MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION

Saint Petersburg Electrotechnical University "LETI"

Interdisciplinary Education, Business, Research and Innovation Solutions for the Finnish-Russian Automotive and Motorsport Ecosystem

(Race4Scale)

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Cross-Border Automotive and Motorsport Industry in the Russian Federation and in Finland

1.1. Automotive Industry Trends in the Russian Federation and in Finland

According to the 'Russian Federation Automobile Manufacturing Industry Development Strategy up to 2025', for passenger cars, the level of localization[1] is expected to increase up to 75% by 2025, and for light commercial vehicles and pickup trucks, up to 75-85%. Moreover, it is expected to achieve the following import volumes by 2025: 296 thousand units of passenger cars and 16 thousand units of trucks. At the moment, over 60 percent of automobiles manufactured in the Russian Federation are highly localized (over 50 % localization) and were designed at world leading automobile manufacturers. About 40 percent of overall production can be attributed to B0 Renault-Nissan, KP2 Hyundai and PQ25 Volkswagen.

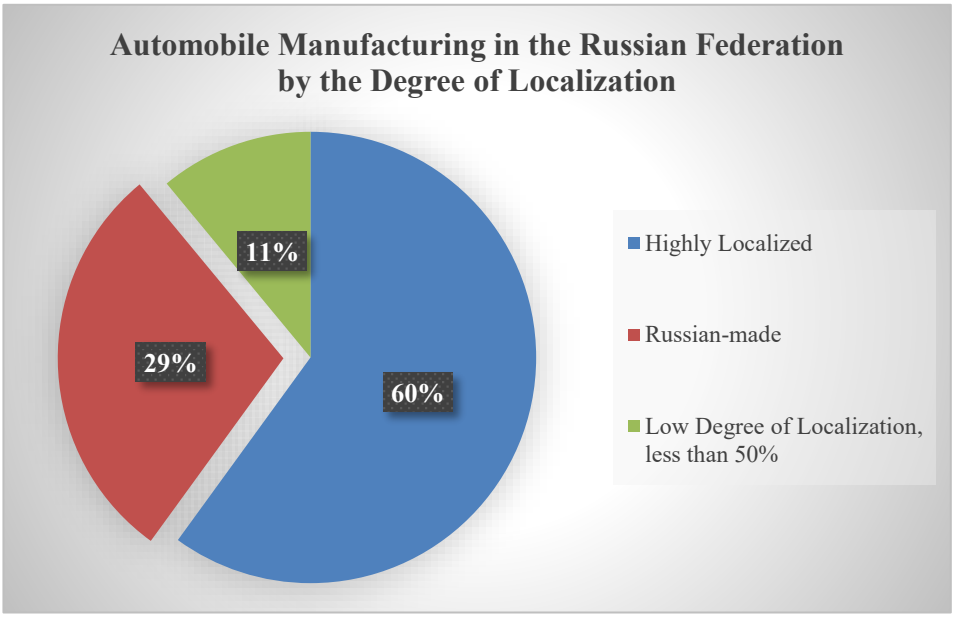

Fig.1. Automobile Manufacturing in the Russian Federation by the Degree of Localization, 2018.

Import dependence in automobile manufacturing can currently be estimated at over 60% (in 2008 it did not exceed 40%), and in truck manufacturing at over 25% (in 2008 - 10%). At the same time, the import dependence in automotive component manufacturing has been increasing as well. For instance, in 2016, for internal combustion engines, the import rate amounted to 26 % (in 2008 – less than 2 %). It is expected that 1,7-1,9 mil. automobiles will be produced in Russia by the year 2020 (with 437 thousand cars sold in the first 4 months) and by the year 2025 - 2,23 mil [16].

[1] Localization means the release of some car parts in the same state where the assembly production is located.

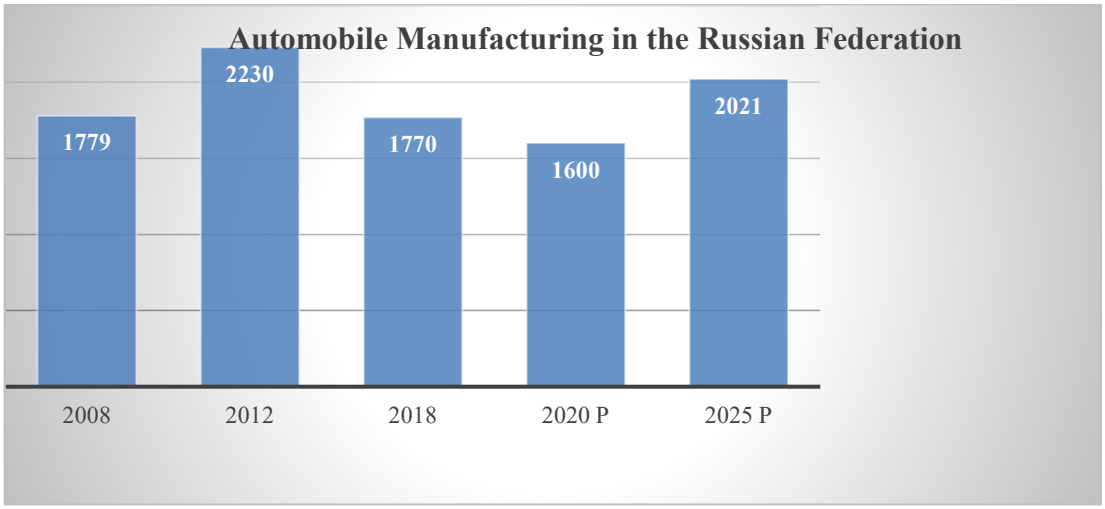

Fig. 2. Automobile Manufacturing in the Russian Federation, thousand units

At the moment, in new product development, R&D and software development are the priority in the following areas:

- Hybrid automobiles and electric vehicles;
- Connected cars (transport systems telematics);
- Autonomous vehicles;
- Gas vehicles.

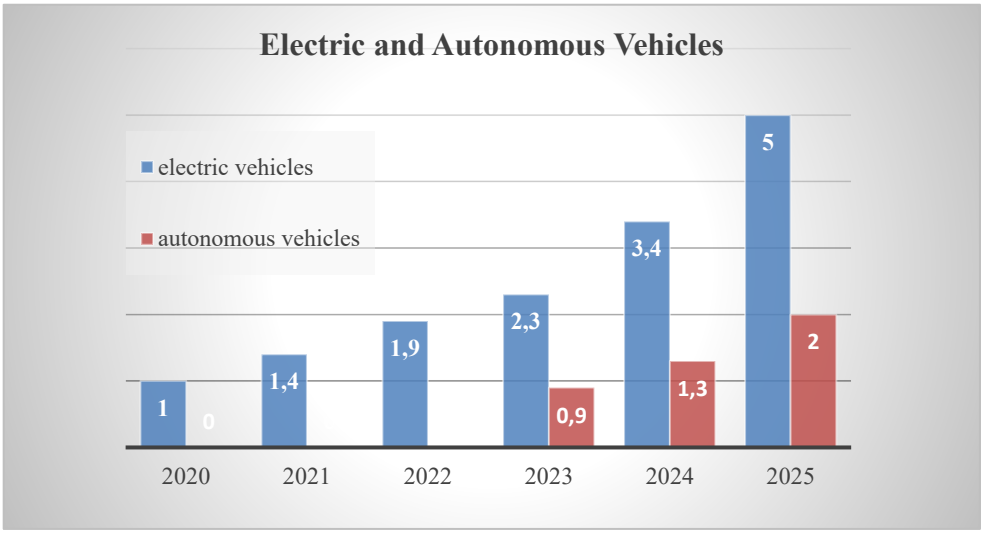

Fig.3. Market Shares of Electric and Autonomous vehicles in the Russian Federation, thousand units

According to the 'Russian Federation Automobile Manufacturing Industry Development Strategy up to 2025', the electric vehicle market share is expected to increase gradually from 1% in 2020 to 5% in 2025 and the market share of self-driving cars manufactured in Russia is expected to increase from 0,9% in 2023 to 2% in 2025, which opens the door for global manufacturers to enter the Russian market.

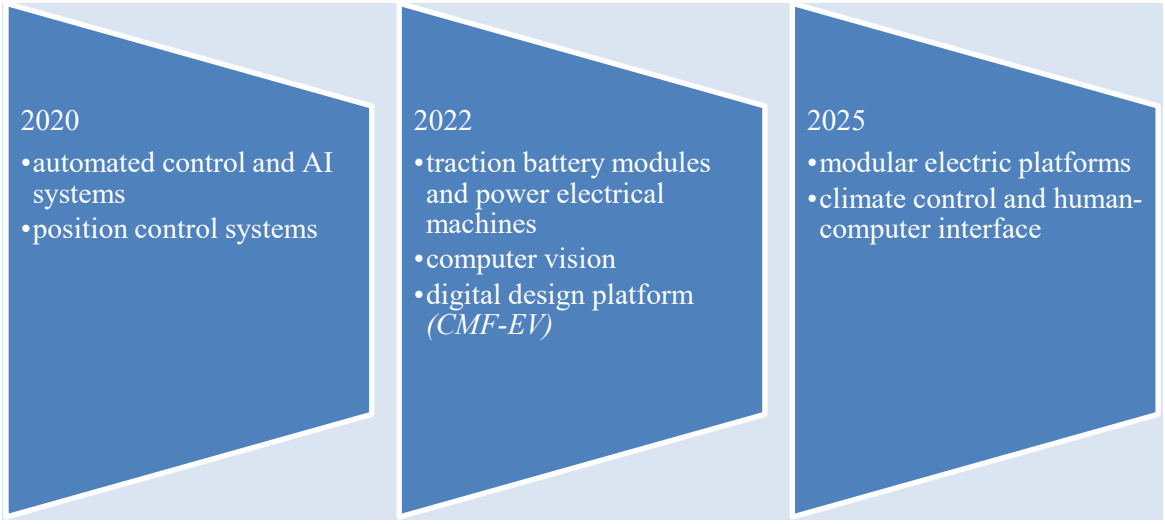

Fig.4. Automotive Industry R&D in the Russian Federation

The Finnish automotive industry is largely dependent on component supply from other countries. However, local manufacturers are slowly but surely gaining ground. Sisu Auto is mostly at the center of truck manufacturing. Sisu Auto is the part of the Oy Sisu Ab conglomerate that manufactures forest equipment, tractors, marine tractors and loaders and military equipment. Sisu Auto is the owner of the Karjaa Plant. At the moment, Sisu is a contract manufacturer only. It offers a wide range of vehicles with 4x4 - 10x10 wheel configuration and over 18-ton gross weight. Despite the competition, Sisu holds 30-40% of the market share in Finnish construction and logging industries. Valmet Automotive represents the automobile industry. It is a contract manufacturer and service provider. Valmet Automotive's focus areas are premium cars, convertibles and electric vehicles. The company has over 5,000 employees in Finland, Germany, Poland and Spain. The headquarters is located in Uusikaupunki, Finland.

The fact that Finland is close to Russia and is a member of the EU, makes it especially attractive for Russian enterprises in terms of accessing very deep EU markets of goods and services. Russia has traditionally been one of the greatest trade partners of Finland. As of year-end 2018, Russia was positioned as the third country in Finland's trade, with a share of 9.7%. Still, Germany (15.3%) and Sweden (10.6%) remain its two most important trading partners. On the other hand, Finland was ranked the 15th among Russian external trading partners.

According to the Russia - Finland South-East cooperation program, the Leningrad region will soon become an important automotive manufacturing center in the European Russia with 20 manufacturers, which attracts international partners to the region. Moreover, automotive cluster development (including automotive component manufacturing) is among the priority economic development areas, as stated in the socio-economic strategy of the region. The industrial potential of the North West Automotive Cluster is based on the fact that its participants operate a wide variety of technology. They are all different in terms of the manufacturing development level and geographical spread of its shareholders. However, the common fact among them is that they have all necessary manufacturing facilities, modern equipment and qualified staff. Another benefit of the region is that it has distribution markets both in Russia and in Europe, as well as a well-developed transport and logistics infrastructure, which allows to increase the localization for automotive manufacturers.

