EcoMobility
TRANSITION

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Project report on The Trnava Self-Governing Region (TTSK), Slovakia

1.0 Overview – general contextual information on the region

1.1. Introduction and background information on the region

The Trnava Self-Governing Region (TTSK) represents one of Slovakia's most industrially intensive territories, with a socioeconomic profile shaped by manufacturing, export-oriented production, and extensive regional labour mobility. Over the past two decades, the region has consolidated its position as a strategic node within the country's broader economic model, marked by a high concentration of foreign direct investment and a labour market closely tied to global value chains. Employment, wage levels, and population movements are strongly influenced by industrial dynamics, making the region particularly sensitive to ongoing technological, environmental, and geopolitical transformations.

Within this context, the automotive and mobility industries hold an exceptional position. Stellantis Slovakia (formerly PSA) serves as the region's dominant employer and production site, providing thousands of jobs and contributing significantly to the regional GDP and public revenues. The automotive sector is therefore not only an economic engine but also a central lens through which to assess the prospects and challenges of a just mobility transformation. Its influence extends outward into a complex industrial ecosystem that includes electronics, battery technologies, and mechanical engineering. Companies such as Samsung Electronics Slovakia in Galanta, Samsung Electronics LCD Slovakia in Voderady, InoBat Gotion, Deren electronic, Datalogic, or ZF SACHS Slovakia form an integrated supply and innovation environment, reinforcing the region's industrial resilience while also deepening its dependence on global production cycles.

This strong industrial concentration has shaped distinct social and mobility patterns. A substantial proportion of workers commute daily from surrounding districts, making the stability of transport infrastructure and regional mobility systems a critical factor in the functioning of local labour markets. These dynamics also raise broader questions of accessibility, environmental impacts, and the adaptability of current systems to the demands of electrification and low-carbon mobility transitions.

The research design of this report follows the logic of the original survey questionnaire used in the broader comparative project. Data collection relied on semi-structured interviews with a diverse spectrum of institutional and labour-market actors. In total, information was gathered from representatives of the Trnava Self-Governing Region (four interviews), the municipal authority of the City of Trnava (one interview), a vocational education and training institution (one interview), a regional NGO (one interview), and trade unions (one OEM-level representative and 3 sectoral and national representatives). These sources offer their perspectives on governance capacities, labour market and education dynamics, industrial strategy, and the perceived opportunities and risks associated with the mobility transformation within the region. Policy document analysis and publicly available statistical reports complemented the interview data, ensuring a coherent interpretation of regional developments.

1.2. Overview of regional sustainable development, green policies and social dialogue

Sustainable development has become a central pillar of strategic planning in TTSK. Regional authorities articulate a long-term vision of a competitive, resource-efficient, and environmentally responsible territory that maintains high living standards. This vision is embedded in several planning documents, including the Smart Strategy, the Low-Carbon Strategy (NUS), and the regional Economic and Social Development Program (PHSR), all of which translate broader international and national climate commitments into locally actionable frameworks. The ongoing transformation of industry, infrastructure, and mobility is therefore situated within a wider political and institutional effort to align regional development with the objectives of climate neutrality, energy security, and responsible resource use.

The dominant discourse surrounding the green transition, both nationally and regionally, is primarily shaped by the imperative of decarbonization. Reducing greenhouse-gas emissions is presented as a foundational requirement for modernising the regional economy, particularly because TTSK remains heavily reliant on fossil fuels - liquid fuels in transport and natural gas for heating. The Low-Carbon Strategy sets a binding target to reduce CO_2 emissions by at least 40% by 2030 compared to 2010, directly reflecting the commitments outlined in the EU Climate and Energy Framework 2030, the Paris Agreement, and Slovakia's national climate strategies. Within this narrative, energy and resource efficiency emerge as priority themes, alongside the need to deploy low-carbon technologies, strengthen building energy performance, and expand renewable energy generation.

The greening of industrial production and infrastructure is closely tied to these strategic imperatives. Regional documents emphasise the need for modernising industrial enterprises through cleaner technologies, circular-economy practices, and innovations that reduce material and energy intensity. This orientation draws on OSN's Agenda 2030 principles, particularly those promoting sustainable industrialisation and responsible consumption and production. In practice, efforts to green the regional economy extend beyond policy rhetoric. Interviews indicate that the City of Trnava has introduced regulatory measures requiring new large industrial halls to incorporate at least 50% green roofing, helping mitigate urban heat islands and improve local environmental quality. Major employers are also adjusting to the changing climate and regulatory landscape: Stellantis is investing in large-scale photovoltaics across its plant and upgrading its heating systems, signalling a gradual shift toward more sustainable production processes.

Regional policy frameworks serve as the institutional framework for these developments. The Low-Carbon Strategy remains the most comprehensive document setting out concrete mitigation measures, while the PHSR integrates environmental objectives into the region's socio-economic development trajectory. The Smart Strategy defines "Smart Environment" as one of TTSK's strongest domains, with a focus on climate adaptation, sustainable energy management, and high-quality environmental services. Complementing these is the Sustainable Mobility Plan, which aims to align transport development with environmental requirements and reduce the carbon intensity of regional mobility systems. These regional strategies are tightly interwoven with national policies, including the National Low-Carbon Development Strategy, the Strategy for Adaptation to Climate Change, and the Integrated National Energy and Climate Plan (NECP). Together, they frame the green transition as a multifaceted process that depends on coordinated governance across all levels.

