SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY 2025
ORGANIZATION AND MANAGEMENT SERIES NO. 237

INNOVATION MANAGEMENT MODEL TOWARDS ELECTROMOBILITY FOR PEOPLE WITH DISABILITIES

Ewa STAWIARSKA

Silesian University of Technology; ewa.stawiarska@polsl.pl, ORCID: 0000-0003-1198-1134

Purpose: The aim of this article is to outline the main issues that should be addressed through broad cooperation between stakeholders of the future system supporting the electromobility of people with disabilities. Key stakeholders include SMEs providing services for electromobile users with disabilities. Therefore, another goal of the article was to present an exemplary business model of a small company contributing to the development of electromobility for people with disabilities.
Design/methodology/approach: The analysis of the need to develop a model was based on statistical data concerning the number of people with disabilities in the European Union, including Poland, and on assumptions regarding the development of electromobility in Europe. The construction of the model was described using literature studies. The SME business model was prepared using a case study method supported by an interview with the owner of a small enterprise.
Findings: The research (through a literature review and available quantitative data) confirmed the hypothesis that "there is a need for cooperation between various stakeholders to support the development of electromobility for people with disabilities". A case study of a developing small enterprise confirmed another hypothesis: "SMEs (developing electromobility services for people with disabilities) require support in developing innovative business models based on Industry 4.0 solutions and artificial intelligence".
Research limitations/implications: Future research should include primary studies conducted among stakeholders of the emerging system. Such research will identify motivation and willingness to cooperate, as well as outline a vision for further development. Based on the research carried out so far, no final conclusions can yet be drawn regarding the future of the innovation management model for electromobility of people with disabilities.
Social implications: The innovation management model for electromobility of people with disabilities presented in this paper may have significant social implications. First, it promotes transport inclusion, increasing mobility and independence of persons with disabilities, which directly improves their quality of life and enhances their social and professional participation. From the perspective of corporate social responsibility (CSR), this model highlights the potential for SMEs to pursue activities aligned with sustainable development, combining economic goals with social and environmental needs. It may also lead to the development of innovative services based on Industry 4.0 and AI technologies. Finally, the article may serve as a starting point for shaping public and industry policies that promote cross-sectoral cooperation (administration, SMEs, NGOs, emergency services) as well as the

creation of dedicated support programs for companies implementing technologies supporting electromobility for people with disabilities.
Keywords: electromobility, disability, management, innovation.
Category of the paper: Research article.

Introduction

In the face of advancing climate change and the European Union's efforts to achieve carbon neutrality, electromobility is becoming one of the pillars of modern transport policy. A particular area of concern is the need to take into account people with disabilities, for whom the development of infrastructure and electric vehicles should be tailored to their needs. This article presents a model for managing innovations developed for the electromobility of people with disabilities. The model is to be based on cooperation between European Union institutions, state administration, road infrastructure managers, public transport operators, emergency services, and the private sector (car manufacturers and service providers).

1. People with disabilities and their expectations regarding mobility

People with disabilities constitute a significant part of the EU population, and their participation in public life is comparable to that of able-bodied people. People with disabilities face various problems. There are people with: mobility disabilities (damaged right lower limb, damaged left lower limb, damaged right upper limb, damaged left upper limb, damaged cervical spine, damaged lumbar spine, etc.); people with sensory disabilities (vision); people with sensory disabilities (hearing) (Stawiarska, E., Stawiarski, M., 2023). Figures 1, 2, 3, and 4 show people with disabilities in the European Union.

Figure 1 shows the proportion of persons with disabilities (in general) – i.e., the percentage of the EU population that reports limitations in daily activities.