Aside from cooperation in the automotive industry, it is worth mentioning that a partnership in motorsport manufacturing and infrastructure development is not far-fetched. In 2019, Russia and Finland opened several world-level race tracks. KymiRing is a FIA/FIM-certified race track. It is located in Finland in the

Kymenlaakso region. The track's main feature is that it can host MotoGP (FIM Road Racing World Championship Grand Prix) — the leading motorcycle racing event.

Therefore, the two regions have reached the level *of manufacturing, infrastructure and functional conformity* **necessary for further cross-border integration between the automotive industries of the Russian North-West and Finland.**

1.2. Competitive Positions and Research Projects of Automotive Manufacturers in the Russian Federation and in Finland

In 2019, Russian automotive plants have produced a grand total of 1,72 million vehicles (Automotive Industry in Russia. 2019 Year's Results, Prospects). In 2018, 1.77 million vehicles were produced.

In 2019, about half (47,1%) of the Russian automotive industry was represented by just three enterprises - AvtoVAZ, Hyundai Motor Manufacturing Rus and Avtotor. Out of these three, AvtoVAZ (20,5%) holds the largest share of the Russian automotive industry.

Hyundai Motor Manufacturing Rus (14,2%) holds the share of the automobile manufacturing market that amounts to about one seventh. Every eighth car in Russia has been produced by Avtotor (12,4%). Other automotive manufacturers hold market shares in the range of 5 – 9%. The four following Russian automotive manufacturers can be placed in this range: Volkswagen Group Rus, GAZ, Lada Izhevsk and Renault Russia. Toyota Motor and Nissan Manufacturing Rus have the shares of 4,3% and 3% correspondingly. Shares of UAZ and KAMAZ can be placed in the range of 2-2,5%. The remaining manufacturers hold even less than that.

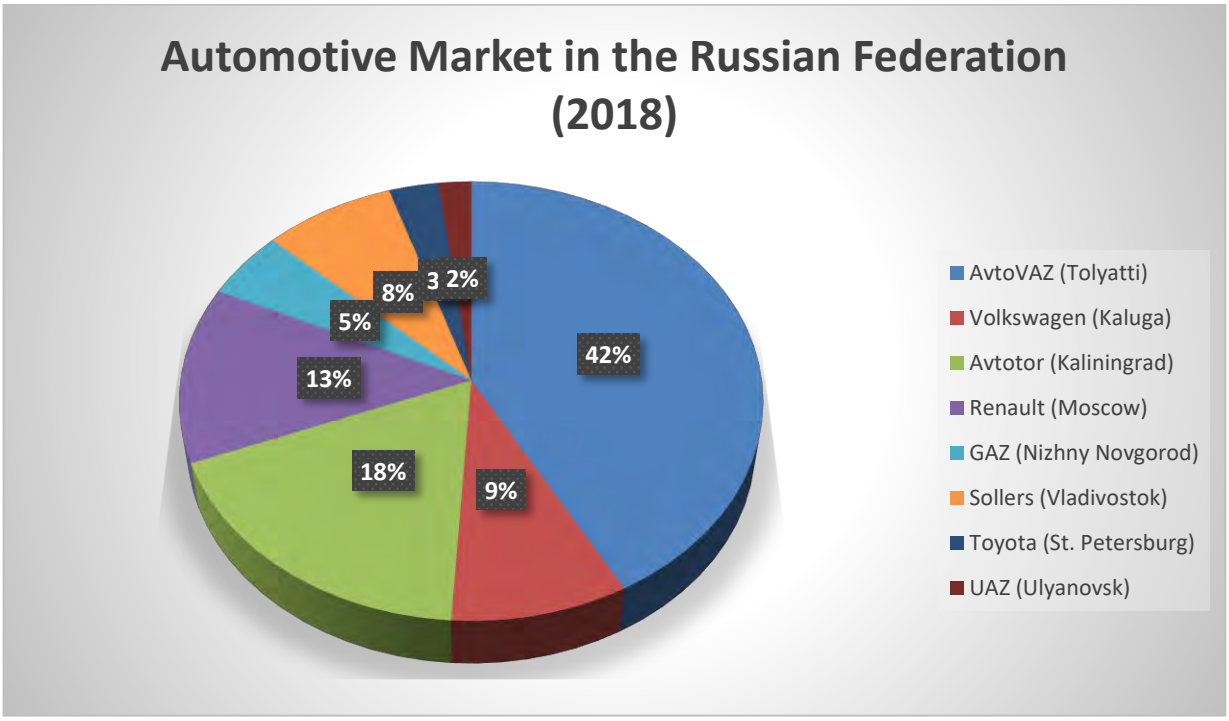

Fig. 5. The Automobile Manufacturing Market in the Russian Federation, 2018.

AvtoVAZ, Hyundai Motor Manufacturing Rus and Avtotor continue to lead the automobile manufacturing market. KAMAZ is the leader in truck manufacturing.

Many automotive manufacturers in Russia have automotive industry R&D and innovation development centers. All R&D projects typically cover the main automotive industry development priorities such as new car ranges, new safe driving technologies, autonomous driving systems and cars of the future (Appendix 1). The Table 1 below lists the largest research projects.

Table 1. Research Projects by the Largest Automotive Manufacturers in the Russian Federation

Enterprise	Project
Gorky Automobile Plant	GAZelle NEXT Mobile Technopark KWANTORIUM
KAMAZ	SHUTTLE Bus
Volkswagen Group Rus	Materials Quality Control Lab
AvtoVAZ	New PWT range development, line-up and non-line-up
Ural Automotive Plant	The URAL truck range development and cab-over-engine road car manufacturing
Ulyanovsk Automobile Plant	Spartan-Range Cars
	Connected Cars

Truck, automobile, trailer and semi-trailer, agricultural, road and specialized equipment constitute the Finnish automotive manufacturing industry. The following are the largest Finnish manufacturing enterprises: Sisu Auto (lorries, semi-trailer trucks, timber trucks and vehicles for the Finnish military), Agco Power (diesel engine and generator, pump and gearbox manufacturing) and Valmet Automotive. Valmet Automotive develops and manufactures hundreds of thousands of 48-volt batteries every year. This is in addition to complete high-voltage battery systems for plug-in and fully electric vehicles. Another company business line is actuating, covering Roof & Kinematic Systems from the development of convertible/cabriolet roof systems to active spoilers to loading flaps for electric vehicles.

Nokian Tyres has implemented a big investment project - a tyre manufacturing plant in the Leningrad region (Vsevolozhsk). The investment amounted to 700 million euro in grand total. As a result, two production lines with an output of about 17 million tyres per year were built in the region. The Russian-made product is supplied to 43 world countries.

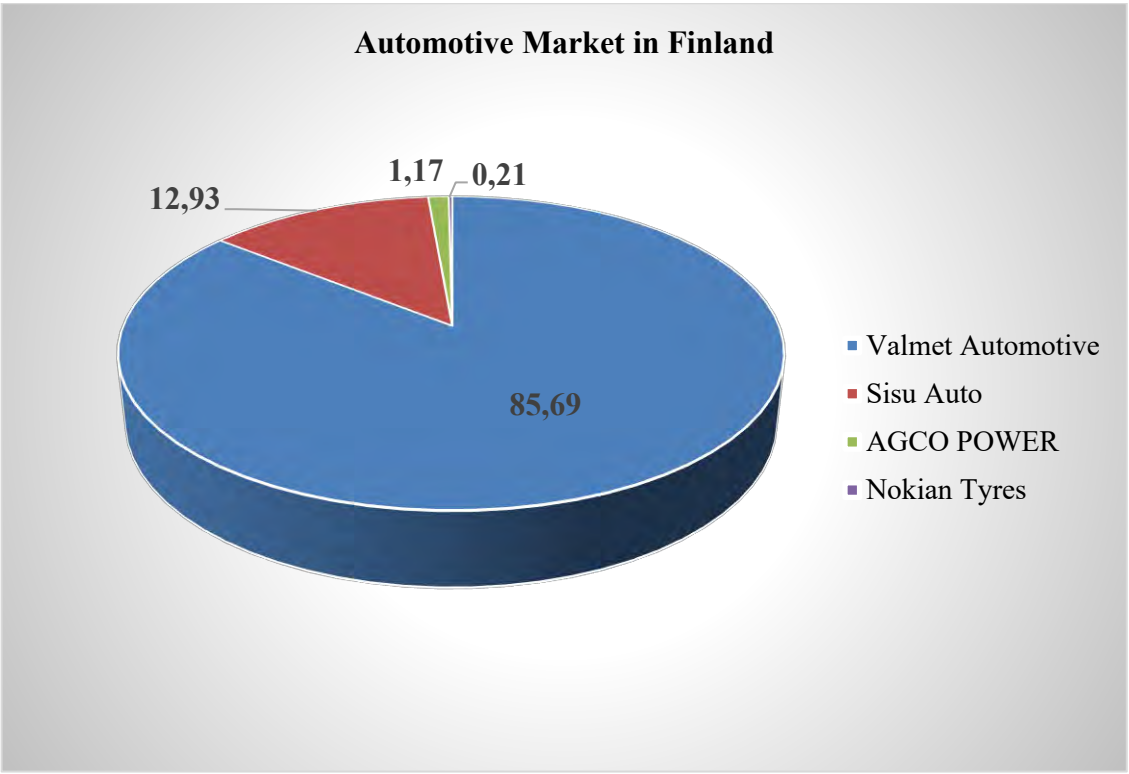

Fig. 6. Automotive Market in Finland, 2018.

All automotive manufacturers in Finland have R&D centers that specialize in areas similar to the ones of their Russian peers such as new car ranges, new safe driving technologies, etc. (Appendix 2). Table 2 below lists the largest research projects carried out by Finnish automotive manufacturers.

Table 2. Research Projects by the Largest Automotive Manufacturers in Finland

Enterprise	Project
Sisu Auto	New SISU Polar truck range development jointly with Daimler AG
AGCO POWER	Wärtsilä-AGCO Power Joint Research Consortium
	High-quality cloud analytics and AI platform engines
Valmet Automotive	Complete battery packs
	Light modular vehicle Scouter
Nokian Tyres	Re-treadable tyre materials
	Safe driving due to innovations
	Retractable stud manufacturing technology

High demand for research and technological developments is a determining factor for large-scale R&D projects launched by Russian and Finnish manufacturers. New safety, automation, Artificial intelligence

(AI) and green technologies are the focal points of research. In the nearest decades they will be on the agenda of the automotive industry. This research is part of the project "Interdisciplinary Education, Business, Research and Innovation Solutions for the Finnish-Russian Automotive and Motorsport Ecosystem (Race4Scale)". It´s funded by the South-East Finland–Russia CBC 2014-2020 programme.

1.3. International Automotive Industry Quality Standards

IATF 16949:2016 is the main quality management system standard for the automotive industry recognized globally. It incorporates the structure and requirements of the **ISO 9001:2015** with additional automotive industry requirements. The term 'automotive' includes automobiles, buses, motorcycles and trucks, however it does not include specialized equipment, e.g. tractors, winter service vehicles, etc.

IATF 16949 was developed by the International Automotive Task Force jointly with the Technical Committee **ISO TC176.** This committee was comprised of such automotive enterprises as *Ford, General Motors, Daimler, Chrysler, BMW, Fiat, Pigeon - Citroen, Renault, Volkswagen* and such automobile associations as *AIAG* (USA), *VDA* (Germany), *SMMT* (Great Britain), *ANFIA* (Italy) and *FIEV* (France). The standard harmonized and encapsulated the following standard automotive industry quality requirements among the industry leaders: **QS9000** (America), **VDA 6.1** (Germany), **EAQF** (France) and **AVSQ** (Italy).

All large world automotive manufacturers require from the automotive component suppliers to adhere to **ISO/TS 16949:2009.** This requirement is applied to the second- and third-tier suppliers (supplier's supplier, etc.)

ISO 9001:2015 and **IATF 16949:2016** define the standards for organizations working in the automotive industry in the European Union and the Russian Federation. **IATF 16949:2016** is a set of technical specifications that combines American, German, French and Italian automotive industry quality standards and harmonizes them. The standard sets the requirements for quality systems in design/development, production, assembly and maintenance services of automotive products.