A central dimension of this governance structure is regional social dialogue, which regional authorities conceptualise as an essential precondition for successful implementation. The Smart Strategy emphasises "Partnership and Networking" as a horizontal priority, highlighting the need for structured cooperation among public institutions, businesses, research organisations, and civil society. Plans to establish a Cluster of Innovative Solutions reflect this ambition, aiming to create a dedicated platform for innovation management, data analysis, and policy coordination. Public participation is also viewed as

increasingly important, with new data-sharing tools and participatory planning processes designed to involve citizens more directly in shaping environmental and mobility policies. As an NGO interviewee emphasised, environmental education initiatives further support this approach by strengthening public awareness and fostering a culture of sustainability.

However, interviews and local observations indicate that the practical functioning of regional dialogue remains uneven. The implementation of the Smart agenda is described by several interviewees as weak, and attempts to operationalise the planned innovation cluster have so far not been successful. While cooperation between the regional authority, education providers, and selected industrial actors is improving (for example, through the planned Centre of Excellence at the Secondary Electrotechnical School), the involvement of the private sector remains limited. This challenge is evident in both regional forums and the generally perceived distant relationship between major cities and large employers. The conducted interviews also show that trade unions are largely absent from these strategic discussions, underscoring the broader difficulty of integrating multinational companies and labour actors into the region's green-transition agenda.

1.3. Relevant regional actors shaping the transition: roles and capacities

The governance of the green and mobility transition in TTSK is shaped by a set of regional public institutions, municipal authorities, education providers and specialised organisations. Their roles, capacities, and degrees of involvement vary considerably, as evidenced by regional policy documents and the interviews conducted.

TTSK has the broadest mandate among regional actors. As the founder of all secondary schools in the region, it plays a critical role in shaping the future skills base for the mobility and energy sectors. For example, through its Mobility Department, TTSK is responsible for developing and implementing key strategic documents, such as the regional electromobility and charging infrastructure plan, which functions as a compulsory annexe for municipalities requesting financial support for infrastructure projects. TTSK also oversees regional initiatives linked to clean mobility and cooperates extensively with national agencies, public transport operators, and selected private partners. While its formal competences are substantial, interviews highlight ongoing challenges in securing consistent engagement from the private sector, which limits the impact of several strategic initiatives.

An important, though less publicly visible, regional actor is KIRA, a non-profit organisation established to support the preparation and implementation of innovation and development projects for TTSK and its affiliated institutions. KIRA's mandate includes improving quality of life, supporting public health initiatives, and strengthening civil society activities across the region. The organisation also supports NGOs, civic associations, and volunteers, contributing to a broader participatory environment. While KIRA has the potential to serve as a coordination and innovation hub, interviewees note that efforts to create a fully operational regional innovation cluster have not yet materialised.

At the municipal level, cities serve as central planning authorities, exerting direct influence over urban development, land use, and local infrastructure, among other areas. Their priorities related to the mobility sector include diversifying the local economy and integrating green solutions. Yet, according to interviewees, cooperation between the city and major employers remains limited, reflecting a broader pattern of cautious or minimal engagement by large industrial actors.

The Vocational Education and Training (VET) institutions constitute a strategic component of the transition, especially given the region's industrial profile. Schools are increasingly adapting curricula to emerging needs in electromobility, renewable energy, and digitalisation. Several have established

cooperation networks across Slovakia and internationally to modernise training models and to anticipate future skill requirements. One notable example is the Secondary Technical School in Trnava, which offers students a new field of study, the Technical Lyceum, combining the best aspects of secondary school and technical education.

Evidence from interviews indicates that employers and labour organisations are only marginally involved in shaping the regional transition agenda. Participation from individual firms is inconsistent and usually limited to ad-hoc consultations, while broader employer associations and trade unions remain largely absent from strategic planning. Overall, the regional landscape is characterised by strong public-sector initiatives and proactive education providers, but only limited involvement from large employers and labour representatives. These dynamics reflect both institutional capacity asymmetries and the structural challenge of integrating key private-sector actors into collective planning processes that are essential for a successful and socially just transition.

1.4. Concerns, needs, and perceptions of primary stakeholders

Overall, the stakeholders recognise the strategic importance of sustainable development and the need to transition towards low-carbon industrial production and cleaner regional infrastructure. Nevertheless, multiple economic, infrastructural, and behavioural obstacles constrain implementation.

From the perspective of labour and industry, stakeholders consistently emphasise a set of operational and workforce-related pressures that shape their outlook on the transition. Automotive manufacturers and their employees point to persistent supply-chain disruptions that destabilise production, create staffing shortages, and cause delays during new model launches. These uncertainties are further intensified by the region's growing dependence on foreign labour, with some companies employing close to 40% of their workforce from abroad. This reliance places additional strain on dormitory housing, public transport, and municipal infrastructure, while also shaping public perceptions of industrial change and migration. In addition, high volumes of freight traffic and commuting flows associated with the industrial sector contribute to congestion, reduced air quality, and increased CO_2 emissions.

A critical concern relates to the shortage of skilled labour. Employers struggle to recruit qualified technicians, maintenance specialists, and workers with the required certifications for operating advanced machinery and robotics. Stakeholders consistently note that vocational education is not keeping pace with innovations in electromobility and digitalised production. Trade unions, for their part, remain predominantly focused on core labour rights, including wages, working conditions, and the enforcement of basic standards such as temperature breaks, while viewing ecological transformation as the employer's domain. Moreover, communication gaps remain significant, with management in some firms reluctant to provide information even when mandated by collective agreements.