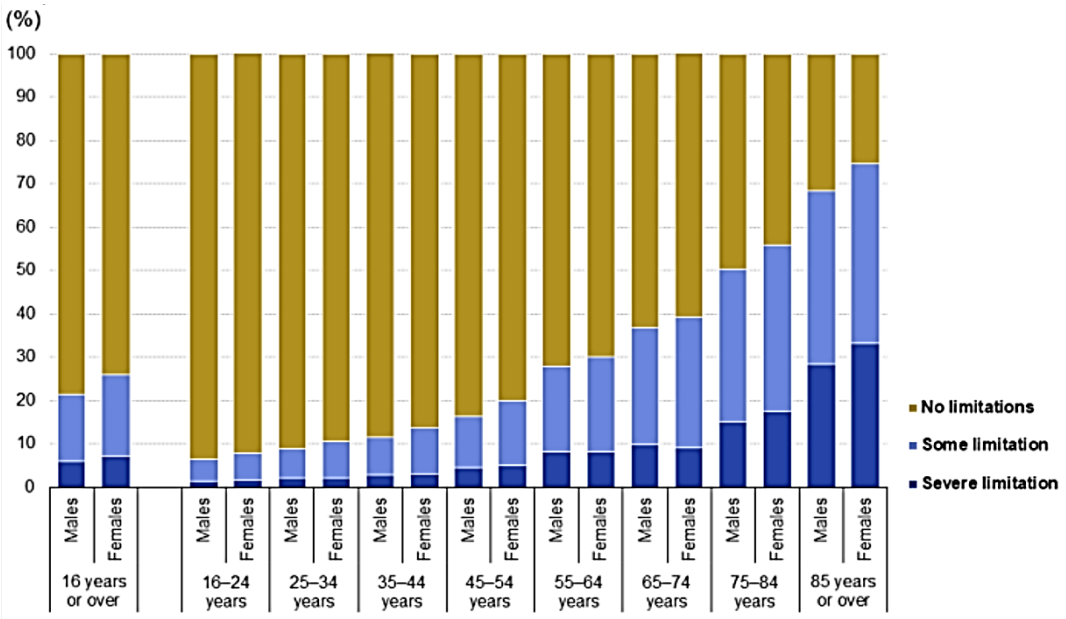

Figure 1. Share of persons with disabilities (total by age of respondents) in 2024.

Source: https://ec.europa.eu/eurostat/statistics-explained/images/thumb/9/96/Share_of_people_with_a_disability_%28activity_limitation%29%2C_by_sex_and_age%2C_EU%2C_2024_%28%25%29_Health2025.png/700px-Share_of_people_with_a_disability_%28activity_limitation%29%2C_by_sex_and_age%2C_EU%2C_2024_%28%25%29_Health2025.png

The figure 1 shows that the percentage of disabled people increases with the age of women and men. Figure 2 shows the percentage of people with difficulties in basic activities – percentage data on physical difficulties in daily activities.

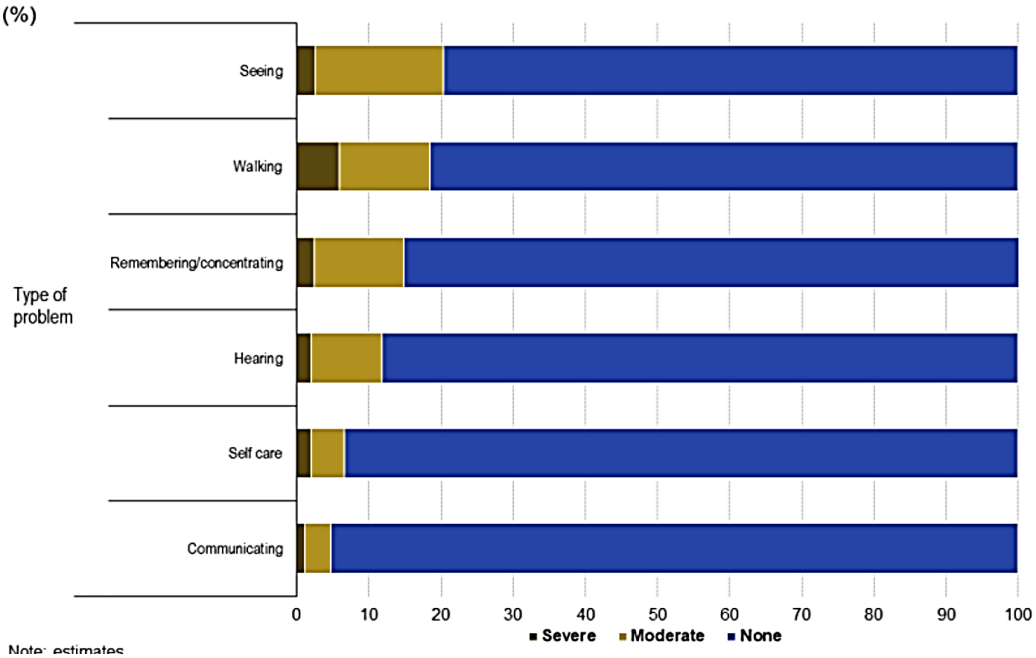

Figure 2. Percentage of people with difficulties in basic motor activities, UE, 2022.

Source: https://ec.europa.eu/eurostat/statistics-explained/images/thumb/c/c7/Share_of_people_aged_16_years_or_over_reporting_difficulties_in_basic_activities%2C_EU%2C_2022_%28%25%29.png/800px-Share_of_people_aged_16_years_or_over_reporting_difficulties_in_basic_activities%2C_EU%2C_2022_%28%25%29.png

The figure 2 shows that the largest group of disabled people are those with mobility disabilities. Figure 3 shows the proportion of persons with disabilities due to activity limitations (overall) – chart showing breakdown by country and level of limitations.

