiska na smanjenje troškova, povećanje energetske efikasnosti i uvođenje CBAM regulative, ovakvi sistemi postaju neophodan alat. Kroz detaljan pregled potrošnje po linijama, mašinama ili vremenskim intervalima, korisnici mogu jasno da identifikuju gde dolazi do najvećih gubitaka i gde postoji prostor za optimizaciju.

Praktične koristi za proizvodne pogone

Implementacijom ovakvog sistema, kompanije dobijaju konkretne i merljive benefite. Pre svega, povećava se preglednost proizvodnje – podaci koji su ranije bili rasuti ili nedostupni sada su objedinjeni na jednom mestu.

Smanjenje zastoja je još jedan važan rezultat. Bržim uočavanjem problema i boljom analizom uzroka vreme potrebno za reakciju se skraćuje, a samim tim raste i ukupna efikasnost linije.

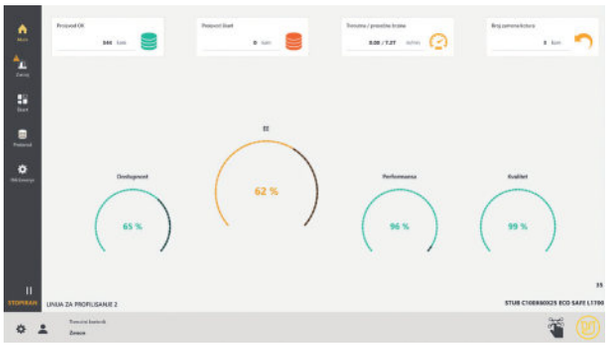
Kada je reč o energiji, uštede mogu biti značajne. Već samo uvođenje transparentnosti u potrošnju često dovodi do racionalnijeg korišćenja resursa, dok dodatne analize omogućavaju i dugoročnije optimizacije.



Fokus na dugoročnu saradnju

Ono što izdvaja *M.A. i. Automation DOO* jeste pristup koji je usmeren na dugoročnu saradnju sa klijentima. Umesto jednokratnih intervencija, cilj je izgradnja partnerskog odnosa, u kome se kontinuirano radi na unapređenju proizvodnih procesa.

Kombinacija iskustva matične kompanije iz Nemačke i fleksibilnosti lokalnog tima omogućava da se brzo odgovori na različite zahteve tržišta. Istovremeno, blizina klijentima i razumevanje lokalnog okruženja daju dodatnu vrednost koja se teško može postići isključivo centralizovanim modelom podrške.



Zaključak

U industriji u kojoj svaka sekunda zastoja ima svoju cenu, pouzdan partner u oblasti automatizacije i podrške proizvodnji predstavlja važan deo ukupne konkurentnosti kompanije.

M.A. i. Automation DOO iz Kragujevca uspešno spaja međunarodno iskustvo i lokalnu ekspertizu, nudeći klijentima ne samo tehničku podršku, već i konkretna rešenja za unapređenje proizvodnje i optimizaciju potrošnje resursa.

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ELOPAR AUTOMOTIVE DOO

U uslovima globalne krize u automobilskoj industriji, Elopar Automotive DOO se uspešno suočio sa svim izazovima, te učvrstio poziciju najjačeg dobavljača za harnes industriju u Srbiji, beležeći konstantan rast, pri čemu je prihod firme u poslednih devet godina, koliko Elopar posluje u Srbiji, više nego udesetostručen.

U protekloj godini, Elopar Srbija je bio drugi po ostvarenom profitu od svih Elopar-a, iza Elopar Maroka, koji beleži rekordne rezultate usled proizvodne migracije usmerene ka severnoafričkom regionu. Kriza u auto-industriji uslovila je da firme iz ove oblasti moraju da se preorijentišu i na proizvode drugih delatnosti. I u ovom slučaju uspeli smo da se prilagodimo i ostvarimo saradnju sa firmama iz farmaceutske i prehrambene industrije, kao i industrije procesne opreme. Neke od njih *su Grundfos, Fresenius Medical Care*, Medela… Takođe, pokrenuli smo proizvodnju *Conipack* sistema za skladištenje špulni, koji mogu biti automatski i manuelni.

