Chapter 9
Examples of Innovative Digitisation Projects

9.1 Framework

The author's numerous discussions in the automotive industry have revealed that there is a high degree of uncertainty about how the issue of digitisation is to be approached. It is evident to all the responsible persons in this industry and its supplier sector that something needs to be done, but how to start? In many cases, one waits for guidelines from management or starts without an overarching planning just with some minor beacon projects.

The intention of this book is to provide assistance in this situation. The previous chapters have laid the foundations for this and structured the topic. First, the background was highlighted, such as IT drivers and the transformation of the industry towards mobility services. This was followed by an explanation of the relevant technologies available for digitisation, Such as IoT, 3D printing, and Cloud computing. In the following, a forecast was developed as to how the industry might evolve by the year 2030, and based on an assessment of the current digitisation status of some manufacturers, proposals were presented for the development of a roadmap to drive digital transformation holistically. Finally, change management and corporate culture are important success criteria as well as IT transformation which as an enabler and pioneer supports the specialist departments in a targeted manner.

As quintessence of the book, Fig. 9.1 summarises the essential steps to establish a digitisation programme for specialist departments or plants.

In the first step, the framework and the vision of digital transformation are defined, based on the fundamental decisions on the company strategy and the business objectives. This vision determines the orientation and successive steps of the implementation. At the initiation stage, it is about identifying possible disruptions in the previous business processes and to assess competitors, neighbouring companies and new technologies. Chapters 2 and 4 give suggestions on this.

In step 2, the vision for the digitisation of the area has to be defined, and the existing processes have to be checked for efficiency potentials, with the relevant

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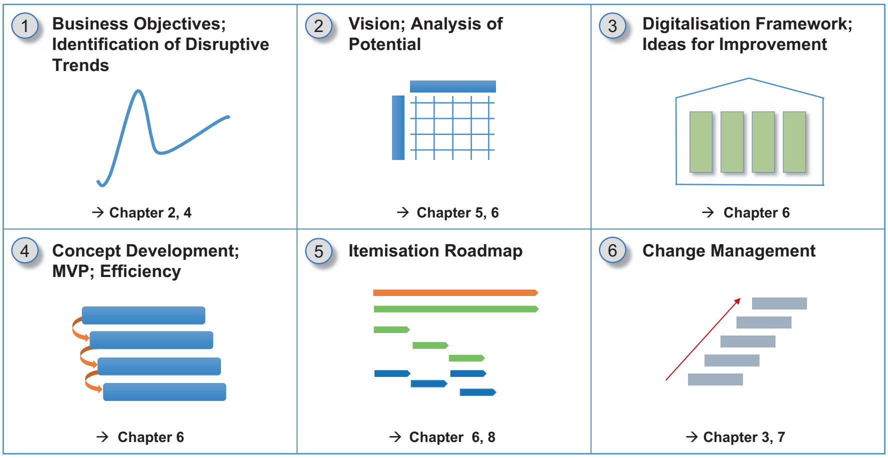

Fig. 9.1 Development steps of a digitisation road map (Source: author)

methods presented in Chaps. 5 and 6. In step 3, the direction of the organisation's digitisation must be described, and first ideas for the implementation have to be developed. Subsequently, further workshops concretise the prioritised ideas in step 4, carry out first cost-effectiveness assessments and create functional models (MVPs) of the prioritised approaches in order to ensure feasibility. Together with the IT, a detailed roadmap is created in step 5 which is integrated into the communication of change management in step 6. There, with the help of suggestions from Chap. 7, all employees should be inspired and motivated to join in order to achieve the vision and the goals on the basis of the roadmap together.

The foregoing explanations contained numerous reference examples on the respective context. In order to further enhance the practical relevance of this book, below more successful examples of innovative digitisation projects as well as additional ideas and impulses for work in the area of digitisation are presented. The chapter follows the four "support pillars" of the proposed digitisation framework (cf. Fig. 6.11), which is shown in Fig. 9.2 as a reminder, with the pillars being highlighted.

Each of the pillars is described in the following by means of examples. Content details, approaches and background information can be found in Chap. 6.

9.2 Connected Services/Digital Products

All car manufacturers are placing high importance on Connected Services and are working intensively to develop offerings for this important growth market. Innovative solutions are seen as an opportunity to be the first provider to differentiate oneself from the competitors and to demonstrate innovative power, especially

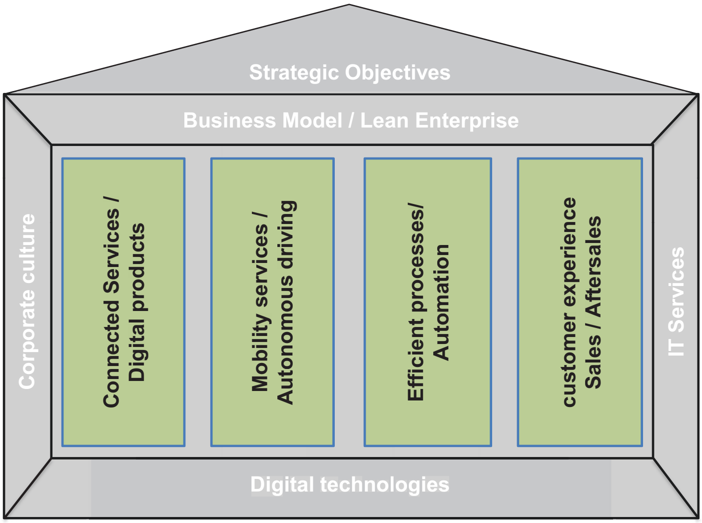

Fig. 9.2 Pillars of digitisation in the automotive industry (Source: author)

for younger buyers. In addition, the subject provides the foundations for new business segments as well as for mobility services and autonomous driving. The opportunities and chances in a market with around 80 million new vehicle registrations every year are also detected by non-industry providers, especially innovative IT companies with their Apps. It is therefore not only important to exploit sales and profit potentials with Connected Services and new business models, but also to improve access to customers for complementary offers and marketing, and to consolidate the own position with customers in respect of mobility services and new offerings, such as intermodal transport services.