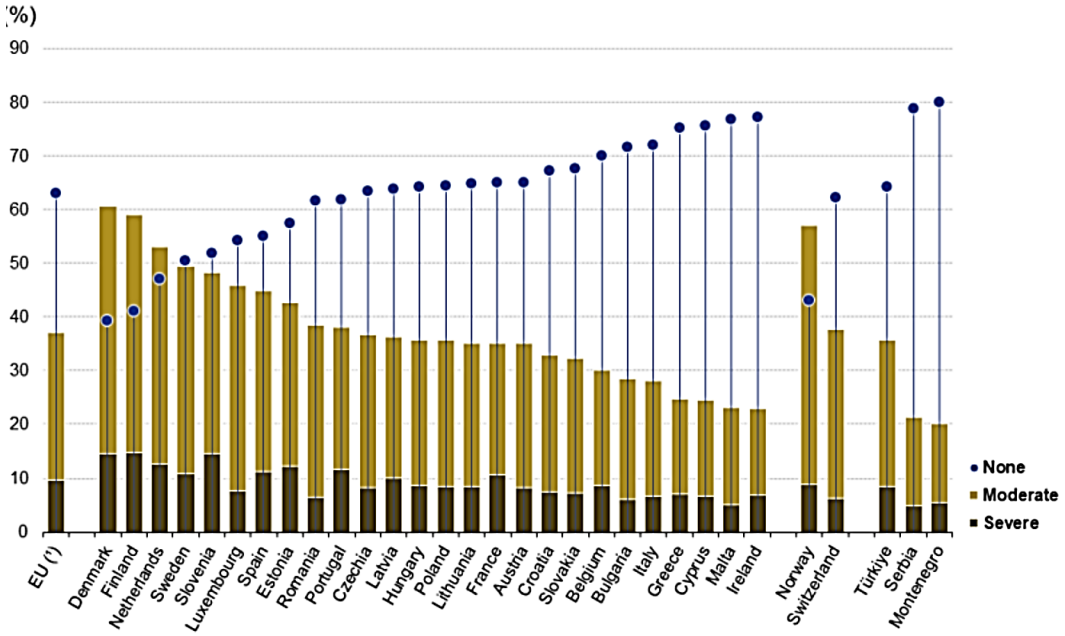

Figure 3. Share of persons with disabilities due to activity limitations (overall), 2022.

Source: https://ec.europa.eu/eurostat/statistics-explained/images/thumb/6/6d/Share_of_people_aged_16_years_or_over_reporting_difficulties_in_basic_activities%2C_2022_%28%25%29.png/800px-Share_of_people_aged_16_years_or_over_reporting_difficulties_in_basic_activities%2C_2022_%28%25%29.png

The figure 3 shows that the largest group of disabled people in relation to the entire population is in Germany and the Scandinavian countries. Figure 4 shows the proportion of persons with disabilities due to activity limitations (overall) – a chart showing the breakdown by country or level of limitations.

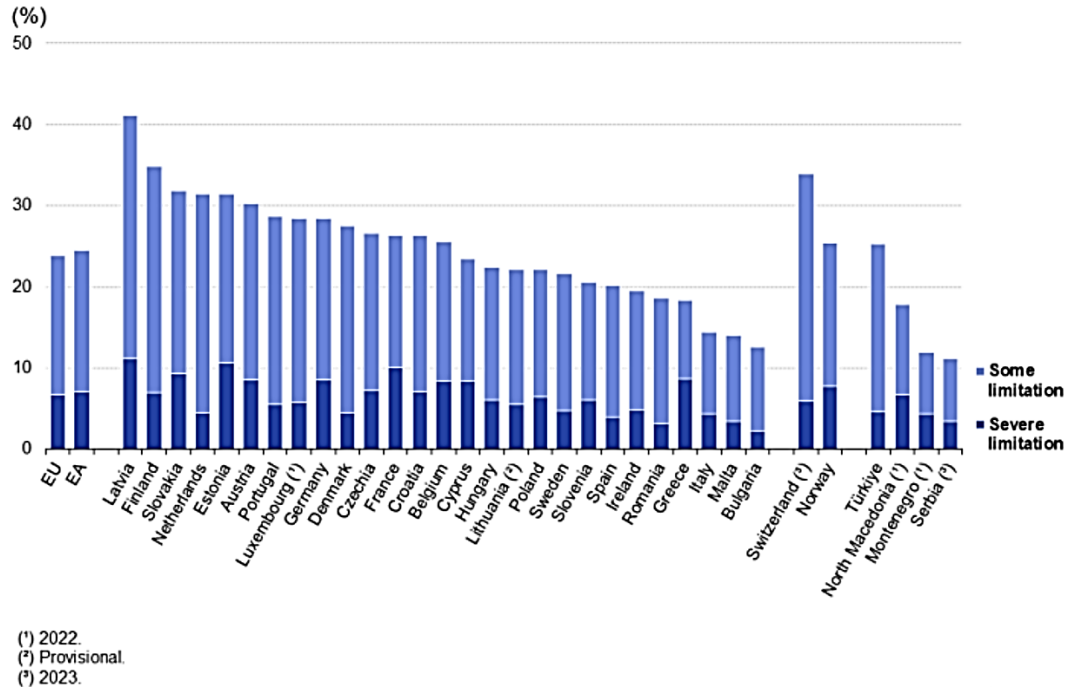

Figure 4. Share of persons with disabilities due to activity limitations (overall), 2024.