U tekućoj godini otpočeli smo razgovore o proširenju saradnje sa firmama iz Republike Severne Makedonije, čime bi pored postojeće saradnje sa Rimcem iz Hrvatske, kao i firmama iz Maroka i Turske, povećali izvozne kapacitete. Iako smo prvenstveno orijentisani na plasiranje proizvoda za firme u Republici Srbiji, značajan procenat prihoda ostvarili smo izvozom u Tursku, Rumuniju i Maroko. Pored direktnog izvoza, naš servisni centar se takođe angažuje na radovima u Nemačkoj, Poljskoj, Rumuniji, Bugarskoj i Turskoj, kao i domaćim kompanijama.

Nakon učešća na minhenskom sajmu *Productronica* prošle godine, privukli smo pažnju potencijalnim kupcima iz celog sveta, a pored toga i započeli komunikaciju sa vodećim kineskim firmama u domenu proizvodnje mašina, čime smo našim kupcima potencijalno obezbedili pristup znatno širem izboru mašina i opreme. U planu je formiranje skladišnog i servisnog centra, čime bismo bili u mogućnosti da obezbedimo rekordno brzo snabdevanje i održavanje mašina i opreme naših kineskih partnera.

U velikoj meri lokacija proizvodnog i skladišnog prostora firme obećava izuzetnu efikasnost u snabdevanju i otpremanju naših proizvoda ka kupcima. Sama firma se nalazi u Rumi, na saobraćajnom čvoru, na samo kilometar od autoputa Beograd-Zagreb, kao i na trasi buduće brze saobraćajnice Šabac-Ruma-Novi Sad.

Pored kataloških artikala, u mogućnosti smo da kreiramo i sprovedemo čitav niz idejnih rešenja iz domena logističkog opremanja proizvodnih hala.

Orijentisani smo ka širenju proizvodnje i povećanju obima usluga, te s toga pozivamo sve privredne subjekte da nas posete i upoznaju se sa mogućnostima saradnje. *Companywall* nam je dodelio bonitetnu ocenu AA+, kao pokazatelj stabilnosti poslovanja, što nas čini kvalitetnim partnerom za dugoročnu saradnju.

Bogdan Petrović
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BEZBEDNOST HEMIJSKIH SUPSTANCI

Bezbednost i zdravlje na radu u auto-industriji često se posmatraju kroz prizmu propisa, procedura i kontrolnih lista. Međutim, iza tih administrativnih okvira nalazi se mnogo dinamičnija i složenija priča.

Auto-industrija je danas jedan od tehnološki najnaprednijih industrijskih sektora, u kome se tempo promena meri mesecima, a ne godinama. U takvom okruženju, bezbednost i zdravlje na radu više nisu statična oblast koja prati proizvodnju – ona mora da se razvija jednako brzo kao i sama tehnologija.

Savremena proizvodnja automobila podrazumeva izuzetno složene procese: od obrade metala i zavarivanja, preko površinske zaštite i lakiranja, do montaže sofisticiranih elektronskih komponenti. Svaki od tih koraka uključuje specifične rizike, a među najznačajnijima su oni koji proizlaze iz rada sa hemikalijama. Upravo zbog toga, bezbedno upravljanje hemikalijama postaje jedna od ključnih tema u savremenim fabrikama automobila i njihovom lancu dobavljača.

U auto-industriji se koristi veliki broj hemijskih supstanci: rastvarači, odmašćivači, lepkovi, boje, lakovi, sredstva za površinsku obradu metala i mnoge druge. Na prvi pogled, ove supstance predstavljaju samo još jedan deo proizvodnog procesa. Međutim, iza svake od njih stoji potencijalni rizik koji zahteva pažljivo upravljanje. Izloženost isparenjima rastvarača, kontakt sa agresivnim hemikalijama ili nepravilno skladištenje zapaljivih materija mogu imati ozbiljne posledice po zdravlje zaposlenih, ali i po bezbednost celog proizvodnog sistema. Zbog toga se savremeni pristup upravljanju hemikalijama sve više udaljava od pukog ispunjavanja formalnih zahteva i postaje deo šire strategije upravljanja rizicima. Kompanije koje prednjače u ovoj oblasti ne oslanjaju se samo na dokumentaciju i propise, već razvijaju sistem koji omogućava potpunu kontrolu nad životnim ciklusom hemikalija – od njihovog uvođenja u proizvodnju do konačnog zbrinjavanja otpada.

Jedan od ključnih elemenata takvog sistema jeste transparentnost informacija.

