Werkplaats Op Weg
Hoe kan in een disruptieve tijd onderhoud en reparatie van auto's toekomstbestendig worden georganiseerd?

Met speciale dank aan:

A-Allround, ACE, Autodidact, Bochane, Pals BV, Bijker - Zorgeloos rijden,
Hyundai Motor Netherlands b.v., Louman en Parqui, Saris - 4x4 Autobedrijf
Autobedrijf Van den Oudenhout, Autobedrijf Theo van der Heijden, Van Leeuwen Auto's
Workshop on the Move

How can car maintenance and repair be future-proofed in a disruptive time?

March 2020
Foreword
The research project 'Workshop on the Move' (WoW) was initiated by the HAN lectorates LEAN & Worldclass Performance and Automotive Research. Within these lectorates, people were looking for the answer to the question from the automotive industry: "How can car maintenance and repair be future-proofed in a disruptive time?". This question is prompted by discussions with various SME partners in the field. The project has been submitted to the SIA management body for a RAAK SME financing. This request was granted in September 2017. After that, the implementation of the project started.

In addition to SME partners, various training institutions, manufacturers, suppliers and consultants were also willing to contribute to the project. In total, the consortium (see Annex 1) around WoW consisted of 14 companies. In the two-and-a-half year study, the partners met regularly to discuss progress.

By now, the finish line has been reached. We can look back on an instructive, interesting, useful and informative research. The research can count on much interest, including within the industry. Articles have been published in various professional journals and the research has also been presented in several places for a diverse audience of automotive entrepreneurs, employees, students, journalists and consultants.

We wish you a lot of reading pleasure with this reference book of the research project.

On behalf of the research team,
Nina Veders (project leader), Jarek Keiren and Arno van der Steen

Research group:
HAN Academy Engineering and Automotive
Lectorate LEAN & Worldclass performance
Lectorate Automotive Research

Date: March 2020

1 The National Governing Body SIA is part of the Netherlands Organisation for Scientific Research (NWO)
2 The RAAK SME scheme finances research projects of colleges in cooperation with SMEs. The aim of the scheme is to promote knowledge exchange in order to increase the innovative capacity of SMEs.
3 Aftersales Magazine: 4 articles / Auto & Motor Techniek (AMT): 1 article
4 Endpresentation 28 January 2020 at Autobedrijf Van Leeuwen / presentations AMT-Live 11, 12, 13 February 2020
Management Summary
In September 2017, the Lectorates LEAN & Worldclass Performance and Automotive Research of the HAN University of Applied Science, together with a consortium of (SME) industry partners, started the research project ‘Workshop on the Move’. The project is the search for the answer to the question as to the best way to organize repair and maintenance of passenger cars effectively and efficiently in the future.

This project was financed by Regional Body SiA through the RAAK SME scheme and with co-financing of the consortium partners.

The study was divided into five work packages. In each work package part of the workload was executed. Each work package was led by one of the consortium partners. Other consortium partners cooperated.

The project management was in the hands of the HAN.

On the basis of work sessions, desk research, focus groups, practical tests, interviews, case studies and student projects this research has:
- mapped out the existing industry situation,
- predicted changes for the industry until 2030,
- determined six types of business using Formative Scenario Analysis (FSA) as a guide,
- built a tool to give automotive entrepreneurs an indication of the best strategic business choice for the future,
- validated interim results by consortium partners.

Finally, the results of the project were translated into a visual representation, various presentations, a research report and a reference book for the automotive industry. The various publications can be found on the website www.werkplaatsopweg.nl.

Current situation and expectations
On the basis of available industry information, the size of the existing vehicle fleet and the composition by powertrain/fuel type has been determined.

For the development of the fleet and powertrains, research has been used by industry associations and estimates from discussions with consortium partners. Important guidance for the basis was the consistent coherence of population growth and the development of the number of passenger cars in the Netherlands. The expected fleet in 2030 consists of 9.6 million units.

By 2020, the Netherlands will have around 61,000 car mechanics and more than 28,000 companies registered with the activity ‘maintenance and repair of passenger cars’.

An estimate for total hourly consumption in 2030 was made based on the composition and expected decrease in vehicle consumption per type of powertrain. This consumption of hours will fall from about 51 million hours in 2020 to around 33 million hours in 2030.

This number of hours will require approximately 34,000 car mechanics and almost 5700 workshops by 2020. This applies to an average of 1500 productive hours per mechanic and six technicians per
Workshop on the Move

workshop. This need will fall to about 22,000 car mechanics by 2030 and only 3650 workshops. This is based on the above figures and averages.

CASE
The research shows that the industry will be strongly influenced by four developments in the next ten years. These can be summarized in the term CASE (Connectivity, Autonomous Driving, (Car) Sharing, Electrification). A characteristic of these developments is that they mostly originated outside the automotive industry. The developments also have a strong disruptive effect on existing vehicle technology, process technology and/or customer behaviour.

The four developments occur both separately and in combination. This allows them to strengthen each other even further. The correct assessment of the extent to which a (potential) workshop will have to deal with the four developments has been converted into a choice tool in the project. This has been made available www.werkplaatsopweg.nl via the website.

Six business types
Using Formative Scenario Analysis as a guide, the research defines six business types. These should be seen by the reader as 'basic forms', which, whether combined or not, can be translated into the practical situation. These six business types appear in the industry in seven forms. The business types are:

 nộp Zero Change: no change, workshop/warehouse/reception, all work, level 1-4, fuel engines, broad knowledge, high costs
 nộp Simplicity is King – simplicity, so a lot: specialist, simple work, low rate, large quantities, level 2/3, certain knowledge, low costs, tires etc.
 nộp Simplicity is King – complicated, so a little: specialist, difficult work, high rate, small amounts, level 4+, lots of analysis, specific knowledge, further training
 nộp DigiDigiDigi: digital working, connected, Over-the-Air, pay-per-view, updates, digital diagnosis, closed system, car connection, high level of knowledge, high costs
 nộp C’mom, on the Move: call fees, mobile workshop, good agreements, broad knowledge, contact characteristics, route planning, pop-up workshop
 nộp Service, that’s it: fleet management, MaaS, from-own-to-use, fleet management, contract agreements, sharing cars, leasing company
 nộp United we stand: online marketplace, joint offer, online, unburdening, low customer loyalty, reviews, collaboration, price comparison, multi vendor

The results of the research will hopefully prompt car maintenance and repair companies to analyse their environment and developments. This should look at the extent to which suppliers (supply), customers (demand), colleagues (competition), providers (substitutes) and the company itself have to deal with the four disruptive CASE developments.

With this analysis, the tool can be filled out at www.werkplaatsopweg.nl. The outcome of the tool gives an indication of the direction in which a company, confronted with certain CASE developments, can start to focus its strategic policy vision. The tool is certainly not an exact science and the outcome
of the tool is indicative. It is always advisable to find out what is needed in one’s own specific situation on the basis of the results.

In collaboration with the European project 'LEAN4.0' of the Lean & World Class Performance Lectorate, a special LEAN4.0 tool has been developed and tested at a car company. Implementation of technological 'industry 4.0' in workshops is an important element in the development of car companies. The LEAN4.0 self-scan tool for car companies can be found on the website [www.werkplaatsopweg.nl](http://www.werkplaatsopweg.nl).