Source: https://ec.europa.eu/eurostat/statistics-explained/images/thumb/a/ad/Share_of_people_aged_16_years_or_over_with_a_disability_%28activity_limitation%29%2C_2024_%28%25%29_Health2025.png/700px-Share_of_people_aged_16_years_or_over_with_a_disability_%28activity_limitation%29%2C_2024_%28%25%29_Health2025.png

The figure 4 shows that the most severe disabilities affect people from Latvia and the Scandinavian countries.

The figures above show that in 2022–2023, around 27% of people (aged 16 and over) in the EU had some form of disability, i.e., activity limitations resulting from health problems. This equates to around 101 million adults across the EU. Disability increases with age:

- 16-19 years old: ~7% of the population has a disability,
- 45-64 years old: ~27% of the population has a disability,
- 65+ years old: over 50% of the population has a disability.

Women were more likely to report disability: ~29-30% compared to ~24% of men.

In Poland, musculoskeletal, cardiovascular, and neurological disorders are the most common causes of disability. Persistent hearing and vision impairments also occur, although less frequently (niepelnosprawni.gov.pl+1.). Unfortunately, Polish public statistics do not provide detailed data on specific impairments (e.g., limbs or spine).

The Irish example provides some approximate proportions:

- Blindness or visual impairment: 6% of the population, representing 27% of all people with long-term difficulties (cso.ie.).
- Deafness or hearing impairment: 5% of the population (21% of the total) (cso.ie.).
- Difficulties with physical activities (walking, climbing): ~7% of the population (31% of all difficulties) (cso.ie.).

People with disabilities constitute a significant part of society, and their participation in public and economic life requires adequate access to means of transport. Electromobility, as a new paradigm in the transport sector, offers opportunities to increase accessibility and comfort of travel, but requires integrated innovation management at multiple levels (Feldner, 2018).

Analysis of data on the number of people with disabilities confirms the need for collaboration between various stakeholders to support the development of electromobility for people with disabilities.

2. Legal and institutional framework for electromobility for persons with disabilities

The European Union plays a key role in shaping electromobility policy. The change in demand for services will result from the implementation of the European Transport Policy. The European Commission has set targets to be achieved and intends to use policy instruments to achieve them (Khurshid et al., 2023). Among other things, the following goals are to be achieved:

- Goal 1. Develop and introduce new fuels and propulsion systems that are compatible with the principle of sustainable development and will contribute to halving the number of conventionally powered cars in urban transport by 2030. As a result, it is assumed that they will be eliminated from cities by 2050, thus achieving essentially CO_2 - free logistics in large urban centers as early as 2030. Directives and regulations on sustainable transport and CO_2 reduction have already been established (e.g., Regulation (EU) 2019/631 on CO_2 emission standards for cars).
- Target 9. Achieve close to zero road traffic fatalities by 2050. In line with the above, the European Union aims to halve road accident fatalities by 2020. Financial programs and grants supporting innovation and infrastructure development include Horizon Europe and CEF – Connecting Europe Facility.
- Objective 10. Support for people with disabilities. Regulations on accessibility for people with disabilities (e.g., European Accessibility Act).

The objectives and already implemented instruments of the European Transport Policy suggest that the number of electric cars will increase (especially those serving cities). This fact will necessitate the creation of modern service points for electric vehicles. The requirements for car diagnostics will be tightened. This will necessitate the retrofitting of service stations with smart devices adapted to the needs of various market segments (including the disabled segment). The financial and non-financial instruments used will support people with disabilities (who want to purchase electric means of transport). Financial support is also accompanied by

other regulations, such as Directive 2007/46/EC and Regulation (EU) 2018/858 (on the approval of vehicles, including electric vehicles); Commission Regulation (EU) No. 1230/2012.

As can be seen from the above, in the model of innovation management towards electromobility for people with disabilities, the EU acts as a regulator, coordinator, and sponsor of innovation, imposing minimum standards of accessibility and energy efficiency.

The Polish government performs implementation, legislative, and supervisory functions, and also coordinates cooperation with local governments. The Polish government is responsible, among other things, for:

- transposing EU law into the national legal system,
- issuing executive regulations concerning technical conditions for vehicles, type-approval standards, and standards for electric car charging infrastructure,
- support programs for people with disabilities (e.g., subsidies for electric vehicles adapted to the needs of people with disabilities, e.g., from the "Mój Elektryk" program),
- regulations concerning the safety and approval of specialized vehicles.

