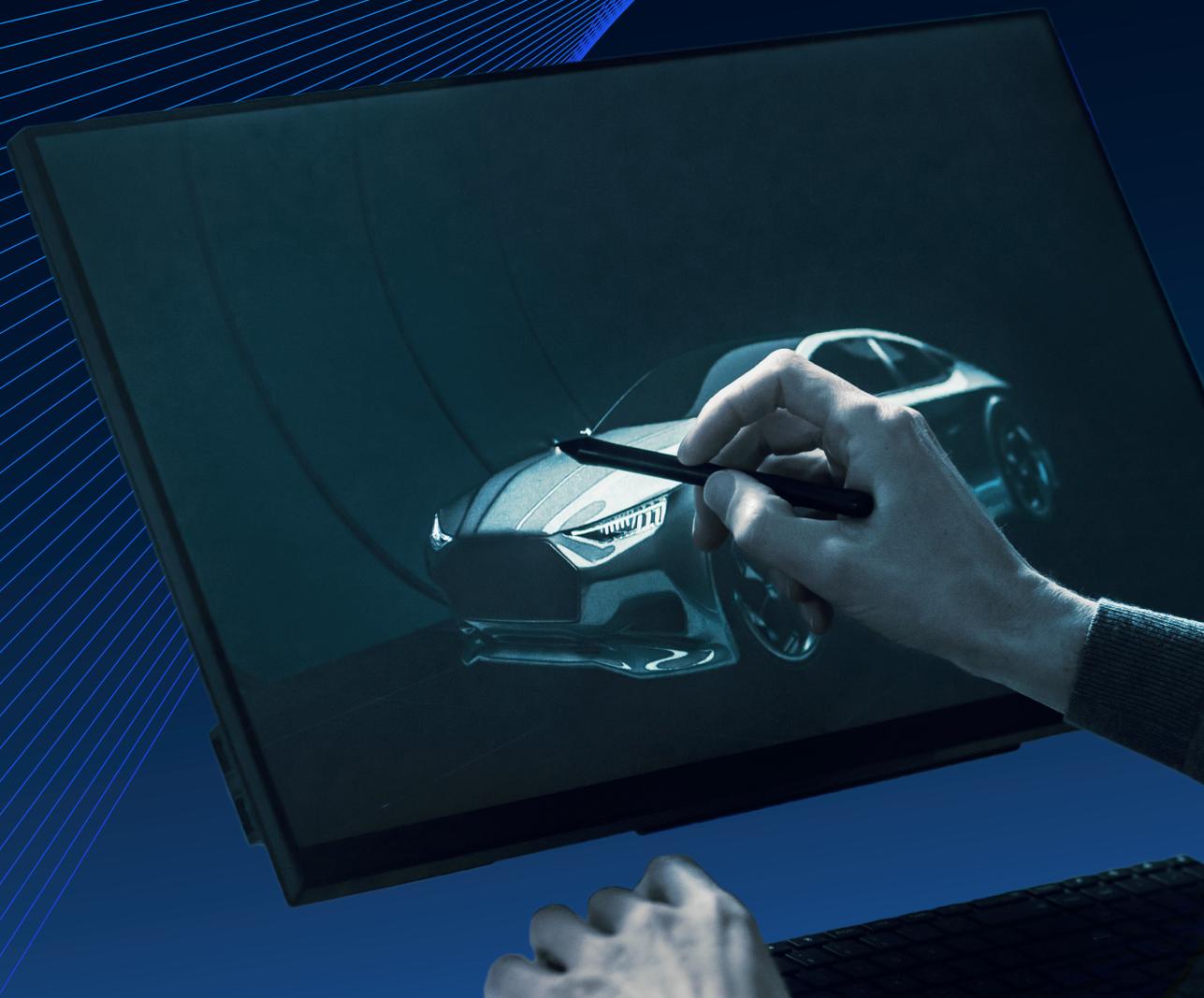


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Rethinking European Automotive Competitiveness

The R&D CEE opportunity



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Preface

Amid the uncertainty of major events like Brexit and China's economic slowdown, automotive players can look to actions within their control to build resilience. As new technologies, such as autonomous driving and electric vehicles, increase the role of software in automotive R&D, automotive players could seek to tackle this shift in order to remain competitive.

Specifically, a shift in the automotive R&D talent profile from mostly engineers to a larger share of developers, programmers, and data scientists is underway, and automotive companies could start investing in these new capabilities early on. Already, skilled labor in Western Europe (WE) is rare and costly, driving up automotive companies' R&D spend. "Near-sourcing," i.e., expanding their R&D footprint and leveraging the talent pool in Central and Eastern Europe (CEE), might be a lever for WE automotive players.

This report lays out the competitive benefits for the European automotive industry of near-sourcing that could future-proof the foundations of car manufacturing in Europe and create a positive situation for both the eastern and western parts of the European community. We provide deep analysis of CEE as an R&D location and insights from conversations with commercial and government leaders in both WE and CEE about the wide-reaching research development activities happening in CEE. At the strategic level, we also aim to help organizations answer the following questions: What R&D activities can be near-sourced to CEE? Where in CEE might an R&D center be best located? How should the setup in CEE be initiated?



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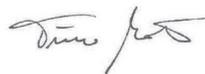
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Table of contents

Introduction	9
1 Pressure: Automotive R&D in WE is under pressure, facing talent-related challenges of scarcity and cost	12
2 Solution: CEE's unique set of characteristics presents a compelling solution	16
3 Activities: Seven actions will help position WE automotive OEMs and suppliers to near-source to CEE	26
3.1 Identify: Develop a complete perspective of the company's R&D landscape and identify activities for near-sourcing	28
3.2 Locate: Assess new R&D center location options based on a set of predefined criteria	35
3.3 Initiate: Build relationships in the selected region and prepare for the new R&D center launch	38
3.4 Deep dive: Pragmatic no-regret moves for both automotive OEMs and suppliers in WE	40
4 Benefits: Near-sourcing R&D activities can bring many long-term shared benefits	42
4.1 Near-sourcing can strengthen economic growth	43
4.2 Sustained R&D activity can contribute to building talent-first economies	44
4.3 Near-sourcing can spur the development of the entire advanced industries sector	45
Outlook: Getting started	46
List of abbreviations	47
Contacts and authors	48
Key contributors	49
Legal notice	49

Introduction

The European automotive industry continues to be a huge success story but is currently facing strong headwinds: revenue pools are shifting towards Asia, new players are entering the market, and the industry is facing disruptive megatrends of a new magnitude, such as autonomous driving, connectivity, electrification, and shared mobility (ACES). What's more, Europe's position as an industry leader may even be endangered, since the core competencies required for remaining successful are changing rapidly. Compared to former evolutions in the automotive and mobility industry, these changes are unique, as they are much more complex, dynamic, and disruptive.

WE automotive players face growing competitive pressure in their R&D functions in particular. Tech-driven industry trends are making software engineering a bigger part of automotive R&D. In 2030, it is predicted that a double-digit share of cars sold (base case) will contain autonomous vehicle content at Level 3 (conditional automation) or higher.¹

In view of this, it becomes obvious that automotive R&D – particularly with regard to the ACES trends and technologies – is critical for automotive players' future competitiveness. Software is fundamental to these trends. As such, software development capabilities are growing in relevance for automotive design and production, and this is putting unprecedented pressure on players' R&D functions. The lines of software code in vehicles increased 15-fold in the last ten years. In WE, in particular, automotive original equipment manufacturers (OEMs) and suppliers are facing several challenges in trying to address the growing demand for software and engineering activities in their R&D functions.² The biggest challenge they are facing is the limited supply and high cost of relevant talent. Competition with tech companies, such as Google or IBM, and the resulting high wage levels make bringing on the requisite talent from within WE a real challenge for players.³

A definition of near-sourcing

In the context of this report, near-sourcing refers to the process by which automotive players headquartered in WE conduct selected R&D activities in and source R&D insights from a strong and affordable CEE region – just a short distance beyond their borders.

The process includes the selection of appropriate R&D activities, the identification of the optimal CEE location, and the building of partnerships with relevant institutions in the region to support the setup.

A compelling solution to these compound challenges could lie just next door.

This report first examines the market-related challenges that automotive players face as software development becomes a more central part of their R&D functions, and then describes the potential value and on-the-ground realities of near-sourcing for WE automotive players as a strategic solution to these challenges.

Next, the report sets out, in detail, the three stages of the near-sourcing process: the selection of appropriate R&D activities, the identification of the optimal location, and the building of partnerships with relevant institutions in the region to support the setup.

Finally, the report offers a road map for how these players might begin their journeys. To paint the clearest picture, we also share examples of the real-world R&D journeys of some automotive players that established significant R&D centers in the CEE region.

¹ *The Internet of Things – how to capture the value of IoT*, McKinsey, May 2018.

² While this report focuses solely on automotive OEMs and suppliers, many of our findings and solution recommendations can also be applied to machinery industry players in WE who are facing a rather similar challenge.

³ Hua, Sha. "German firms face staffing woes as Chinese labor costs skyrocket," *Handelsblatt*, August 2018, <https://www.handelsblatt.com/today/companies/not-so-cheap-german-firms-face-staffing-woes-as-chinese-labor-costs-skyrocket/23583006.html?ticket=ST-34728192-EiYZedWcPKx7OqqcyIQT-ap2>.

Overall, we found that:

CEE countries are a promising solution to the R&D challenges of WE automotive players.

A range of benefits makes near-sourcing selected R&D activities to CEE a consideration that WE automotive players cannot ignore. An R&D density approximately seven times lower than in Germany (Exhibit 1)⁴ makes the large software talent pool of 6.6 million people not only accessible but, with 60 percent lower wages, also more affordable.⁵ Additionally, countries in the region provide tax breaks or direct investment aid. Finally, an up-to-date infrastructure, including transportation, real estate, and Internet, make CEE a destination that checks all of the boxes today.

Identifying potential R&D activities aligned with business objectives is essential to the near-sourcing journey.

Automotive players should gain clarity on how near-sourcing might bring value to their specific organizations. Reducing cost or increasing access to talent are just some of the possible upsides, but the relevance of the different potential benefits will determine which activities get near-sourced and to which region in CEE specifically.

The benefits of near-sourcing R&D activities to CEE extend beyond the individual automotive players to the larger economy, society, and entire sector.

Currently, while on average 4.6 of the top 20 OEMs are present with production sites in the CEE countries most active in automotive, generally only 0.8 of them also have R&D activities in these source countries. This gap between production and R&D exists for the top 20 tier-1 automotive suppliers as well, with an average of 9.6 producing in CEE countries but only 3.8 also conducting R&D activities there.⁶ The trend of growing R&D in CEE, however, is clear, and now seems like the time for automotive players to look towards the region. In the future, the increase in R&D in CEE will potentially mean more than a competitive advantage for individual players. A rich R&D ecosystem in CEE may have a positive, multi-economy impact and become a valuable asset for the larger advanced industries sector with its automotive, aerospace and defense, and advanced electronics industries.

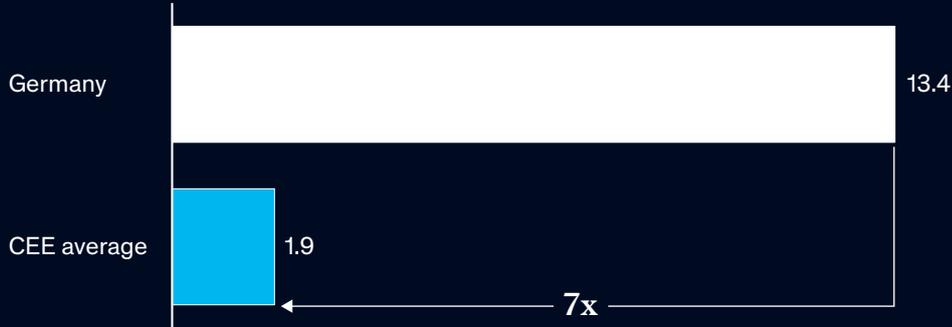
⁴ Eurostat's data on NACE job categorization; UNESCO Institute for Statistics.

⁵ Labor agency reports (2017-18) in IT-related segmentation of respective countries; Eurostat's data on NACE job categorization; fDi Benchmark, a service of the Financial Times Limited 2019.

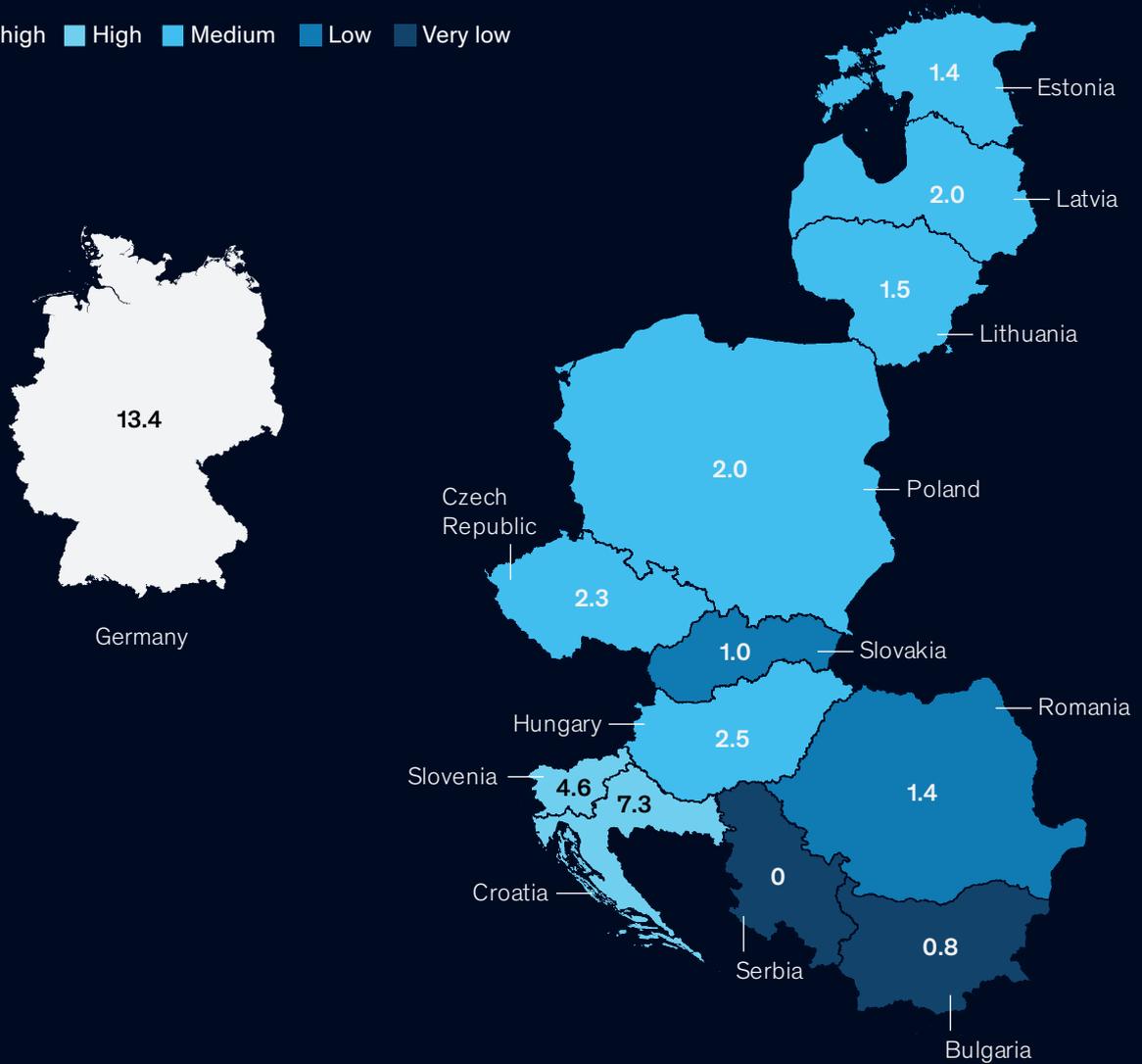
⁶ Open source and press research on top 20 OEMs classified by revenue with official statement on R&D locations (e.g., company websites, financial year-end reports); McKinsey report: *Automotive OEM R&D footprint*.