Organizations that follow **IATF 16949:2016** are required to use the following instruments:

- FMEA - Potential Failure Mode and Effects Analysis;
- SPC - Statistical Process Control;
- PPAP - Production Part Approval Process;
- MSA - Measurement Systems Analysis;
- APQP – Advanced Product Quality Planning and Control Plan;
- QSA - Quality System Assessment.

In the Russian Federation the application manuals for these tools are presented as standards that are essentially translations of the abovementioned documents:

- ГОСТ Р 51814.2-2001 – Quality systems for the automotive industry. Potential failure mode and effects analysis – similar to FMEA;
- ГОСТ Р 51814.3-2001 - Quality systems for the automotive industry. Methods of statistical process control– similar to SPC;
- ГОСТ Р 51814.4-2004 - Quality systems for the automotive industry. Production part approval process – similar to PPAP;
- ГОСТ Р 51814.5-2005 - Quality systems for the automotive industry. Measurement systems analysis – similar to MSA;

- ГОСТ Р 51814.6-2005 - Quality systems for the automotive industry. Advanced product quality planning and automotive component pre-manufacturing– similar to APQP;
- ГОСТ Р 51814.7-2005 - Quality management systems for the automotive industry. Quality system assessment – similar to QSA.

In the current COVID and the subsequent post-COVID era, it is essential to adapt to and harmonize the existing Russian practices with the *ISO 45001 Occupational Health and Safety Management Systems* standard. The Russian Union of Industrialists and Entrepreneurs work group entitled as Public Health Protection has taken some major steps to ensure that Russian manufacturers adopted this standard.

The automotive industries in the Russian Federation and in Finland are regulated by a single international quality standard or its harmonized versions adopted by the manufacturers in both countries, which provides an opportunity to unify and harmonize the Russian professional and education standard with the European Qualifications Framework.

1.4. Best Practices in the Cross-Border Automotive Industry Ecosystem Development

Similar EU projects were analyzed in order to provide a reference point for the cross-border automotive industry ecosystem development strategy. These projects were taken as a reference. The following points were used to benchmark against and to subsequently adopt all the best practices:

1. **Legal limitations** are significant when it comes to cooperation between countries. Therefore, state regulations are an integral part of the analysis.
2. **History of cooperation between the countries** (particularly, in the automotive industry): a) between Russia (North-West) and Finland (Nokian Tyres plant in Vsevolozhsk - since 2005) and b) benchmarking against other countries with the shared borders.
3. **Shared source of information for cross-border ecosystem participants** and/or information and support center is essential in an umbrella project with many participants from different areas such as R&D, industry, higher and vocational education.
4. **A free-trade zone** at the Finland-Leningrad region border has long been discussed. The Savonlinna city administration has recently been proposing such measures (https://www.kommersant.ru/doc/4267468). Visa-free travel and other privileges could be implemented in this zone.
5. **History of participation in automotive clusters** is important because it guarantees that the participant knows how to manage a large ecosystem with a lot of players and a complex infrastructure. With such experience under its belt, the participating country has an easier time during cross-border ecosystem development.
6. **Local automotive component manufacturers** play a significant role for enterprises that do not complete the entire production cycle. There are enterprises in Russia that achieved it.
7. For our case, **unified requirements to technical products** and services, e.g. **education programs inside the ecosystem,** are of equal importance.

Table 3. Leading Europe-Based Ecosystems

Benchmarks	**German-Czech Cross-Border Automotive Ecosystems**	**Spanish-Italian Cross-Border Automotive Ecosystems**	**Spanish-Portuguese Cross-Border Automotive Ecosystems**
Regulated free labor mobility and other forms of cooperation (no tariff and nontariff barriers trade exchange, laxer foreign trade regulation)	EU regulation on visas and employment Cluster support programs (all cross-border automotive ecosystems) Both countries are in the border-free Schengen Area, so the citizens of both countries can work at the other. Germany is the most important trading partner of the Czech Republic. Such regions as Baden-Württemberg (Germany) - local cluster support programs.	EU regulation on visas and employment Cluster support programs In 2012, laxer local labor regulation to resolve disputes with trade unions more efficiently. With relatively low labor costs, Spain became one of the most attractive European countries in terms of automotive industry investment.	EU regulation on visas and employment Cluster support programs Portugal supports clusters at the national and regional levels. Government strategy for support export industries in clusters. Spain – regional cluster support. Such regions as Catalonia (Spain) and Norte (Portugal) - local cluster support programs.
Cross-country cooperation support, in the automotive industry in particular	Active partner country language learning German is the second most popular foreign language after English among Czech pupils and students.	Ecosystems participants informed on cross-country cooperation tradition and history Cooperation since 1919 (Italian *FIAT* opened a branch near Barcelona that later became *SEAT* or *Society of Spanish Automobile Tourism*).	Joint approaches to economic and political problems Experience of the partner country used for economic recovery So called *Iberian Peninsula Countries* have many economic problems in common. During the 2008-2009 crisis, the automotive industry propelled the economic recovery of both countries. During the current pandemic-related crisis, the governments are expecting for the automotive industry to play a similar role.
Information Support Through Joint Channels (Information Channels established and Maintained)	Open communication channels for all ecosystem participants Ministry of Industry and Trade of the Czech Republic and the CzechTrade agency supervise the website *www.BusinessInfo.cz* - a key	-	NGOs for informing and consulting industry members Automotive industry-related NGOs – *Ganvam* (National Association for Sellers of Motor Vehicles, Repairs and Parts,

Benchmarks	German-Czech Cross-Border Automotive Ecosystems	Spanish-Italian Cross-Border Automotive Ecosystems	Spanish-Portuguese Cross-Border Automotive Ecosystems
	instrument for supplying export-oriented enterprises with information from various state government institutions.		Spain) and *Anfac* (Spanish Association of Automobile and Truck Manufacturers).
Strategic industry zones/free economic trade zones for automotive manufacturing facilities	Automotive Ecosystems supported by the government by creating a Free Economic Trade Zone in **Kolin-Ovčary**. It is an over 370 hectare, free-investment zone 50 km. away from Prague. The main investor is the automobile manufacturing company *TPCA.* Investors are offered free 115-hectare strips of land. **Nošovice**, 260 hectare. Automotive industry area, for such enterprises as *Hyundai* in particular. Established by the Czech government to attract investment and fight local unemployment.	Italy has no free economic zones or free trade zones. Thus, there is no legislation for this type of activity.	Automotive industry ecosystems are supported by the government through free economic zones that investors have open access to. Spain has four free economic zones. The largest one of them is *Zona Franca de Barcelona* that is comprised of an industrial polygon, free storage space and a free trade zone. An industrial polygon near Barcelona is directly connected with the Spanish and European highway network, has a freight station and a CFS at the polygon. *Volkswagen* - owner of the Spanish automotive manufacturer *SEAT S.A*. intends to use the advantages of the free-trade polygon to expand.
Enterprises in the allied and adjacent industries	-	Allied and adjacent industries are accessible for Italian cross-border ecosystem participants. Automotive component manufacturing based in Piemonte. The region consolidates: • 36% of Italian automotive manufacturing • 55% of Italian car design and development	Allied and adjacent industries are accessible for Spanish cross-border ecosystem participants. Local automotive component manufacturers, with Gestamp being the largest (manufactures chassis, pedal boxes, bumpers and other components for 20 world countries)

Benchmarks	German-Czech Cross-Border Automotive Ecosystems	Spanish-Italian Cross-Border Automotive Ecosystems	Spanish-Portuguese Cross-Border Automotive Ecosystems
		• 68% of these enterprises invest in R&D	
Automotive clusters	Integrated automotive industry ecosystems: 1. Nordrhein-Westfalen automotive cluster with **230** enterprises Staff: about **84,500** employees Agiplan GmbH has been managing the cluster since 2008. The cluster aims to increase the presence of electric and hybrid vehicles in Germany up to one million units by 2020. 2. Automotive Cluster Ostdeutschland (ACOD) https://www.acod.de/ is the initiative for sustainable automotive industry development in East Germany. It includes five car manufacturers (OEM), suppliers of goods and services, R&D centers, unions, etc. Small and middle-sized enterprises, with no substantial experience of working with OEMs are interested in entering the supply chain of large manufacturers. That is why, ACOD is aimed, among other things, at up-skilling small and middle-sized enterprises so that they could provide OEMs or their direct suppliers with goods and services. 4. AMZ https://www.amz-sachsen.de/. With the assistance of the cluster 284 projects were launched (158 joint and 49 development projects). 1064 enterprises took part in the projects.	Integrated automotive industry ecosystems: Spain: 1. Automotive Cluster of Aragon (CAAR) https://caaragon.com/ was established in March of 2008 by **14** automotive component and **6** R&D enterprises for business internationalization and economic development. Currently, the cluster has 52 enterprises. 2. Automotive Cluster of Valencia (AVIA) https://avia.com.es/ has 86 various automotive industry-related enterprises: metalworking, plastic production, machinery manufacturing, safety, packaging, logistics and consulting. Due to the interdisciplinary approach, the AVIA cluster encapsulates a full chain of car production. Ford is the member of AVIA and a backbone enterprise in its structure. Cluster Staff: 22,800 employees. Italy: Centro Estero per l'Internazionalizzazione http://www.centroestero.org/it/- organization dedicated to advance the	Integrated automotive industry ecosystems: In Portugal, as a crisis management measure, special support was offered to high-tech enterprises and cross-enterprise cooperation. As a result, there a few powerful clusters in the country, namely an automotive cluster based on the Autoeuropa enterprise.

Benchmarks	German-Czech Cross-Border Automotive Ecosystems	Spanish-Italian Cross-Border Automotive Ecosystems	Spanish-Portuguese Cross-Border Automotive Ecosystems
		automotive cluster in the Piedmont region. Piedmont with its capital city Turin was the birthplace of Fiat (FCA Group after merging with Chrysler). It is the center of national automotive industry and European automotive and mobile machinery. Piedmont is the home to large manufacturers, small and medium-sized enterprises, as well as supply chains, R&D centers and engineering schools. Starting from 2007, the cluster has been actively developing business in Russia.	
1. Unified Requirements to Goods and Services in the Cross-Border Automotive Cluster	Benchmark – inside the cross-border ecosystem all product and service standards are unified (ecological, technical and other standards). -	-	-

Legal limitations **are significant for the Finnish-Russian cross-border ecosystem, because of the fact that all other benchmarking countries are EU members, therefore they exist in a visa-free zone with free workforce mobility. Thus,** *a free-trade zone* **with laxer entry, residential and employment regulations at the Finland-Leningrad region border gains particular significance both for the Russian Federation and for Finland.**

In some areas such as *cluster development and local automotive component manufacturers,* **Russian enterprises do not lose in any way to their foreign peers. Specifically, an industrial cluster Automotive Industry North-West has been operational since 2015. The cluster also acts as an information center for long-time industry members and new players alike and works to improve the legislation in the industry. For the current cross-border ecosystem development project, it is worth working with these and other existing industry members.**

Conclusions for Section 1: the automotive industries in the Russian Federation and in Finland have high growth potential due to the demand for innovative solutions and well-developed infrastructure. Several large automotive manufacturers in both countries are implementing major R&D projects in such areas as safety, automation and AI. Cooperation between Saint Petersburg and Finland seems to be potentially beneficial due to the industrial, infrastructure and functional complementarity of the two regions in terms of cross-border automotive industry integration. As it is apparent from the existing cross-border ecosystems that such a free-trade zone could have laxer entry, residence and employment regulations. Thus, a single quality standard package or its harmonized versions relevant for the manufacturers in both countries is a precursor for rapid development of the cross-border ecosystem. Moreover, there is an opportunity to unify and align professional and educational standards in the Russian Federation with the European Qualification Framework. The Race4Scale project could help speed up these processes.

Section 2. Staffing for the Automotive Industries in the Russian Federation and in Finland

2.1. Professional Education Requirements: European Qualifications Framework and Russian Professional Standards

The European Qualification Framework (EQF) is a multi-level reference framework whose purpose is to make qualifications, diplomas and certificates more transparent, comparable, readable, understandable and admissible. The EQF was established in order to improve academic and labor mobility at the European continent.