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5 LEAN4.0: this multi-year erasmus international project explores how smart technologies can best be applied and how these technologies fit into Lean and production improvement concepts.
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1. Introduction

In September 2017, the LEAN & World Class Performance and Automotive Research lecturates from HAN University of Applied Sciences started implementing 'Workshop on the Move'. This research was made possible by SiA through the RAAK-SME scheme. Researchers, project partners, teachers and students (HAN and ROC Aventus) have been working for two and a half years to answer the central research question:

"How will car maintenance and repair be organised effectively and efficiently in the future?"

This abridged summary of the research aims to give a good picture of the challenging, complex and interesting research project.

*Note: the research therefore explicitly does not focus on the sale of cars or parts. These two departments have only been investigated if it affects the work in the workshop.*

1.1. Reason

The workshop of the future will no longer resemble the workshop as we now know it, where maintenance and repair of cars is carried out. This is due to various changes such as: new technology, care for the environment, a different vision for the future of mobility and also, for example, a different status around car ownership.

These changes lead to a high degree of uncertainty among SME entrepreneurs. The question is how vehicle developments will affect the workshops in the future. In addition, they want to know what the effect will be on the maintenance demand. Previous studies have provided insights into the role that certain vehicle developments will play. However, they did not yet offer the entrepreneurs any handles on whether and how they can change their maintenance processes. It was also unclear what opportunities these changes offer and what knowledge development is necessary to continue to exist in this changing world.

The research 'Workshop on the Move' has been carried out to gain insight into these developments and the changing maintenance demand. This insight has then been translated into the design and staffing of the workshop of the future. Not only does this answer the question of how workshops can be set up, but also how work can be carried out and organised.

The results of the research are important for SMEs, educational institutions and trade associations to make strategic, tactical and operational choices for the future.

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6 [www.regieorgaan-sia.nl/onderzoeksfinanciering/RAAK-mkb](http://www.regieorgaan-sia.nl/onderzoeksfinanciering/RAAK-mkb)
1.2. Background

The preliminary study in 2017 identified the three main drivers for change. These affect the workplace of the future; the 'Workshop on The Road'. Of these drivers, two are technological in nature and one is specifically aimed at the end user. During the execution of the research, a distinction was always made between: vehicle technology, process technology and customer requirements.

Changes in vehicle technology.
In vehicle technology, the use of information technology to control, monitor and control systems in the vehicle has increased. A second change is an increase in comfort and safety related systems. These so-called ADAS\(^7\) are a significant change that demonstrably affects the maintenance and repair of the vehicle. Fleet management technology and communication technology connect the car with all kinds of service and product providers. A third change in vehicle technology is the powertrain. The most characteristic of this is the growth in the number of electric vehicles. Change in vehicle technology can be split into:
- on board technology (including data management technology),
- control technology and
- drive technology.

Preliminary research\(^8\) has determined that (all-round) technicians in the automotive sector should have knowledge of all systems in the vehicle. A major shift in vehicle systems is caused by the explosive growth of electronic and digital information systems. The vehicle technician will also need to have knowledge of this. Furthermore, it has been established that mechanical knowledge is more than present within the industry. Knowledge of electronics is limited, while knowledge of specific ICT systems is virtually absent\(^9\).

Changes in process technology.
With regard to the changes in process technology, the preliminary study has identified the main concern of the emergence of process technologies associated with the concept of Smart Industry\(^10\). This includes the use of big data\(^11\), Virtual Reality\(^12\) (VR), Augmented Reality\(^13\) (AR) and Internet of Things\(^14\) (IoT). The changes can be divided into: vehicle data, AR/VR and organizing service and maintenance.

The way in which data from vehicles can be used for the optimization of the maintenance process in the future will play a big role. Data from vehicles can be compared to remote diagnoses. Automatic

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\(^7\) ADAS = Advanced Driver Assistance System
\(^9\) Innovam, Werkplaats van de Toekomst, december 2018
\(^10\) Smart Industry of Industry 4.0: automatisering en gegevensuitwisseling gebruikt bij fabricagetechnieken
\(^11\) big data: one or more datasets that are too large to handle with regular database systems
\(^12\) VR: computer simulation to allow a user to experience something through various senses
\(^13\) AR: live, direct or indirect, image of reality to which a computer adds elements
\(^14\) IoT: development of the Internet, where everyday objects exchange data over the network
Notifications for maintenance can also be generated. Corrective actions may even be possible. AR/VR could enable the execution of maintenance with remote support. Not so much the knowledge of the mechanic is then important to be able to carry out maintenance or repairs, but the availability and experience to work with AR/VR applications are central.

**Changes in customer behavior.**

A shift from possession to use is a trend that is taking place slowly but steadily\(^\text{15}\). This is a shift from private property to organized/professional property\(^\text{16/17}\).

This change as well has major implications for the organization of service and maintenance.

The shift from ownership to use of vehicles is causing a growth in professional ownership (e.g. on-call cars such as Greenwheels\(^\text{18}\), Uber\(^\text{19}\), Amber\(^\text{20}\) etc. or rental cars). This shift leads to a more flexible need for service capabilities.

![Figure 1: global car sharing expectations, Morgan Stanley June 2016](image)

If this development continues, who is the customer for whom maintenance is carried out? How do the requirements for the maintenance of the vehicle change?

Both the customer and the owner of a vehicle fleet, as well as the individual owner of a vehicle, impose changing demands on the time and location of maintenance and repair. This change in customer behaviour offers opportunities for on-site maintenance.

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\(^{15}\) Rabobank, A convincing case, oktober 2016

\(^{16}\) Morgan Stanley, Shared mobility on the road of the future, juni 2016 en Morgan Stanley, Ride sharing’s big role in electric car adaptation, oktober 2019

\(^{17}\) Arthur Little, The future of automotive mobility, maart 2017

\(^{18}\) Greenwheels (1995) is the largest private and business car sharer in the Netherlands

\(^{19}\) Uber (2009) undertaking mediating between travellers and passenger transport providers

\(^{20}\) Amber (2016), provider of commercial electric sharing cars
1.3. Method

A research design has been established for the execution of the research. In addition, five consecutive work packages have been distinguished, namely:

1. Foresight
2. Create a scenario
3. The workshop(s) of the future
4. Pilot testing and proof of concept
5. Dissemination

A work package is a coherent set of activities that includes the interpretation of a complete phase of the project. One of the members of the steering committee was always responsible for the implementation of a work package. The results of previous work packages have been used each time to shape the activities of later work packages. The work packages were in principle followed timely, but could also run parallel in time. The sharing of the results of the study has already started in an early stage of the study. Several articles have been published in professional media. The final results were presented to one of the consortium partners. The final results were also presented at the AMT Live trade fair.

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21 Dissemination: any form of publication/dissemination of the results of research through, among other things, publication, presentation, articles or the inclusion in teaching materials
22 Aftersales Magazine: ‘Komt de klant straks nog naar de werkplaats?’ July 2019 and ‘Werk maken van de werkplaats’ December 2019
23 AMT Live: ‘HAN Automotive onderzoekt hoe jouw werkplaats er in 2030 écht uit ziet’, February 2020
Within work packages, different tasks were defined. These were each to produce one or more results. Consortium partners involved in the implementation were also linked to the work packages.