Bezbednosni listovi, pravilno obeležavanje hemikalija i jasne procedure rukovanja moraju biti dostupni svakom zaposlenom koji dolazi u kontakt sa tim supstancama. Međutim, iskustvo pokazuje da sama dostupnost informacija nije dovoljna.

Mnogo važnije pitanje je da li zaposleni zaista razumeju te informacije i znaju kako da ih primene u svakodnevnom radu.

Upravo tu na scenu stupa obuka zaposlenih, koja predstavlja jedan od najvažnijih alata u unapređenju bezbednosti. U tradicionalnom pristupu, obuke su se često svodile na formalno upoznavanje sa procedurama i potpisivanje evidencija o prisustvu. Danas, takav pristup više nije dovoljan. Moderni sistemi bezbednosti sve više se oslanjaju na interaktivne metode obuke, praktične demonstracije i simulacije realnih situacija.

Kada zaposleni kroz praktičan primer vide kako izgleda curenje hemikalije, kako pravilno reagovati u slučaju prosipanja ili kako funkcioniše zaštitna oprema, znanje postaje mnogo konkretnije i primenljivije. Takav pristup ne samo da povećava nivo bezbednosti, već doprinosi i razvoju kulture odgovornosti, u kojoj svaki zaposleni razume svoju ulogu u očuvanju bezbednog radnog okruženja.

Posebnu dimenziju bezbednosti u radu sa hemikalijama predstavlja lična zaštitna oprema. U mnogim proizvodnim pogonima zaštitne rukavice, naočare ili respiratori postali su uobičajen deo radne opreme. Ipak, prava vrednost lične zaštitne opreme ne leži samo u njenoj dostupnosti, već u pravilnom izboru i doslednoj upotrebi.

Različiti proizvodni procesi zahtevaju različite vrste zaštite. Rukavice koje štite od mehaničkih povreda često nisu adekvatne za rad sa hemikalijama, dok određeni respiratori pružaju zaštitu samo od specifičnih vrsta isparenja. Zbog toga je pravilna procena rizika ključna za izbor odgovarajuće opreme.

Jednako je važno obezbediti da oprema bude udobna i prilagođena radnim uslovima. U praksi se često pokazuje da zaposleni nerado koriste zaštitnu opremu koja otežava rad ili smanjuje pokretljivost. Savremeni proizvođači zaštitne opreme zato sve više pažnje posvećuju ergonomiji, materijalima i dizajnu, kako bi oprema bila istovremeno efikasna i praktična za svakodnevnu upotrebu.

Dok se upravljanje hemikalijama, obuka zaposlenih i lična zaštitna oprema mogu posmatrati kao tri ključna stuba bezbednosti, savremena auto-industrija donosi i nove izazove koji zahtevaju dodatnu pažnju.

Brz tehnološki napredak menja način na koji se vozila projektuju i proizvode. Uvođenje novih materijala, poput naprednih kompozita i specijalnih premaza, često podrazumeva i upotrebu novih hemijskih supstanci čiji uticaj na zdravlje i bezbednost mora biti pažljivo analiziran.

Istovremeno, automatizacija i robotizacija proizvodnje značajno menjaju ulogu čoveka u proizvodnom procesu. Radnici sve ređe obavljaju fizički zahtevne operacije, ali sve češće upravljaju složenim sistemima i nadgledaju procese u kojima se koriste različite hemikalije i tehnološke instalacije. Ovakva transformacija zahteva nove kompetencije, ali i drugačiji pristup obuci i upravljanju rizicima.

Paralelno sa tehnološkim razvojem, menja se i regulatorni okvir u oblasti bezbednosti i zdravlja na radu. Zakonska regulativa postaje sve detaljnija i sve više usmerena ka preventivnom pristupu upravljanju rizicima. Od kompanija se očekuje da ne reaguju tek kada se problem pojavi, već da kroz sistematsku procenu rizika prepoznaju potencijalne opasnosti i preduzmu mere pre nego što dođe do incidenta.

Za kompanije u auto-industriji to znači stalno praćenje propisa, ali i kontinuirano unapređenje internih procedura. U praksi, najuspešnije organizacije su one koje regulatorne zahteve ne posmatraju kao administrativni teret, već kao priliku za unapređenje sopstvenih sistema upravljanja bezbednošću.

Na kraju, možda je najvažnija promena u savremenom pristupu bezbednosti i zdravlju na radu upravo promena perspektive.

Bezbednost više nije samo odgovornost službi za zaštitu na radu ili menadžmenta. Ona postaje zajednička vrednost cele organizacije.