Being a lifelong learning tool, the framework encapsulates general education and adult education, vocational education and training, as well as higher education. If implemented in participating countries, the EQF could provide for the continuity of primary, secondary and higher education, vocational and further training. The EQF allows to combine various education systems even if they are structurally different from each other. It allows for the competences and qualifications to be acquired both formally and informally (self-learning) and supports mobility between countries, as well as lifelong learning.

The EQF was adopted by the European Parliament and the Council in April 2008. Since 2012, all new European qualifications have sited the appropriate EQF level.

As it is apparent from the international practices, qualification frameworks have significant potential to perfect the formal knowledge and skill recognition procedure; further reform the education system; promote demand-orientated lifelong learning, putting the spotlight on the needs of the learner; democratize learning and qualification acquisition; targeted fund allocation and learning expenditures optimization; **form partnerships** with all stakeholders; **impose greater threshold competence requirement**.

The EQF consists of eight (8) levels. Each level of the European Qualification Framework is defined by a set of descriptors (knowledge, skills and competences) that describe learning outcomes for all qualifications at this level. Therefore, the qualifications when combined in various ways can cover a wide range of learning outcomes, including theory, practical and technical skills and social competences where the ability to work with others is of fundamental importance.
The following are the relevant levels of the European Qualification Framework:

- **Level 4: Completed vocational and professional training** at various schools and education institutions; the curriculums are standard and are regulated by the competent structures appropriate for the field; opens the access to **higher education**, as well as to vocational careers and positions with high qualification requirements; holders of this qualification typically opt to either continue education (including higher education) or apply for high-qualification employment; the level is an entry point for further advanced learning, even when obtained unofficially, which allows to complete the job tasks unassisted and coordinate work-related activities at the workplace.
- **Level 6: Higher education**; this level is sufficient for industry and professional bodies; **the foundation for the level 6 is secondary education**, which requires advanced learning materials and covers the current trends of the area in question, such qualifications are awarded to graduates with **professional/knowledge-holder positions or those hired as professional managers**; Level 6 qualifications are associated with the **first tier of higher education (Bachelor's level)** developed during the Bologna Process; students learn from teachers and/or experts in the field during **in-class or hands-on training**; students get a limited amount of theoretical knowledge and professional techniques but they have to be **prepared to conduct research and solve problems unassisted**; education quality is largely assured by certification requirements and education institution accreditation; the level-holders can access a wide range of professional positions and typically apply to management positions and professional careers.
- **Level 7:** education is **highly specialized, is carried out at higher education institutions and builds on the Level 6 education; these qualifications are attributed to professional experts and high-level managers**; level 7 qualifications are associated with the **second tier of higher education (Master's level)** developed during the Bologna Process; level 7 qualifications are associated with active unassisted work that can be done jointly with peer professionals; this qualification level typically implies that there is some degree of supervision from more qualified professionals in the field; education quality at this level is largely assured by **individual certification by peer specialists**, as well as duly regulated education institution accreditation; the level opens the **access to employment and career in the field of specialization or in the adjacent area**; it opens the door to the next tier of higher education (PhD).

In the Russian Federation, the employers are required to go by these professional standards, because each particular employee has to adhere to certain qualification requirements to do a particular job. The difference is that the European qualifications framework reflects the general requirements for existing levels of qualifications, and the professional standard specifies these requirements in relation to the requirements of each type of professional activity. The term professional standard first appeared in the Labor Code in 2012. Standard 31 was developed for and applies to the automotive industry.

All Group 31 Automotive Industry professional standards are listed below.

- 31.001 Industrial Engineer in the Automotive Industry;
- 31.002 Mechatronic Engineer in the Automotive Industry;
- 31.003 Tool Equipment Engineer in the Automotive Industry;
- 31.004 Automotive Mechatronic System Engineer;
- 31.005 Automotive Painter;
- 31.006 Vehicle Designer;
- 31.007 Machinery and Vehicle Assembly Engineer;
- 31.008 Chemical Engineer in the Automotive Industry;
- 31.009 Foundry Engineer in the Automotive Industry;
- 31.010 Automotive Design Engineer;
- 31.011 Car Salesperson;
- 31.012 Automotive Marketing Specialist;
- 31.013 Heat Treat Engineer in the Automotive Industry;
- 31.014 Automotive Technologist;
- 31.015 Preproduction Engineer in the Automotive Industry;
- 31.016 Press Specialist in the Automotive Industry;
- 31.017 Equipment Adjustment Specialist in the Automotive Industry;
- 31.018 Automotive Logistic Engineer;
- 31.019 Metalworking Manufacturing Engineer in the Automotive Industry;
- 31.020 Steelwork Specialist in the Automotive Industry;
- 31.021 Testing and Research Engineer in the Automotive Industry.

All Group 31 qualifications have 7 qualification levels, except for standard 31.017 Equipment Adjustment Specialist in the Automotive Industry that is limited by the Level 6.

2.2. Higher Education Programs for the Automotive Industry in the North-West Region of the Russian Federation

When analyzing higher education programs that produce graduates for the automotive industry in the North-West region of the Russian Federation, we took into account education programs at 19 universities. We found out that **8** following **universities** have education programs relevant to the automotive industry:

In Saint Petersburg – at 5 universities:
Peter the Great St. Petersburg Polytechnic University
ITMO University
State Marine Technical University
Saint Petersburg Mining University
St. Petersburg State Transport University

In Vologda – at 1 university:
Vologda State University

In Pskov – at 1 university:
Pskov State University

In Syktyvkar (the Komi Republic) – at 1 university:
Syktyvkar Forest Institute, branch of Saint-Petersburg State Forestry University

At the *Appendix 4,* the program distribution analysis for the automotive industry in the North-West region can be seen. The list was compiled with the existing automotive industry professions in mind, such as Self-Driving Vehicle Intelligent Control Systems Architect, Equipment Engineer, Automotive Service Engineer, Maintenance Engineer, Autonomous Vehicle Service Engineer, Electric Vehicle Engineer, Automotive Design Engineer, Mechanical Engineer, Mechanic, Automotive Industry Mechatronic Engineer and Manufacturing Engineer.

These professionals typically graduate from Bachelor's programs. Among the relevant education programs there are 4 Bachelor's, 3 Master's and 1 Specialist's program.

1. **The integrated group 23.00.00** is the largest. **The Integrated Group 23.00.00 Ground Vehicle Engineering and Technology** is represented by 3 degree programs in 5 areas by degree level**:**

Bachelor's programs:

- 23.03.01 Transport Process Technologies: 1 program - Organization of Transportation and Transport Management, at 1 university;
- 23.03.02 Ground Transport and Engineering Systems: 2 programs - Transport and Engineering Systems, and Automotive Engineering and Maintenance, at 1 university.

Master's programs:

- 23.04.02 Ground Transport and Engineering Systems: 1 program - Computer-Aided Design of Autonomous and Electric Vehicles, at 1 university.
- 23.04.03 Vehicle and Transportation Systems Operation: 2 programs – Functional Safety of Autonomous Vehicles, and Vehicle Operation, at 2 universities.

Specialist's programs

23.05.01 Ground Vehicle Technology: 1 program - Automotive Engineering in Transport Technology, at 3 universities.

2. **The Integrated Group 13.00.00 Electric Power Engineering and Heat Engineering** is represented by 3 degree programs in 3 areas by degree level:

Bachelor's programs:

- 13.03.02 Electric Power Engineering and Electrical Engineering: 1 program – Electric Vehicles, at 1 university.
- 13.03.03 Power Engineering: 1 program – Internal Combustion Engines, at 1 university.

3. **The Integrated Group 15.00.00 Mechanical Engineering** is represented by 1 degree program in 1 area

Master's programs:

- 15.04.05 Design and Technology of Machinery Manufacturing - Automotive Engineering program

There are **178 federal budget scholarships in all North-West region universities that produce graduates for the automotive industry. They are distributed among the Integrated Groups in the following way:** Integrated Group 23.00.00 – **133 scholarships,** Integrated Group 13.00.00 – **33 scholarships** and Integrated Group 15.00.00 – **12 scholarships.** The most amount of scholarships is allocated to Bachelor's programs **(103 scholarships). 41 scholarships** are allocated to Master's programs and **34 scholarships** to Specialist's programs. **139 scholarships** are allocated to Saint Petersburg universities.

Key competences in the Appendix 5 vary depending on the program and the degree level. Among Bachelor's programs, most key competences are related to engineering, manufacturing and research. Among Master's programs, the key competences are related to scientific research, projects and experiments, but vary depending on the program. The Specialist's programs focus more on specialization and additional profession-related competences, with most of them being related to design and engineering.

At the moment, in the Russian Federation there is a wide range of education programs that produce graduates for the automotive industry. However, lifelong learning and further training programs are yet to be put in place.

2.3. Higher Education Programs for the Automotive Industry in Finland

Out of **45** Finnish universities analyzed, **13 universities** produce graduates for the automotive industry, which is a major focus of university marketing materials. University programs that produce industry engineers are mostly represented by Bachelor's programs. *Metropolia University of Applied Sciences, Turku University of Applied Sciences, Tampere University of Applied Sciences, Seinäjoki University of Applied Sciences* and *University of Oulu* also offer Master's programs that focus on the automotive engineering. *Centria University of Applied Sciences* has a Specialist's level program that produces automotive industry managers. The Mechanical Engineering program at the *University of Oulu* has two levels of degree programs – Bachelor's and Master's programs that constitute an entire education trajectory. The programs are delivered in Finnish or in Swedish for the most part, however there can be some modules in English. It is worth mentioning that other programs can also produce graduates for the automotive industry, namely Electrical Engineering, Logistics, etc. However, the descriptions of these programs do not mention automotive manufacturing; therefore, they were not initially selected.

In the Kouvola region (*South-Eastern Finland University of Applied Sciences*), universities do not have any education programs related to the automotive industry. However, these programs existed at the university before. The enrollee website about Finnish universities mentions them; however, this information is evidently outdated. The analysis results are contained in the *Appendix 6*.

Currently, there is a wide range of Bachelor's level higher education programs that produce graduates for the automotive industry in Finland. Master's and further training programs are particularly popular at the moment.

2.4. Vocational Training Programs for the Automotive Industry in the Russian Federation

In the North-West region, there are about 223 vocational training institutions, out of which 108 are located in Saint Petersburg. **35** of them have a ground, air and water transport program that is directly related to automotive manufacturing.

All programs are part of the Integrated Group 23.

23.00.00 Ground Vehicle Engineering and Technology

23.01.03 Car Mechanic (10 vocational education institutions of Saint Petersburg): a multi-skilled worker who does vehicle maintenance and repair using diagnostic equipment and tools, and operates vehicles. Qualifications: automotive service technician, driver and filling station operator.

23.01.08 Construction Machinery Service Technician. Qualifications: automotive service technician, road construction machinery and truck service technician, electrical/gas welder.

23.01.17 Automotive Repair and Service Technician. Qualifications: automotive service technician, driver.

23.02.02 Automotive and Tractor Manufacturing. Work Activity Management, Automotive and Tractor Manufacturing. Qualifications: technician.

23.02.03 Vehicle Maintenance and Repair. Work Activity Management, Vehicle Maintenance and Repair, Primary Work Group Management. Qualifications: technician.

23.02.05 Electrical and Automatic Transport Equipment (by vehicle type, except for water vehicles). Graduates are competent in operation, maintenance and repair of electrical and automatic transport equipment. Qualifications: technician/electrician.

23.02.07 Maintenance and Repair of Car Engines, Systems and Parts. Automotive Repair Shop Management, Vehicle Maintenance, Repair and Operation. Qualifications: specialist.

It should be noted that these programs are of very high quality. For example, mid-level professional training programs **23.02.03 Vehicle Maintenance and Repair** award the graduates with Maintenance and Repair Engineer or Senior Engineer (in-depth training) qualifications. Graduates of **the Bachelor's level program 23.03.03. Vehicle and Transportation Systems Operation** can apply to **Engineer or Automotive Maintenance Mechanic** positions. Graduates of the Master's level standard program **23.04.03 Vehicle and Transportation Systems Operation** can solve much more complex problems in their field of expertise.