Formative Scenario Analysis (FSA) was used as a guide to apply the structure. In FSA, design-oriented research is carried out. In the FSA, stakeholders have been looking for the buttons that car companies can use to develop a future-proof workshop.

FSA consists of nine steps:
1. Case and target definition
2. Establishing system properties
3. Determining influence variables
4. Development of influence variables
5. Establishing relationships and dependencies between the influence variables
6. Establishing the underlying dependency system of influence variables
7. Scenario construction
8. Consistency analysis & scenario selection
9. Scenario interpretation

In the development of the FSA, there has been intensive cooperation with the consortium partners. In addition, external developments, such as legislation and trends, have been mapped by the researchers.

The first two steps were taken by the HAN Lectorates in collaboration with Innovam and ROC Aventus. In steps 3 to 6, stakeholders from outside the automotive sector have provided important input. In the final steps, entrepreneurs from car companies are heavily involved.

1.4. Research Group

The HAN lectorates LEAN & World Class Performance and Automotive Research carried out this research jointly. In addition to the lecturers involved, Jannes Slomp (WCP) and Frans Tillema (Smart Mobility), the research was coordinated by project leaders of both lectorates, with the final implementation of the research led by Nina Veders.

The original planning and composition of the WoW consortium at the start of the project are set out in Annex 2.

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24 Scholz & Tietje, 2002
25 Since 1 January 2020, both lecturers are part of the HAN Academy Engineering and Automotive
2. Current situation and expectations

The project was set up to get a picture of the opportunities that entrepreneurs have to be able to continue to exist in the future. As the aforementioned question from SME entrepreneurs pointed out: "How can car maintenance and repair be future-proofed in a disruptive time?"

Before an answer is given to the question of what work in the workplace will look like in the future, it makes sense to first bring into focus the current state of affairs in the industry. By consulting various sources, a picture has been sketched of the number of active companies in the Netherlands that are engaged in the maintenance and repair of cars. The figures range from 5300\(^26\) (BOVAG) to 28,000\(^27\) (CBS) companies. Within this last figure, more than 21,000 companies\(^28\) are included employing only one or two people. BOVAG is based solely on its own members in the calculation, while vehicle maintenance and repair is done by many more companies, including approximately 1000 fastfit\(^29\) companies.

Small universal workshops generally focus more on the maintenance and repair of older cars. These cars have a higher hourly consumption\(^30\) than new cars. Some of these small businesses are not members of a trade association. They are often not included in the official figures. They do have an entry in the Chambers of Commerce. However, the figures of the Central Bureau of Statistics (CBS) do include these companies.

In addition to the number of workshops, the number of cars in the current and future fleet is important for estimating the impact on the workplace of the future. For the calculation, the development of the fleet in the past was looked at and a translation was made into the future.

2.1. Vehicle fleet

The number of passenger cars and the population show a clear correlation. On average, one passenger car appears to be available in the Netherlands for every two inhabitants. This ratio has grown in recent decades from just under 1-to-2 to just over 1-to-2. Based on this ratio, the fleet for the next ten years is estimated on the basis of the expected growth rates of the Dutch population according to the CBS.

This calculation deliberately does not take into account uncertain external factors. These factors include changes to legislation or an extreme increase in shared car ownership. The possible developments of these factors have been taken into account in the design of future-proof workshops, but not in the number of companies required. It is impossible to make and/or predict a real estimate of these factors.

\[^{26}\] BOVAG: 5290 leden in 2019, waarvan 2002 dealers, dit is exclusief fastfit bedrijven
\[^{27}\] CBS: 27.870 bedrijven ingeschreven met de kenmerken 4511 (handel en reparatie personenauto’s) en 4520 gespecialiseerde autoreparatiebedrijven, januari 2020
\[^{28}\] CBS Statline, overzicht Bedrijfstak G, Autohandel en –reparatie, januari 2020
\[^{29}\] Onder fastfit bedrijven worden ook alle glasreparatie-, banden- en snelservicebedrijven gerekend. Het aantal hiervan is door VACO geschat op ca. 1000 bedrijven.
\[^{30}\] Hourly consumption: industry term for the number of hours of maintenance and repair per car per year
The calculations in this paragraph show that the developments that the industry is facing are already having a major effect on the number of workshops, the number of employees and the required level of knowledge of employees. If these developments are further reinforced by the above-mentioned uncertain external factors, the calculated effects will only become even greater.

In the graph below, we see an expected growth of the fleet, without external influences, to approximately 9.6 million passenger cars by 2030.

![Graph showing population/fleet ratio](image)

**Chart 1: Population/fleet ratio, source: CBS (2009-2019), extrapolation 2020 e.g. HAN**

### 2.2. Fuel and powertrain

In addition to the total figures of the fleet, it is important to look at the composition of powertrains or fuel types.

Various studies reveal different images for this composition. For this study, we have taken over estimates of the common scenario of VMS for electric vehicles (EV) | Insight in the BOVAG study 'The effect of the electric powered (business) car on the aftersales business model' from March 2018\(^{31}\). For other fuels, developments have been passed on over the past decade.

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\(^{31}\) Scenario conform algemene verwachting OEM’s en opinieleiders. Meest realistisch: Full EV in 2025: 5% van het park, in 2030: 18% van het park.
In this design we are already seeing shifts in the composition of the fleet towards alternative fuel types. However, these changes seem small. If we look at the same figures, but leave the passenger cars on petrol in the same way, we really see the impact of the growth of EV and the decline of diesel cars.

2.3. Maintenance and repair

The third factor, after fleet size and fleet composition, is hourly consumption. Obtaining figures for this from objective sources proves difficult. The calculation is based on assumptions submitted to various project partners. Over the past 30 years, hours of consumption have fallen from more than 10 hours a year for a new petrol car in 1990, down to about two and a half hours for a newly delivered petrol car in 2020. With an average car lifespan of around 18 years\(^{32}\), a conservative estimate of current average hourly consumption will look like this:

\[^{32}\text{Berekening: rijdend wagenpark} / (\text{nieuwverkopen + import}) \text{ per jaar} = 8,5 \text{ miljoen} / 475.000 = 17,89 \text{ jaar}\]
The hourly consumption of hybrid cars appears to be around 75% of that of internal combustion engines, mainly due to longer maintenance intervals\textsuperscript{33}. The intervals for all-electric cars are again larger than those of hybrid cars. As a result, the consumption of hours is only about 50%. In the absence of objective industry figures, the average hourly consumption is estimated on the basis of interviews with the project partners.