Important documents supporting electromobility for people with disabilities in Poland include:

- Road Traffic Law (Journal of Laws 1997 No. 98 item 602).
- Regulation of the Minister of Infrastructure on technical conditions for vehicles (Journal of Laws 2016 item 2022).
- Polish law and regulations / AFIR: Journal of Laws "Electromobility and alternative fuels".
- PN-ISO 7176-19:2013 and PN-EN 1756-2:2015 (technical standards).
- Act on ensuring the possibility of obtaining additional needs (Journal of Laws 2019, item 1696).
- Regulation of the Minister of Transport on vehicle type approval (Journal of Laws 2015, item 1475).
- Regulations on financing: PERON funding; disability allowance (DLA); increased mobility component of Personal Independence Payment (PIP); Armed Forces Independence Payment (AFIP); mobility allowance for war pensioners.

Analysis of the literature and legal acts confirms that there are grounds for organizing cooperation between various stakeholders to support the development of electromobility for people with disabilities.

3. Stakeholders in the innovation management model for the electromobility of persons with disabilities

In addition to the European Union institutions and the governments of the Member States, the following are important stakeholders in the model:

3.1. Road infrastructure managers

Their role includes:

- Designing and building charging infrastructure that takes into account the needs of people with disabilities (e.g., maneuvering space at charging stations).
- Adapting road infrastructure (sidewalks, crossings, P+R parking lots) for specialized vehicles.
- Ensuring digital integration with navigation systems (data on accessible charging points for people with disabilities).
- Implementation of AI-based Smart Traffic Management systems that automatically prioritize vehicles for people with disabilities in urban traffic (e.g., extending green lights, automatic opening of barriers).
- Integrating charging infrastructure with IoT technology – stations that recognize users with disabilities (e.g., through digital IDs, PFRON cards) and automatically adjust interfaces (e.g., lowered screens, voice assistant).
- Designing inclusive mobility hubs that combine EV charging with support services (e.g., medical equipment rental, digital passenger service kiosks).

3.2. Public transport operators.

They play a key role in the integration of public transport:

- Purchase and operation of fully accessible electric buses (low-floor, lifts, information systems).
- Integration of passenger information systems with solutions supporting people with disabilities (e.g., voice announcements, mobile applications) (Oladele et al., 2021).
- Creation of coordinated multimodal routes with disability-friendly transfers (Lee, Sener, 2023).
- Implementation of autonomous electric minibuses serving “last mile” routes dedicated to people with mobility impairments (Oladele et al., 2021).
- Integration of data from health and mobile applications – the possibility of automatic reservation of a seat on a bus/tram by persons with disabilities (e.g., notifying the driver of the need to use a ramp).
- Digital twins of the transport system – simulating the journeys of people with different types of disabilities to identify barriers and test solutions (Lee, Sener, 2023).

3.3. Emergency services.

They play a key role in ensuring safety, e.g.:

Fire department:

- Responsible for safety procedures in the event of fires in electric vehicles, especially those adapted for people with disabilities.
- Participation in training and testing of prototypes of specialized vehicles.
- Cooperating with manufacturers to develop rescue procedures.
- Developing VR/AR rescue simulations for training in the evacuation of people with disabilities from electric vehicles.
- Creating real-time EV battery monitoring sensors that send data to emergency services in the event of a breakdown or fire.

Medical rescue:

- Ensuring accessibility to rescue systems in EVs (e.g., e-Call systems, liftable seats, emergency opening).
- Consulting with vehicle and infrastructure designers.
- Developing smart stretchers and lifting systems integrated into EVs to facilitate the evacuation of people with reduced mobility.
- Applying telemedicine in EVs – an e-Health system that allows remote diagnosis of a passenger's health in an emergency.

3.4. Industry and the private sector.

Basic functions performed in the model by:

Electric car manufacturers:

- Design and implementation of EV platforms adapted for people with disabilities (e.g., manual operation, space for wheelchairs) (Golbabaei et al., 2024).
- Participation in pilot projects testing innovative solutions.
- Designing modular EV platforms that allow for quick adaptation of the vehicle to different types of disabilities (Golbabaei et al., 2024).
- Integration of AI assistance systems (e.g., voice control, eye-tracking, gestures) enabling touchless vehicle operation.
- Development of shared EVs designed specifically for users with disabilities.

Car tuning/refurbishment companies:

- Adaptation of production vehicles to the individual needs of users with disabilities.
- Cooperation with the National Health Fund, the State Fund for Rehabilitation of Disabled Persons, and the Ministry of Family, Labor, and Social Policy to standardize and finance vehicle adaptations.