Compared to the size of their automotive sectors, CEE countries have 7 times less R&D than Germany

Share of R&D FTEs in total automotive FTEs, 2016, percent



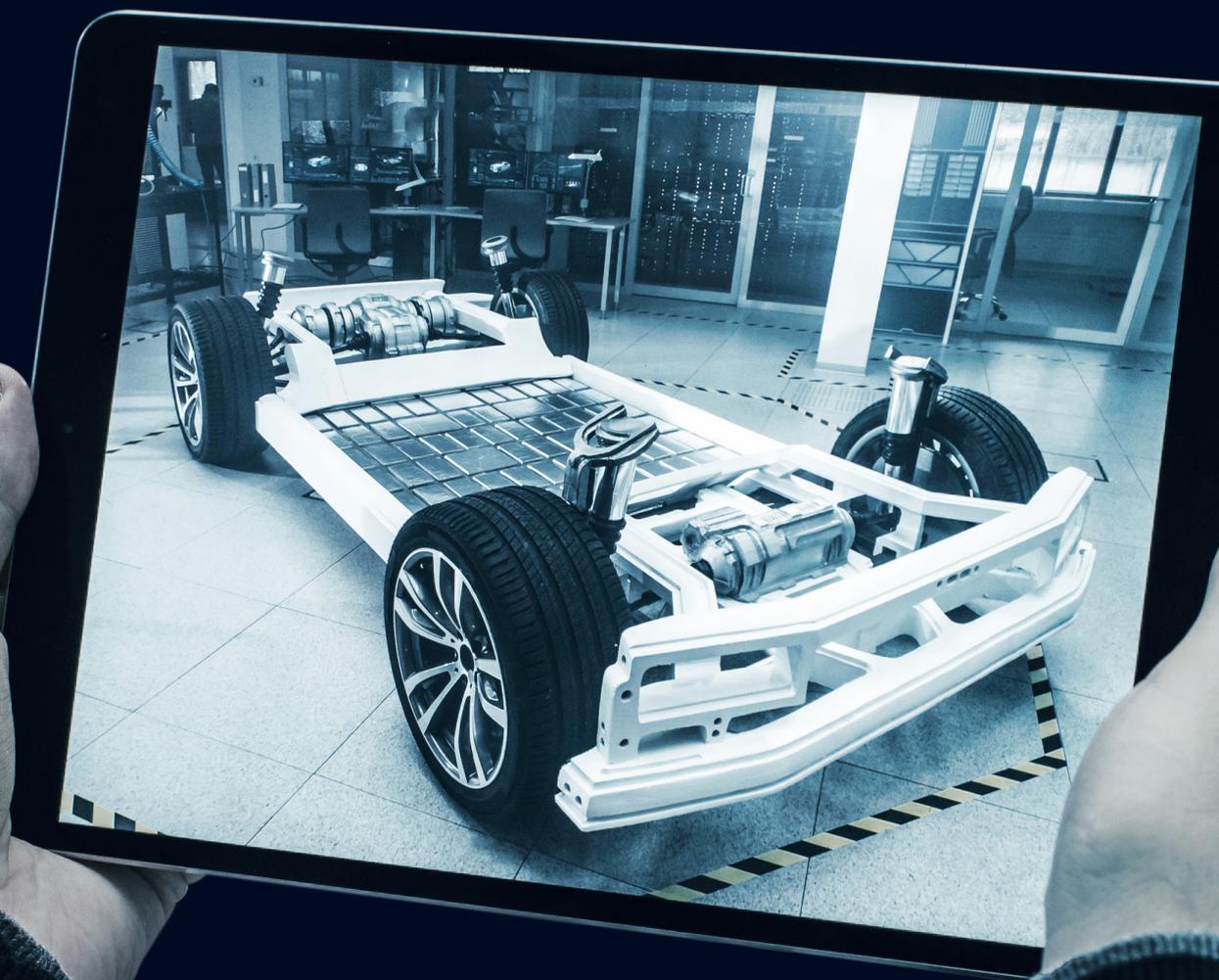
■ Very high
 ■ High
 ■ Medium
 ■ Low
 ■ Very low



Source: Eurostat's data on NACE job categorization; UNESCO Institute for Statistics

1 Pressure

Automotive R&D in WE is under pressure, facing talent-related challenges of scarcity and cost





Automotive R&D is already under pressure. Increased virtualization, parallel development of internal combustion engine (ICE) and battery electric vehicle (BEV) technology, and tighter emissions restrictions have direct implications for automotive R&D. On top of this, three inter-related realities are putting further pressure on automotive companies' R&D functions. First, the ACES trends are making software an increasingly central aspect of new vehicles. It is predicted that in 2030, a double-digit share of cars sold (base case) will contain autonomous vehicle content at Level 3 (conditional automation) or higher,⁷ requiring new types of engineering talent, such as data scientists and architects. Looking at the market for software development in automotive alone, it is expected to climb 13 percent between 2020 and 2025 (Exhibit 2), translating into a talent demand for software engineers with a 6 percent year-over-year increase until 2025.

This trajectory puts automotive players in the position of facing necessary and significant increases in R&D spend, which leads to the second high-pressure reality: The relevant R&D labor in WE is significantly more expensive than it is in Asia, putting WE players at a structural

disadvantage compared to their counterparts in Asia. Third, not only is R&D talent in WE expensive, it is increasingly scarce as automotive companies must compete directly with tech giants for the exact same talent profiles.

The new profile of automotive R&D talent is comprised of expertise in robotics, advanced industries, software development, and data science, among other capabilities that were once the domain of high tech. For example, the number of unfilled positions in the information and communication space in WE jumped from 117,000 to 167,000 between only 2016 and 2018,⁸ and given the growing demand for talent, the shortage is only likely to continue.

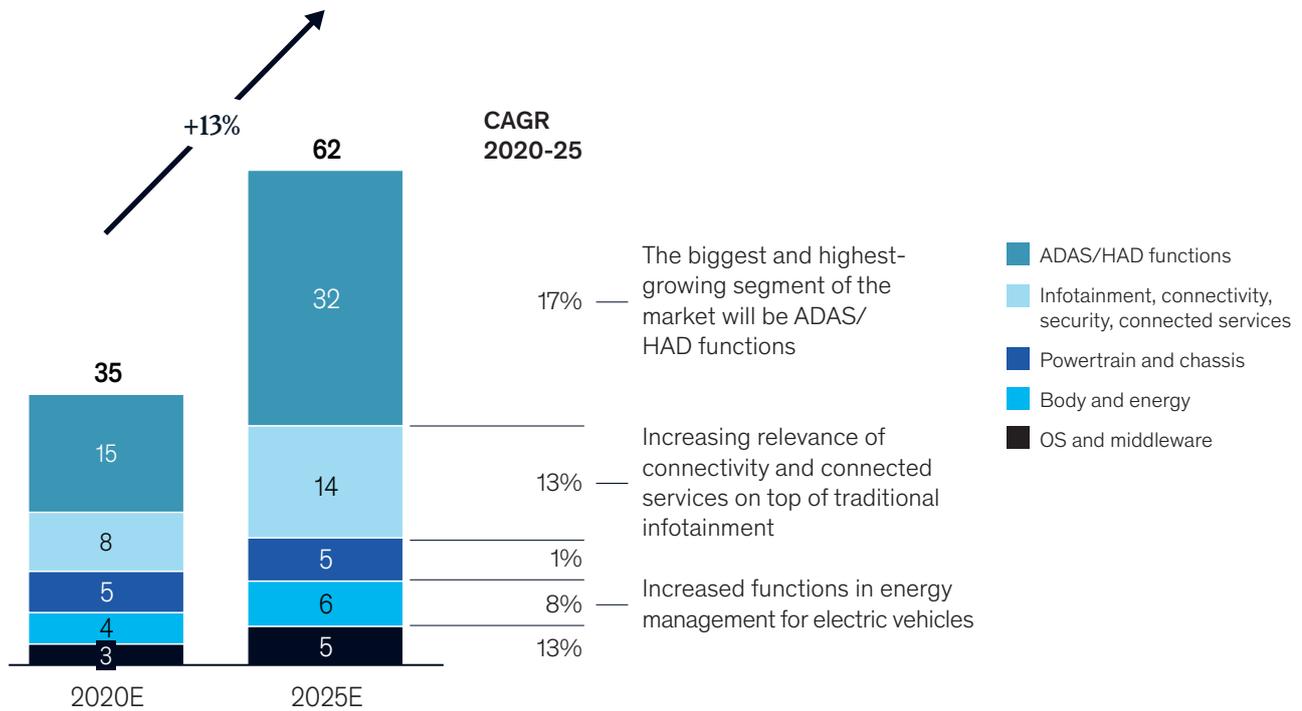
As this demand squeezes the supply and raises the cost of relevant talent in WE, automotive players have an opportunity to look eastward – just beyond their regional borders, as they did in the past with manufacturing.

⁷ Mobility Market Model, McKinsey Center for Future Mobility, 2019.

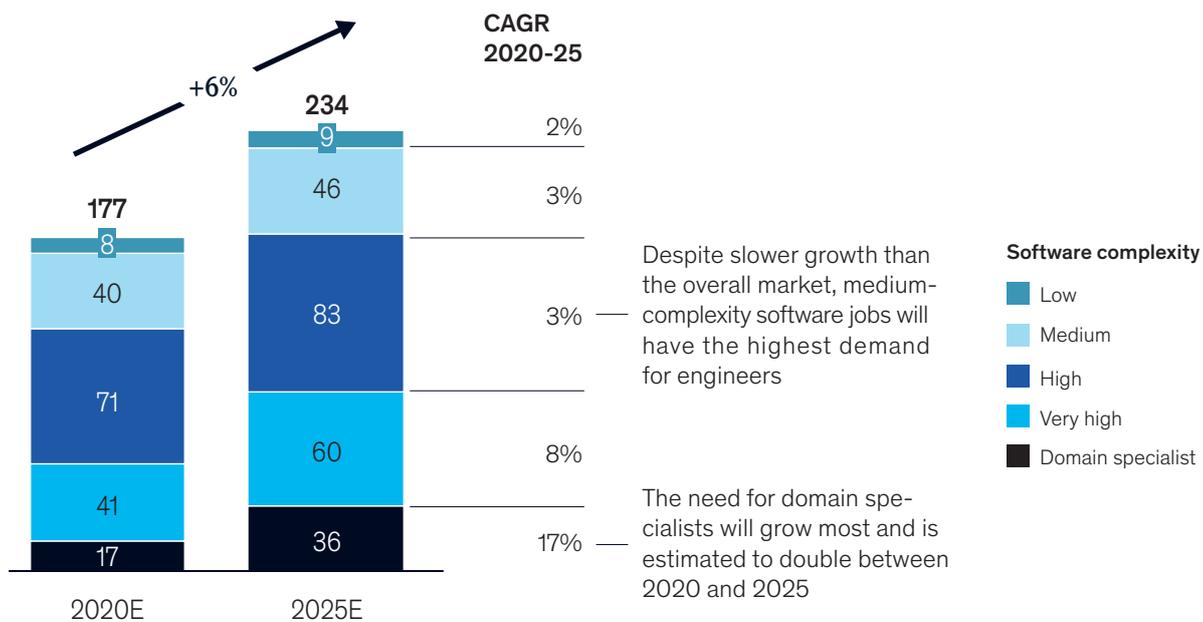
⁸ Eurostat's data on NACE job categorization; UNESCO Institute for Statistics.

The annual 13% growth of the software market in automotive will result in a 6% yearly increase in the demand for software engineers

Global market for software development efforts by domain,¹ 2020-25, USD billions

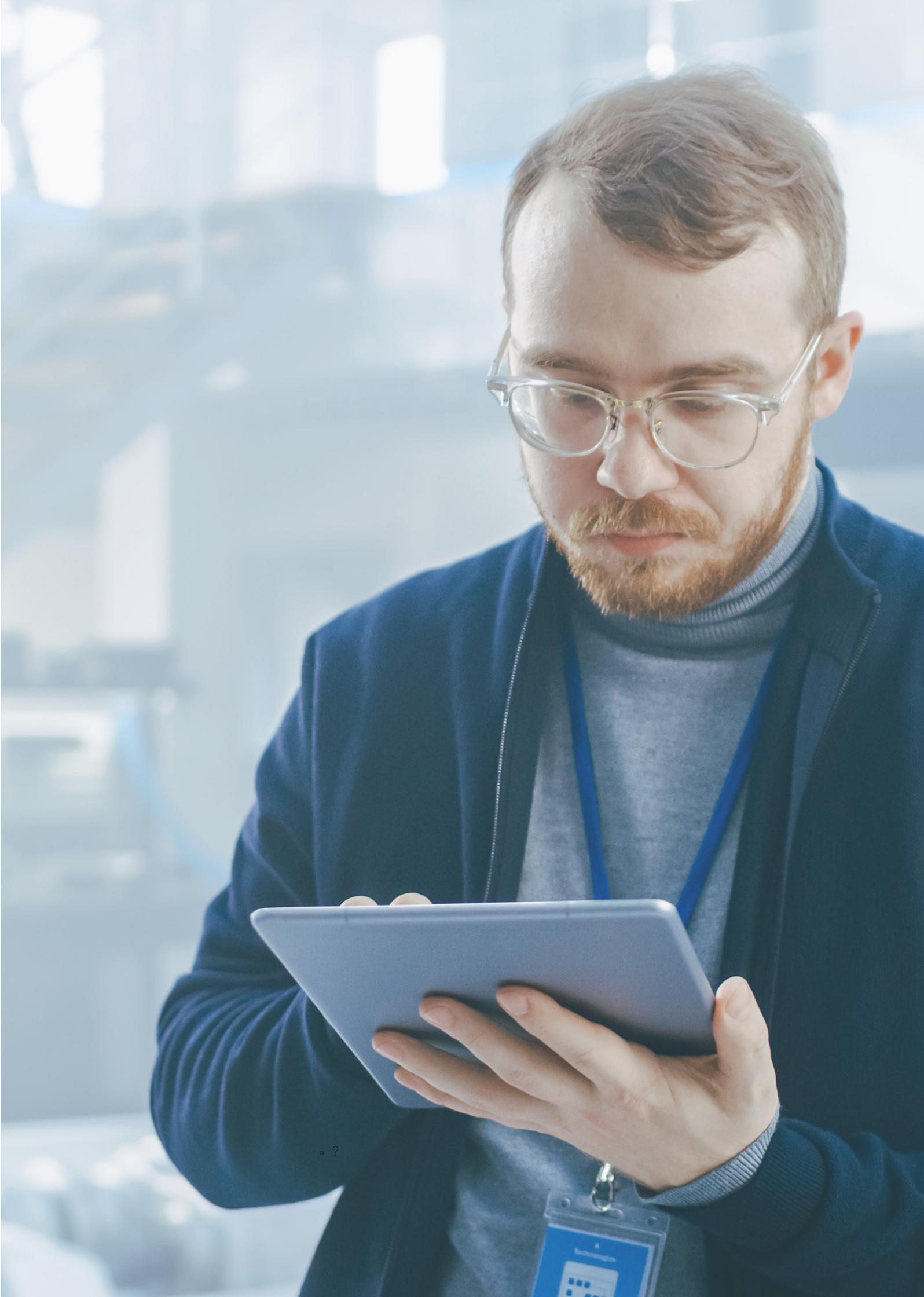


Global software FTEs need in the automotive industry, thousand software FTEs



¹ Software, incl. function development, integration, and verification/validation

Source: *The Internet of Things – how to capture the value of IoT*, McKinsey, May 2018; *Mapping the automotive software-and-electronics landscape through 2030*, McKinsey, July 2019



» ?