In addition, generally low market demand for electric vehicles in Slovakia limits the immediate business case for major industrial investment in green technologies. At the same time, the upfront costs of more eco-friendly vehicles, energy-efficient solutions, and low-carbon infrastructure are considered prohibitively high by both public and private actors. Meanwhile, civil society organisations draw attention to the generally low level of public awareness on environmental and climate matters. In the absence of accessible and trusted information, community engagement tends to surface primarily in response to controversial infrastructure projects proposed in close proximity to residents.

From the perspective of regional governance and planning, public authorities emphasise the structural risks stemming from the region's heavy dependence on the automotive sector. The City of Trnava, in particular, views this reliance as a significant economic vulnerability and has begun pursuing industrial

diversification to reduce exposure to external shocks. At the same time, local planning efforts are hindered by inconsistent national strategies, frequent legislative changes, and unpredictable funding schemes. Even priority green infrastructure projects face significant delays. For example, the planned cycling path to the Stellantis plant remains unrealised due to fragmented land ownership, complex engineering requirements, and the difficulty of coordinating tasks among multiple institutions. These conditions compel municipalities and regional authorities to operate largely on an ad hoc basis, often without the long-term policy stability needed for coordinated development.

A further structural constraint is the fiscal framework governing Slovak municipalities. Because local budgets depend heavily on state transfers rather than employment-related revenues, municipalities have limited direct financial incentives to engage in proactive industrial or economic development. This institutional misalignment discourages long-term investment planning at the local level and often shifts responsibility for strategic decisions to the national government.

2.0 Employment and production: stakeholder assessment

The economic and social trajectory of the TTSK remains closely tied to the structure and performance of its automotive, mobility, and related industries. This section synthesises quantitative data, strategic planning documents, and insights obtained through stakeholder interviews to evaluate current conditions, emerging pressures, and the future outlook for employment and production in the region.

To ground this analysis, the following data overview reflects the core evidence base on which regional stakeholders rely. The regional data landscape is characterised by fragmentation, selective transparency, and differing levels of access across stakeholder groups. Public authorities rely heavily on national statistical sources, including data from the Statistical Office of the Slovak Republic (ŠÚSR), on topics such as employment structure, demographic trends, vehicle registration, and research and development expenditures. These datasets provide the quantitative foundation for regional strategies and are used to prepare documents such as the Low-Carbon Strategy, Smart Strategy, and sustainable mobility plans. Planning authorities also utilise benchmarking tools, including the Slovak SMART City Index, to evaluate competitiveness and pinpoint areas requiring investment, particularly in innovation and R&D capacity. Educational institutions and VET councils rely on data from sectoral councils, Trexima (a specialised research, statistical, advisory, and consulting company), and national ministries to adapt curricula and forecast labour demand.

Trade unions, however, operate with far more limited access to information. Interviews suggest that unions primarily rely on publicly available annual reports (e.g., from FinStat) for basic financial and employment data. Obtaining strategic or forward-looking information from employers (such as detailed production plans, projected model changes, or the breakdown of foreign labour by nationality) is often difficult. In some cases, unions must invoke the Labour Inspectorate to enforce information-sharing provisions embedded in collective agreements. This lack of accessible data restricts their ability to anticipate workforce risks or engage proactively in discussions about transition measures.

2.1. Overview of current production and employment in automotive and mobility Industries

The automotive sector constitutes the backbone of the regional economy. Stellantis Slovakia, the region's flagship manufacturer, forms the central node in an extensive production network comprising Tier 1 and Tier 2 suppliers, logistics operators, and specialised engineering firms. The plant's production capacity is estimated to be between 320,000 and 360,000 vehicles per year, although recent performance has fluctuated: 372,000 units in 2019, falling to 312,000 in 2022 and 264,000 in 2023 due to supply chain issues, model phase-outs, and the introduction of several new projects.

Employment patterns reflect this industrial concentration. As of 2024, nearly one-third of the region's economically active residents were employed in industrial manufacturing (ŠUSR, 2025). Production is sustained by a sizeable share of agency workers and a substantial foreign labour force, which together help offset very low local unemployment. At the same time, this reliance intensifies pressure on housing availability, dormitory capacity, and public transport systems, exposing structural constraints in the region's social and mobility infrastructure.

The region's industrial profile extends beyond automobile assembly into a broader mobility-oriented manufacturing ecosystem. At its core are mechanical engineering firms such as ŽOS Trnava and ZF Sachs Slovakia, which supply railway and automotive components, alongside electronics and advanced manufacturing companies - including Samsung Electronics Slovakia, Datalogic, Hyoseong Electric, InoBat Gotion, and Deren Electronics - producing key technologies such as electric vehicle chargers and high-tech components for global markets. This core is complemented by smaller but symbolically relevant activities, notably bicycle manufacturing, represented by Kellys Bicycles (approximately 95,000 units annually with 100–150 employees as of 2020) and Dema (approximately 40,000 units annually until November 2024). In addition, cooperation facilitated by the TTSK through its Regional Innovation and Development Agency, as reported by the Automotive Skills Alliance (ASA), links the region to firms specialising in robotics and process automation (Bizzcom s.r.o.), ultralight aircraft manufacturing (SHARK.AERO), and hydrogen applications in regional transport (JESS a.s.), indicating early but still modest diversification beyond the dominant automotive core.