The Russian Automotive Manufacturing Union noted that the professional standards for the following qualifications need to be updated:

- **Automotive Mechatronic System Engineer;**
- **Automotive Industrial Engineer;**
- **Preproduction Engineer in the Automotive Industry;**
- **Vehicle Designer.**

Furthermore, Russian standards need to be cross-referenced against their international counterparts, for example, as part of the model project **Vehicle Repair Mechanic Degree Recognition in the Russian Federation and the Federal Republic of Germany**.

The labor market in the automotive industry requires highly qualified staff with various kinds of degrees. Automotive industry enterprises are currently craving for experts with advanced professional skills. This need is partially fulfilled by vocational training programs. *Appendix 7* **contains the analysis of the existing programs.**

2.5. Vocational Training Programs for the Automotive Industry in Finland

Secondary vocational education for the automotive industry in Finland is provided by the education program **Professional Qualifications in the Automotive Sector** (Code **351301**) that awards six qualifications.

Qualification (certificate) levels:

- *National Qualifications Framework (nqf) 4*
- *European Qualifications Framework (eqf) 4*

The main qualifications are the following: competence area in vehicle technology (vehicle mechanic)*;* competence area in vehicle body repair (vehicle body repairer)*;* competence area in vehicle painting (vehicle painter)*;* competence area in car sales (car salesperson)*;* competence area in parts sales (parts salesperson)*;* competence area in small motor machinery repairs (small machinery mechanic). The basic competences are the following: **maintenance and repair; electric equipment performance measurement and repair; tyre service; hydraulic and pneumatic system repair; accessory and consumable sales; spare part and inventory management; warehouse management; business planning; work-place instructor training; vehicle painting; communication and interaction skills; skills and knowledge in mathematics and science (applied mathematics, physics, chemistry, etc.); social skills and work experience, etc.**

This education program is currently present at **19 vocational colleges, education centers and consortiums** – in all six or separate areas.

Some institutions are not just oriented towards vocational training, but also have further training programs for experienced professionals in the automotive industry.

Vocational college *OSAO* is particularly noteworthy because of student employment opportunities. Students enrolled at automotive industry-related programs can be hired through the university to work in vehicle, machinery and small equipment maintenance and repair at very competitive prices. *South Kymenlaakso Vocational College* has a similar approach and offers student car repair shop services in Kotka. *Global Education Services Taitaja, GEST*, is the leading and most versatile

vocational training center in the area of Kymenlaakso having about 4 000 students involved in various training activities annually. The education programs are described in *Appendix 8.*

Currently, there is a wide range of vocational training programs in Finland that fulfil the requirements of the Level 4 European Qualifications Framework.

2.6. Occupations of the Future in the Automotive Industry

According to the Atlas of Emerging Jobs, such automotive industry trends as globalization, increased competition and higher control system complexity have caused the emergence of the following groups of professions in 2020:

Intelligent Control System Architect

Develops autonomous vehicle and steering control software, and operates intelligent control systems. Currently, there are various solutions to control complex transport operations. However, these are the people who manage these operations. In the future, we will need to develop automated transport control systems for this purpose.

This group of professions requires such soft skills as:

- Systematic thinking (the ability to see complex systems and engage them. Including systems engineering);
- IT solutions development / Complex automated systems control / Ability to operate AI systems;
- Cross-industry communication skills (understand the technology, processes and the market in various adjacent and non-adjacent fields);
- Project and process management skills;
- Lean manufacturing as the methodology of manufacturing process management known to focus on minimizing waste, which means maximum consumer orientation and each employee involved in business optimization;
- Multilingual and multicultural abilities (fluent in English and another foreign language, understand the national and cultural context of a partner country, understand the realities of working in foreign countries);
- Customer-oriented approach, ability to meet consumers' needs;
- Ability to work in highly uncertain and rapidly changing work conditions (ability to make decisions fast, react to the changing work conditions, resources distribution and time management skills);
- Ability to work with groups and individuals;
- Green thinking.

This group of professions has newly emerged in Russia, and will be in-demand at other countries in the nearest future at the present rate of technological development.

At the same time, it is worth noting that professions do not emerge in all countries simultaneously. It depends on the economic and industrial development of the particular counrty. For Russia, it means that some of the future professions that will be in-demand in the nearest decade are already emerging in other countries. They may not be included in vocational and higher education curriculums but in practice such positions and job descriptions are slowly taking shape.

For the Russian automotive industry, the profession of Automotive Composite Structures Design Engineer was supposed to emerge by 2020. The group of such professions is taking shape at the moment.

Other industry trends are **the Internet of Things** and **Artificial Intelligence**. The IoT and AI technology will continue to revolutionize the automotive industry, which will lead to the unprecedented level of connectedness between vehicles and machines, as well as autonomous driving and joint mobility. Employers and employees in the industry will need new skills and practices to flourish in the dynamic digital economy.

According to *Accenture*, technology does not just replace people, it adds to the intellectual potential. Industrial automation will develop further, specifically to accommodate the growing demand for flexible product development. Furthermore, next-level automation will expand the functions of front and back office. AI will be essential in increasing the quality and productivity of labor. AI-assisted decision-making will help people concentrate on creating objects of value, rather than deal with tactical tasks, and upgrade from routine to more complex problems. Taking into account this new human-machine labor-division dynamic, **automotive manufacturers have to rethink the roles of employees, redistribute responsibilities to accommodate the technology. The workers also have to be prepared to work with AI.**

Job slashing in the manufacturing industry caused by the new technology will lead to the emergence of new jobs in other areas. Because of the big amount of data transmitted by vehicles**, data scientists, AI specialists and computer security experts** may find themselves in more favorable position.

Teaching the automotive industry staff of the whole development chain from drawing board to retail-shop how to use AI is just one way to deal with further training. Workers are also expected to learn how to use **robotics**, **data-driven systems and RPA (Robotic Process Automation).**

Currently there is a higher demand for electrical engineers**.** Moreover, according to the expert opinion of General Motors, there will be a higher demand for **analytics experts, web programmers, 3D printing engineers, sustainability integration experts and interaction designers** because the control over all technology in a vehicle has to be developed based on usability. **Autonomous driving engineers and alternative propulsion engineers** will also be in demand.

The need to keep up with technological development in the industry when producing automotive industry experts will have to be reflected in modern education programs. Special attention has to be paid to the competences that a graduate needs to possess in the rapidly changing job climate.

Conclusion

The automotive industries in the Russian Federation and in Finland are experiencing some similar trends such as the demand for innovative solutions, further staff training and lifelong learning, as well as the growing share of local suppliers. Cross-border ecosystems in the European Union can act as a cooperation reference point, which will help to build effective communication and interaction between the members of the automotive cluster. The territorial proximity of Finland and Saint Petersburg, as well as well-developed logistical and information infrastructures of both regions are the precursors for a cross-border ecosystem aimed at best practice exchange and innovative product development. In creating such an ecosystem, regulated travel, labor mobility and other cooperation permeability (no tariff and nontariff barriers in trade exchange and laxer foreign trade regulation) will be of particular importance.

In the advancement of the technological process, the issue of qualified personnel production has to be addressed. Such automotive industry trends as globalization, automation, increased competition and higher control system complexity will lead to a substantial shift in the automotive industry labor market. The applicant competence requirements will also change. Critical thinking, cross-industry communication skills and the ability to work in the conditions of uncertainty will be the skills expected from the workers of the future. Russian and Finnish higher education in the field of automotive manufacturing rarely integrate modules aimed at developing these skills. When talking about Russian vocational training programs, it is worth mentioning that there is a growing demand for advanced professional qualifications that are not fully covered by the existing vocational training programs.

Therefore, a Russian-Finnish cross-border automotive industry ecosystem opens a wide range of possibilities for cooperation and improvement of education programs in light of the demand for experts of the future who develop globally competitive product.

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Appendix 1.

R&D PROJECTS IN THE RUSSIAN AUTOMOTIVE INDUSTRY

Enterprise	Project	Description
Gorky Automobile Plant	GAZelle NEXT Mobile Technopark KWANTORIUM	A new type of additional education. Mobile education platform. End Goal – educating children in remote Russian villages, producing engineers of the future. 72 hour programs (2 weeks).
KAMAZ	SHUTTLE Bus	Jointly with NAMI (Central Scientific Research Automobile and Automotive Engines Institute) – a 12-seat SHUTTLE Bus, using an autonomous steering control system.
Volkswagen Group Rus	Materials Quality Control Lab	For Polo Sedan manufacturing needs. Later, a simila lab was established in Nizhny Novgorod (Skoda Octavia and Yeti, as well as Volkswagen Jetta manufacturing site)
AvtoVAZ	New PWT range Development Line-Up и Non-Line-Up	Power unit, various drives, driver assistance systems and cloud technology.

Ural Automotive Plant	The URAL truck range development and cab-over-engine road car manufacturing	Road cars - a 6x4, modernized cabover dump truck. Such cars are good for construction, as well as road and municipal services.
Ulyanovsk Automobile Plant	Spartan-Range Cars	MW Motors - a small private high-end electric car manufacturer from the Czech Republic - has announced two innovative modifications of the Ulyanovsk off-road car. MWM Spartan is an electric vehicle that is based on the UAZ-Hunter and combines advanced technology with legendary off-road capabilities, characteristic for all UAZ vehicles.
	Connected Cars	A connected car has built-in telematics, online services and a mobile app for the customers to control new functionalities and receive data from various car systems. Project by the IT-company C-Cars. Partner of Sollers that develops and implements connected car ecosystems and technology for automotive and specialized vehicle manufacturers. The solutions developed by the company allow to lower the vehicle operating cost as a result of real-time telematic data and predictive analytics, as well as additional online services based on the needs of individual clients.

Appendix 2.

R&D PROJECTS IN THE FINNISH AUTOMOTIVE INDUSTRY

Enterprise	Project	Description
Sisu Auto	New SISU Polar truck range development jointly with Daimler AG	A truck that combines the quality of large-scale manufacturing with the speed and versatility of small-scale manufacturing, which is more than enough to meet the needs of each individual customer.
AGCO POWER	Wärtsilä-AGCO Power Joint Research Consortium	Four Finnish higher education providers, the University of Vaasa, Aalto University, Tampere University and Åbo Akademi University, are engaged in establishing a research consortium together with the companies Wärtsilä and AGCO Power and other corporate and research partners. The research consortium sets out to create a roadmap towards low-emission seafaring technology and work machines and realise these objectives through innovation. The consortium also aims at developing flexible fuel technologies and estimating the effects of these on the entire value chain of the industries involved. Business Finland is financing the preparation project.
	High-quality cloud analytics and AI platform engines	Insta is developing a data lake-based analytics and AI platform in cooperation with AGCO Power to process and utilize data from diesel engines. It enables AGCO Power's R&D team to systematically review vast amounts of data and capture details about the operation of field test engines that previously went unnoticed. This way, engines are more stable when they are moved to serial production and operate more steadily under varying conditions. This is visible to end customers in improved quality. At the same time, it decreases AGCO Power's warranty-related costs.
Valmet Automotive	Complete battery packs	Valmet Automotive has been producing battery systems and modules since 2019. In addition to their first high-volume battery plant in Salo, Finland, the end of 2021 will see the launch of the second plant at their headquarters in Uusikaupunki – as an integral part of the car factory and the commitment to electric mobility. In this way, Valmet Automotive is underscoring its position as a Tier 1 system supplier and giving an additional powerful outlook for growth.

	Light modular vehicle Scouter	Valmet Automotive emphasizes solutions for the future electric mobility in its strategy. Rideascout's light modular vehicle Scouter is an excellent example of an innovative solution for mobility, and is therefore well suited to Valmet Automotive's strategic goals and technological know-how. Valmet Automotive has engineered the entire technical structure of the Scouter from electronic transmission to chassis and bodywork. In addition, Valmet Automotive is responsible for product testing and compliance with the regulatory requirements. Vehicle design work has been carried out by Valmet Automotive's product development in Uusikaupunki and Turku.
Nokian Tyres	Re-treadable tyre materials	SUV (Sport Utility Vehicle) tyres
	Safe driving due to innovations	Nokian Hakkapeliitta 8, Nokian Hakkapeliitta R2 and Nokian WR G3 SUV. Nokian Tyres has a testing center for winter tyres in Ivalo (Lapland, Finland) and a new testing centre for summer tyres in Spain (near Madrid).
	Retractable stud manufacturing technology	The idea of the combined non-studded and studded tyre is that the driver can make the switch when the conditions clearly change. Studs are not used on dry roads and stable winter conditions, but they can be activated in icy weather for extreme safety. The concept tyre of the world's leading winter tyre specialist utilises the tread pattern and structural solutions of the newly introduced Nokian Hakkapeliitta 8 SUV studded winter tyre. The studs on all four tyres raise and lower at the same time. The body of the stud remains in place, and the moving part is the hard metal pin in the middle of the stud.