2 Solution

CEE's unique set of characteristics presents a compelling solution



Automotive players may want to consider three main options for addressing the challenges related to the growing demand for R&D talent. First, an organization could decide to source some of its R&D from Asia, where a large talent pool is available. In this scenario, however, WE players would face the challenges that accompany vast geographic distances in the supply chain at a time when supply chains are shortening, and the risks that come from working in a region where IP protection is a less realistic expectation. Additionally, there is some evidence to suggest that whatever cost benefit might come from relocation could diminish quite quickly given the rapid rise in labor costs in the Asian countries where relevant talent abounds.⁹ In China, for example, the annual salary for senior software developers nowadays is only EUR 10,000 less than it is in Germany (EUR 55,000 vs. EUR 65,000).¹⁰ For data scientists, the gap is even slimmer at EUR 87,000 in Germany and EUR 85,000 in Asia.

Second, automotive companies could outsource certain R&D activities to other companies. This could certainly be a path to decreasing costs, but companies could pay a steeper price in giving up control of a core capability.

A third strategy, near-sourcing, may potentially build on the pros of the first two options and limit the set of cons. Specifically, a set of five characteristics makes CEE an interesting option for automotive players looking to rethink their approach to R&D activities. The relative value of each and the way they combine vary by country and the needs of the particular automotive player.

Five beneficial characteristics of the region make CEE countries optimal locations for R&D centers

Available talent pool

In CEE, there is a high-potential workforce available with a relevant talent pool of approximately 6.6 million people, similar to Germany's of approximately 8 million but with less competition for talent.

Competitive wages

Prevailing R&D and software-development-related wages in CEE are, on average, 60 percent lower than in WE, with wages varying by as much as four times between countries.

Automotive manufacturing and R&D maturity

R&D activity in the region is far from saturated, with less than a 1.5 percent gross value added (GVA) share. Significant white spots are non-saturated R&D capabilities, especially for OEMs where R&D is seven times smaller in CEE (1.9 percent) than in Germany (13.4 percent).

Well-developed infrastructure

Well-developed physical infrastructure exists, such as short distances to international airports, approximately two-hour flights, an efficient highway network, and high-quality digital infrastructure.

Government support

Programs and incentives such as tax exemptions and cash grants administered by local governments and investment agencies attract higher-value-adding work to the region.

⁹ Hua, Sha. "German firms face staffing woes as Chinese labor costs skyrocket," *Handelsblatt*, August 2018, <https://www.handelsblatt.com/today/companies/not-so-cheap-german-firms-face-staffing-woes-as-chinese-labor-costs-skyrocket/23583006.html?ticket=ST-34728192-EiYZedWcPKx7OqqcylQT-ap2>.

¹⁰ "Germany," *Salary Survey 2018: Europe*, Robert Walters, 2018; "China," *Salary Survey 2019: Greater China & South East Asia*, Robert Walters, 2019.

Available talent pool

CEE ranks high in the availability of software development talent; in the availability ranking, the top five countries are all in CEE. The total talent pool of all related professions in the CEE region stands at 6.6 million.¹¹ This set of appropriately skilled prospective employees – including current university students studying highly relevant fields – is only about 10 to 15 percent smaller than the current talent pool in Germany (8 million) (Exhibit 3).¹² And unlike Germany, for example, the relevant employer market in CEE is far from saturated.

Much of the availability is simply a matter of competition. Looking at the 50 most attractive employers for engineers, the average country in WE hosts 47 of them, whereas the average CEE country hosts only 30 (from around 20 in Estonia to around 40 in the Czech Republic and Poland) (Exhibit 4).¹³ A limited presence of engineering/IT companies in CEE means less competition for software engineering talent. However, it is reasonable to assume that given a wider set of employment options, a significant share of the most talented might consider working for a

¹¹ Labor agency reports (2017-18) in IT-related segmentation of respective countries; Eurostat's data on NACE job categorization.

¹² Labor agencies of respective countries.

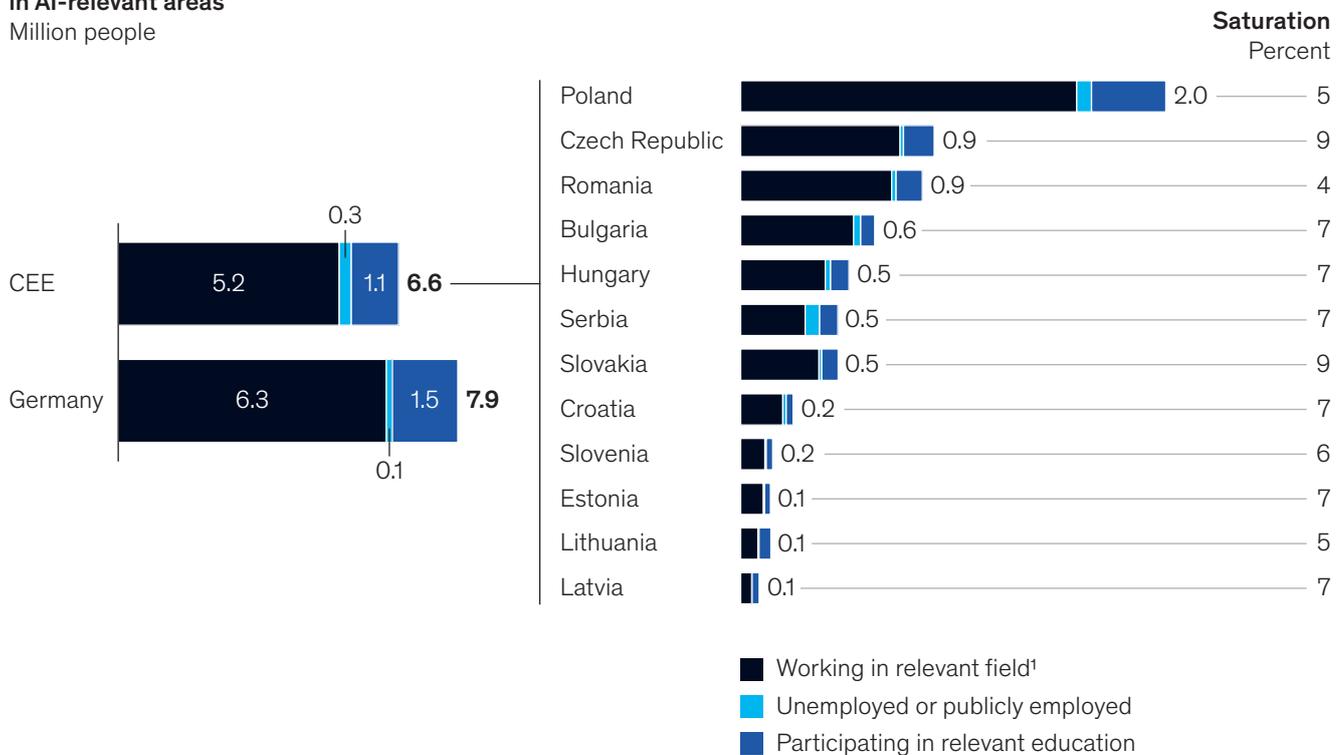
¹³ Barck, Jonas. *Europe's Most Attractive Employers 2018* (engineering/IT category – top 50 list), Universum, 2018.

Exhibit 3

With 6.6 m people, CEE has a similar relevant workforce size to Germany while still being far from saturated

Total talent pool consisting of relevant profiles¹ currently working, studying,² or looking for jobs³ in AI-relevant areas

Million people



¹ Classification of professions differs between CEE and Germany, thus "working in relevant field" was determined after a matching exercise, but defined as engineer, software engineer, data engineer, machine operator (employment in other industries excluded)

² Current STEM university, vocational school, and adult education students

³ Publicly employed or unemployed

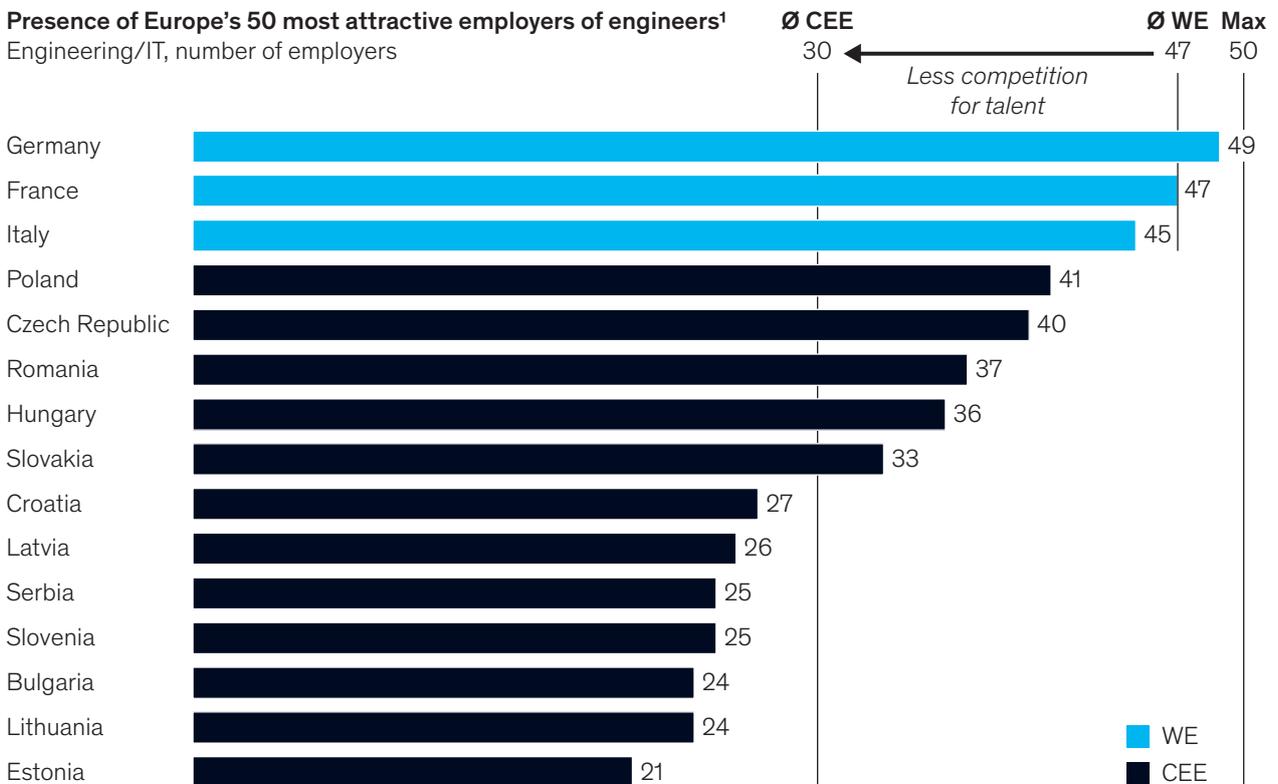
Source: Labor agency reports (2017-18) in IT-related segmentation of respective countries; Eurostat's data on NACE job categorization

WE automotive player that has set up an R&D center in their country. With a foothold in CEE, the automotive company is then in a position to further build and shape the talent supply in the region through, for example, internal upskilling/reskilling or collaborations with local universities.

Nearly a quarter of the top 20 OEMs and half of Europe's top suppliers are already present in the core automotive countries in CEE, but the focus is currently on manufacturing as only a few players are engaging in R&D activities in the region.

Exhibit 4

Competition for talent is less intense in CEE due to fewer top engineering employers



¹ Universum Global, *Europe's Most Attractive Employers 2018*, engineering/IT category – top 50 list: Google, Microsoft, IBM, Siemens, Daimler/Mercedes-Benz, Bosch, General Electric, Airbus Group, Intel, BMW Group, McKinsey & Company, Apple, Nestlé, BCG, Amazon, Unilever, VW Group, Bayer, L'Oréal, ABB, Bombardier, Shell, Deloitte, PwC, Philips, EY, IKEA, Volvo Car Corporation, Samsung, BASF, Heineken, Sony, Johnson & Johnson, Rolls-Royce, Accenture, Coca-Cola, E.ON, Procter & Gamble, Oracle, Cisco Systems, Huawei, Goldman Sachs, Novartis, Roche, Thales, Adidas, European Space Agency, Schneider Electric, KPMG, J.P. Morgan

Source: Universum Global, *Europe's Most Attractive Employers 2018* (engineering/IT category – top 50 list)

Competitive wages

Near-sourcing to CEE countries can also address the challenge of the high cost of R&D talent in WE. Although there is a wage variance factor of four across CEE countries for the technical field from an annual salary of approximately EUR 40,000 in Slovenia to EUR 10,000 in Serbia,¹⁴ on average, annual salaries in the relevant technical fields in CEE are around 60 percent lower than those in WE.¹⁵ As one would expect, wages also vary within CEE countries, with average wages lower in rural areas compared to those in urban centers. However, it should be noted that the universities that might develop this software-related talent are not solely located in urban centers, but also in the

lower-wage cities of less developed regions of many CEE countries. In Hungary, for example, three of the lower-wage cities are home to universities with technical faculties as well.¹⁶ Even though CAGR in wages in CEE rose approximately 3.1 percent over the last ten years – a faster pace than in WE, which showed average growth of approximately 2.7 percent – the nominal wage difference between CEE and WE for these fields actually widened due to the baseline effect. The wage difference is highest for software developers, and this category is also where the largest increase happened (Exhibit 5). Combined, these data points make the region even more attractive for WE automotive companies.

¹⁴ National statistics agencies.

¹⁵ Labor agency reports (2017-18) in IT-related segmentation of respective countries; Eurostat's data on NACE job categorization; fDi Benchmark, a service of the Financial Times Limited 2019.