2.2. Present challenges and drivers shaping production and employment

Interviews and secondary data indicate that several structural challenges shape the current labour and production environment. A dominant concern among municipal planners is the region's heavy dependence on the automotive sector. Trnava's stakeholders characterise this reliance as economically "risky", given the city's modest size relative to the scale of its largest employer. Any downturn in automotive demand, regulatory shifts, or major relocation of investment could generate rapid socio-economic shocks.

The automotive industry reports persistent operational difficulties linked to supply-chain volatility, with delivery delays causing production stoppages and even the cancellation of entire shifts. Trade unions authenticate these findings, noting that supplier turnover driven by cost minimisation has resulted in declining product quality, with the Trnava plant falling from a top position in corporate quality rankings to the bottom.

A pronounced skills deficit also undermines production stability. Companies report particular difficulty in recruiting certified maintenance personnel and technicians capable of operating increasingly complex robotic systems. Interviewees from both the industry and vocational education sectors highlight that the regional training system struggles to keep pace with the technological demands of modern production, a

gap that is likely to widen with the rapid electrification.

The limited depth of regional research and development capacity constitutes another structural weakness. Stakeholders emphasise that most core technological development occurs abroad, with local plants and suppliers mainly performing tasks considered interchangeable within corporate groups. This lack of embedded R&D limits regional resilience and reduces potential for high-value employment growth.

2.3. Trends and future prospects across carmakers, suppliers, and related industries

The regional outlook is shaped by multiple transition pressures, including the shift to low-carbon technologies, the market uncertainty surrounding electric vehicles (EVs), and the strategic ambition of public authorities to diversify the industrial base.

The transition to electromobility remains a central driver. Stellantis benefits from flexible production platforms that allow rapid switching between petrol, hybrid, and electric models depending on market demand. Yet, interviews reveal a significant gap between anticipated and actual EV uptake: while their forecasts expected 30 per cent EV production, EV adoption in Slovakia remains quite limited. This gap slows the pace of technological and workforce transformation, introducing operational uncertainty. Recent model launches have exposed vulnerabilities in the production organisation. The past introduction of three new models simultaneously generated substantial quality and supply-chain problems. In response, management is exploring strategies to reduce complexity, including limiting model variability and relocating lower-value components to other plants within the corporate network.

At the sectoral level, automotive manufacturers are lobbying EU institutions to reconsider the phase-out timelines for combustion engines, arguing that charging infrastructure and public readiness remain insufficient. Trade union interviews confirm that unresolved infrastructure deficits, combined with volatile energy prices, are shaping employers' strategic decisions and risk assessments.

Beyond the automotive sector, regional development strategies identify opportunities in railway engineering, renewable energy technologies, and the circular economy. Municipal planners emphasise diversification not only as an economic priority but as a core pillar of the city's long-term vision centred on quality of life, urban attractiveness, and workforce stability.

Future prospects are marked by several fundamental uncertainties. The most substantial insecurity concerns the capacity to retrain the workforce. Interviewees from vocational training institutions estimate that converting a conventional mechanic into an EV-ready technician requires approximately three years, which is far beyond the scope of short-term labour market interventions. Without long-term planning and stable financial support, the region risks a widening mismatch between labour supply and the skill set required for electrified production.

Investment uncertainty also persists. While significant upgrades are underway within existing factories, such as large-scale photovoltaic installations, regional authorities have limited insight into potential future relocations or new projects. Governance challenges present another long-term risk. Stakeholder interviews indicate a consistent difficulty in establishing and maintaining structured communication with large employers. This gap undermines public-sector planning, creates vulnerabilities for workers, and limits the collective capacity to anticipate and manage transition-related disruptions.

3.0 Skill formation

As the regional founder of secondary vocational schools, TTSK plays a decisive role in shaping this landscape. VET institutions rely primarily on data from the Ministry of Education, professional sectoral councils, and TTSK's Graduate Tracking Project to monitor labour market trends and graduate outcomes. These sources provide insight into occupational demand, skill shortages, and the relevance of study programmes. However, neither the regional authority nor national institutions systematically track the outcomes of corporate training or requalification programmes conducted directly by employers. This limits comprehensive understanding of skill utilisation and restricts the ability to design coordinated interventions.

3.1. Skill formation for the automotive Industry: institutional setup and ongoing changes

The VET system relies on a well-established dual education model, historically anchored in cooperation with Stellantis and other key manufacturers and suppliers. In recent years, however, the region has begun to shift from a narrowly sectoral approach to a more integrated, multi-actor governance model. Strategic plans outline a gradual shift toward a coordinated innovation ecosystem, like the still-conceptual and not yet operational Cluster of Innovative Solutions. This body is intended to function as a management and data governance platform, linking industry, research institutions, non-profit organisations, and public authorities. As already mentioned, the concept remains largely aspirational, with no concrete implementation steps in place for now. Collectively, these planned institutions are expected to address the persistent mismatch between education, industrial needs, and technological change - an area that stakeholders consistently identified as structurally weak.

In this context, TTSK's participation in the Automotive Skills Alliance (ASA) illustrates both the potential and the limits of current skills governance arrangements. As a member of ASA, TTSK is formally embedded in a European-level platform dedicated to re-skilling and up-skilling in the automotive sector, intelligence-building on future skills needs, and structured dialogue among public authorities, industry, education providers, and social partners. Through regular participation in workshops and exchanges, TTSK gains access to strategic foresight, best practices, and policy-relevant guidance on workforce transformation in the automotive ecosystem. However, interview evidence suggests that these outputs are only weakly translated into regional practice. The main barriers are not a lack of engagement, but insufficient financial resources, limited administrative capacity, and weak coordination mechanisms to embed ASA-derived insights into regional VET reform, adult training, or requalification programmes. As a result, European-level coordination and knowledge generation remain largely decoupled from local implementation, reinforcing the broader gap between strategic orientation and operational delivery in automotive skill formation.