- Introduction of digital adaptation configurators – the customer selects adaptations online (e.g., manual throttle, lift, information systems), and the system generates a digital model of the vehicle. (e.g., handles, control joysticks).
- Blockchain for transparency in adaptation financing – digital recording of subsidies, refunds, and service costs, which increases trust between companies and public institutions.

A literature review and a retrospective of possible activities of various organizations confirmed that there are opportunities for cooperation to support the development of electromobility for people with disabilities.

4. Cooperation model for the electromobility of people with disabilities – a systemic approach

The proposed model assumes vertical and horizontal cooperation (according to: Tidd, Bessant, 2018; Stawiarska, 2023, 2024) stakeholders supporting the development of electromobility for people with disabilities. The following can be distinguished:

- Vertical institutional cooperation:
  EU → Polish Government → Local governments → Operators
- Horizontal sectoral cooperation:
  Automotive industry ↔ Emergency services ↔ Users ↔ Scientific institutions ↔ Organizations of people with disabilities

The key elements of the innovation management model for the electromobility of people with disabilities are presented in Table 1.

Table 1.
Key elements of the innovation management model for electromobility for people with disabilities

System Element	Function	Cooperation with
EU	Legislation, funding	Government, industry
Government of the Republic of Poland	National legislation	EU, local governments
Local governments, road managers	Infrastructure	Government, companies
EV manufacturers	Production, innovation	Adaptation companies, emergency services
Tuning companies	Adaptation	Users, emergency services
Emergency services	Safety	Manufacturers, local governments
Organizations of people with disabilities	Consultations	All stakeholders

Source: Own work based on: (Stawiarska et al., 2024, 2025).

Electromobility for people with disabilities cannot be developed in isolation from a systemic approach to innovation. An effective innovation management model requires integrated cooperation between all stakeholders, from EU institutions to vehicle tuning companies.

A special role here falls to the bodies appointed by the Member States, which must ensure the implementation of regulations, as well as initiate local pilot projects and manage cross-sector cooperation (in Poland, this role is performed by the Polish Chamber of Electromobility Development).

The Polish Chamber of Electromobility Development (PIRE) does not offer direct support to SMEs, but acts as an organization promoting electromobility, identifying the sector's needs in terms of support policies (e.g., subsidies, preferential energy prices, infrastructure development) and cooperating with institutions such as PARP to create programs that may be available to companies. The Chamber conducts lobbying and educational activities and is also a member of the international organization CharIN, which supports the development of interoperable charging standards. PIRE actively monitors and publishes data on the development of electromobility, which is a valuable source of information for companies planning investments in this area.

How PIRE supports SMEs (indirectly):

- Identification of needs: The Chamber identifies which support measures are key to the development of electromobility in Poland, including subsidies and preferential conditions for entrepreneurs.
- Cooperation with institutions: As a supporting member of organizations such as CharIN, PIRE has an influence on shaping regulations and standards in electromobility, which may translate into better conditions for SMEs in the future.
- Providing information: PIRE regularly publishes analyses and reports on the electromobility market, which helps entrepreneurs make investment decisions and identify development opportunities.
- Activities for infrastructure development: The Chamber promotes the development of charging infrastructure, which is crucial for the accessibility and profitability of electromobility for companies.

Examples of organizations working in the field of electromobility are presented in the TRL/PIARC report Managing Innovation in Transport Agencies. There you can find practical materials on the implementation of innovation in transport agencies. It is a good source of examples of innovation project management and implementation barriers.

Entrepreneurs working to develop electromobility for people with disabilities should intensively model their businesses in this direction.

Chapters 1, 2, 3 and 4 of the article confirm the hypothesis that "there is a need for cooperation between various stakeholders to support the development of electromobility for people with disabilities".

5. A new business model focused on the development of electromobility for people with disabilities – a case study

In the context of the growing number of electric vehicles, ensuring the accessibility of transport for people with disabilities remains an important issue. This chapter presents a business model that integrates the adaptation of electric vehicles for people with disabilities with a short-term rental service for adapted vehicles, supported by process innovation and digitization.

A business model can be defined as the logic of creating, delivering, and capturing value by an organization (Osterwalder & Pigneur, 2010). It covers the key elements of a company's operations: customer segments, value proposition, distribution channels, customer relationships, revenue streams, key resources, key processes, strategic partners, and cost structure. In the context of electromobility for people with disabilities, the business model should be characterized by:

- flexibility (ability to serve different types of disabilities),
- transparency (clear cost and service rules),
- digitization (remote customer service),
- service integration (adaptation + rental + service).

Table 2 presents the Business Model Canvas – case studies. Table 2 shows the key elements of the business model according to the Business Model Canvas methodology.