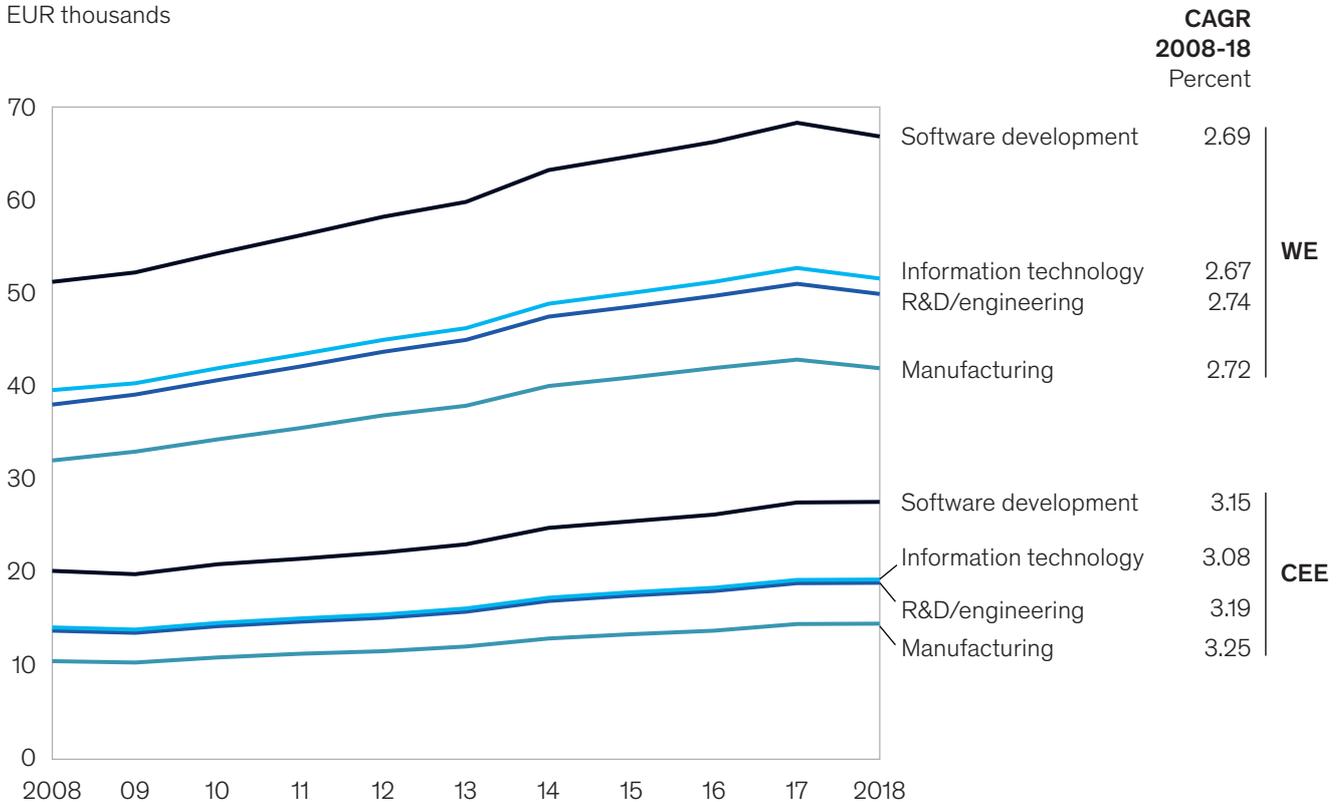
¹⁶ National statistics agencies.

Exhibit 5

Although wages have been growing in CEE slightly more quickly percentagewise than in WE, the nominal difference has widened, especially for software developers

Annual wages in different technical fields of the R&D value chain in CEE and WE¹

EUR thousands



¹ Selected EU members with strong automotive industry relevance: Sweden, Spain, Portugal, Netherlands, Italy, Germany, France, Austria

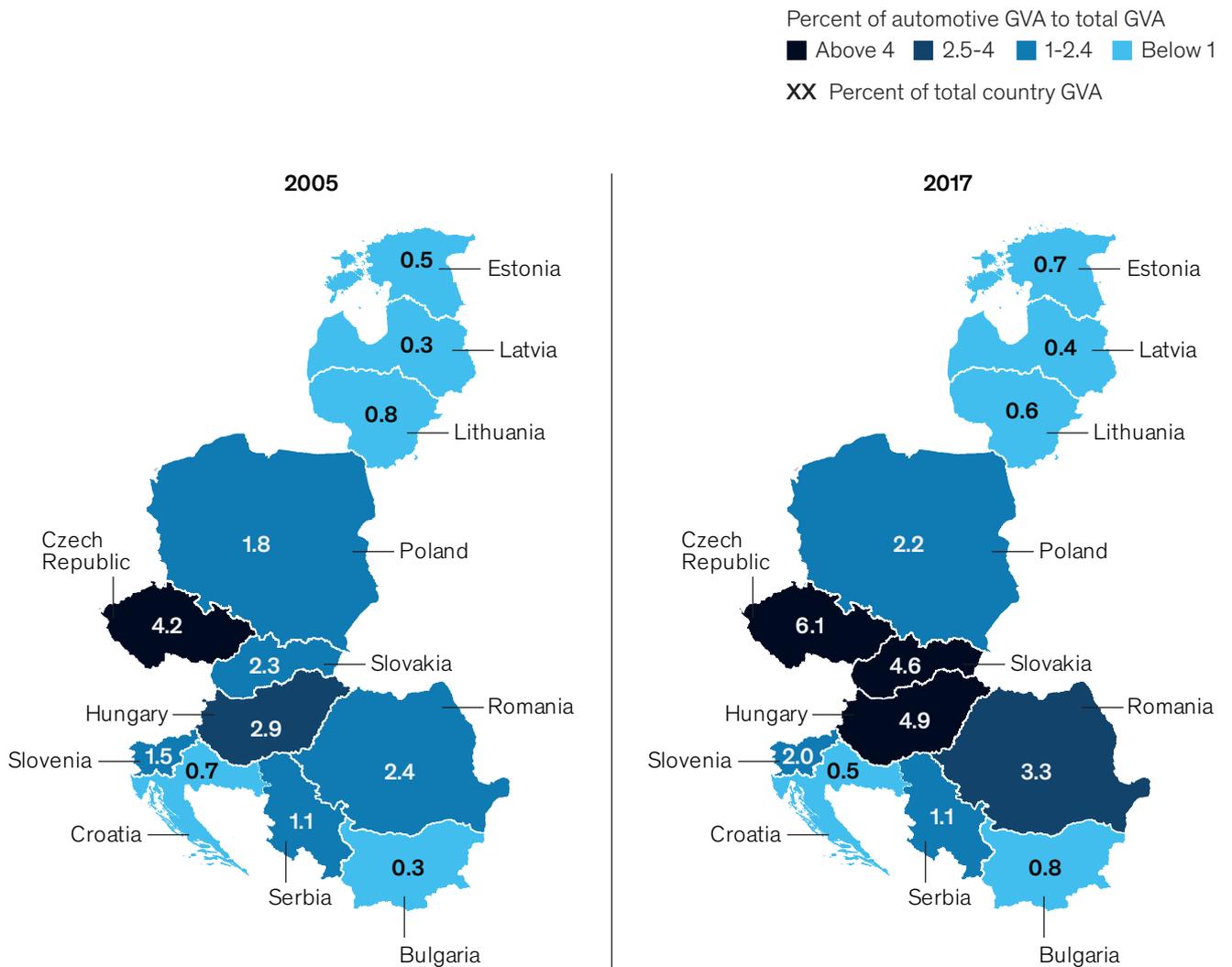
Source: fDi Benchmark, a service of the Financial Times Limited 2019

Automotive manufacturing and R&D maturity

Automotive players looking to establish R&D centers in CEE will find that the region has the benefit of already having automotive companies, while not being oversaturated with R&D activities. Specifically, the automotive sector has been growing rapidly in the past 12 years, exceeding 4 percent of country GVA in countries such as the Czech Republic, Slovakia, and Hungary. In other CEE regions, growth has reached a maximum of 0.9 percent GVA (Exhibit 6).

Exhibit 6

The automotive sector has grown rapidly within the region, exceeding 4% of country GVA in some countries



Source: National statistics offices

Business R&D activity did not follow a growth trajectory similar to that of automotive manufacturing within the CEE region. In most CEE countries, the GVA share remains below 1.5 percent, leaving further potential for growth (see Exhibit 7). R&D activity in all of CEE amounts to just one-seventh of the activity in Germany, the most developed automotive country in WE.¹⁷

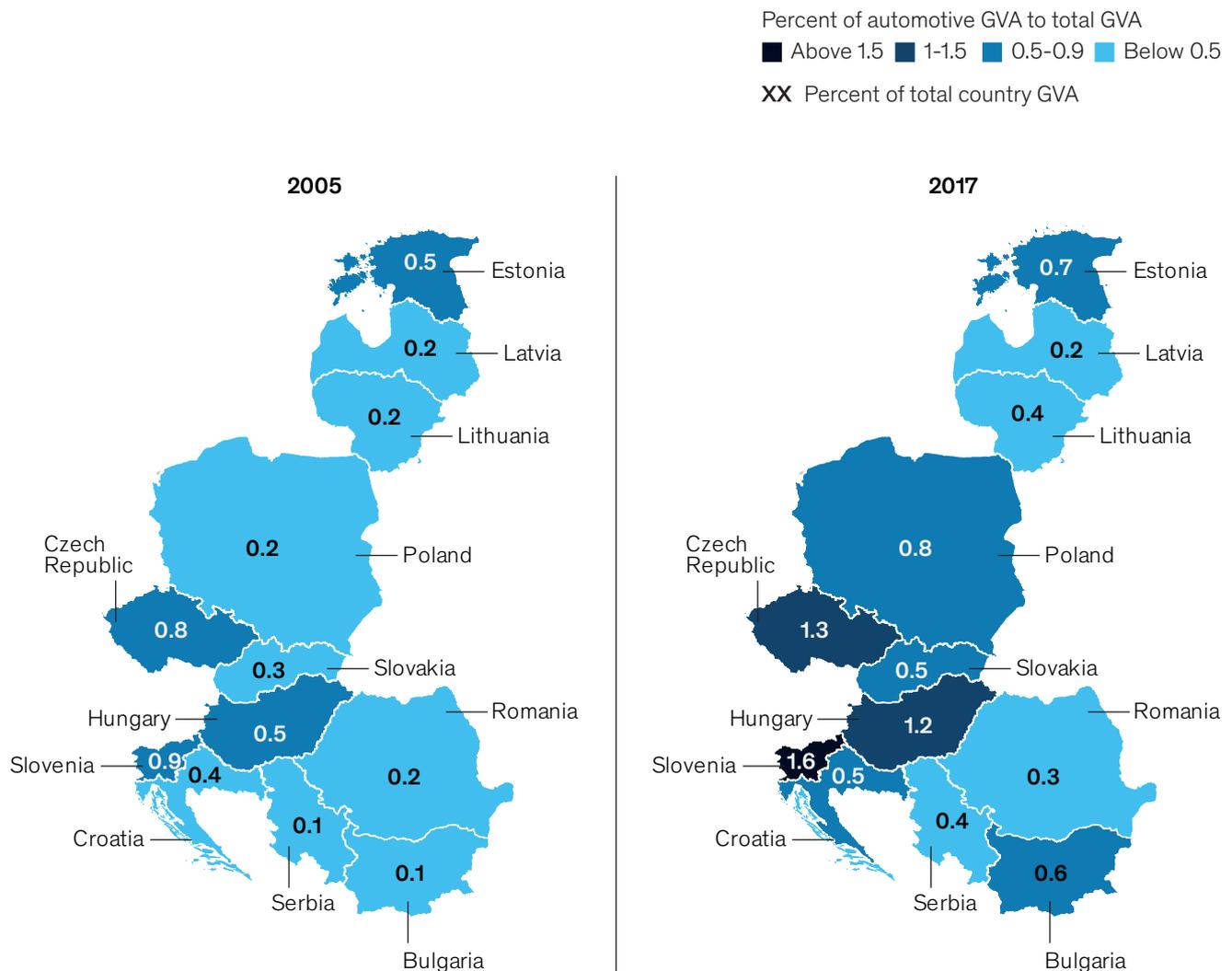
But there are also great examples of companies already making use of the CEE opportunity. Bosch, for example, has 4,300 R&D FTEs in CEE working on software development, ADAS,¹⁸ and braking systems. Continental has 6,700 such FTEs in the region working on similar R&D activities.

¹⁷ Eurostat's data on NACE job categorization; UNESCO Institute for Statistics.

¹⁸ Advanced driver-assistance systems.

Exhibit 7

Business R&D activity did not follow a similar growth pattern to automotive manufacturing, leaving further potential for growth



Source: National statistics offices

Well-developed infrastructure

On the physical side, a network of airports accessible to most CEE cities with short, direct flights to Germany and an established highway network efficiently connect WE and CEE (Exhibit 8). On the digital side, fast and secure

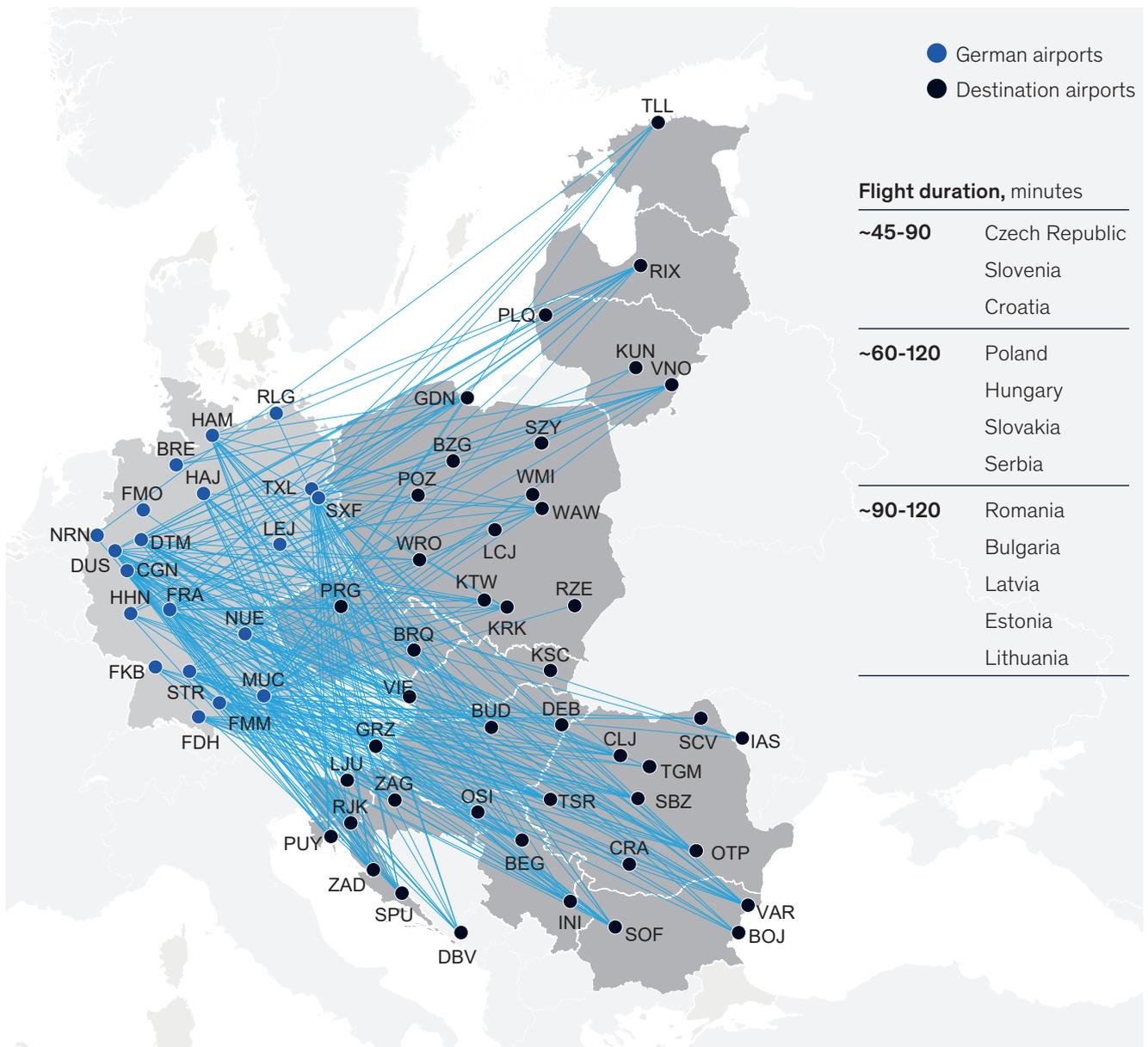
Internet connectivity provides a solid infrastructure for business. For example, most of the region has 90 to 100 percent LTE network coverage, with only some parts of the region lagging behind with coverage of around 70 to 80 percent.¹⁹

¹⁹ Eurostat's data on NUTS 2-3 level on mobile network/Internet coverage for all CEE countries; press search on 3GPP, GSMA, IEEE for network coverage; R&I and McKinsey Rapid Research at Evalueserve Research.