Across both the automotive and broader mobility sectors, curricular reform is advancing but remains uneven. The integration of sustainability and digitalisation is progressing, but the pace of implementation is constrained by national regulatory limits, teacher shortages, and the time required for accreditation. Schools can directly modify roughly 20% of their curriculum, allowing them to integrate topics such as robotics, renewable energy, solar installation, and selected digital competencies. The recent establishment of the Technical Lyceum in Trnava, combining general and technical training, is widely viewed as a positive step toward cultivating more analytically oriented graduates capable of progressing into technical higher education.

Nonetheless, several structural problems persist. Interviewed educators and industry representatives highlight a significant skills gap in maintenance, diagnostics, robotics operation, and high-voltage

technologies. These deficits stem from both the rapid pace of innovation in progressive automotive manufacturing and the limited capacity of the regional system to update curricula, equipment, and teaching staff in real-time. The depth of required knowledge presents an additional challenge as well. As a result, while the dual system provides valuable real-world experience, its ability to produce the next generation of specialised technicians remains constrained.

3.2. Skill formation for the broader mobility industry and emerging needs for sustainable development

The shift toward a low-carbon, digitally supported mobility system requires a broader conceptualisation of skills beyond the traditional automotive focus. VET institutions in the region are increasingly positioning themselves as leaders in the energy transition and sustainable mobility, actively engaging in national and international partnerships to monitor global trends. Educational priorities now include the development of competence in electromobility, alternative fuels, renewable energy systems, and the principles of energy efficiency. Schools have begun integrating environmental literacy, green skills, and basic sustainability concepts into their local curricula, utilising their flexible components to introduce modules aligned with decarbonization and circular economy goals. The region is also expanding adult education through newly accredited programmes on photovoltaic systems, drone operations, and related energy technologies - fields viewed as strategic for the future labour market.

Yet the broader sustainability agenda faces its own constraints. Public awareness of climate and environmental issues remains relatively low, which reduces student and community engagement with these topics. Teacher preparation represents another weak point. The effectiveness of sustainability-related curricula depends heavily on the pedagogical capacity of educators, and interviewees note substantial gaps in both subject knowledge and modern teaching methods. Moreover, collaboration with universities may remain only superficial, with limited integration of research capabilities into VET programs. Furthermore, school founders face financial limitations that hinder investments into modernised facilities, digital equipment, and specialised laboratories.

3.3. Mechanisms for adapting to labour market change

TTSK's strategy for adapting to labour-market change prioritises practice-oriented tools. A centrally planned initiative is the mobile laboratory equipped with robots, CNC machines, and similar technologies, which will circulate among schools to provide hands-on exposure to production systems used across the automotive, engineering, and energy sectors. The proposed Environmental-Educational Centre is intended to complement this by serving as a regional hub for methodological support, experiential learning, and targeted training for municipalities, teachers, students, and the broader public. Together, these projects aim to narrow the long-standing gap between theoretical instruction and rapidly evolving industrial needs.

Demographic trends complicate this agenda. While interest in several technical disciplines declines, programmes linked to robotics and IT continue to expand, producing an imbalance between student preferences and actual labour demand. High-voltage occupations, especially in maintenance and specialised electrical roles, remain chronically undersupplied, limiting the region's capacity to respond to industrial restructuring.

Another persistent weakness is the limited strategic involvement of major employers. Although companies maintain individual partnerships with VET schools, their engagement in medium- and long-term skills planning is minimal. This reinforces institutional asymmetries, slows the alignment of training supply with industry needs, and reduces the predictability of future workforce development. Dual education remains an important mechanism, exemplified by Stellantis' in-plant Dual Academy. Yet retention challenges

persist: many graduates choose to leave after completing their training or repay costs instead of taking up employment. Employers similarly report difficulties in securing long-term commitment from young workers, reflecting wider demographic pressures and a competitive labour market.

Digitalisation is expected to support adaptation by expanding digital teaching tools, strengthening ICT skills, and modernising learning environments. In parallel, schools are placing stronger emphasis on soft skills (communication, problem-solving, and entrepreneurial thinking) to strengthen resilience in a rapidly changing labour market. Overall, while TTSK is introducing promising mechanisms, their effectiveness will depend on stronger employer involvement, sustained investment in requalification pathways, and continuous alignment between educational content and technological change

4.0 Infrastructure development and services

4.1. Infrastructure

Trnava Region is traversed by major corridors, as well as key rail lines. Public-transport infrastructure includes bus stations and intercity terminals. There are also regional airports (Piešťany) and planned upgrades to rail/road intermodality. Private mobility is enabled by a dense road network. Major transport projects (motorways, railways) are typically led by national agencies, but implementation requires coordination across regions. Within TTSK, the region's mobility/planning departments, municipalities, and private stakeholders (e.g., major employers) work together to identify and co-fund projects. The Integrated Territorial Strategy (Integrovaná územná stratégia - IÚS) and the regional development program (PHSR) provide a formal framework for aligning regional priorities with EU and national funding. While these planning documents allow for stakeholder input, the available documentation, as well as interviews, does not clearly demonstrate consistent or institutionalised engagement of labour unions and employer associations, specifically in transportation planning discussions (except, e.g., shift schedules or shuttle services).