By multiplying the figures of the expected fleet by fuel by the expected hour consumption per vehicle type, a total picture of the annual hour consumption of the entire Dutch fleet is created.

\begin{table}[h]
\centering
\begin{tabular}{|l|c|c|c|}
\hline
           & 2020 & 2025 & 2030 \\
\hline
benzine    & 6    & 5    & 4    \\
\hline
diesel     & 6    & 5    & 4    \\
\hline
LPG        & 6    & 5    & 4    \\
\hline
EV         & 3    & 2.5  & 2    \\
\hline
hybride    & 4.5  & 3    & 3    \\
\hline
overig     & 5    & 4    & 3    \\
\hline
\end{tabular}
\caption{Hourly consumption by fuel, conservative estimate seen by partner calls}
\end{table}

\textbf{2.4. Employees and workshops}

In order to calculate the number of required car technicians, an average number of 1500 productive hours\textsuperscript{34} per employee was calculated. These figures mean that all repair and maintenance work on

\textsuperscript{33} Onderhoudsinterval: het kilometrage tussen twee onderhoudsbeurten. In de jaren 80 was dit voor benzineauto’s eens in de 5000 km, op dit moment eens in de 15.000 – 30.000 km. Voor hybride auto’s zijn intervallen van 40.000 km acceptabel, terwijl bij EV in sommige gevallen sprake is van 80.000 km.

\textsuperscript{34} Berekening: beschikbare uren 52x5x8 = 2080 uur \(-/-\) 6 feestdagen, 20 vakantiedagen, 20 ziekedagen = 1712 uur. Geschatte inproductiviteit \(\approx 10\% \quad 1500\) verkobare/productieve uren
passenger cars in the Netherlands could currently be carried out with 34,045 FTE\textsuperscript{35} car technicians. There are currently 61,000 car mechanics\textsuperscript{36} working in the Netherlands.

Since workshops are different in size, the calculation of the number of workshops is based on an average workshop of six automotive technicians\textsuperscript{37}.

In addition, receptionists, managers, warehouse staff and the like will be needed. These employees are not included. For this average company size, only 5674 (average) car repair companies would be needed in the Netherlands by 2020. As previously stated, our country has almost 28,000 companies involved in the maintenance and repair of passenger cars.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{graph5.png}
\caption{Graph 5: Number of employees / workshops including calculation HAN-AR}
\end{figure}

From this analysis of the current situation and the projections for the next ten years, it is clear that the industry will face major changes. What changes are those? How can the workshop of the future keep its head above water? What is that workshop going to look like? These questions will be answered in the next chapter.

\textsuperscript{35} FTE: full time equivalent van 40 uur
\textsuperscript{36} CBS: 4\textsuperscript{e} kwartaal 2019, beroepsgroep 0743, automonteurs, ca. 61.000, waarvan ca. 1000 vrouwen
\textsuperscript{37} CBS: 61.000 werkzame automonteurs, 10.970 autoreparatiebedrijven met 2 of meer werkzame personen, gemiddelde aantal autotechnici = 5,6. Voor professionele werkplaatsen naar boven afgerond op 6.
3. Research

The automotive industry is constantly evolving and all kinds of changes that the industry is currently facing are the result of past developments. As early as 1968, BOVAG\(^{38}\) announced in the national media that it expected car showrooms to become a thing of the past in the short term. On 14 June 1978, the industry announced that it expected the fleet to increase by one million units to 5 million cars within ten years. The lifespan of cars would also be ten years on average.

In the meantime, that fleet has grown to 8.5 million cars with an average life span of almost 18 years. The work in the industry would also become more fascinating, but also more difficult. The cause: a sharp increase in electronics in cars. This was reported to us in the late 1980s. In 1987, the EIM\(^{39}\), based on industry research, also told us that there was going to be a considerable restructuring of the number of garage companies.

In short, the automotive industry has always been in development and the number of maintenance and repair companies has apparently been a concern for decades.

What makes us expect that current developments are so much different from those of the previous era? Almost all previous developments came from within the industry and were more evolutionary than revolutionary. The developments that the industry is now facing are considerably more disruptive, they go faster and they also come from outside the industry.

3.1. C.A.S.E.

The automotive is faced with four important developments, which can be easily summarized in the word ‘CASE’\(^{40}\). This abbreviation stands for

- Connectivity
- Autonomous Driving
- Sharing
- Electrification

These four developments are currently taking place almost simultaneously. Because of this they strengthen each other.

In popular terms, developments are even linked. Autonomous driving is regularly seen by people as something typical of the electric car. Perhaps also because Elon Musk\(^{41}\) with Tesla often pays attention to this. Electric cars are also looked at in the case of sharing cars. This may include the app, which connects provider and user.

\(^{38}\) BOVAG: brancheorganisatie voor auto-onderhoud- en reparatiebedrijven
\(^{40}\) Rabobank: A convincing case: The best of four worlds, oktober 2016
\(^{41}\) Elon Musk: ‘Tesla rijden volgend jaar volledig autonoom’, Autovisie 25 oktober 2019
However, in practice, petrol cars can also be made autonomous or be shared with each other. The petrol car has been providing data – whether or not via a plug, Wi-Fi or 4G – to people other than the user\textsuperscript{42/43} for a longer time. The four developments are separate, but can also occur together.

### 3.1.1. C = Connectivity

The first major development we see is Connectivity. Cars are increasingly connected. Not just with the owner or with the dealer. Cars are also connected to the manufacturer, each other, providers of services and so on. With the correct use of this privacy-sensitive data (in accordance with GDPR\textsuperscript{44}), this offers opportunities for all parties.

Being connected to the manufacturer makes it possible to perform diagnoses remotely. An update of the car’s software can also take place. If desired, it is even possible to open the door, start the engine and carry out small – digital – repair work. It is also conceivable that the car, via an online connection, already informs 'his' workshop that a problem has been identified, for which a visit to the workshop is desirable. In fact, it is conceivable that the workshop will proactively approach the driver, who does not yet know anything, with a request to visit or perhaps visit the car himself.

When vehicles are connected to each other, the car can 'look around the corner from the street'. He then sees another vehicle (car, bicycle, etc.) approaching. This function will certainly be useful in autonomous driving. A connection to the road makes it unnecessary to read road signs by the driver. In the long run, these may not even have to be put down at all. By issuing a distress signal for a specific area, all vehicles there can drive more carefully. This can prevent additional accidents. This feature creates a connection between Connectivity and Autonomous Driving.

The connection of the car with providers can lead to opportunities for both commercial providers and public organizations. This can be done in various areas for all kinds of services, including digital radio and traffic information. It is conceivable that safe traffic behaviour leads to a lower insurance premium. But also making information about the condition of the road surface available can lead to advantages for the benevolent rider. New features, which have not yet been conceived, could eventually be offered to the rider.

Connectivity can be seen as a threat, but is certainly also a very big opportunity. It has been calculated that data from cars already represent a greater value than all cars and the work on them added up\textsuperscript{45/46}. Only part of this total data stream will be able to be used for or by workshops.

\textsuperscript{42} ANWB: De ‘connected’ voertuig en uw data, uit campagne my-car-my-data
\textsuperscript{43} Nationale Databank Wegverkeersgegevens (NDW): Data uit voertuigen (2020)
\textsuperscript{44} AVG = Algemene Verordening Gegevensbescherming: belangrijkste regels voor omgang met persoonsgegevens in Nederland.
\textsuperscript{45} CNN Business: Your car’s data may soon be more valuable than the car itself, februari 2017
\textsuperscript{46} McKinsey &Co: The overall revenu pool from car data monetization at a global scale might add up to $750 billion by 2030, oktober 2016
3.1.2. A = Autonomous driving

The second development we identify is Autonomous driving. To enable autonomous driving, cars will need to be equipped with Advanced Driver Assistance Systems (ADAS). Some well-known ADAS are Adaptive Cruise Control (ACC), Advanced Emergency Braking System (AEBS), Lane Departure Warning (LDW), Lane Keeping Assistant (LKA) and Blind Spot Detection (BSD).