Exhibit 8

Most international airports in CEE have a direct connection with frequent flights to Germany's main airports

Direct flight connections between Germany and CEE airports



Source: Airline websites; McKinsey analysis

Government support

Government support varies across countries (Exhibit 9), but in general, the governments of CEE countries have implemented policies and procedures to encourage bringing R&D activities to the region. Specifically, tax breaks and investment subsidies, among others, incentivize near-sourcing, and streamlined processes minimize bureaucratic red tape and facilitate the process. The Czech Republic's investment incentives increasingly favor R&D work,²⁰ and Hungary's shift from "Made in Hungary" to "Invented in Hungary" are emblematic of a growing R&D culture in the region.²¹ For these countries, along with Poland and Romania, total direct funding and subsidies for business R&D exceed the OECD average.²² Hungary's government has provided 18.6 percent of the country's investment in R&D, nearly twice the OECD average of 10.2 percent (the proportion of R&D business coming from a combination of direct funding and tax subsidies). Additionally, governments fund universities to offer training and establish partnerships that are aligned with the needs of WE automotive players, such as the Lithuanian Akademija. IT project – a state-funded program to develop IT talent.²³ In addition to the clear and direct monetary benefits, CEE governments also offer a range of support services to companies investing in the region. The portfolio of services depends on the country and the size of the operation but can include everything from coordinating access to healthcare and offering temporary office space all the way to providing language-related services for expatriates.

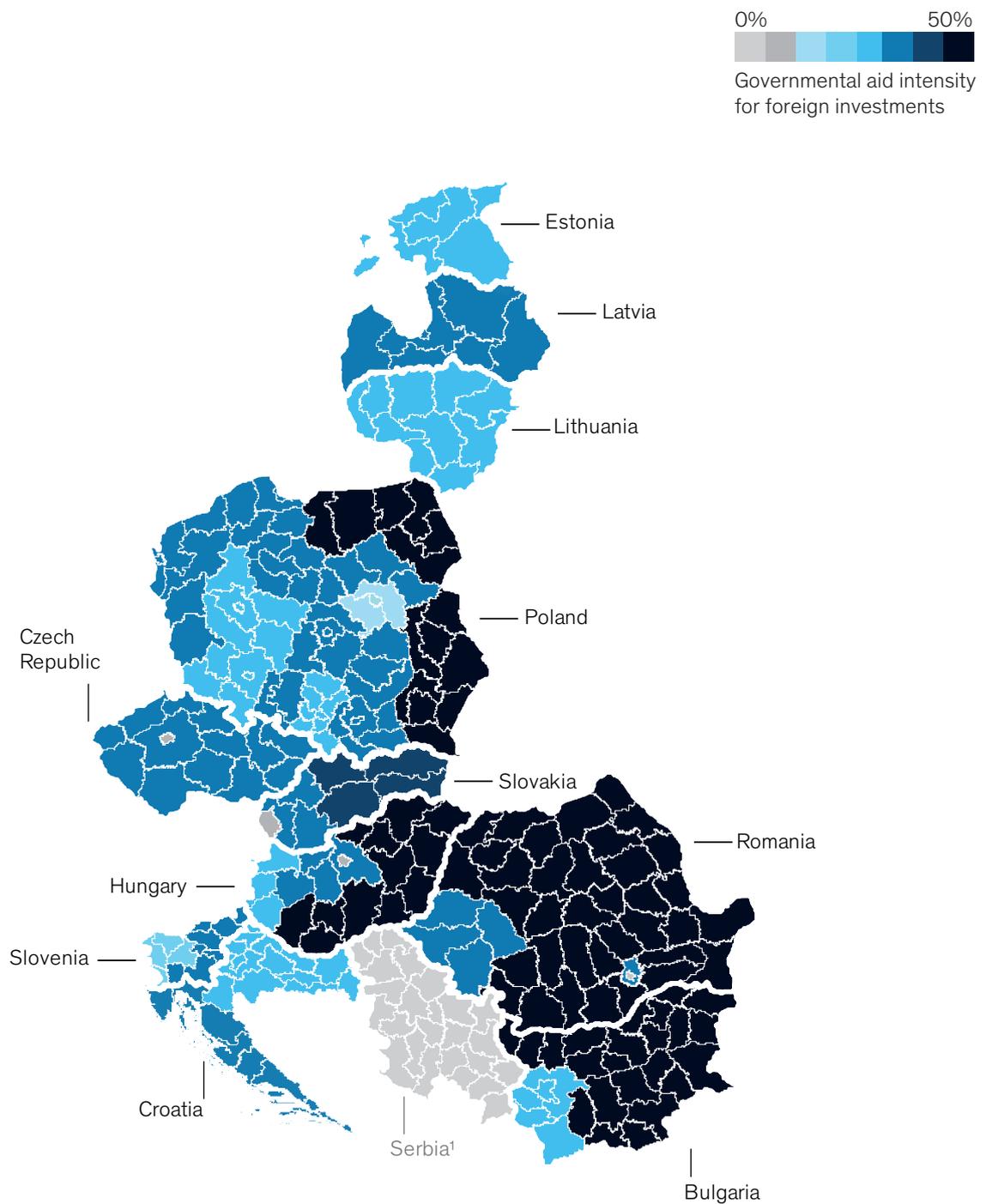
²⁰ "R&D funding," CzechInvest, <http://www.czech-research.com/rd-funding/>.

²¹ Béni, Alexandra. "The road from 'made in Hungary' to 'invented in Hungary,'" *Daily News Hungary*, April 2019, <https://dailynewshungary.com/the-road-from-made-in-hungary-to-invented-in-hungary/>.

²² "Measuring tax support for R&D and innovation," OECD R&D Tax Incentive Database, March 2019, <http://oe.cd/rdtax>.

²³ <http://akademija.it/>.

The intensity of available governmental support differs not only between countries but also between regions



¹ Not included in EU state incentives

Source: List of all investment agencies: InvestBulgaria; Investment Promotion Division, Croatian Chamber of Economy; CzechInvest; Invest in Estonia; Hungarian Investment Promotion Agency (HIPA); Investment and Development Agency of Latvia; Invest Lithuania; Polish Investment and Trade Agency; InvestRomania; Development Agency of Serbia; Slovak Investment and Trade Development Agency (SARIO); InvestSlovenia; press search

3 Activities

Seven actions will help position
WE automotive OEMs and
suppliers to near-source to CEE



The growing importance of R&D in automotive and the abundance of affordable, highly skilled engineering talent in CEE are what make the R&D near-sourcing strategy a potentially valuable solution. Automotive OEMs that want to position themselves to benefit from this potential value are advised to engage in seven strategic actions across three key objectives:

- Developing a complete perspective of the company's R&D landscape and identifying activities suitable for near-sourcing
- Assessing new R&D center location options based on a set of predefined criteria
- Building relationships in the selected region and preparing for the new R&D center launch.

McKinsey has a proven framework, derived from numerous near-sourcing projects over the years, that could help WE automotive industry players successfully set up a near-sourced R&D center in CEE. In the following, we will discuss in greater detail the three key objectives and the relevant strategic activities (A to G) relating to them.

Three key objectives organizations should pursue when setting up an R&D center to near-source activities to the CEE region

Identify

- A. Diagnose and benchmark your organization's R&D landscape
- B. Develop an R&D target picture and define clear objectives for near-sourcing activities
- C. Systematically review the R&D activities

Locate

- D. Apply a scoring model to all potential sites
- E. Further evaluate sites based on specific company requirements and resources

Initiate

- F. Contact the local investment promotion agency
- G. Plan the site setup

3.1 Identify: Develop a complete perspective of the company's R&D landscape and identify activities suitable for near-sourcing

The first set of strategic actions helps create a full picture of an organization's R&D landscape and places that landscape in a broader context. With this information, an organization is then in a position to make informed decisions about its R&D aspirations and identify specifically how near-sourcing might help get them there.

A. Diagnose and benchmark your organization's R&D landscape to identify improvement potential from near-sourcing

Automotive companies have historically made decisions about how to optimize their R&D activities, for example through a pure cost play lens. In the best cases, focusing only on cost has meant that even when a strategy was ultimately able to deliver cost savings, the ramp-up took much longer than expected. In the worst cases, these strategies have failed completely.

Looking ahead, R&D footprint optimization requires more balanced thinking. Automotive companies will likely want to consider a set of broader aspects when setting their particular R&D near-sourcing strategies:

Access. Evaluate globalization opportunities considering access to markets, talent, and technology, and factor cost advantages.

Capabilities. Optimize the worldwide R&D footprint and partner network by taking advantage of local capabilities.

Efficiency. Increase efficiency by bundling activities with specific competence requirements in R&D centers.

Governance. Install global governance with clear competence profiles for each location and enable effective collaboration between the R&D hub and local R&D centers.

In general, and by their own admission, automotive players exhibit low readiness when it comes to restructuring their R&D footprint. Nearly two-thirds of the respondents in a survey of automotive players who describe themselves as top R&D performers report near-sourcing more than 30 percent of their R&D spend. But only about one-fourth of average R&D performers report near-sourcing such a large share.²⁴

B. Develop an R&D target picture and define clear objectives for near-sourcing R&D activities to CEE

Organizations are advised to have a clear R&D target picture and defined objectives for near-sourcing R&D activities to the CEE region (Exhibit 10). Near-sourcing R&D activities is typically driven by six main objectives – (i) a low R&D cost base, (ii) access to local market information, (iii) access to talent, (iv) proximity to technology/manufacturing, (v) reduced complexity and interfaces, and (vi) access to the relevant ecosystem.

Near-sourcing objectives are likely to differ based on the nature of R&D activities in question. Near-sourcing low-complexity, traditional R&D activities, such as simple design, data conversion, prototyping, and testing, may be motivated by the objective to lower the R&D cost base for these activities or ensure proximity to local manufacturing sites. On the other hand, the motivation for near-sourcing high-complexity, innovative R&D activities, such as software development for the next-generation human-machine interface (HMI) and autonomous driving, is more likely to be about accessing the relevant talent and ecosystem.

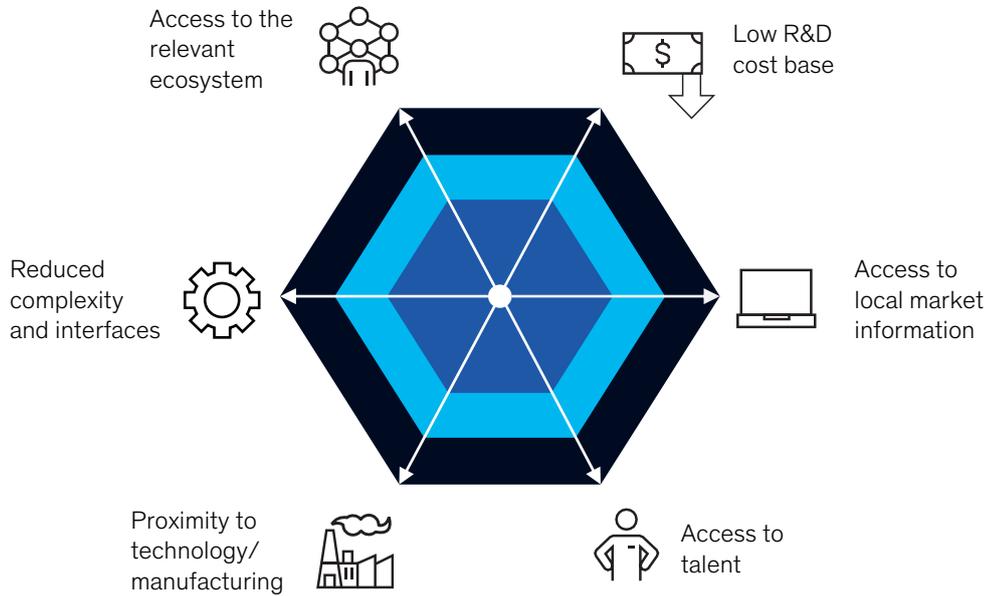
Of the objectives outlined above, the CEE region is particularly beneficial in terms of a lower R&D cost base, access to talent, and reduced complexity and interfaces.

²⁴ "R&D of the future," global survey, McKinsey, 2018.