TTSK's plans emphasise green and sustainable infrastructure. Key priorities include expanding cycling networks (e.g. the Vážska cyklomagistrála linking Zavar village with the Stellantis plant); in 2024-25 TTSK began construction of a 1.7 km cycle path including a bridge over the D1 motorway. This project (total cost €1.8M, Recovery Plan-funded) is cited as the first regional bike route under the national Recovery and Resilience Plan (TTkraj, 2025). Further cycling links are planned around towns and between villages. For electromobility, the region is installing dozens of public chargers. By 2019, at least 14 DC fast-charging stations (GreenWay, MTOP, ZSE) were operating in TTSK. TTSK aims to increase this network significantly (roughly 230 charging points in ~100 locations by 2024 were projected, per local planning). Hydrogen fueling is discussed, but remains at an early pilot stage. Road infrastructure needs include completion of missing expressway links (e.g. bypasses to relieve urban congestion), and rehabilitation of ageing county roads and bridges. New park-and-ride facilities are considered to connect car drivers to public transport.

Transport is a major emitter in TTSK: as mentioned, the region has adopted a formal target to cut CO_2 emissions by 40% by 2030. Road traffic contributes significantly to air pollution; for example, data from 2010 to 2020 show average annual emissions of ~1,640 tonnes of particulates (PM/TZL) and ~1,570 tonnes of NO_x, primarily from vehicles (NUS). Urban air quality is a concern in the Trnava, Piešťany, and Galanta districts during peak traffic hours. Additionally, land-use pressure is high, as suburban sprawl and highway expansion have reduced the amount of farmland around Trnava. The region also faces climate

impacts (flooding in river basins, occasional summer droughts), which require resilient infrastructure (e.g. stormwater retention, green corridors). These environmental constraints are driving the push to low-emission infrastructure (electrification, green roofs, water-saving measures).

4.2. Services

Public transport in TTSK is provided by bus and rail operators under a partially integrated system. The regional authority, via Timetable Cestovný poriadok TTSK and its web portal Cestuj ľahko ("Travel easily"), coordinates suburban bus services around Trnava and district towns. ZSSK (Slovak Railway Company) and private bus carriers (Slovak Lines, Arriva, etc.) run inter-city and commuter trains/buses on key routes. Public services offer e-ticketing (Cestuj ľahko tickets) and real-time information apps. Workforce mobility is also significant: some large employers (especially Stellantis) operate shuttle buses for employees and coordinate with public timetables. On-demand and car-sharing services are still limited in the region. Digital mobility services are emerging (urban traffic dashboards, info kiosks) - for example, the City of Trnava's "Smart Trnava" portal displays live traffic conditions and public bike/scooter stats, and similar digital tools are planned region-wide.

Service improvements are driven by both public planning and private initiatives. TTSK subsidises socially necessary bus routes and sets service standards in tender contracts; it also works with cities to integrate transit (e.g. Trnava's city buses with suburban routes). EU and national grants (e.g. for bus fleet modernisation) help upgrade services, e.g. the 2022 Smart Strategy commits to using "technological and social innovations" to improve quality of life - interpreted to include intelligent transport systems (GPS tracking, digital ticketing) and green fleet replacement (e-buses, hybrid, CNG). Green and sustainable mobility priorities also include expanding bicycle-sharing schemes across the region and deploying mobility-management tools, such as integrated journey planning applications and a unified fare system. TTSK integrates environmental education into schools and community centres through regular campaigns, such as the Európsky týždeň mobility (European Mobility Week) and the "Do práce na bicykli" (To work by bike) initiative, as well as structured educational programmes like the "Jesenná škola cyklodopravy" (Autumn school of cycling), which addresses sustainable transport planning, awareness, and campaign design.

4.3. Prospects and risks

Stakeholders see strong opportunities in EU-driven smart mobility and climate agendas. The new Integrated Territorial Strategy (IÚS) mechanism lets the region bundle projects (roads, cycling, digital) for EU funding. There is momentum from national policies: for example, tens of millions in Recovery Plan funds are channelled to regional projects (such as the mentioned cycle path). The region's climate goals also facilitate co-financing for renewable energy projects (e.g., solar energy on public buildings, district heating expansion). Digital integration, linking traffic management, e-ticketing and infrastructure data, is viewed as a growth area, in line with the Smart strategy principles. If fully leveraged, these trends could help TTSK meet EU 2030 targets while boosting regional competitiveness.

However, stakeholders warn of funding and governance challenges. Much depends on external aid: without continued EU or national support, infrastructure projects (especially large ones, such as road interchanges or water-treatment plants) may stall. Regional fragmentation can hinder development, necessitating delicate inter-agency negotiations. Political discontinuity is another risk: frequent changes in leadership (at the regional or municipal level) could disrupt long-term plans unless institutional frameworks remain strong. Finally, underfunding of maintenance (roads, bridges, flood defences) could compound environmental and safety problems, given the region's (country's) legacy infrastructure.

5.0 Social Dialogue

5.1. Current state of regional social dialogue

Regional social dialogue in the TTSK remains institutionally weak and fragmented, despite broad recognition of its strategic importance among stakeholders. Existing coordination between employers, trade unions, municipalities, and regional authorities is inconsistent, and the absence of mandatory frameworks results in highly variable engagement across sectors. Formalised platforms, such as tripartite councils or regional partnership bodies, either do not operate or lack a clearly defined mandate, limiting their ability to facilitate structured consultation on socio-economic or environmental challenges.