These so-called driver assistance systems are generally offered as comfort systems in the industry. The government calls these systems safety systems. This difference in opinion is clearly reflected in the report of the Research Council for Safety\(^{47}\). It strongly questions the contribution of ADAS to traffic safety. Commercially, the motorist also appears to be better seduced by the term 'comfort' than with 'safety' as the name for the option package on the car\(^{48}\).

With regard to work in the workshop, the emergence of ADAS seems to lead to a limited number of additional work for the workshop. Research by both BOVAG\(^{49}\) and FOCWA\(^{50}\) and HAN Automotive Research\(^{50}\) shows that repair of the sensors 'behind' ADAS takes place mainly in the claims company. The various sensors – radar\(^{51}\), lidar\(^{52}\), sonar\(^{53}\), ultrasonic\(^{54}\) and (stereo) camera\(^{55}\) – appear to be so well designed that they only break when they are broken in a crash. The latter generally means that the car has more damage. The car then ends up at the claims company.

Another type of business that has a lot to do with ADAS is the car glass repair company. Not so much the sensor – usually a camera – is then broken, but the window is damaged. This must then be replaced, with the camera being placed again and calibrated\(^{56}\).

The upcoming commitment of 11 additional safety systems in 2022\(^{57}\) will increase the number of systems in cars. The repair of these technologically complex systems will certainly increase as well. After all, more systems, both in number of systems and in the number of cars in which they are mounted, will increase the number of repairs.

\(^{48}\) HAN-AR i.o.v. RWS: Beleidsondersteunend advies ADAS & (schade)reparatie, november 2019
\(^{49}\) VMS|Insight i.o.v. BOVAG: Het effect van ADAS op schadeherstel, onderhoud en reparatie, februari 2019
\(^{50}\) VMS|Insight i.o.v. BOVAG: Het effect van ADAS op schadeherstel, onderhoud en reparatie, februari 2019
\(^{51}\) Radar: sensor die werkt met behulp van radiogolven
\(^{52}\) Lidar: sensor die werkt met behulp van laserpulsen.
\(^{53}\) Sonar: sensor die gebruik maakt van geluid om voorwerpen te detecteren.
\(^{54}\) Ultrasoon: sensor die werkt met geluidsgolven op frequenties hoger dan waarneembaar voor het menselijk oor.
\(^{55}\) Stereo camera = systeem dat werkt met twee camera’s vanuit een verschillend standpunt, waardoor betere herkenning mogelijk is en diepte meetbaar is.
\(^{56}\) Kalibreren: brancheterm voor het af- of instellen om een systeem in overeenstemming te brengen met de specificatie. Eigenlijk is de juiste term hiervoor justeren.
\(^{57}\) Verplichte ADAS op nieuwe auto’s vanaf 2022: Waarschuwing voor noodstop, automatische noodremmingreen, voorbereiding voor alcoholislot, waarschuwing voor slaperigheid, waarschuwing voor smartphonegebruik, verbeterde gordels, intelligente snelheidsassistent, rijstrook assistent, achteruitrijcamera of –sensoren, datarecorder voor ongevallen, verbeterde bescherming bij aanrijding voetgangers en fietsers
3.1.3. S = Sharing

‘Sharing’ is the new ‘having’ is a commonly heard\textsuperscript{58} statement. This way of thinking can lead to a more sustainable society. What doesn’t need to be produced saves on raw materials, emissions etc. In densely populated areas, joint use of movable property is becoming increasingly commonplace.

The third disruptive development is Car Sharing, the multi-user use of cars together. Typically, the user is not the owner. There are several possibilities for car sharing. It is also a great wish from the government that the number of car-sharing concepts and their use will increase\textsuperscript{59}.

Car sharing can take place with a private group, for example a family that uses one car together. It can also be used with a platform, with multiple members deploying one or more cars for shared use. This creates a kind of ‘Association of Owners’ of a car (park). Car rental or commercial use of shared cars is also possible. The owner of the car is a company that charges the user for use to time and/or distance.

Mobility-as-a-Service (MaaS) is part of car sharing. In MaaS, the car is part of a range of services that enable the user to meet their mobility needs. The shared car can be combined with public transport (PUBLIC TRANSPORT), sharing bike, part-zip, taxi etc. All these services are dealt with centrally with the user. The user has an app available for his mobile phone from almost all MaaS providers. This makes use of the different modalities.

At the end of 2019, the official number of (commercial) sub-cars in the Netherlands\textsuperscript{60} is 51,149. The number of car sharers is estimated at 90,000. Higher figures are regularly shown for this. Research shows that users use multiple apps from multiple providers to meet their needs.

Car sharers appear to own fewer cars, drive fewer kilometres and emit less CO\textsubscript{2}. However, car sharing is also done by people who did not previously own a car. The average car ownership of car sharers fell from 1 to 0.7 cars per household. Their average mileage from 9100 to about 7500 kilometres per year. There are also car sharers who have started to drive more. This is because the car is more readily available or because they used to travel by bike or public transport. Car sharing has positive effects on CO\textsubscript{2} emissions, both in driving less and by producing fewer cars. The decrease in car ownership itself and the newer or electric (partial) cars also contribute to lower CO\textsubscript{2} emissions.

Han Automotive Research’s own research\textsuperscript{61} shows that the current sub-car concepts do not present an attractive proposition for the (potential) user in various aspects. It also appears that users are dropping out due to gaps in the service of providers, the sharing cars and the apps.

\textsuperscript{58} Zie o.a. milieucentraal.nl, wijzijntilburg.nl, goedvoordewereld.nl, emerce.nl, baaz.nl en mkb-Nederland
\textsuperscript{59} Green Deal Ministerie van I&W: 40 partijen met als doel 100.000 deelauto’s en 700.000 gebruikers in 2021
\textsuperscript{60} Bron: autodelen.info/cijfers autodelen
\textsuperscript{61} HAN-AR i.o.v. ACE: Automotive Design voor Mobility as a Service, december 2019
Figure 3 shows that various processes require some (yellow) or a lot of (red) attention before they reach a level acceptable to the user. Only the green processes are reasonably well under control at the moment.

3.1.4. E = Electrification

Finally, the last of the four developments mentioned is Electrification. The impact of this development is enormous and we can therefore easily argue that the CASE3 order does not necessarily equal the importance of developments.