Appendix 3.

EUROPEAN QUALIFICATIONS FRAMEWORK (EQF)

		KNOWLEDGE	SKILLS	COMPETENCES
		In the context of EQF, knowledge is described as theoretical and/or factual.	**In the context of EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments).**	**In the context of the EQF, competences are described as responsibility and autonomy.**
LEVEL 4	**Level 4** Learning Outcomes	A wide range of skills and knowledge in an area of work or study required to solve well-defined complex and unpredictable problems. Various approaches and view points in the area of work or study.	• Choose, adapt and use relevant specialized cognitive and practical skills when solving well-defined complex and non-standard problems points in the area of work or study, • Carry out background studies for work-related issues, if necessary, and • Assess the effectiveness of the methods and actions applied, as well as the outcomes.	• Certain degree of self-organization in the predictable circumstances that can change, • Manage the work of other employees, if necessary, • Take responsibility for assessing and perfecting his or her work performance, self-training and training of other workers, and • Limited participation in resource allocation.

LEVEL 6	**Level 6** Learning Outcomes	Knowledge and skills at the front edge of the work or study area through a critical understanding of relevant theories and principles to develop the area of work or study in multi-factor situation. Know various approaches, research areas and schools in the area of work or study.	• Advanced skills, demonstrating mastery, innovation and critical thinking, required to solve complex and unpredictable problems in a specialized field of work or study, in multi-factor situation, • Critically assess and interpret complex information, concepts and ideas, • Choose, perfect, adapt and use the required skills and methods, • Use and develop research methodology required for work-related activities, and • Assess the actions, methods and outcomes, as well as their consequences.	• Manage complex professional activity and projects, responsible approach to decision-making in unpredictable work or study conditions, • Take responsibility for managing professional development of groups and individuals, • Take responsibility for planning and developing processes and activity that would lead to considerable changes and progress, • Initiate assignments and control their completion, • A larger degree of autonomy, and • Participate in resource scheduling and allocation.
LEVEL 7	**Level 7** Learning Outcomes	Highly specialized knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research. Critical awareness of knowledge issues in a field and at the interface between different fields.	• Specialized skills that include critical thinking, interpreting and assessing complex information, concepts and ideas, integrate knowledge from various areas required for scientific research, including strategic studies, implement innovations and create new knowledge and processes for solving problems with multiple interconnected factors to change, develop and perfect the area of professional expertise, • Ability to choose and apply relevant methodologies and approaches, and • Critically assess the results, methods and outcomes, as well as their long-term and short-term consequences.	• Take responsibility for planning and developing processes, leading to substantial changes or development, • Large degree of autonomy, • Initiate and control complex assignments and processes, responsibility for developing knowledge in the area of expertise, manage and assess work of other employees, • Organize and plan the instruction of other employees, and • Participate in resource scheduling and allocation.

Appendix 4.

Higher Education Program in the Automotive Industry in the North-West Region

No	University	Location	Program Code	Program	Degree Level	Number of Students
1.	Vologda State University	Vologda	23.05.01	Automotive Engineering in Transport Technology	Bachelor's Intramural	16
2.	Pskov State University	Pskov	23.05.01	Automotive Engineering in Transport Technology	Специалитет Очно	15
3.	St. Petersburg State Transport University	Saint Petersburg	13.03.02	Electric Vehicles	Bachelor's Intramural	0
4.	State Marine Technical University	Saint Petersburg	13.03.03	Internal Combustion Engines	Bachelor's Intramural	33
5.	Polytechnic University	Saint Petersburg	23.03.02	Automotive Engineering and Maintenance	Bachelor's Intramural	18
6.	Polytechnic University	Saint Petersburg	23.03.02	Transport and Engineering Systems	Bachelor's Intramural	18
7.	Polytechnic University	Saint Petersburg	23.03.02	Automotive Engineering and Maintenance	Bachelor's Intramural, extramural	18
8.	Polytechnic University	Saint Petersburg	15.04.05	Automotive Engineering	Master's, Intramural	4
9.	Polytechnic University	Saint Petersburg	23.04.02	Computer-Aided Design of Autonomous and Electric Vehicles	Master's, Intramural	10
10.	Saint Petersburg Mining University	Saint Petersburg	23.04.03	Vehicle Operation	Master's, Intramural	4
11.	ITMO University	Saint Petersburg	23.04.03	Functional Safety of Autonomous Vehicles	Master's, Intramural	15

12.	Saint Petersburg Mining University	Saint Petersburg	23.05.01	Automotive Engineering in Transport Technology	Specialist's Intramural	19
13.	Syktyvkar Forest Institute, branch of Saint-Petersburg State Forestry University	Syktyvkar	23.03.01	Organization of Transportation and Transport Management	Bachelor's Intramural, extramural	0
	ALL PROGRAMS					178
	INTEGRATED GROUP 23.00.00					133
	INTEGRATED GROUP 13.00.00					33
	INTEGRATED GROUP 15.00.00					12
	Overall, by degree level - Bachelor's/Master's/Specialist's					103/41/34
	In Saint Petersburg					139

Appendix 5.

Competences

At the Bachelor's level, most key competences are related to engineering, manufacturing and research.

1. 23.03.03 Vehicle and Transportation Systems Operation comprises the following competences:

Engineering and manufacturing:

The ability to participate in group research and to model transport processes and transport engineering operations and operation elements (ПК-9);

Research:

The ability to complete group laboratory, bench, field and acceptance testing, as well as other types of testing for vehicles, machinery and equipment (ПК-20);

The ability to conduct and assess the results of measurement experiments (ПК-21);

The ability to examine and analyze the information, engineering data, figures and progresses related to process improvement for the operation, repair and maintenance of various vehicles, machinery and equipment, as well as their parts, systems and elements, do calculations using modern tools and instruments (ПК-22);

2. 23.03.02 Ground Transport and Engineering Systems:

Design and engineering:

The ability to participate in developing technical documentation for new or modernize the existing ground vehicles and systems (ПК-4);

Engineering and manufacturing:

The ability to participate in developing ground vehicle and equipment testing programs and methodologies (ПК-6);

The ability to participate in ground vehicle and equipment testing (ПК-9);

3. 23.03.01 Transport Process Technologies

Research:

The ability to carry out research and engineering work, related to basic automotive manufacturing design, information support and production engineering, as well as labor and other types of manufacturing management, measurement assurance and quality control in the automotive industry (ПК-25);

4.13.03.03 Power Engineering

Design and engineering:

The ability to carry out research and engineering (ПК-1);

The ability to participate in calculations and experimental studies, process and analyze the results (ПК-5);

The ability to participate in objects testing, related to the area of work or study, as required (ПК-6).

At the Master's level, most key competences are related to research, projects and testing, depending on the program:

1. 23.04.02 Ground Transport and Engineering Systems

Research:

The ability to plan, set the goals for and carry out scientific research and experiments related to the search for and review of novel solutions for the advancement of ground vehicles, machinery, equipment and systems (ПК-2);

Design and engineering:

The ability to formulate project goals, criteria and methodology to achieve these goals, define the goal linkages and priorities related to manufacturing and modernization of ground vehicles and machinery, equipment and systems (ПК-3);

The ability to develop problem solutions, related to ground vehicle manufacturing, analyze these solutions, predict outcomes, find compromises in multi-criteria and uncertain conditions (ПК-4);

The ability to develop design and technical specification for ground vehicles, machinery and equipment (ПК-7);

Engineering and manufacturing:

The ability to test ground vehicles, machinery and equipment (ПК-11).

3. 23.04.03 Vehicle and Transportation Systems Operation

Design and engineering:

The ability to develop technical and managerial documentation, technical standards and methodology for vehicles, equipment and transportation systems operation, as well as process and auxiliary equipment for its operation and maintenance (ПК-1);

Engineering and manufacturing:

The ability to develop manufacturing and technological standards for materials, fuel and electric energy consumption, support the choice of equipment and tools, algorithms and calculation programs required for manufacturing (ПК-13);

The ability to apply the knowledge on materials and materials' properties used in construction and operation of various vehicles, machinery and equipment (ПК-14);

The ability to apply the knowledge on wear, corrosion and strength loss of various vehicle, machinery and equipment parts and structural elements (ПК-15);

Research:

The ability to develop research methodologies, plans and programs, prepare research assignments, organize experiments and tests, analyze and summarize the outcomes (ПК-17);

The ability to gather, analyze and organize the information on the topic of research, prepare research/technical reports and review literature on the topic of research (ПК-18);

The ability to develop physical and mathematical models (including computer simulations) for objects and phenomena related to the topic of research (ПК-19);

The ability to obtain and protect intellectual property, manage research outcomes and commercialize intellectual property (ПК-20);

The ability to apply key industry standards, browse through patent information channels, carry out infringement search for the technology and items under development, prepare primary documents for inventions patenting, and software and data base registering using the key concepts of intellectual property regulation, rights of authors, employer enterprises and patent holders, as well as the fundamental provisions of patent and copyright laws of the Russian Federation (ПК-21);

3. 15.04.05 Design and Technology of Machinery Manufacturing (Master's level)

Design and engineering:

The ability to set project goals and the goal linkage (agenda) based on the set of criteria, objectives and limitations, develop technical specifications for new and effective manufacturing technologies in machine industry and other related industries, develop tools and systems for measurement assurance, diagnostics and management, modernization and automation of the existing manufacturing and technological processes and industries, develop tools and systems required for modernization and automation, and define the priorities (ПК-1);

The ability to participate in project development in machine industry and other related industries, accounting for technology and design, as well as esthetic, economic and managerial factors, develop generic solutions for project issues, analyze and choose the optimal ones, predict the outcomes, plan out projects, do patent research to ensure the patentability and the lack of

infringement for novel project solutions, and define the level of technological sophistication for projects in machine industry and other related industries (ПК-2);

The ability to describe the underlying principles of design and engineering of machinery production processes, devices, tools and systems, develop the schematic, engineering and detailed design, carry out engineering computations for the projects at hand, conduct technical, engineering and function cost analyses to assess the effectiveness of machine industries, manufacturing technologies, tools and systems under design, and assess the project innovative potential and risks (ПК-3);

The ability to develop the functions, logic, technology and the economic principles of machine industries, their elements, technology, algorithms and software, using modern methodology, tools and design technology (ПК-4);

Engineering and manufacturing:

The ability to develop and implement effective mechanical engineering technology, participate in the modernization and automation of various current and new machine industries, their tools and systems, manufacturing and technological processes using automated preproduction systems (ПК-5);

The ability to choose and apply materials, equipment, tools and instruments for automation, control, diagnostics and management, algorithms and software for choosing and calculating technological process parameters, technical and operational characteristics of machine industries, as well as the tools for implementing manufacturing and technological processes in the machine industry (ПК-6);

The ability to organize and carry out effective quality control for materials, equipment, technological processes and products, assure the required reliability of machine industries negatively impacted by the changing external factors, plan out constant improvement of engineering products (ПК-7);

The ability to analyze the current conditions and the changes in the machine industries and machine industry elements using the modern analysis methods and tools, product testing programs, machine industry elements, carry out metrological calibration tests for key quality measurement tools, look for production defects and minimize and eliminate these defects (ПК-8);

The ability to standardize and certify machine industry products, technological processes, tools and systems, develop approaches for comprehensive and effective use of materials and resources, replace defective materials, industrial waste reuse and recycling, ensure industrial and ecological safety, reliability and stability (ПК-9);

Research:

The ability to carry out experimental studies, assess research outcomes, compare new experimental data against the existing models to assess their validity and propose changes to improve them, carry out mathematical modeling of the processes, tools and systems in the machine industries, using modern research technology, develop theoretical models to investigate the quality of machine industry products, technological processes, tools and systems (ПК-16);

The ability to apply new research outcomes and the well-known research and engineering problem-solving methodologies, apply problem-oriented analysis, synthesis and optimization methods for preproduction design and engineering, develop algorithms and software for these industries (ПК-17).