Where dialogue does occur, cooperation often weakens once decisions or resource allocations need to be made. Actors tend to protect organisational interests rather than pursue a shared regional strategy, leading to fragmented outcomes. This pattern is reinforced by the institutional rigidity of Slovakia's multilevel governance arrangements, which limit the capacity of municipalities and regional authorities to act proactively in economic development or transition planning. Fiscal dependence on state transfers weakens local incentives to engage strategically, contributing further to the governance gap.

At the enterprise level, trade unions focus on core workplace issues, including labour law compliance, health and safety, staffing shortages among subcontractors, line speeds, and basic working conditions. Information sharing with management remains challenging, as unions often need to rely on enforcement mechanisms (such as the Labour Inspectorate) to access data that should be routinely available. These constraints leave unions with little capacity to participate in broader regional debates or to shape long-term transition strategies. The absence of an institutional mechanism capable of convening employers, unions, municipalities, regional authorities, and police (to streamline the foreign workforce) limits the region's ability to respond to these cross-cutting social challenges.

5.2. The agenda of social dialogue: inclusion of eco-transition issues

The integration of green and digital transition topics into regional social dialogue remains uneven. At the factory level, ecological themes have not yet become part of routine social partner agendas. Trade unions view such topics as secondary to unresolved fundamental issues related to working conditions and production systems. Strategic questions concerning electrification, production restructuring, or technological upgrading are typically addressed at the European Works Council level rather than within local dialogue structures.

Regional authorities, however, are increasingly incorporating eco-transition themes into their planning and coordination efforts. For example, TTSK's Mobility Department addresses clean and sustainable mobility, electromobility, environmental quality, smart transport solutions, and public awareness as part of its broader development agenda. Yet the translation of these region-level objectives into enterprise-level dialogue remains limited, resulting in a separation between strategic planning and everyday workplace governance.

Public awareness and societal engagement also represent an ongoing challenge. Regional institutions highlight persistent information deficits and vulnerability to misinformation regarding environmental and climate policies. Without a broader public understanding of transition objectives, social dialogue actors face additional barriers in mobilising support for long-term structural change.

5.3. Prospects and pathways for strengthening social dialogue

The region's stakeholders generally agree that effective governance of the green transition requires stronger, more predictable, and more inclusive forms of social dialogue. This will depend on advances in three interconnected areas:

Stable, institutionalised platforms - such as regional tripartite councils, permanent roundtables, or thematic working groups - are essential for reducing fragmentation. These platforms would enable ongoing consultation, shared monitoring of transition impacts and developments, and coordinated planning across employers, trade unions, municipalities, educational institutions, and the regional government. Without such systemic alignment, the region risks entering the ecological transformation with fragmented capacities and reduced strategic resilience.

Moreover, trade unions require targeted support to broaden their engagement beyond immediate workplace conditions. This includes, e.g. developing toolkits for integrating green transition issues into collective bargaining, enhancing analytical capacities, and improving coordination with municipal and regional bodies. Similarly, municipalities need greater fiscal and institutional incentives to participate actively in regional economic governance and transition management.

For social dialogue to contribute meaningfully to the ecological transition, its scope must expand to include skills development, technological upgrading, infrastructure resilience, and the broader social dimensions of industrial change. Priorities include updating vocational education in line with electromobility and automation; coordinating responses to housing and transport pressures associated with labour mobility; and supporting low-carbon public procurement and service delivery. These areas offer concrete entry points for multi-actor collaboration.

6.0 Key conclusions and policy implications

The evidence presented in this report indicates a broad consensus among regional stakeholders on the necessity of sustainable development and proactive preparation for industrial transformation. However, this shared strategic orientation has not yet translated into a coherent and effective transition pathway. Progress is constrained by fragmented governance arrangements, uneven employer engagement, persistent skills shortages, infrastructural bottlenecks, and weak coordination across institutional domains. While public authorities and education providers demonstrate a high level of commitment, their efforts are not sufficiently matched by major employers or labour representatives, limiting the region's collective capacity to steer change.

Taken together, the findings point to a set of interlinked structural and systemic constraints that shape the region's readiness for green and industrial transformation. These constraints encompass economic structure, institutional capacity, labour market dynamics, and mobility infrastructure. Addressing them requires not only incremental project-based interventions but a more integrated and policy-driven approach that aligns economic development, skills formation, social dialogue, and infrastructure planning. The key conclusions and related policy implications are summarised below.

Structural economic exposure

The region's strong dependence on a single, dominant manufacturing sector, most notably automotive production, creates systemic vulnerability to global market fluctuations, technological disruptions, and strategic decisions made outside the region. Although diversification strategies are formally articulated, they remain at an early stage of implementation and have not yet significantly reduced this structural exposure. At the same time, the regional innovation ecosystem remains weak, with core research and development functions largely located abroad. This limits opportunities for higher-value employment and constrains the region's influence over technological trajectories.

Policy implications:

- Diversification strategies should move from aspirational planning to targeted implementation, with clearer prioritisation of sectors linked to green mobility, energy systems, and industrial services.
- Public support instruments should more strongly incentivise the localisation of applied R&D, testing, and pilot production, rather than focusing predominantly on assembly activities.
- Regional development policy would benefit from tying investment incentives to knowledge spillovers, workforce upgrading, and collaboration with local education and research institutions.