By electric vehicles (EV) we mean cars that are fully or partially powered by electric motors. The hybrid powertrains have certainly ensured a broad acceptance of the EV. The following terms are used in electric vehicles:

- **BEV**: Battery Electric Vehicle, storage of energy in a battery
- **FCEV**: Fuel Cell Electric Vehicle, storage of energy in a hydrogen cell
- **FEV**: Full Electric Vehicle, concerns both BEV and FCEV
- **PHEV**: Plug-in Hybrid Electric Vehicle, storage of energy via a plug in a battery
- **HEV**: Hybrid Electric Vehicle, uses both fuel and electric motor
- **E-REV**: Electric Range Extender Vehicle, hybrid vehicle with electric drive on the wheels, where a fuel engine(s) ensures the recharging of the batteries

Various studies, inside\(^62\) and outside\(^63\) the industry, show that the amount of work in the workshop will be significantly reduced by the advent of the electric powertrain. That’s not surprising when you

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\(^62\) VMS|Insight i.o.v. BOVAG: Het effect van de elektrisch aangedreven (bedrijfs)auto op het aftersales businessmodel, maart 2018

\(^63\) VMS|Insight i.o.v. BOVAG: Het effect van de elektrisch aangedreven (bedrijfs)auto op het aftersales businessmodel, maart 2018
consider that an ICE\textsuperscript{64} powertrain contains on average about 1,400 components, of which nearly 300 are moving parts, while a BEV\textsuperscript{65} powertrain contains on average only about 200 components, including about 10 moving parts.

![Figure 4: change in number of components from ICE to BEV, image from ING 2017 report](image)

The growth of the EV share in the fleet is proving difficult to estimate in the Netherlands. This is largely dependent on fiscal measures\textsuperscript{66}. In addition, the infrastructure\textsuperscript{67/68} for loading the EVs also plays a big role. Nevertheless, it is undeniable that the electric car has already far exceeded the point-of-no-return in Dutch society. In fact, the 2017 coalition agreement decided that from 2030 only new zero-emission cars can be sold in our country. The chances that these are electric cars with a battery or a fuel cell as an energy carrier is considerable. There are, after all, no other zero-emission alternatives available yet.

Not only does the work on electric vehicles lead to about half fewer hours in the workshop; the type of work also changes. The car technician must become an electrical engineer. Perhaps he shares his work with a car mechanic who picks up the specific car work, such as the tyres, wipers, brakes, lights and the like. This creates a clear dichotomy in the work. They also no longer need to be run within the same company.

This brings us to the next step of the research: the classification of the automotive industry by business types. Only here can our research question be answered: "How will car maintenance and repair be organised effectively and efficiently in the future?"

\textsuperscript{64} ICE: Internal Combustion Engine, brandstofmotor voor benzine, diesel of LPG
\textsuperscript{65} BEV: Batterij Elektrisch Voertuig, opslag van energie in een accu
\textsuperscript{66} Algemene Rekenkamer: brief ‘Fiscale stimulering van elektrische auto’s’, 26 juni 2019
\textsuperscript{67} Ministerie EZK: Visie op de laadinfrastructuur voor elektrisch vervoer, november 2016
\textsuperscript{68} APPM i.o.v. VNG: Samenhang elektrisch vervoer met de energietransitie in de woonwijk, februari 2018
3.2. Six business types

The research project 'Workshop on the Move' has focused exclusively on the repair and maintenance of passenger cars. The research therefore explicitly does not focus on the sale of cars or parts. These two departments have only been investigated if it affects the work in the workshop.

![Image of automotive landscape of 2030, illustration by Jarek Keiren](image)

Figure 5: the automotive landscape of 2030, illustration by Jarek Keiren

The image above gives a brief summary of the study. It shows in one image the automotive landscape that will be able to emerge as a result of the four disruptive developments – CASE. The most important aspect of this whole is of course the factor 'time' (tijd). Discussions with the project partners show that the developments do not take place uniformly over the Netherlands. In urbanised areas, some developments are moving faster than in rural areas. In cities in the Randstad, developments are happening faster again than in cities in the rest of the country. A general statement about developments over time is therefore not to be made. However, there is a clear choice for a business type to make, based on the four developments.

The latter proved to be a useful input for developing a choice tool. The four developments each have their influence on the work in the workshop. This allows an automotive entrepreneur to determine whether or not each of the developments (will) play a part. This is important for the strategic policy choice regarding the future of his company. In the tool, each development can be 'switched on' or 'off' with four 'switches'. The interplay of the four choices then shows the most efficient business type or the combination of business types for the entrepreneur.

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69 Op [www.werkplaatsopweg.nl](http://www.werkplaatsopweg.nl) staat een interactieve versie van deze afbeelding met uitleg van de bedrijfstypes

70 De keuzetool is te vinden op de website [www.werkplaatsopweg.nl](http://www.werkplaatsopweg.nl)
With Formative Scenario Analysis as a guide, the research defines six business types, which must be seen by the reader as 'basic forms', which, whether combined or not, can be translated into the practical situation. These business types have seven forms.

### 3.2.1. Zero Change

This is the type of business we find now – almost standard – in the automotive industry. In many respects it is a dealership or universal car company consisting of at least three technical departments: workshop, warehouse and reception.

The workshop of this company is characteristic of the technicians that carry out all the necessary maintenance and repair work themselves. This requires car technicians of different levels who (collectively or not) need to have a broad knowledge of the product.

Keeping track of this knowledge and accessing all equipment leads to high costs. The specific number of workshops that remain within this company profile does not specifically depend on one or more factors for change. It depends on the speed (time) with which the current fleet will change.

This type of business is expected to continue for many years to come. After all, the share of the fleet consisting of vehicles with an internal combustion engine will still be large in the coming decades. This expectation is based on the average age of cars\(^71\) and current legislation. Changes in legislation can speed up developments.

**Main features:** workshop/warehouse/reception, all work, level 1-4, fuel engines, broad knowledge, high costs

### 3.2.2. Simplicity is King

Under the denominator ‘Simplicity is King’ (specialisation) we distinguish two business profiles. The business that focuses on simple work in large quantities, such as tyres, glass repair, etc., and the business that focuses on difficult diagnostic work, which requires specific knowledge and analytical power, but is offered in smaller quantities.

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\(^{71}\) Gemiddelde leeftijd van auto’s: wagenpark 8,5 miljoen / jaarlijkse vernieuwing 475K = 17,9 jaar
3.2.2.1. **Specialist, simple, so ‘much’**

This is the company profile of focusing on large amounts of simple work. Increasingly, this work also appears to be becoming more complex. Because the same job will be offered regularly, it can be sufficient with car technicians of level 2 or 3.

Things like calibration after a glass repair and the vibration-free use of tyres for electric vehicles require more and more expertise from employees.

At present, the Netherlands has around 1000 glass\textsuperscript{72}, tyre\textsuperscript{73} and fastfit\textsuperscript{74} companies. A part of these is combined with a car company. Depending on the possibilities of continuing to do work for brands (steered repairs), this number of companies could increase or decrease.

Due to the limited number of different types of work for this type of company, the costs of further training will remain lower. The – relatively – expensive equipment will be used efficiently. Work on these devices is carried out on a daily date. This means that the operating costs for this equipment can also be divided over a larger number of activities and thus remain low per activity.

In this business type, the work is carried out in large quantities at a lower hourly rate. In many cases, the rate is even discounted in the price (per piece) of the parts. For example, most tyre companies know ‘free assembly’ when purchasing tyres.