At the Specialist's level, programs focus more on specialization and additional profession-related competences, with most of them being related to design and engineering.

1. 23.05.01 Ground Vehicle Technology, specialization No 5 Automotive Engineering in Transport Technology:

Research:

The ability to investigate, both at the practical and theoretical levels, search for and validate new vehicle, vehicle systems, machinery and equipment improvement solutions (ПК-2);

The ability to provide the technology for and organization of research, outcome analysis and technology implementation solution development (ПК-3);

Design and engineering:

The ability to develop design and engineering documentation using information technology for making new and modernizing the existing ground vehicles, machinery and equipment (ПК-7);

The ability to use applied design and engineering software for calculating nodes, parts and equipment systems to carry out ground vehicle and machinery maintenance, diagnostics and repair (ПСК-5.5);

The ability to develop specific solutions for ground vehicle and machinery maintenance, diagnostics and repair equipment, analyze the options, predict the outcomes, find compromises in multi-criteria and uncertain conditions (ПСК-5.7);

Engineering and manufacturing:

The ability to test ground vehicle and machinery operation equipment on a regular basis (ПСК-5.11);

Management:

The ability to find optimal solutions for making and applying new technology and tools, using analytical and numerical methods (ПСК-5.12);

Appendix 6.

Higher Education Programs and Competences

Higher Education for the Automotive Industry in Finland

No	University	Location	Programs /Areas of Study	Competences
1	Metropolia University of Applied Sciences (Metropolia Ammattikorkeakoulu) https://www.metropolia.fi/en	Helsinki	1. **Automotive Engineering** (**Bachelor of Engineering**) In Finnish/Swedish. Specialization options - Automotive Electronics Engineering - After Sales Auto Engineering - Automotive Design https://www.metropolia.fi/en/academics/degree-programmes-in-finnish/automotive-engineering	The competences provided are comprised of the knowledge and skills in electrical, mechanical and automotive engineering. In addition to the traditional vehicle technology, the curriculums cover autonomous, electric and hybrid vehicles, as well as the Mobility-as-a-Service concept. The graduates are aware of the main vehicle constructions, nodes and systems, as well as the automotive manufacturing methodology, can describe and model transportation systems using the mathematical apparatus, know how the internal combustion engine, electric and hybrid vehicles work, are familiar with automotive electronics and sensors, can manage automotive diagnostics, are aware of the most popular materials and compounds, their properties and uses.
			2. **Mechanical Engineering** **Bachelor's Degree** (**Engineer**) In Finnish	Specialization options: Energy and Environmental Engineering, Machine Automation, Production Engineering, and Machine Design Engineering

No	University	Location	Programs /Areas of Study	Competences
			https://www.metropolia.fi/en/academics/degree-programmes-in-finnish/mechanical-engineering	
			3. Intelligent Industrial Solutions **Master's Degree** In Finnish https://www.metropolia.fi/en/academics/degree-programmes-in-finnish/intelligent-industry	The Master's Degree in Intelligent Industrial Solutions (M.Eng) is tailored to engineering professionals working in the industry. The studies deepen the students' previous engineering know-how and prepare them to work more efficiently in a modern intelligent industrial environment. The learning outcomes of the program have been defined together with representatives of the local industry and it provides solutions to the increasing needs and challenges of the constantly developing fields of engineering.
2	Aalto University https://www.aalto.fi/en	Helsinki	**Mechanical Engineering** **Master's Degree (Engineer)** In English https://www.aalto.fi/en/study-options/masters-programme-in-mechanical-engineering	Mechanical Engineering covers a wide range of activities and technology sectors, from energy and transportation to medical devices and environmental protection. Specialization options: Arctic Technology, Engineering Materials, Marine Technology, Mechatronics, Product Development, Production Engineering and Solid Mechanics
3	Tampere University of Applied Sciences /Tampereen teknillinen yliopisto (TUT) https://www.tuni.fi/fi	Tampere	**Automotive Engineering** **Bachelor's Degree** In Finnish https://opinto-opas-ops.tamk.fi/index.php/fi/167/fi/186707/19AUTO/year/2020	The program prepares students for engineering jobs in the modern and environmentally friendly automotive industry.

No	University	Location	Programs /Areas of Study	Competences
			Majors: • industrial vehicle engineering • garage engineering • intelligent machines	Students master the mathematical and physical basis of automotive engineering, basics of automotive engineering, engineering methods and software, automotive business, automotive design and digital automotive technology.
4	University of Oulu https://www.oulu.fi/university/	Oulu	**Mechanical Engineering** **Bachelor and Master of Engineering** (3 years + 2 years) In Finnish. You can also complete the studies in English. https://www.oulu.fi/yliopisto/hakijalle/konetekniikka A degree program in mechanical engineering has six specialization options: **automotive and mechanical engineering**, machine design, materials science, mechatronics and machine diagnostics, engineering mechanics and production engineering. https://opintopolku.fi/app/#!/korkeakoulu/1.2.246.562.17.95165550906	Graduates know the characteristics of various equipment, machinery and vehicles, as well as their specifications. They are able to develop work plans and complete them and ensure equipment safety. The students learn about AI and digitalization, information technology and sensors and vehicle automation. Graduates are able to use modern equipment for 3D printing, laser and waterjet cutting. If the student chooses Automotive Engineering, he or she is able to implement technology, learn about design and development of mobile machinery. As a professional in mechanical engineering, he or she is able to design and develop client-oriented valuable investment products, gains expertise in materials science, properties and development of materials.
5	Oulu University of Applied Sciences или Oulun Seudun	Oulu	**1. Mechanical Engineering** **Bachelor's Degree (Engineer)** Vehicle and Machinery Technology	As a mechanical engineer, a student is involved in the making or design of all man-made objects, devices and

No	University	Location	Programs /Areas of Study	Competences
	Ammattikorkeakoulu (OAMK) https://www.oamk.fi/fi		https://www.oamk.fi/fi/koulutus/ammattikorkeakoulututkinnot/konetekniikka-amk There is also the opportunity for a double degree: a student can get both Finnish and German or Dutch engineer degree at the same time. Double degree programs are provided in English.	machines. In the program, students learn about hybrid and electric autonomous vehicles. In the studies of the automotive engineering and machinery technology specialization option, students become familiar with automotive aftermarket, car and work machine electronics, internal combustion engine and hybrid transmission technology, and modern control and regulation systems.
			2. Energy and Environmental Engineering **Bachelor's Degree (Engineer)** https://www.oamk.fi/fi/koulutus/ammattikorkeakoulututkinnot/insinoori-amk-energia-ja-ymparistotekniikka	In the studies of energy engineering, students get acquainted with energy production methods, energy use and distribution. Graduates can work at, for example, production plants in different industries. Electric vehicles are mentioned.
6	Turku University of Applied Sciences https://www.tuas.fi/en/	Turku	**Vehicle and Transportation Engineering** **Bachelor's Degree (Engineer)** In Finnish https://www.turkuamk.fi/fi/tutkinnot-ja-opiskelu/tutkinnot/tuotantotalous_ajoneuvo_ja_kuljetustekniikka/	Students gain knowledge related to the structure and operation of vehicles or, alternatively, transport organization and supply chain management. In the course of studies, students can specialize in vehicle design, maintenance and repair, inspection, sales, or various forms of local and long-distance transportation as well as internal and external logistics.
7	Seinäjoki University of Applied Sciences/Seinäjoen ammattikorkeakoulu (SEAMK)	Seinäjoki	**Mechanical Engineering** **Engineer** (**Bachelor of Science in Engineering**). In Finnish	Vehicle and Machinery Technology is the specialization that produces automotive engineers who, in addition to basic mechanic engineering skills, have special abilities and competences

No	University	Location	Programs /Areas of Study	Competences
	https://www.seamk.fi/		The program has two specializations: Vehicle and Machinery Technology or Mechanical Engineering and Production Technology. https://www.seamk.fi/kaikki-koulutukset/insinoori-amk-konetekniikka/	in vehicle and machinery technology, get acquainted with the automobile mechanics and design, testing and methodology of automotive electronics.
8	Novia University of Applied Sciences или Yrkeshögskolan Novia (SYH) https://www.novia.fi/	Vaasa	**Mechanical and production technology** **Bachelor's Degree** In Swedish One of the majors is Automotive and Transport Technology https://www.novia.fi/utbildning/utbildningsutbud/teknik-och-sjofart/ingenjor-yh-maskin-och-produktionsteknik/	The key topics are mechanical and energy engineering, machine elements and strength calculations, design, automation, vehicles, manufacturing and production technology, robotics, operation and maintenance technology as well as finance and management systems. The profiling studies in car and transport technology focus on car and vehicle technology, as well as logistics and transport.
9	Häme University of Applied Sciences/Hämeen ammattikorkeakoulu (HAMK) https://www.hamk.fi/	Hämeenlinna	Transport Engineering **Bachelor's Degree (Engineer)** In Finnish https://www.hamk.fi/amk-tutkinto/liikenneala-insinoori-amk/	Knowledge on transport planning, smart mobility and intelligent transport services. One specialization involves smart mobility, the Mobility-as-a-Service concept and autonomous transport development.
			Mechanical Engineering **Bachelor's Degree (Engineer)** In Finnish https://www.hamk.fi/amk-tutkinto/konetekniikka-insinoori-amk/	In the studies of mechanical engineering, in addition to the basic engineering skills, students develop special expertise in the design processes and methods of machinery, equipment, products and structures, learn to work in various digital design environments; study production technology, production

No	University	Location	Programs /Areas of Study	Competences
				planning and modern manufacturing methods. Specilaization: machinery design, simulation and modeling, and manufacturing automation.
			Mechanical engineering and production technology **Bachelor's Degree (Engineer)** In English https://www.hamk.fi/dp-bachelor/mechanical-engineering-and-production-technology/?lang=en	In addition to conventional mechanics and mechanical engineering, the curriculum includes robotics, industrial Internet and 3D scanning. Mechanical design uses modern calculus, simulation and design software tools as well as automated production and manufacturing technologies when developing intelligent machinery and equipment for the future needs.
			Future Transportation Systems **Engineer** **Upper Bachelor of Science** In English https://www.hamk.fi/yamk-tutkinto/tulevaisuuden-liikennejarjestelmat-ylempi-amk/#opiskelijakartta	Graduates have a broad understanding of the interactions and impact mechanisms in different areas of the automotive industry and are able to evaluate future developments and their impact on their own field of work. Among the main study topics are mobility needs and transport services, transportation system design and intelligent transport services.
10	Centria University of Applied Sciences/ Centria ammattikorkeakoulu (or Centria) https://web.centria.fi/	Kokkola	**1. Industrial Management** **Bachelor's Degree** **In English and partly in Finnish** https://web.centria.fi/hakijalle/paivatoteutukset/insinoori-amk/industrial-management	Students specialize in **mechanical engineering**, chemical engineering or information technology. In the course of study, students get acquainted with management and finance.
			2. Industrial Engineering and Management **Bachelor's Degree (Engineer)**	Program in engineering, economics and management.

No	University	Location	Programs /Areas of Study	Competences
			In Finnish https://web.centria.fi/hakijalle/paivatoteutukset/insinoori-amk/tuotantotalous	Students specialize in **mechanical engineering**, chemical engineering or information technology. The possibility to be hired to fill managerial and expert positions in industrial enterprises in the area of financial management, marketing and sales, as well as engineering.

Appendix 7.