Table 2.
Business model for adapting and renting electric vehicles for people with disabilities

Canvas Element	Case Study Description
Customer Segments	People with permanent and temporary mobility and sensory disabilities; tourists; public institutions; fleet management companies.
Value Proposition	Access to electromobility through adapted electric vehicles; short-term rental of adapted cars; digital end-to-end service and maintenance.
Channels	Adaptation workshop, online platform, mobile app, cooperation with airports (e.g., Modlin).
Customer Relationships	Empathetic and individual service; transparent pricing; 24/7 digital communication; loyalty program.
Revenue Streams	Fees for vehicle adaptation, car rental, service subscriptions, additional services (GPS monitoring, inspections).
Key Resources	Skilled employees, adaptive technologies, equipped workshop, IT system, brand and reputation.
Key Activities	Customer needs analysis, adaptation design, installation of devices, rental, service, digital support.
Key Partners	Suppliers of adaptive devices, financial institutions (e.g., PFRON, EU), organizations supporting people with disabilities, fleet rental companies.
Cost Structure	Investments in workshop and IT, staff training, equipment maintenance, marketing, software license costs.

Source: Own work based on: (Stawiarska et al., 2024, 2025).

The proposed business model is innovative on the Polish market because it combines the adaptation of electric cars with a short-term rental service. The integration of processes through an IT system that ensures the following is of key importance:

- automation of customer service,
- cost transparency,
- personalization of services,
- monitoring of vehicle safety and location.

The customer service process for both services has been developed in a comprehensive and digitized manner. It consists of eight stages: needs analysis, modification design, device installation, testing, training, monitoring, servicing, and vehicle return.

The implementation of an innovative IT system (e.g., FIRAMA2000 software) enables:

- automatic vehicle data acquisition (e.g., via Aztec code),
- transparent cost estimation of services,
- digital communication with the customer,
- monitoring of order progress,
- integration with the warehouse systems of parts suppliers,
- generation of reports, invoices, and JPK files.

This makes the customer service process more user-friendly, transparent, and time-efficient.

Implementing the model requires high investment costs, but at the same time allows the use of EU and PFRON funds, which reduces the financial risk. The new business model supports the development of inclusive electromobility, in line with the assumptions of the European Transport Policy. The inclusion of people with disabilities in the area of zero-emission transport requires not only technology, but also an appropriate organizational and business model. Thus, it is an example of how product, process, and organizational innovations can support sustainable transport development and social inclusion.

Chapter 5 of this article confirms the hypothesis that "SMEs (developing electromobility services for people with disabilities) require support in developing innovative business models based on Industry 4.0 solutions and artificial intelligence."

6. Discussion

The model of innovation management towards electromobility for people with disabilities presented in the article is part of a growing trend in research on transport inclusion and the development of services oriented towards the needs of specific user groups. The results of research by Lamedica et al. (2022) indicate that the creation of electromobility solutions for people with mobility limitations requires a systemic approach that integrates different

institutional levels and sectors of the economy. Similarly, the article emphasizes the need for multi-level cooperation—from EU institutions, through national and local authorities, to the private sector and SMEs.

There is a noticeable trend in the literature to extend the concept of electromobility to micromobility and alternative solutions. A review by Lee and Sener (2023) shows that e-bikes and other light vehicles can serve as a tool for inclusion, especially in the context of cost or infrastructure barriers. This article complements this theme by pointing to the potential of SMEs to create flexible business models that combine vehicle adaptation with rental services, thereby expanding the range of available forms of transport.

An important contribution of this work is the proposal of an innovative business model based on digitization and integrated services. In the literature on the subject, the role of Industry 4.0 technologies and the Internet of Things has been emphasized, among others, by Oladele et al. (2021), who pointed to the possibilities of integrating mobility assistance devices with digital and telemedicine systems. The customer service management system proposed in the article, based on transparency, personalization, and digital monitoring, is in line with this trend.

From a social perspective, the presented business model corresponds with the research of Feldner et al. (2018), which confirms that providing early access to mobility assistance solutions improves the quality of life and social integration of people with disabilities. The introduction of systemic EV adaptation and rental services can therefore significantly increase the independence and social participation of this group.

It is also worth noting the aspect of vehicle and infrastructure design. Golbabaei et al. (2024) emphasize that the development of accessible electric vehicles, including autonomous vehicles, requires consideration of universal design and consultation with end users. The article expands on this theme by pointing to the role of disability organizations as key stakeholders in the innovation management process.

7. Conclusion

Electromobility, understood as the development of transport based on electric drives, is one of the key areas of economic and social transformation. Its aim is to reduce greenhouse gas emissions, improve the quality of life of city dwellers, and increase transport safety. The development of electromobility must take into account the needs of people with disabilities in order to implement the idea of sustainable and inclusive transport. The presented model of innovation management towards electromobility for people with disabilities and an example of a selected business model based on the adaptation and rental of electric vehicles and digital support for the service process form the foundation for the mobility of people with disabilities. Their implementation will contribute to increasing the independence of people with disabilities, improving transport safety, and achieving the objectives of European transport policy.