Strategic intent versus implementation gaps

The region has articulated ambitious long-term climate and sustainability objectives. However, implementation capacity consistently lags behind strategic intent. Fragmented governance structures, fiscal limitations, and unresolved coordination problems across regional, municipal, and national levels hinder the delivery of key initiatives, including the Smart agenda and the proposed innovation cluster. Existing dialogue platforms often function as consultative forums rather than decision-making arenas, and key actors (particularly trade unions) lack systematic access to strategic information and planning processes.

Policy implications:

- Governance reform should prioritise clearer division of responsibilities and stronger horizontal coordination between economic, transport, education, and environmental policy domains.
- Strategic platforms should be upgraded from ad hoc consultation mechanisms to structured co-decision or co-design arrangements, with guaranteed participation of social partners.
- Capacity-building support for regional and municipal administrations is essential to translate strategic frameworks into implementable projects with measurable outcomes.

Labour-market constraints and skills mismatch

Persistent shortages of skilled technicians, maintenance workers, and digitally proficient employees undermine the region's ability to absorb technological change and move up the value chain. Vocational education and training systems have not kept pace with developments in electromobility, automation, and digitalisation. While promising initiatives are emerging (such as new specialised study tracks) their scale and uptake remain insufficient relative to anticipated transformation pressures. The growing reliance on foreign labour sustains production in the short term but intensifies pressures on housing, transport, and public services.

Policy implications:

- Skills policy should shift from reactive, firm-specific training toward anticipatory planning based on medium-term transition scenarios.
- Stronger coordination is needed between employers, VET providers, and public authorities to align curricula with emerging technological needs, particularly in green and digital domains.
- Complementary housing and mobility policies are required to manage the social and infrastructural

impacts of labour inflows and to support workforce retention.

Infrastructure Bottlenecks and Mobility Pressures

High levels of commuting and freight traffic place sustained pressure on transport systems, making mobility resilience a critical condition for labour-market stability and industrial competitiveness. Infrastructure development is hindered by administrative complexity, land fragmentation, and inadequate coordination among responsible authorities, resulting in delays for even well-defined green mobility projects. Nevertheless, incremental progress is visible through the expansion of charging infrastructure and investment in priority cycling routes.

Policy implications:

- Transport and land-use planning should be more tightly integrated with industrial and labour-market strategies, recognising (eco)mobility as a core enabler of transition rather than a standalone policy area.
- Streamlining administrative procedures and strengthening inter-municipal coordination would significantly reduce delays in infrastructure delivery.
- Continued investment in low-carbon mobility should be complemented by demand-management measures and employer engagement to reduce peak congestion and commuting intensity.

Overall, the region's transition challenge is less a lack of strategic vision than a deficit in coordination, implementation capacity, and institutional alignment. Addressing these weaknesses through integrated, participatory, and policy-driven interventions will be essential to translate sustainability ambitions into tangible economic, social, and environmental outcomes.

7.0 Other useful materials and sources

- **Open Data Portal – TTSK** (https://opendata.trnava-vuc.sk)
    - This is the regional open-data and geospatial information portal operated by the Trnava Self-Governing Region (TTSK). The portal includes a wide variety of datasets: infrastructure, environment, demographics, transport, land-use, and more. It is particularly useful for quantitative analysis because it provides raw data, georeferenced layers, and historical trends that can be used to assess infrastructure capacity, spatial inequalities, mobility patterns, and environmental impact.

- **KIRA Data Portal** (https://data.kira.sk)
    - Managed by KIRA (the regional innovation and development agency), this portal offers data related to innovation, economic development, green technologies, and project performance in TTSK. It supports analysis on how regional innovation ecosystems function, how development funds are deployed, and which sectors (such as low-carbon or digital) are most active. It is especially relevant for understanding how public-private collaboration, research institutions, and social stakeholders contribute to sustainable regional development.

- **SMART Strategy TTSK** (https://www.trnava.sk/userfiles/file/Strategicky%20dokument.pdf)
    - This strategic document outlines the region's long-term vision for digital transformation, smart mobility, environmental sustainability, and modern public services. It defines priority areas, key interventions, governance arrangements, and performance indicators. The strategy serves as a reference point for evaluating policy coherence, implementation progress, and alignment with national and EU-level frameworks (e.g., Green Deal, Cohesion Policy 2021–2027).

- **Nízkouhlíková stratégia TTSK (Low-Carbon Strategy)** (https://trnava-vuc.sk/wp-content/uploads/2022/03/201641.pdf)
    - This strategic plan is specifically focused on climate mitigation and low-carbon development in the Trnava region. The document includes a SWOT analysis, emission-reduction targets, sectoral measures, and adaptation strategies. It is a fundamental source for any policy report or research project on decarbonization, as it reveals the region's formal climate ambitions, planned interventions, and key risks.

- **SMART platform city of Trnava** (https://smart.trnava.sk)
    - This platform documents the city's ongoing smart-city initiatives across mobility, energy management, digital participation, and public-space monitoring. It features project descriptions, pilot results, and interactive tools (e.g., traffic management dashboards). For regional analysis, the portal illustrates how local-level innovation aligns - or fails to align - with regional ambitions.

- **Cestuj ľahko** (https://www.cestujlahko.sk)
    - *Cestuj ľahko* ("Travel easily") is the public transport ticketing and information platform for the Trnava region. It provides real-time transit schedules, fare information, and multimodal route planners. For a report, it is an important empirical resource to assess how integrated, user-friendly, and "smart" public transport services are in practice. It also helps evaluate gaps in transport service delivery, especially concerning accessibility, digitalization, and mobility demand.

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