Organizations need to have a clear R&D target picture and defined objectives for near-sourcing R&D activities to CEE

Near-sourcing objectives

■ High ■ Medium ■ Low



Near-sourcing R&D activities is typically driven by 6 main objectives – CEE is especially favorable for having access to talent and a lower R&D cost base while keeping interface complexity manageable

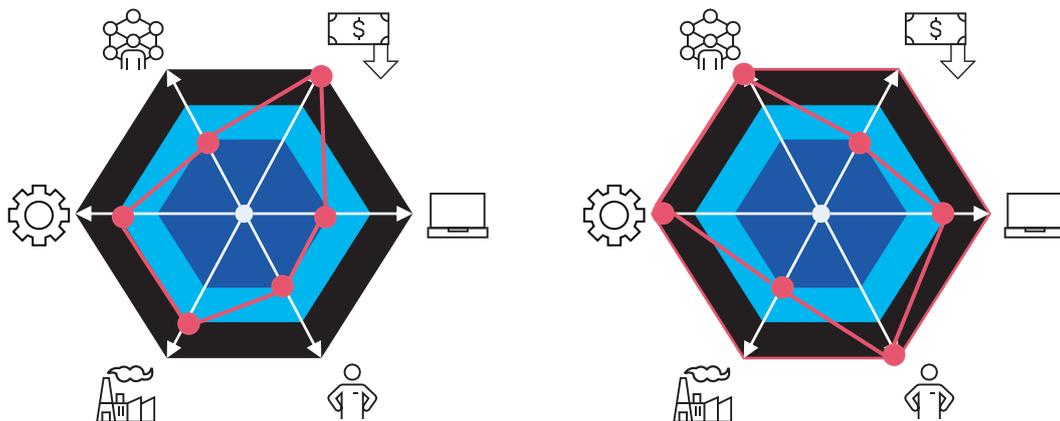


Example – prioritization of objectives according to the nature of R&D activities

● Example target picture

Low-complexity, traditional R&D, e.g., simple design, data conversion

High-complexity, innovative R&D, e.g., next-generation HMI, autonomous driving



Near-sourcing objectives are likely to differ based on the nature of the R&D activities to be near-sourced

Source: McKinsey

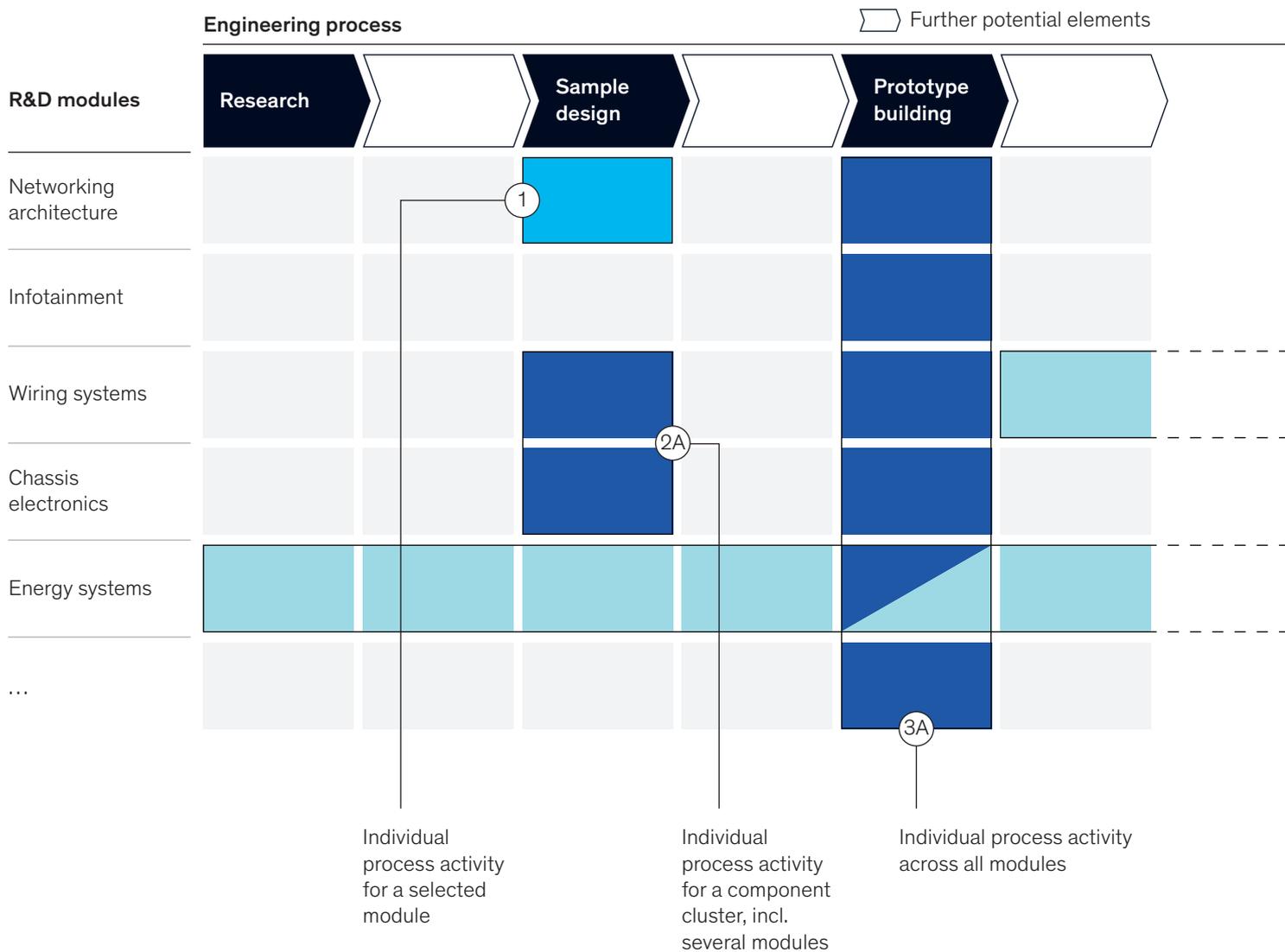
C. Systematically review the R&D activities and identify suitable ones for near-sourcing

Mapping R&D activities by module as well as by the number of engineering processes they involve is the first step in prioritizing the merits of near-sourcing those activities (Exhibit 11). Many companies choose to start with one intersection on this map, i.e., bringing one R&D activity of one module into

a new, near-sourced R&D center (1 in Exhibit 11). As activities ramp up and processes, structures, and the organization as a whole solidify, companies might start expanding along different pathways. Some companies have opted to grow their new R&D centers into global hubs or competency centers for particular aspects of R&D (2A and 3A in Exhibit 11).

Exhibit 11

Organizations have several options for how to approach the near-sourcing of R&D activities



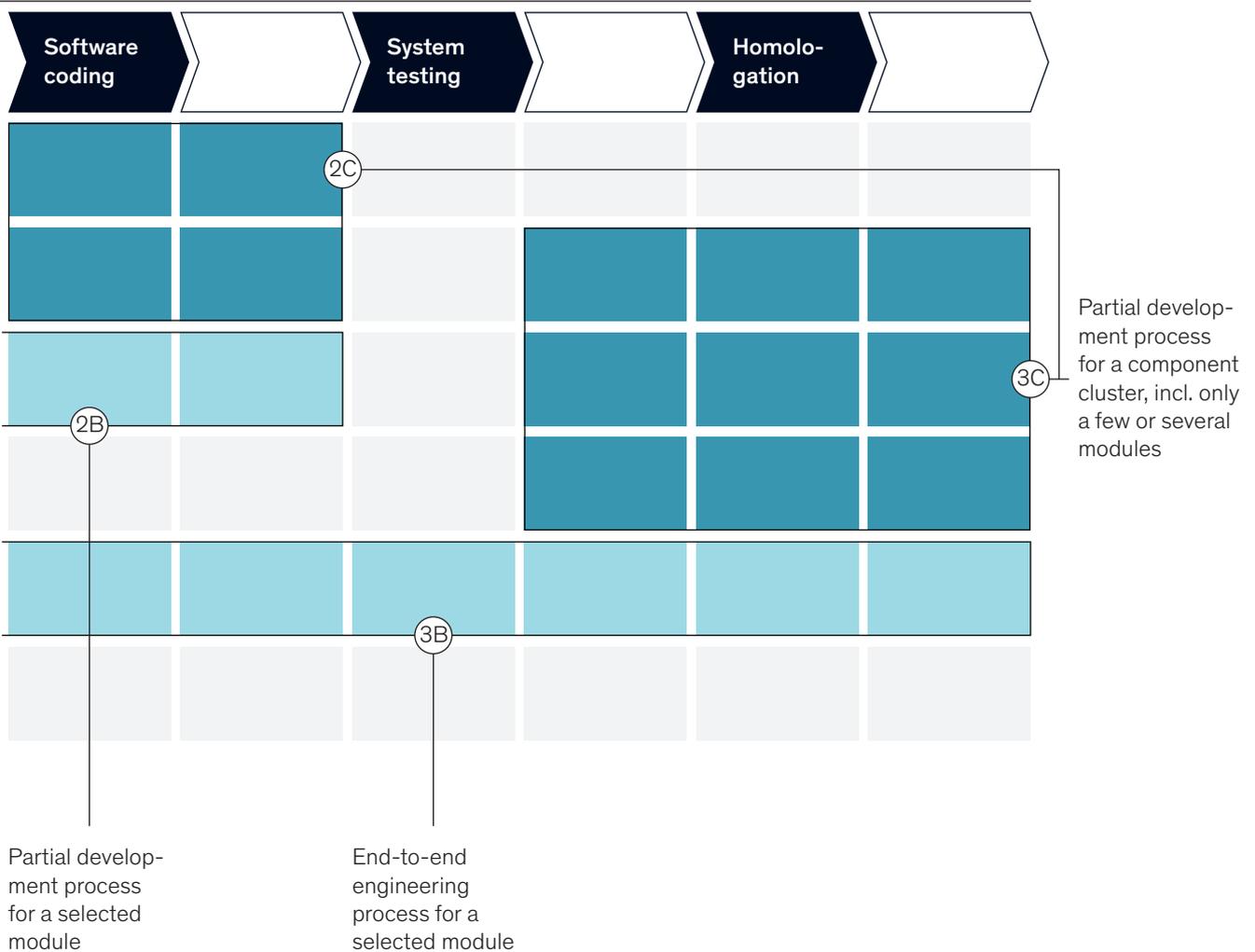
Source: McKinsey

Others have expanded their activities within the same modules but this time including additional steps of the R&D process (2B and 3B in Exhibit 11). A third option that has been observed is building on the existing functional strengths of the new R&D center and starting the same type of R&D activity for other products too.

These pathways can also be applied in combination. Companies can choose to grow both the functional and module angles in parallel so that they deepen the original activity at the same time (2C and 3C in Exhibit 11).

Near-sourcing options to expand R&D activities

- ① Start with the near-sourcing of individual process activities
- ②A / ③A Expand these processes to additional modules or across all modules
- ②B / ③B Start transferring a few other processes or the entire end-to-end process for a selected module (or module cluster)
- ②C / ③C Transfer both additional processes and modules as a combination of 2A/3A and 2B/3B



Key to success is that the horizon for activities to be near-sourced to the new location can progress over time by adding more business-critical activities.

This approach allows upskilling, provides career advancement opportunities, maintains motivation of existing employees, and leverages the full potential of near-sourcing. Failing to consider this could lead to attrition problems, a fall in motivation, loss of efficiency, and friction losses at the interfaces.

This concept of sequencing the near-sourcing activities still leaves us with the question of which R&D activity in which R&D process and in which module to near-source first.

One way of looking at this question is to assess all R&D activities along two dimensions: (i) business criticality and (ii) modularity (Exhibit 12).

Activities with well-defined interfaces and low criticality for business success are best suited for near-sourcing (normally 40 to 50 percent of the total engineering workload).

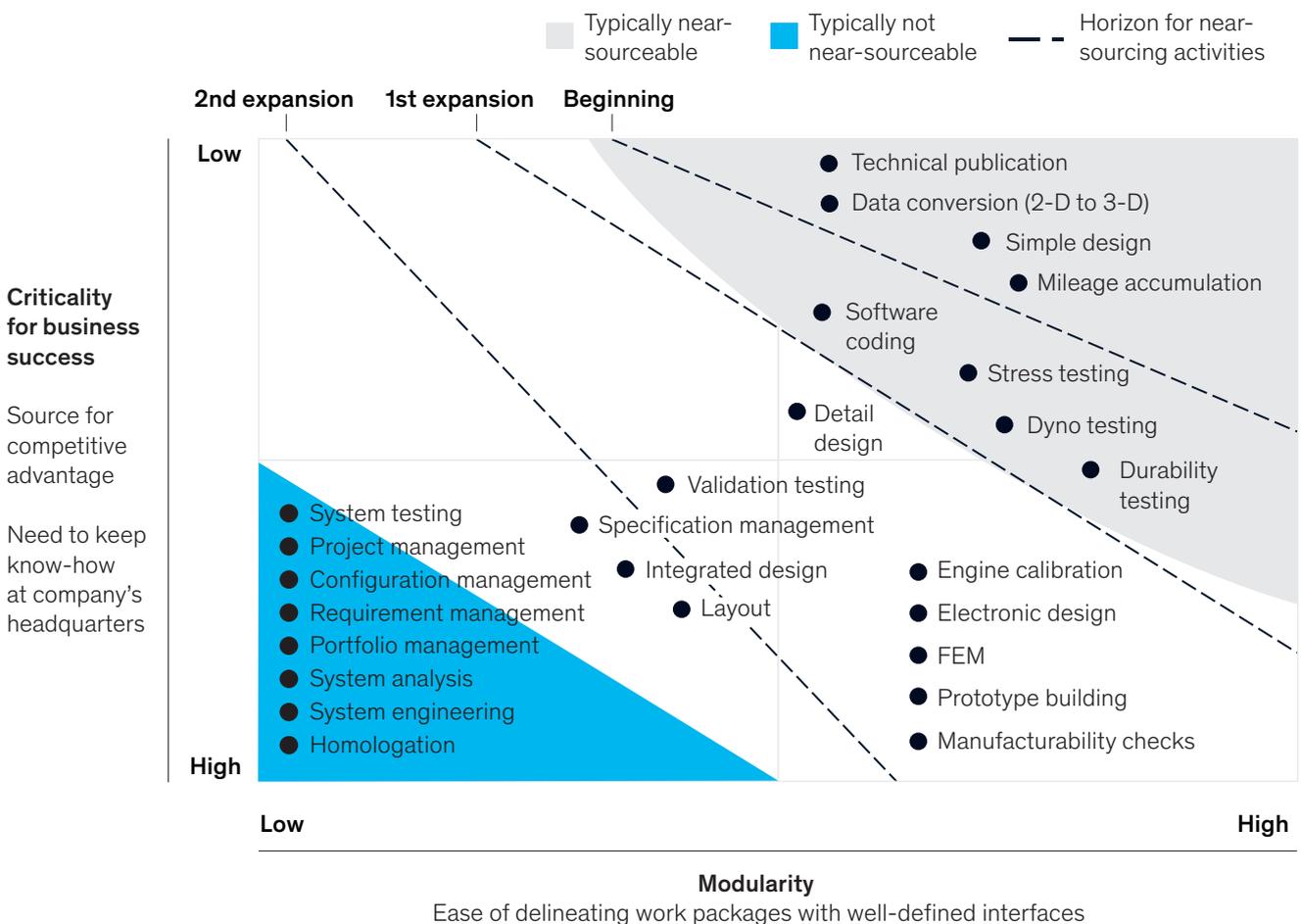
Before reaching a final decision on the activities to be near-sourced, critical analyses should be conducted (Exhibit 13). Specifically, when determining whether an activity can be near-sourced, automotive players should:

- Assess the skill base in the new location
- Define the interfaces and split of work
- Determine the need for local proximity
- Get clarity on location risks
- Identify the legal/regulatory hurdles.