*Main features: simple work, low rate, large quantities, level 2/3, certain knowledge, low costs, tires etc.*

3.2.2.2. **Specialist, complex, so ‘little’**

This business profile is characterized by accepting complex work. As complexity increases, it becomes attractive for more companies to specialize in diagnostic work, analysis and repairing complex problems. For this, higher margins can be enforced.

Specialization in, for example, the repair of radar, lidar, sonar and camera systems requires great expertise on the cooperation between these sensors used to provide ADAS with information.

This type of business has high training costs. The technicians must always keep up to date with the latest developments. The diagnostic equipment also needs to be continuously equipped with the latest software. Besides the costs this will – especially when working on different brands – also have a certain degree of difficulty in acquisition. This software is generally not freely available. Specialized

\textsuperscript{72} Glasbedrijven: deskresearch vier grootste ketens (Carglass/Glasgarage/Autotaalglass/Autoglaz) 250 bedrijven

\textsuperscript{73} VACO: 300 bedrijven met 720 vestigingen, bron website

\textsuperscript{74} KwikFit: 170 vestigingen
companies have an extensive ICT department that uses reverse engineering\textsuperscript{75} to enable the analysis of data from cars. This setup also creates a high cost in obtaining the software and/or applications.

With this business type, every job is a new study. Each time, complex problems will have to be solved with the help of diagnosis, analysis, knowledge, skills and/or innovative thinking. A high hourly rate can be calculated for this, but the number of jobs will be limited.

*Main features: difficult work, high rate, small amounts, level 4+, lots of analysis, specific knowledge, further training*

### 3.2.3. DigiDigiDigi

More and more cars can be read, diagnosed, analysed and even updated remotely. In some cases, problems can be solved by giving over-the-air (OtA) commands or modifying software.

The car only has to go back to the garage for those activities that cannot be solved digitally. This involves replacing parts or performing complex diagnoses. Referrals to one of the other business types will be required in such a case.

This business type is highly dependent on the changes in process technology and the extent to which vehicles become connected.

Investments for this business type will be high. After all, this concerns complex, advanced systems that can vary by brand, type and design of cars. In some cases, manufacturers even have specifications by chassis number. Then each car has its own unique software. In these cases, an – often expensive – cooperation with the manufacturer is the only way to carry out the work.

Employees of this company type will need to have a high level of knowledge of ICT, combined with specific automotive expertise. The personnel costs, both of the employee and of his further training, will be high. The work of this business type will only be offered at high (subscription) rates.

*Key features: connected, over-the-air, pay-per-view, updates, digital diagnosis, closed system, car connection, high level of knowledge, high costs*

\textsuperscript{75} reverse engineering: het onderzoeken van een stuk software om de precieze interne werking ervan te achterhalen
3.2.4. C’mon, on the Move

Waiting for the replacement of tyres or carrying out an MOT, or use a loan car for days because the own car is gone for repair; customers don’t see maintenance and repair as pleasant and especially if their vehicle is temporarily unavailable.

In this business profile maintenance work and certain repairs are done on site (at home or at work). The electric car in particular seems to be eligible.

The question is to what extent this business type – on its own – has a right to exist. A combination with one of the other business types may have to be sought out. A pop-up workshop that is set up in a car park or on site of a large customer for a few days also falls under this type.

Of course, this type of business requires an investment in a completely new form. After all, the workshop is not located in a fixed location. It moves through a certain area. In addition to the necessary transport capacity (van, trailer, tractor/trailer combination, etc.), the legal possibilities, such as environmental requirements and permits for carrying out the work on site, must also be considered. Permits may also be required when creating a pop-up workshop. When setting up a pop-up location on private (parking or business) sites or parking garages, account will have to be taken of both the legal and municipal requirements, but also the regulation of the owner of the location in question.

In addition to knowledge of the work, the car mechanic at the mobile workshop must also have an extra large dose of customer skills. He will have to deal with the customer on the spot, make the correct diagnosis of a problem and also have to ‘sell’ it.

The knowledge level of the mechanic will depend on the type of work. If only matters such as tyre replacement, brake control and air conditioning service – the most important things in the maintenance of an electric car – take place, no broad knowledge is required. As a result, the costs of training remain low.

If a mechanic is chosen to fix all faults or unplanned downtime, especially for several brands, a very broad knowledge is required. This is similar to the knowledge and experience of a ‘Road Watch mechanic’. The costs of further training and the maintenance of the different systems will then be high.

Key features: call fees, mobile workshop, good agreements, broad knowledge, contact characteristics, route planning, pop-up workshop
3.2.5. Service, that’s it

Increasingly, we see cars whose driver is not the owner, but only the user. The (end) user has no control over the location where the work takes place.

Examples include (private and business) lease, sharing cars, rental cars, Mobility-as-a-Service (MaaS), car-of-business etc.

The fleet manager chooses, often on the basis of price, the workshop that is allowed to carry out the maintenance or repair.

Parties, of all other business types, who can conclude a contract with these fleet owners, receive the turnover.

This development has far-reaching consequences for workplaces and efficiency. This business type can also be set up by parties outside the automotive industry. The most important disruptive development underlying this is: ’Driving/sharing together’. Within the leasing world, this design has been used for companies’ own customer base for some time. Due to a large amount of data, fleet management employees can estimate the necessity or cost of an activity. The data contains information about maintenance and repair of passenger cars within the fleet. The fleet manager will assign the execution to a workshop on the basis of contract agreements. These can also be different types of business for different types of work.

An fleet management employee will need to have knowledge about contracts, technical knowledge of maintenance and repair, communication/negotiation skills (both procurement and sales), analysis of data and use of various software applications. For this mainly administrative function, at least a secondary vocational education, but with higher professional education thinking level, will be requested.

*Key features:* MaaS, from-own-to-use, fleet management, contract agreements, sharing cars, leasing company
3.2.6. **United we stand strong**

Nowadays, what can't we organise, order or compare online? This online shopping has already had a strong impact on shopping behaviour and the street scene.

Online platforms such as Bol.com, Trivago, Booking.com, Werkspot, Funda, Uber and AirBnB\(^\text{79}\) offer services on behalf of entire industries. The customer only puts in their demand in one place, but at the same time can see an offer from a large number of companies.

Customer loyalty plays less and less of a role and depending on the service, the reviews and willingness to give discounts, companies are assigned the work.

Within this so-called multi-vendor\(^\text{80}\) setup (online marketplace) it is important to come to the top of the list of attractive companies.

Although desk research has shown multiple multi-vendor sites in virtually all industries, this service exists only sporadically within the automotive industry. An example is mijngarage.nl\(^\text{81}\). This website is available to members of mijngrossier.nl. This is a website for supplying parts and technical knowledge to workshops.

This provider does not have its own companies, but offers the work of 1500\(^\text{82}\) connected workshops. When entering the car’s registration number and the desired job, based on make and type of vehicle, the prices of multiple car businesses (dealer or universal) are displayed in the applicant’s area.

**Key features:** joint offer, online, unburdening, low customer loyalty, reviews, collaboration, price comparison, multi vendor

3.3. **Choice tool**

On the website\(^\text{83}\) of the project 'Workshop on the Move' the advice tool is included that has been developed based on the results of this research.

This simple tool uses a comprehensive calculation module based on the four disruptive developments, CASE (Connectivity, Autonomous Driving, Sharing and Electrification). The tool gives the user an indicative advice on the strategic policy direction in which to think for the future.