References

1. Feldner, H. (2018). Impacts of early powered mobility provision on disability identity: A case study. *Rehabil. Psychol., 2019 May; 64(2),* 130-145. doi: 10.1037/rep0000259. Epub 2018 Dec 20. PMID: 30570332; PMCID: PMC6768560
2. Golbabaei, F., Dwyer, J., Gomez, R., Peterson, A., Cocks, K., Bubke, A. (2024). Enabling mobility and inclusion: Designing accessible autonomous vehicles for people with disabilities. *Cities*, *154*, *Article number: 105333*.
3. Idris, M.C. et al. (2021). Innovation Management Systems and Standards. *Sustainability, MDPI.*
4. Khurshid, A., Khan, K., Saleem, S., Cifuentes-Faura, J. Cantemir, C.A. (2023). Transport sector innovation, climate change and social welfare. *Journal of Cleaner Production, 11, Vol. 427, Article 139250*, p. 139250.
5. Lamedica, R., Maccioni, M., Ruvio, A., Carere, F., Mortelliti, N., Gatta, F.M., Geri, A. (2022). Optimization of e-Mobility Service for Disabled People Using a Multistep Integrated Methodology. *Energies, 15(8),* 2751. MDPI. https://doi.org/10.3390/en15082751
6. Lee, K., Sener, I.N. (2023), E-bikes toward inclusive mobility: A literature review of perceptions, concerns and barriers**.** *Transportation Research Interdisciplinary Perspectives, 22.* ScienceDirect.
7. Oladele, D.A., Markus, E.D., Abu-Mahfouz, A.M. (2021). Adaptability of Assistive Mobility Devices and the Role of the Internet of Medical Things: Comprehensive Review. *JMIR Rehabil. Assist. Technol., 8(4),* e29610. doi: 10.2196/29610. PMID: 34779786; PMCID: PMC8663709.
8. Polska ustawa i regulacje / AFIR: Dz.U. „Elektromobilność i paliwa alternatywne" (akt prawny) oraz komunikaty UDT dotyczące AFIR (rozporządzenie UE i wpływ na infrastrukturę ładowania). SIP LexUrząd Dozoru Technicznego, Źródła prawne i regulacyjne niezbędne przy budowie modelu zarządzania (wymogi infrastrukturalne, dostępność, wyjątki dla niepełnosprawnych).
9. Stawiarska, E. (2023). Planowanie i rozwijanie sieci obsługi pojazdów z wykorzystaniem rozwiązań Przemysłu 4.0. In: L. Knop, S. Olko (eds.), *Wyzwania zarządzania przedsiębiorstwami w regionie przemysłowym.* Toruń: Towarzystwo Naukowe Organizacji i Kierowania „Dom Organizatora", ISBN 978-83-67153-08-9.
10. Stawiarska, E. (2024). Management system for innovations created in the open model (with managerial tools). *Scientific Papers of Silesian University of Technology Organization and Management Series, 166*, 731-768, DOI: 10.29119/1641-3466.2022.166.47

11. Stawiarska, E. (2024). Sustainable Electrical Innovation, A Systemic Approach to Innovation Management in the Automotive Supply Chain. *European Research Studies Journal, XXVIII, Iss. 1,* 342-371, DOI: 10.35808/ersj/3907
12. Stawiarska, E., Górecki, K., Mateusz, K. (2025). Human resources management in automotive supply chains in the time of the fourth industrial revolution. *Scientific Papers of Silesian University of Technology Organization and Management Series, 225*, 571-601, DOI: 10.29119/1641-3466.2025.225.32
13. Stawiarska, E., Pawłowska, E., Machnik-Słomka, J. (2024). *Innovation management model for the development of electromobility in european union countries.* 11th SWS International Scientific Conferences on SOCIAL SCIENCES - ISCSS 2024, Doi, 10.35603/sws.iscss.2024/s04/30
14. Stawiarska, E., Stawiarski, M. (2023). Assessment of Patient Treatment and Rehabilitation Processes Using Electromyography Signals and Assessment of Patient Treatment and Rehabilitation Processes Using Electromyography Signals and Selected Industry 4.0 Solutions. *International Journal of Environmental Research and Public Health (IJERPH), 20(4)*, DOI: 10.3390/ijerph20043754
15. Tidd, J., Bessant, J. (2018). *Managing Innovation: Integrating Technological, Market and Organizational Change (6th ed.)*. Wiley.
16. *TRL / PIARC (raport). Managing Innovation in Transport Agencies (przewodnik / raport praktyczny).* trl.co.uk