Vocational Training Programs for the Automotive Industry in the Russian Federation

No	Vocational Schools	Location	Program
1.	Vocational College 'Automotive Service' (Multi-functional applied qualification center)	Saint Petersburg	23.01.03 Car Mechanic 23.02.07 Maintenance and Repair of Car Engines, Systems and Parts 23.01.17 Automotive Repair and Service Technician 23.02.03 Vehicle Maintenance and Repair
2.	Saint Petersburg Technical College	Saint Petersburg	23.02.07 Maintenance and Repair of Car Engines, Systems and Parts 15.02.08Mechanical Engineering
3.	Academy of Transport Technology	Saint Petersburg	23.02.05 Electrical and Automatic Transport Equipment 23.02.02Automotive and Tractor Manufacturing
4.	Izhora College	Saint Petersburg	23.01.08 Construction Machinery Service Technician
5.	College 'Petrostroiservice'	Saint Petersburg	23.01.03 Car Mechanic
6.	Metrostroi College	Saint Petersburg	23.02.07 Maintenance and Repair of Car Engines, Systems and Parts 23.01.03 Car Mechanic
7.	Maloohta College	Saint Petersburg	23.01.17 Automotive Repair and Service Technician Mechatronics and Mobile Robotics (depending on the industry)
8.	Petrodvorets College	Saint Petersburg	23.01.03 Car Mechanic
9.	Sestroretsk Vocational School	Saint Petersburg	23.01.03 Car Mechanic 23.01.17 Automotive Repair and Service Technician
10.	Car Mechanic School	Saint Petersburg	23.01.03 Car Mechanic 23.02.07 Maintenance and Repair of Car Engines, Systems and Parts 23.02.01Transportation and Transport Management
11.	Industrial Ship-Building College	Saint Petersburg	23.01.08 Construction Machinery Service Technician
12.	Road and Transport College	Saint Petersburg	23.01.03 Car Mechanic
13.	Primorsky Vocational School	Saint Petersburg	23.01.03 Car Mechanic
14.	Kronstadt Vocational School	Saint Petersburg	23.01.03 Car Mechanic 23.02.02 Vehicle Maintenance and Repair
15.	Service and Industrial Technology Vocational School	Saint Petersburg	23.01.17 Automotive Repair and Service Technician

16.	Russian College of Traditional Culture	Saint Petersburg	23.01.17 Automotive Repair and Service Technician
17.	Kronstadt Vocational School	Saint Petersburg	23.01.03 Car Mechanic
18.	Fire-Fighting and Rescue College 'Saint Petersburg Emergency Response Worker Training Center'	Saint Petersburg	23.01.03 Car Mechanic
19.	Volhov Alluminum College	Leningrad region	23.02.03 Vehicle Maintenance and Repair
20.	Tikhvin Industrial and Technology Vocational School	Leningrad region	23.02.03 Vehicle Maintenance and Repair 15.02.08 Mechanical Engineering
21.	Sosnovybor Polytechnic College	Leningrad region	23.02.03 Vehicle Maintenance and Repair
22.	Slantsy Industrial Vocational School	Leningrad region	15.02.01 Industrial Equipment Installation and Operation
23.	Priozersk Polytechnic College	Leningrad region	23.02.03 Vehicle Maintenance and Repair
24.	Podporozhsk Polytechnic College	Leningrad region	15.19.01 Mechanical Engineering 23.02.03 Vehicle Maintenance and Repair
25.	Mechanical Engineering College Vologda State University	Vologda region	15.02.08 Mechanical Engineering 15.02.01 Industrial Equipment Installation and Operation 23.02.03 Vehicle Maintenance and Repair
26.	Veliky Ustyug Automotive Vocational School	Vologda region	23.02.03 Vehicle Maintenance and Repair 43.02.06 Transport Service
27.	Soviet College of Technology	Kaliningrad region	23.02.03 Vehicle Maintenance and Repair
28.	Kaliningrad Vocational School of Sectoral Technology	Kaliningrad region	23.02.03 Vehicle Maintenance and Repair
29.	Gusev Polytechnic Vocational School	Kaliningrad region	23.02.03 Vehicle Maintenance and Repair
30.	Monchegorsk Polytechnic College	Murmansk region	23.02.03 Vehicle Maintenance and Repair
24	Pecheng Polytechnic Vocational School	Murmansk region	23.02.03 Vehicle Maintenance and Repair

25	Petrozavodsk Branch of St. Petersburg State Transport University	Petrozavodsk	27.02.03 Transport Automation and Telemechanics
26	Petrozavodsk Automotive College	Petrozavodsk	23.02.03 Vehicle Maintenance and Repair 08.02.05 Road and Airfield Construction and Operation 43.02.06 Transport Service 23.02.04 Operation of Transporting, Construction and Road Vehicles and Machinery
27	Intin Polytechnic Vocational School	The Komi Republic	23.00.00 Ground Vehicle Technology
28	Vorkuta Polytechnic Vocational School	Arkhangelsk region	23.02.05 Electrical and Automatic Transport Equipment

Appendix 8.

Vocational Training Programs for the Automotive Industry in Finland

No	Vocational Schools	Location	Website	Programs
1	Iisakki Vocational Institute/ Ammatti-instituutti Iisakki, Hämeenkyrön toimipiste SASKY Municipal Education and Training Consortium	Hämeenkyrö is a municipality in the Pirkanmaa region	https://sasky.fi/oppilaitokset/ammatti-instituutti-iisakki/	Vehicle Mechanic https://www.studentum.fi/koulutukset/sasky-koulutuskuntayhtyma/ammatti-instituutti-iisakki-hameenkyron-toimipiste/autoalan-perustutkinto-ajoneuvoasentaja-191659 https://sasky.fi/koulutus/autoalan-perustutkinto-jatkuva-haku/
2	Vammala Vocational College SASKY Municipal Education and Training Consortium	Sastamala	https://sasky.fi/in-english/training-offer-at-the-different-schools-of-sasky/vammala-vocational-college/	Vehicle Mechanic https://sasky.fi/koulutus/autoalan-perustutkinto-ajoneuvoasentaja/ Small Machinery Mechanic https://sasky.fi/koulutus/autoalan-perustutkinto-pienkonekorjaaja/
3	Tavastia Vocational College	Hämeenlinna	https://www.kktavastia.fi/	Vehicle Mechanic https://www.kktavastia.fi/ammattiopisto-tavastia/perustutkinnot/ajoneuvoasentaja/ Vehicle Body Repairer https://www.kktavastia.fi/ammattiopisto-tavastia/perustutkinnot/autokorinkorjaaja/ Vehicle Painter (automotive painting) https://www.kktavastia.fi/ammattiopisto-tavastia/perustutkinnot/automaalari/ Parts Salesperson https://www.kktavastia.fi/ammattiopisto-tavastia/perustutkinnot/varaosamyyja/
4	Axxel Axxell Utbildning Ab	Karjaa (and other cities)	https://www.axxell.fi/	Vehicle Mechanic (Youth Education) https://www.axxell.fi/en/fordonsmekaniker

No	Vocational Schools	Location	Website	Programs
				Vehicle Mechanic (multi-form) https://www.axxell.fi/en/fordonsmekaniker-flerform
5	Careeria	Helsinki / **Porvoo** / Vantaa	https://www.careeria.fi/	Vehicle Mechanic https://www.careeria.fi/koulutus/autoalan-perustutkinto?educationid=5608-5
6	Kpedu The Federation of Education in Central Ostrobothnia	Kokkola	https://www.kpedu.fi/kpedu/kpedu-in-english	Professional qualification in the automotive industry https://www.kpedu.fi/hakijalle/ammatilliset-tutkinnot/koulutus/autoalan-perustutkinto_(l5471)
7	Keuda Group	Nurmijärvi is a municipality in south Finland, in the Uusimaa region	https://www.keuda.fi/	Professional qualification in the automotive industry https://www.keuda.fi/koulutustarjonta/koulutushaku/tutkinnot/autoalan-perustutkinto-ajoneuvoasentaja-varaosamyyja-automyyja-autokorinkorjaaja-automaalari-pienkonekorjaaja?backlink=https%3A%2F%2Fwww.keuda.fi%2Fkoulutustarjonta%2Fkoulutushaku%2F%3F Further qualification in automotive engineering https://www.keuda.fi/koulutustarjonta/koulutushaku/tutkinnot/ajoneuvoalan-ammattitutkinto?backlink=https%3A%2F%2Fwww.keuda.fi%2Fkoulutustarjonta%2Fkoulutushaku%2F%3F
8	Education Center JEDU	Haapavesi, Nivala	https://www.jedu.fi/	Professional qualification in the automotive industry https://www.jedu.fi/koulutus/autoalan-perustutkinto/3984
9	Luksia	Haapavesi, Nivala	https://www.luksia.fi/	Professional qualification in the automotive industry https://www.luksia.fi/koulutustarjonta/koulutusalat/tekniikan-alat/tutkinnot/ajoneuvoasentaja
10	Vocational Education and Training Educational Consortium OSAO (VET)	Haukiputaan, Muhos	https://www.osao.fi/	Vehicle Mechanic https://www.osao.fi/opinnot/ajoneuvoasentaja/ Vehicle Body Repairer https://www.osao.fi/opinnot/autokorinkorjaaja/

No	Vocational Schools	Location	Website	Programs
				Vehicle Painter https://www.osao.fi/opinnot/automaalari/ Продавец запчастей https://www.osao.fi/opinnot/varaosamyyja/
11	Raseko Raisio Regional Education and Training Consortium	Raisio	www.raseko.fi	Vehicle Mechanic https://www.raseko.fi/ajoneuvoasentaja/
12	Salo Region Vocational College	Salo	https://www.sskky.fi/en	1. Vehicle Mechanic 2. Vehicle Body Repairer https://www.sskky.fi/koulutukset-1/tiedot/5160-autoalan-perustutkinto
13	Sedu Professional education provider	Seinäjoki, Ähtäri, Lapua	https://www.sedu.fi/	1. Vehicle Mechanic https://www.sedu.fi/fi/Hakijalle/Ammattialat/Autoala/Ajoneuvoasentaja 2. Vehicle Body Repairer https://www.sedu.fi/fi/Hakijalle/Ammattialat/Autoala/Autokorinkorjaaja
14	Tampere Vocational College Tredu	Tampere	https://www.tredu.fi/index.html	1. Vehicle Painter 2. Vehicle Mechanic 3. Vehicle Body Repairer https://www.tredu.fi/etsi-koulutusta/autoalan-perustutkinto.html?nro=5 4 Further qualification in automotive engineering (Vehicle Mechanic, Salesperson) https://www.tredu.fi/etsi-koulutusta/ajoneuvoalan-ammattitutkinto.html?nro=2
15	TTS Professional education provider	Nurmijärvi	www.tts.fi	Professional qualification in the automotive industry Further qualification in automotive engineering https://www.tts.fi/koulutustarjonta/autoala

No	Vocational Schools	Location	Website	Programs
16	Ylä-Savo Vocational College Education and Training Consortium	Iisalmi	https://www.ysao.fi/	Professional qualification in the automotive industry https://www.ysao.fi/Suomeksi/Hae-opiskelemaan/Ammatilliset-perustutkinnot/Ajoneuvoasentaja
17	Vantaa Vocational College Varia	Vantaa	https://sivistysvantaa.fi/en/varia/artikkelit/aboutus.html	1. Vehicle Mechanic 2. Vehicle Body Repairer https://sivistysvantaa.fi/varia/artikkelit/varia/ammatillisettutkinnot/autoalanperustutkintoajoneuvoasentajataikorinkorjaaja.html
18	South Kymenlaakso Vocational College The Joint Authority of Education of Kotka-Hamina Region Group (Ekami)	Kotka, Hamina	https://www.ekami.fi/in-english	1. Vehicle Mechanic 2. Vehicle Body Repairer 3. Vehicle Painter https://www.ekami.fi/hakijalle/koulutusalat/autoala
19	Stadin Vocational and Adult Education Center	Helsinki	https://www.hel.fi/ammatillinen/fi/tyoelamalle/	Professional qualification in the automotive industry https://www.hel.fi/ammatillinen/fi/koulutukset/koulutukset-tutkinnot/koulutukset-perustutkinnot/autoalan-perustutkinto
20	Global Education Services Taitaja, GEST	Kouvola	https://www.taitajantie.fi/about-us/	Autobody Repair • Bricklaying • Car Painting • CNC Milling • Concrete Construction Work • Construction Metal Work • Cooking • Formula Car Mechanics and Rally • Mechanics • Painting and Decorating • Plumbing and Heating • Restaurant Service • Technical visit programmes • Welding