U industriji koja se razvija tako brzo, kao što je auto-industrija, upravo ljudi ostaju najvažniji resurs. Njihovo znanje, iskustvo i svakodnevne odluke imaju presudan uticaj na bezbednost proizvodnog procesa. Zato ulaganje u bezbedno upravljanje hemikalijama, kvalitetnu obuku i adekvatnu zaštitnu opremu nije samo pitanje usklađenosti sa propisima – to je ulaganje u stabilnost, reputaciju i dugoročnu održivost kompanije.

U vremenu ubrzanih tehnoloških promena, kompanije koje prepoznaju značaj bezbednosti i zdravlja na radu neće samo smanjiti rizike, već će stvoriti radno okruženje u kome se inovacije, produktivnost i bezbednost međusobno podržavaju. Upravo takav pristup predstavlja temelj moderne i odgovorne auto-industrije.

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ERP I EDI KAO TEMELJ DIGITALNE TRANSFORMACIJE U AUTOMOBILSKOJ INDUSTRIJI

Kako integracija poslovnih sistema postaje ključ stabilnog i konkurentnog lanca snabdevanja

Automobilska industrija danas funkcioniše kao visoko koordinisan ekosistem u kojem svaka karika lanca snabdevanja mora raditi precizno i bez zastoja. Proizvodni procesi zavise od pravovremene isporuke komponenti, dok razmena informacija između partnera mora biti brza, tačna i standardizovana. U takvom okruženju, digitalna transformacija više nije opcija, već nužnost.

Jedan od ključnih stubova ove transformacije predstavljaju ERP (*Enterprise Resource Planning*) i EDI (*Electronic Data Interchange*) sistemi. Njihova implementacija omogućava kompanijama da unaprede operativnu efikasnost, smanje rizike u poslovanju i odgovore na sve kompleksnije zahteve tržišta.

ERP sistemi omogućavaju centralizovano upravljanje poslovnim procesima, od finansija i nabavke do proizvodnje i logistike. Kroz jedinstvenu platformu, kompanije dobijaju potpunu kontrolu nad svojim poslovanjem, uz pristup tačnim i ažurnim podacima u realnom vremenu. Ovakav pristup značajno unapređuje donošenje odluka i omogućava bržu reakciju na promene u okruženju.

Sa druge strane, EDI sistemi omogućavaju automatizovanu razmenu poslovnih dokumenata između kompanija. U automobilskoj industriji, gde se svakodnevno obrađuju velike količine podataka, EDI eliminiše potrebu za manuelnim unosom, smanjuje mogućnost grešaka i ubrzava celokupan proces komunikacije između partnera.

Međutim, prava vrednost ovih tehnologija dolazi do izražaja kroz njihovu međusobnu integraciju. Povezivanjem ERP sistema sa EDI platformama, kompanije ostvaruju potpunu automatizaciju toka informacija – od prijema narudžbine do isporuke i

fakturisanja. Ovakav nivo integracije omogućava veću transparentnost, bolju kontrolu procesa i značajno smanjenje operativnih troškova.

U praksi, jedan od najvećih izazova predstavlja povezivanje različitih sistema i standarda koje koriste poslovni partneri širom sveta. Upravo tu ključnu ulogu imaju integracione platforme, koje omogućavaju sigurnu i pouzdanu razmenu podataka između različitih IT sistema.

Rešenja poput onih koje razvija kompanija SEEBURGER omogućavaju kompanijama da efikasno upravljaju kompleksnim integracijama i odgovore na zahteve globalnih partnera. Kroz standardizaciju komunikacije i automatizaciju procesa, ove platforme postaju centralna tačka digitalnog ekosistema kompanije.

Na lokalnom i regionalnom tržištu, uspešna implementacija ovakvih rešenja zahteva i stručnu podršku partnera koji razumeju specifičnosti industrije. Kompanija *Technologent* se kroz implementaciju ERP i EDI sistema pozicionira kao pouzdan partner u procesu digitalne transformacije, pomažući organizacijama da optimizuju svoje poslovne procese i unaprede operativnu efikasnost.

U vremenu kada su brzina, preciznost i pouzdanost ključni faktori uspeha, kompanije koje investiraju u integraciju poslovnih sistema ostvaruju značajnu konkurentsku prednost. Digitalna transformacija tako postaje strateški alat koji omogućava stabilan rast i dugoročnu održivost poslovanja.

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