\(^{79}\) Sites voor, achtereenvolgens: alle denkbare producten, hotelkamers, reizen, klussen, huizen, taxidiensten en bed&breakfast

\(^{80}\) Multi vendor / online marktplaats: een soort e-commerce site waar informatie over producten of diensten wordt aangeboden van meerdere derde partijen, terwijl de transacties worden behandeld door de operator van de marktplaats.

\(^{81}\) Mijngarage.nl: concept van mijngrossier.nl / onderdelenleverancier Van Heck & Co.

\(^{82}\) Claim van website www.mijngarage.nl

\(^{83}\) www.werkplaatsopweg.nl
The tool has one screen, divided into three compartments: the switches, the description and a visual representation.

By indicating of each of the four developments whether the user expects the development to occur 'much' or 'little' in the future, an outcome is automatically created with one or more of the six company profiles as defined in paragraph 3.2.

Disclaimer: The tool is not an exact science and the outcome of the tool is indicative. It is advisable, on the basis of the results, to find out what is needed in one's own specific situation.
4. Conclusions

Before indicating the conclusions of the research, first the starting points:

- From the industry a request has been made to look at possibilities to indicate how repair and maintenance can be set up effectively and efficiently in the future;
- We have also been asked to develop a tool to help entrepreneurs make a choice for their business design in the future;
- The focus of the 'Workshop on the Move' project has been set to 2030;
- The 'Workshop on the Move' project focuses exclusively on the repair and maintenance of passenger cars. Explicitly, it did not look at sales of cars or parts;

As a result of the investigation, the following conclusions can be drawn:

❖ CASE:
  - The automotive industry is facing four disruptive developments, largely from outside the industry;
  - These developments can be summarized in the term CASE: Connectivity, Autonomous Driving, (Car) Sharing, Electrification;
  - CASE has implications for vehicle technology, process technology and customer behaviour;
  - CASE creates uncertainty about the future among existing companies in the industry;

❖ Fleet:
  - The Dutch fleet of passenger cars is expected to grow to around 9.6 million units by 2030;
  - The composition of the fleet will change considerably, with the percentage of (fully) electric cars in particular increasing to about 18% and hybrid powertrains to around 5%. The proportion of ICE powertrains (petrol, diesel, LPG) will therefore fall from more than 96% in 2020 to around 76% in 2030;
  - The consumption of hours in maintenance and repair of passenger cars will decrease further as a result of this change. In addition to the autonomous decrease due to longer maintenance intervals, this is further enhanced by the significantly lower maintenance needs of electric and hybrid vehicles (ICE hour consumption ratio : hybrid : EV = 100: 75: 50);

❖ Workshops and technicians:
  - The number of car technicians and workshops was calculated using 1500 productive, marketable hours per car mechanic and an average workshop with six car mechanics;
  - The decrease in hourly consumption multiplied by the number of vehicles indicates a sharp decrease in the need for both employees and passenger car workshops:
    - Current number of car companies (CBS, 2020) set up for the maintenance and repair of passenger cars is approximately 28,000, of which 21,000 are one- or two-man businesses;
    - Current number of car mechanics (CBS, 2020) working in the Netherlands is about 61,000;
    - 2020: The number of workshops required for maintenance and repair is approximately 5675;
    - 2020: The number of car mechanics required on the basis of current work supply is approximately 34,000;
● 2030: The number of workshops required for maintenance and repair is approximately 3650;
● 2030: The number of car mechanics required on the basis of current work supply is approximately 22,000;
❖ Business types:
   » In order to carry out the work effectively and efficiently, the research defines six business types. These should be seen by companies as 'basic forms', which, whether combined or not, can be translated into the practical situation. These business types have seven forms.
   ❖ Zero Change:
     ▪ main features: workshop/warehouse/reception, all work, level 1-4, fuel engines, broad knowledge, high costs
   ❖ Simplicity is King – specialist, simple, so ‘much’:
     ▪ key features: simple work, low rate, large quantities, level 2/3, certain knowledge, low costs, tyres etc.
   ❖ Eenvoud is King – specialist, complex, so ‘little’:
     ▪ key features: difficult work, high rate, small amounts, level 4+, a lot of analysis, specific knowledge, further training
   ❖ DigiDigiDigi:
     ▪ key features: connected, over-the-air, pay-per-view, updates, digital diagnosis, closed system, car connection, high level of knowledge, high costs
   ❖ C’mon, on the Move:
     ▪ key features: call fees, mobile workshop, good agreements, broad knowledge, contact characteristics, route planning, pop-up workshop
   ❖ Service, that’s it:
     ▪ key features: MaaS, from-own-to-use, fleet management, contract agreements, sharing cars, leasing company
   ❖ United we stand:
     ▪ key features: joint offer, online, unburdening, low customer loyalty, reviews, collaboration, price comparison, multi vendor
❖ The TIME factor plays a major role in the speed at which developments are unfolding in different areas – metropolitan, urbanised or rural;
❖ Tool:
   With the help of the tool, (potential) companies in the automotive industry can determine which business type or combination of business types best suits their situation. By indicating the extent to which each of the developments C.A.S.E. occurs in the specific case, the tool provides an advice for the most appropriate choice in that situation.
5. Recommendations

Based on the results of this project, the following recommendations can be made:

- Entrepreneurs of car repair and maintenance companies would do well to make an analysis of their environment, looking at the extent to which suppliers (supply), customers (demand), colleagues (competition), providers (substitutes) and the company itself will have to deal with the four disruptive developments Connectivity, Autonomous driving, (Car) Sharing and Electrification (CASE);

- In addition, the time factor is of great importance. In some regions, some developments are moving faster than in other regions. This may depend on the type of region, – metropolitan, urbanised or rural – but also on other factors, such as dealership or specialisation;

- With the analysis, the tool can be filled out on www.werkplaatsopweg.nl. The outcome of the tool gives an indication of the direction in which a company, confronted with certain CASE developments, can start to focus its strategic policy vision;

- The tool is not an exact science and the outcome of the tool is indicative. It is advisable, on the basis of the results, to find out what is needed in one’s own specific situation.
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Annex 1

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- Nina Veders (projectleider)
- Arno van der Steen

**Project Partners**

- Regioorgaan Sia
  - www.regieorgaan-sia.nl
- ROC Aventus Apeldoorn
  - www.aventus.nl
- Innovam
  - www.innovam.nl
- Automotive Center of Expertise
  - www.acemobility.nl
- A-Allround
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- Autodidact
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- Bijker Zorgeloos Rijden
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- Bochane Auto’s
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- Autobedrijf Theo vd Heijden
  - autobedrijftheovanderheijden.nl
- Hyundai Nederland BV
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- Van Leeuwen Auto’s
  - www.vanleeuwenautos.nl
- Louwman & Parqui
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- Garagebedrijf Pals BV
  - www.pals.nl
- Autobedrijf Saris
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- Van den Udenhout
  - www.udenhout.nl
## Annex 2

### Planning:

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Original wow planning in Proposal RAAK/SIA

### Consortium:

Oorspronkelijke opzet van WoW-consortium