Exhibit 12

Which process activities to near-source depends on business criticality and modularity

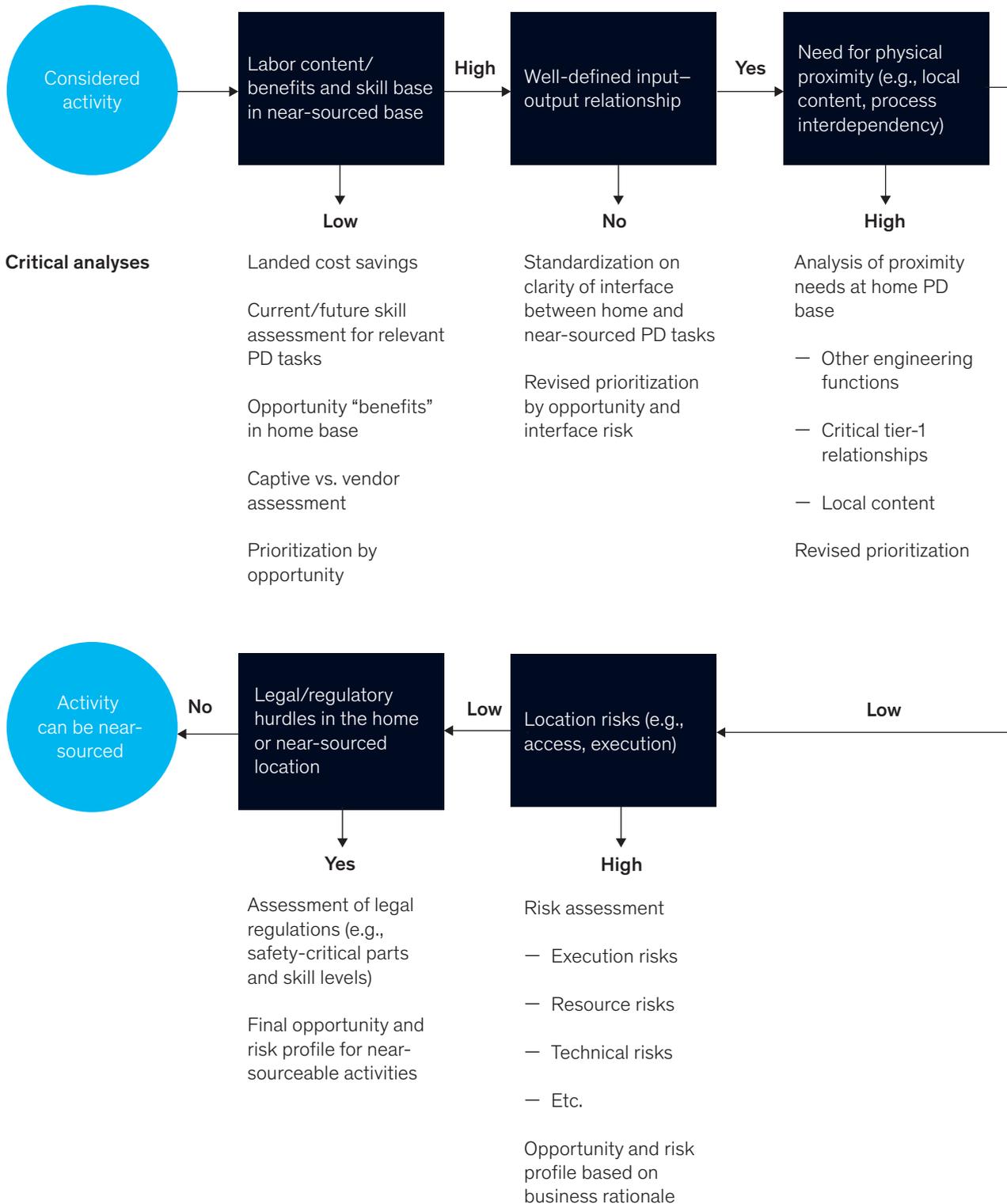
Company-specific line, determined by willingness to near-source



Source: McKinsey



For each selected R&D activity, critical analyses need to be performed to determine the actual potential for near-sourcing



Source: McKinsey

3.2 Locate: Assess new R&D center location options based on a set of predefined criteria

The 12 countries of the CEE region – Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, and Serbia – have very different characteristics. This next set of strategic actions helps organizations determine which might be the best country to set up an automotive R&D center in (Exhibit 14).

CEE is very heterogeneous across countries and above all across regions. There are related strengths and weaknesses to be considered, and if we look at regions within a specific country, there

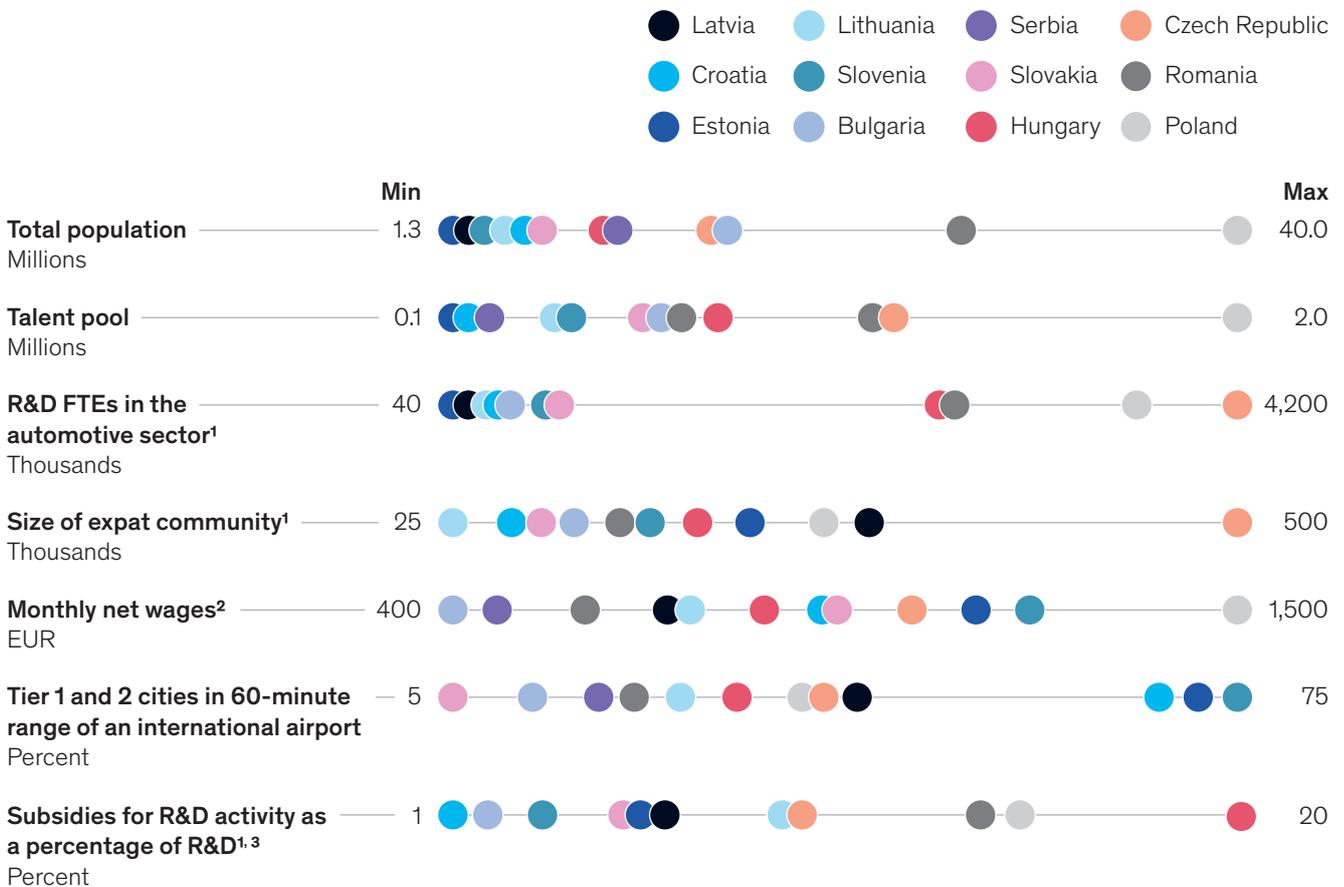
are differences beyond those that arise in a cross-country comparison. For example, the average monthly gross wage in Hungary is approximately EUR 993 (2018) compared to the average wage in Romania of about EUR 833 (2018).²⁵ However, within Hungary, the spread of overall net wages is as high as 82 percent between the lowest in Szabolcs-Szatmár-Bereg (EUR 501) and the highest in Budapest (EUR 911).²⁶ Similarly, other elements are also uneven. Thus, selecting the right location based on wages should be decided not primarily on a national level but rather on a regional or even municipal level.

²⁵ "Country comparison Romania vs Hungary," countryeconomy.com, <https://countryeconomy.com/countries/compare/romania/hungary?sc=XEAA>.

²⁶ Average gross earnings report of 2018, Hungarian Central Statistical Office, February 2019, <http://www.ksh.hu/gyorstajekoztatok/#/en/document/ker1812>.

Exhibit 14

CEE is a colorful region – its 12 countries vary to a high degree



¹ No information available for Serbia

² Maximum average salaries in the region

³ Direct funding and tax subsidies

Source: Government websites; country labor agencies; OECD data; McKinsey

D. Apply a scoring model to all potential sites to find possible locations

McKinsey’s R&D near-sourcing index for each subregion in CEE was developed to evaluate potential locations based on their most relevant characteristics. The index is based on the five main R&D-related characteristics that we described above as the key benefits of establishing a CEE-based R&D center.

By applying these criteria – weighted based on a company-specific prioritization (Exhibit 15) – a ranking of possible locations is obtained, specific to the given situation. Through this, locations can be found that are specific fits for certain R&D work, despite not being popular targets for other investments.

Exhibit 15

A scoring model has been developed to help companies identify a long list of locations according to their requirements

Example story

- 1 R&D center for high-end software development with a focus on designing digital user experiences, applying machine learning, and working on digital business innovation
- 2 R&D center for body and lighting testing and management of cloud infrastructure
- 3 R&D center for the development of a new braking system
- 4 R&D center for simple HMI programming as well as media and cluster functions
- 5 R&D center for work on embedded functions, i.e., engine, steering, and braking management

Model settings example
Percent

■ Weighted high □ Weighted low

	R&D maturity	Wages	Talent	Infrastructure			Government support	Example of top results	
	Number of R&D centers	Wages	University rankings	Competition for talent	Travel time	Network coverage	Population		Incentives
1	20	5	20	5	15	20	10	10	Krakow
2	15	5	25	20	5	5	5	20	Miskolc
3	15	35	15	5	5	10	10	25	Cluj-Napoca
4	15	20	10	10	10	5	10	20	Košice
5	15	40	10	0	0	0	0	35	Varna

Source: McKinsey

Final evaluation of short-listed locations requires a deep-dive analysis involving local stakeholders

Final evaluation criteria and example analyses

	Low R&D cost base	Detailed wage benchmark (e.g., of competitors, similar job profiles)
	Access to local market information	Relevant regional market size Relevant target group in the region
	Access to talent	Sizing of existing job market for AI/automotive R&D specialists and related professions (e.g., software engineer, data scientist, project manager, tester) Assessment of competition for talent Local university assessment and testing of appetite for cooperation
	Proximity to technology/manufacturing	Existing company operations in the region Relevant suppliers/vendors in the region
	Reduced complexity and interfaces	Door-to-door travel time from R&D or main company headquarters
	Access to the relevant ecosystem	Analysis of start-up, university, and automotive sector landscape Testing of appetite for cooperation
	Physical infrastructure	Full catalogue of available Class A office space locations from local real estate agency
	Digital infrastructure	Availability of 4G/5G coverage and glass fiber network
	Level of R&D maturity	Available market intelligence on automotive and other industry R&D centers in the region Maturity of local R&D ecosystem
	Culture and language fit	Foreign language literacy in the target group
	Provided government support	Contact with local investment promotion agency to understand support framework and requirements First meetings with national and local government representatives to “test the waters” Overview of future infrastructure investments that are already in the planning stages Government reference cases for bringing in R&D centers
	Legal/regulatory hurdles	Assessment of legal regulations

Source: McKinsey

E. Further evaluate sites based on specific company requirements and resources

A set of 12 characteristics may then be applied to the short list of locations in order to further narrow down the options (Exhibit 16). These characteristics span an organization's needs from cost and access through infrastructure to government support and regulatory hurdles.

3.3. Initiate: Build relationships in the selected region and prepare for the new R&D center launch

What can pose a real challenge for many organizations implementing their near-sourcing projects is the implementation process. Two actions related to the final stand-up of the CEE-based R&D center are designed with smooth implementation in mind.

F. Contact the local investment promotion agency to initiate the discussion for site selection

As discussed in Chapter 2, many CEE countries have policies to attract foreign investment. To support this, they run programs designed to help interested companies find their best investment location and have a smooth ramp-up. CEE countries also provide incentives that include direct funding and tax subsidies as well as a range of nonmonetary support services.

The benefits vary across CEE countries, but each country has a dedicated investment promotion agency. Establishing early contact with the appropriate agency is an important move for automotive players looking to source some of their R&D from CEE. This relationship usually proves very helpful for the design and setup of the R&D center and will help ensure that automotive players are in a position to take full advantage of every benefit the host country has to offer. The local-knowledge aspect of this relationship is especially important in light of the variability across cities within a given country, as described earlier.

G. Plan the site setup

Successfully setting up a new site requires careful planning along six work packages: i) business plan and top management alignment, ii) governance and organizational setup, iii) internal processes, iv) recruiting and retention, v) know-how transfer, and vi) infrastructure.

To commence a successful buildup, companies may want to follow a rigorous master plan (Exhibit 17; simplified version).

An OEM near-sources specialty software R&D to CEE

One automotive player's accounting of its objectives led it to determine that talent (access, not cost) was its biggest priority in meeting its R&D goals related to specialty software. With the R&D maturity of the prospective CEE location being the second priority, the framework outlined above identified three prospective CEE city locations. Of these three, the specifics of its talent pool – namely the size of the addressable market and how soon that market would be addressable – were the reasons that the automotive player ultimately chose the final city.

With the importance of smooth implementation in mind, three post-selection activities in three areas were identified:

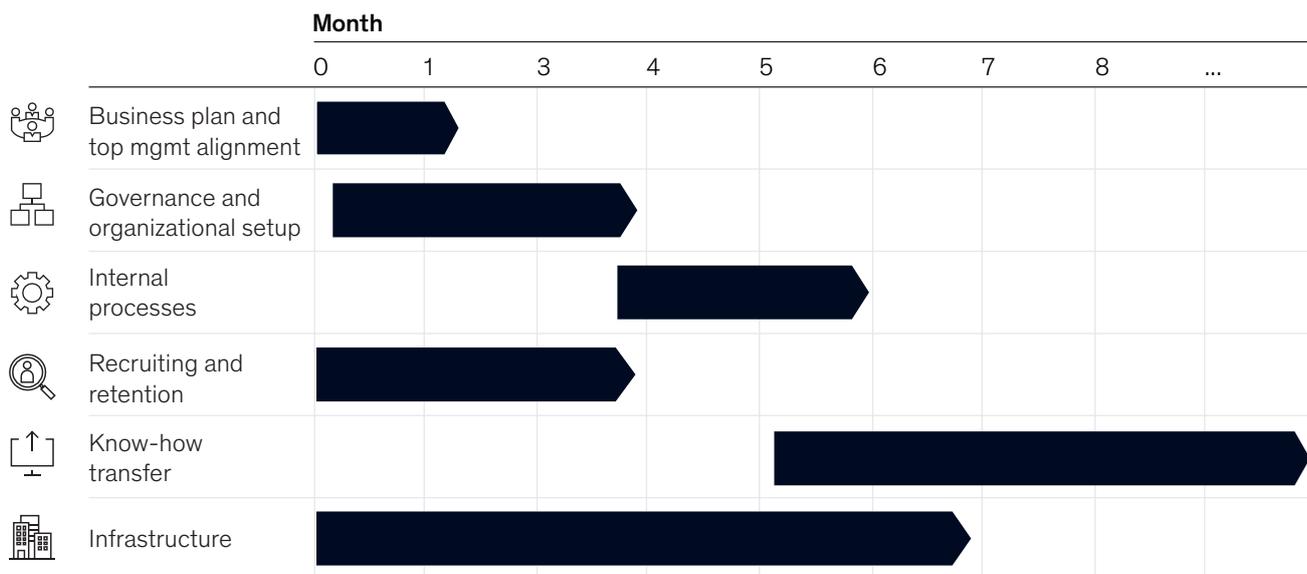
1. Government incentives. Work with the local investment promotion agency before the activity in order to build on incentives

2. University collaboration. Collaborate with a selected university or multiple universities to ensure direct access to new talent pools and enable local R&D collaboration with academia

3. Talent recruitment. Partner with HR agencies and local employment offices to recruit talent

Exhibit 17

Site setup has 6 crucial elements that need to be carefully planned



Source: McKinsey

3.4. Deep dive: Pragmatic no-regret moves for both automotive OEMs and suppliers in WE

Without a doubt, there is no one-size-fits-all approach to optimally leveraging the opportunities and tackling all of the challenges involved in navigating the near-sourcing of different types of R&D activities to CEE. The following ten key principles can help keep both automotive OEMs and suppliers firmly on track, regardless of their individual starting positions and irrespective of their ultimate R&D goals.

Ten principles for near-sourcing R&D activities

1. Be clear

Define and clearly state the objectives of R&D near-sourcing

2. Be selective

Identify suitable activities for near-sourcing based on both criticality to business success and modularity

3. Consider geography

Evaluate different site options based on fit with your near-sourcing objectives and selected R&D activities

4. Invest in interface

Select the right model for interconnection between R&D headquarters and the CEE hub

5. Rely on your road map

Create a long-term transformation road map following a “battle-tested” playbook for building an R&D hub

6. Hire the right talent

Work with local staffing agencies and universities to ensure you bring on the right talent with the relevant skills

7. Invest in partners

Build close relationships with local partner organizations, including government agencies and universities

8. Practice patience

Typical setup for a greenfield R&D hub is around 18 months, and scaling up can take another three years

9. Commit to change

Do not be satisfied with the status quo. Start adding development process activities/modules to the site

10. Scale up quickly

R&D centers with less than 200 employees suffer from interface and retention problems



4 Benefits

Near-sourcing R&D activities can bring many long-term shared benefits



The benefits of strategically near-sourcing selected R&D activities are clear and compelling for both WE automotive players and the local economy and society of CEE countries. Over time, growth in the number of partnerships and level of R&D activity in CEE would lead to three specific long-term benefits to both the host country and the OEM.

4.1 Near-sourcing can strengthen economic growth

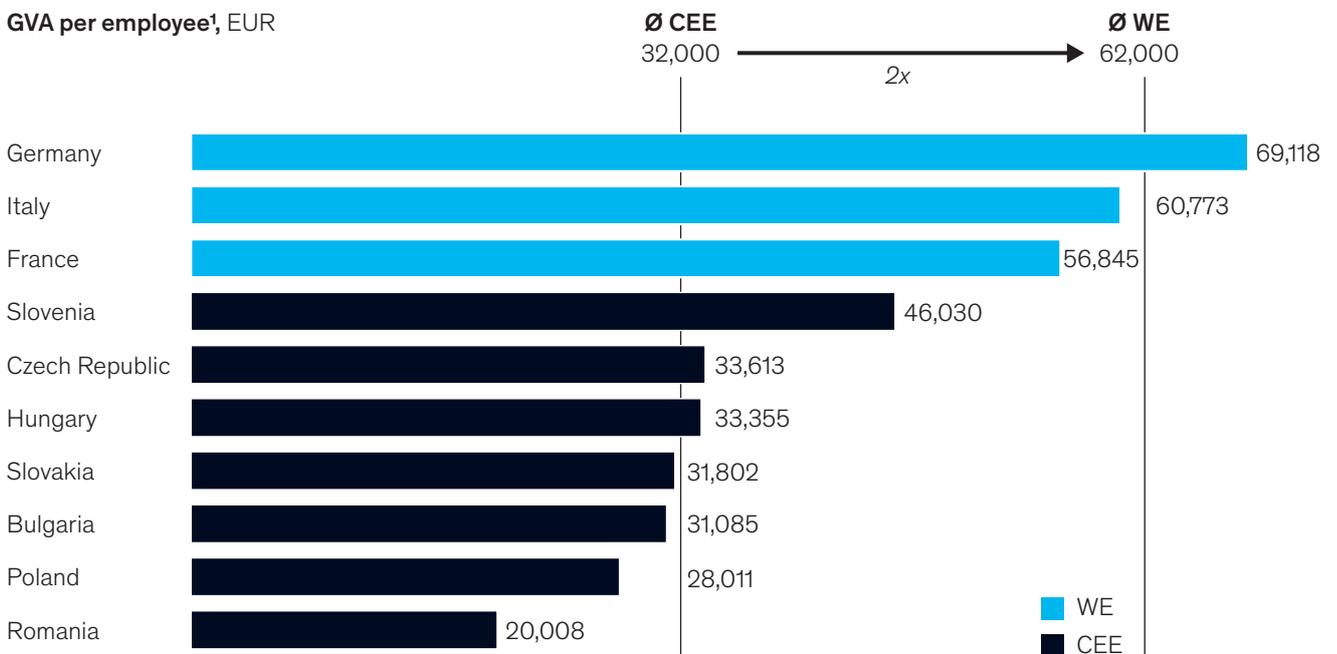
One of the clearest benefits of sustained R&D activity in CEE countries is the three-pronged way it fosters the host country's economic growth. First, this activity drives GDP growth by boosting productivity and attracting investments. GDP is thus boosted directly and also indirectly by, for example, the products and services consumed by the R&D center itself. GDP growth is further induced by consumption by employees related to the R&D center and higher economic activity in adjacent centers.

Second, improved productivity is its own contributor to economic growth, and empirical evidence suggests that R&D drives productivity well beyond the immediate automotive sector to the broader economy. For example, the GVA is, on average, about two times higher in WE,²⁷ where the share of R&D in the economy is higher than in CEE (Exhibit 18). Causality of course remains a question here, but generally, we can say that economically more developed countries have significantly higher shares of R&D in their economy. Third, R&D activity will contribute to greater resilience in CEE economies. Specifically, countries that focus on R&D in parallel with assembly and manufacturing are better able to handle GDP cycles due to more robust local capabilities and skills, unique talent development hubs, and an ecosystem that is hard to replicate. R&D itself is also an activity more resilient to economic downturns due to its cross-cycle nature with longer timelines.

²⁷ Including Germany, France, and Italy.

Exhibit 18

The region needs to catch up in R&D performance – increasing automotive R&D work has a potentially positive effect on productivity



¹ Research and experimental development on natural sciences and engineering GVA/employees from 2017, or from 2016 for Bulgaria, Czech Republic, Italy, Poland, and Romania

Source: Eurostat 2019

Economic growth in CEE also benefits WE automotive players. For those already near-sourcing to the region, it helps secure long-term success. One way this happens is by creating an environment that attracts more skilled people, thus supporting a sufficient pipeline of talent in the long run. As more talent moves to the region, the individual R&D centers and hubs as well as the whole ecosystem are strengthened.

4.2 Sustained R&D activity can contribute to building talent-first economies

An increase in R&D activity can also contribute to a stronger talent base in CEE economies. First, students who study in local universities have greater opportunities to begin their careers locally, thus helping to retain critical talent. Second, the presence of R&D centers is an opportunity for nearby universities to work with businesses to enhance their research and curricula and then transfer new knowledge to the broader economy. This university–business cooperation (UBC) model is a powerful driver of innovation and skill and capability development (Exhibit 19).

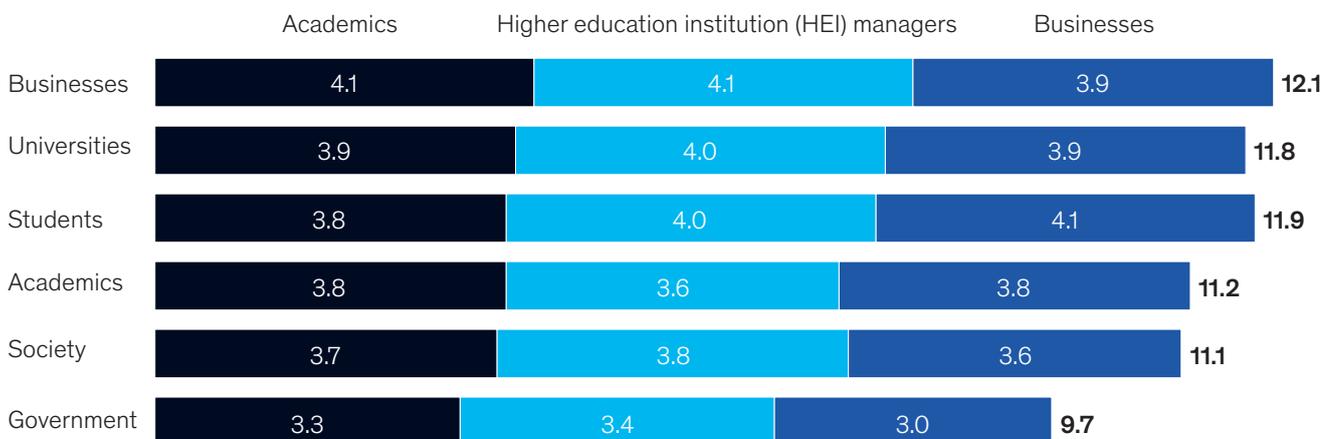
Exhibit 19

A UBC benefits both sides and many other stakeholders

Questionnaire on UBC benefits by different stakeholders¹

Scale: 1 = not at all, 10 = to a high extent

To what degree do you think these stakeholders benefit from UBCs?



¹ Answered by academics, HEI managers, and businesses

Source: European Commission, "The state of university – business cooperation in Europe"

WE automotive players also benefit from these collaborations by getting early access on two fronts: i) access to the latest technological developments coming out of university research and ii) early access to newly minted university graduates, i.e., prospective future employees.

Automation may make some of the jobs redundant in the region, given the current focus on manufacturing and assembly. Shifting focus to R&D can help mitigate such negative effects.

Finally, the interplay of enhanced training and greater employment opportunities elevates the local labor market – increasing job satisfaction and contributing to a pull effect on the overall market.

4.3 Near-sourcing can spur the development of the entire advanced industries sector

The infrastructure and talent pool that are created by and for individual automotive-focused R&D centers generate opportunities for other advanced industries, companies, and suppliers to set up R&D centers in close proximity, building an even richer ecosystem. Beyond any official network or collaboration with other centers, the talent pool rich in advanced industries and R&D-related knowledge as well as general work skills will be a growing and critical resource for the entire advanced industries sector. The penetration of automotive manufacturing into CEE years ago – and the accompanying skills and knowledge that came from investment in this area – have led to benefits that these countries reap today. Importantly, these benefits have extended well beyond the automotive industry to the entire industrial sector. R&D is expected to have a similar role in and impact on the development of these countries.

As this happens, near-sourcing to the region becomes an even more attractive proposition for automotive companies still considering growing their R&D footprint.

The role of UBCs in building talent-first economies

UBCs are important for companies as they support:

- Innovation in their field of interest
- Recruiting
- Early capability building opportunities for potential future employees

Similar to companies, UBCs also address universities' challenges and help academics with

- Funding
- Quality publications
- Competitiveness vs. other universities through increased attractiveness
- Knowledge transfer from international companies (best-in-class R&D knowledge), improving potential for innovation

In addition, UBCs also have a major positive impact on society and the economy due to:

- Local employment potential
- Skill and capability development
- Increasing local GDP and disposable income, creating opportunities for next generations (generation multiplier)

Outlook: Getting started

To get started on an R&D near-sourcing journey, automotive players in WE can consider this short list of actions that are based on the common themes of several companies that ran successful near-sourcing journeys over recent decades:

1. Set the ambition at CEO level. Near-sourcing R&D activities entails a rethinking of the R&D footprint as well as the value chain. This potentially includes the possibility of new revenue streams and requires new capabilities.

2. Build a strong team with a healthy talent mix.

When sourcing talent for a new R&D center, opt for a healthy mix of current employees and new hires. The category of new hires is comprised of both experienced R&D talent and recent university graduates. Early investment is needed to acquire the experienced talent, while building long-term partnerships with universities will be helpful in developing and identifying university students who might be a good fit.

3. Focus efforts on a limited number of relevant R&D activities. The players most likely to achieve sustainable success in the area of near-sourcing will be the ones who test smaller development centers within the region (10 to 300 FTEs) before gradually scaling up to larger R&D hubs.

By contrast, governments and municipalities in CEE countries may want to get started by setting up a strategy road map for attracting the R&D activities of multinational companies. The road map relies on three levers:

- **Co-creation.** Governments working closely with interested companies could build a set of requirements that meet the needs of all stakeholders.
- **Co-location.** Focus on rich geographic clusters as opposed to widely dispersed R&D activities. A critical mass of co-located R&D resources becomes the ecosystem that benefits both companies and the region.
- **Cooperation.** Encourage partnerships between relevant organizations within the growing R&D ecosystem. Explore the range of incentives that can build value-creating ties between academic, commercial, and government institutions.

These early actions and no-regret moves are solid first steps for WE automotive players on the journey towards establishing selected R&D activities in CEE.

List of abbreviations

ACES	Autonomous driving, connectivity, electrification, and shared mobility
ADAS	Advanced driver-assistance systems
AI	Artificial intelligence
BEV	Battery electric vehicle
CAGR	Compound annual growth rate
CEE	Central and Eastern Europe
FTE	Full-time equivalent
HAD	Highly autonomous driving
HEI	Higher education institution
HMI	Human–machine interface
HR	Human resources
ICE	Internal combustion engine
LTE	Long-term evolution
OEM	Original equipment manufacturer
GVA	Gross value added
OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
UBC	University–business cooperation
WE	Western Europe

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Rethinking European Automotive Competitiveness – The R&D CEE opportunity

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