In this new competition between manufacturers and newcomers from the IT environment, the infotainment unit of the vehicles emerges as a strategic control point. These units have since long been not just control panels for radio, navigation and telephone as well as display units for vehicle systems, but also the control centre for the use and operation of Apps. This is where Google and Apple get into the car and to the driver via mirroring solutions. It is the “rendezvous” of vehicle electronics and the mobile App-world, as illustrated in Fig. 9.3.

Here the value chain of the infotainment units can be seen. On the hardware of these units with the associated operating system (OS), a middleware level is installed. It comprises a software layer with core services, for example, for operation and communication. Here is also the so-called mirroring positioned which Apple uses with its CarPlay solution and Google with Android. This feature transfers Apps from the smartphone to the infotainment unit, displays them there and makes them usable instantly. The next step in the chain is the integration of services for system components such as radio and media. Then the vehicle IT is integrated, followed by the application services.

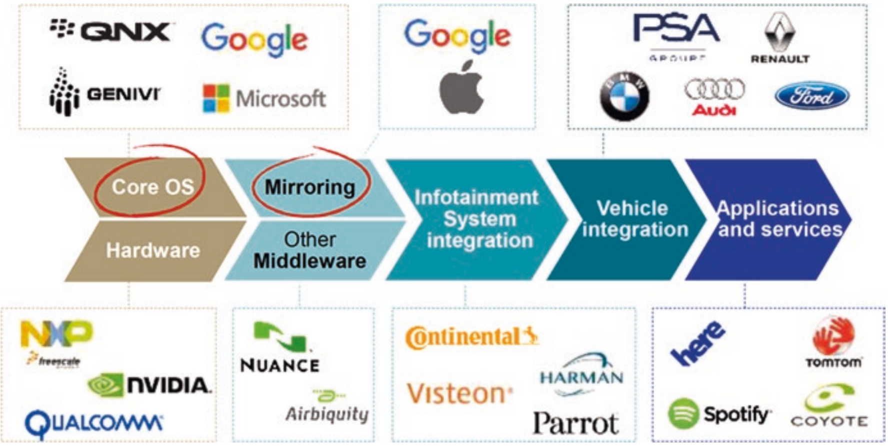

Fig. 9.3 Value chain infotainment unit [Cou16]

Various providers offer systems to implement the value chain. Important control points in order to control the solution area for the customers are the operating system and the mentioned mirroring, as marked in red colour in Fig. 9.3. In the operating systems, the QNX software has a high market share of approx. 50%, while with GENIVI and Google Android, two competitors on Open Source basis, follow [Cou16]. Due to their market leadership in smartphones, Google and Apple have by far the highest market shares in the field of mirroring. Other challengers are open manufacturer consortia such as Ford and Toyota with the SynchAppLink solution.

In the following sections of the value chain, other vendors such as Nvidia and Qualcom are positioning themselves in the hardware section; Continental and Visteon as integrators, and in the area of solutions the company ‘here’ with map information as well as Spotify for music streaming. It is important that the mirroring services determine the content that runs through this interface. For example, Google will surely favour its own Maps rather than ‘here’. There is a conflict of interests between manufacturers and IT providers.

At present, this field is not dominated by the manufacturers and they have to weigh up how they can strengthen themselves in the environment of smartphone connection. The mirroring should therefore become part of the proposed integration platform with a device management function as shown in Fig. 9.4. The details, such as the function and modules of the integration platform, were explained in Sect. 6.2.1.

Two vehicles are sketched below the integration platform. On the left is a vehicle with a very heterogeneous embedded IT landscape with many individual control devices and complex linkage, and on the right is as a vision – explained in detail in Sect. 5.3.5 – a vehicle with central and backup computers with simple digital linkage. The integration platform provides the integration of the vehicles into different services, which is complex in the heterogeneous world yet considerably easier in the centralised architecture. The services are available through programming interfaces (APIs) for application development. The applications use this interface

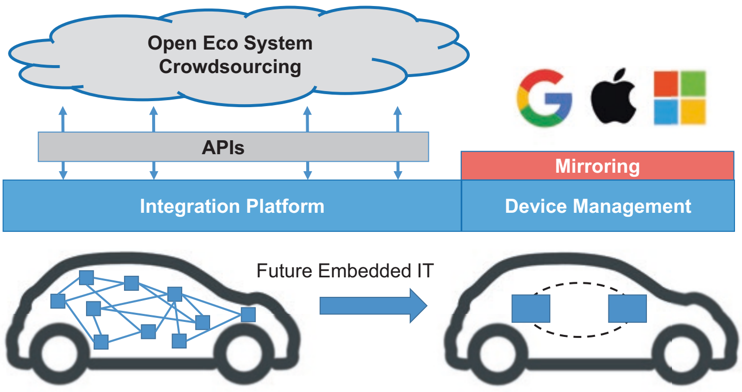

Fig. 9.4 APIs as basis for an open ecosystem and for crowdsourcing (Source: author)

for installation on the platform, are displayed on the infotainment unit and operated from there. Alternatively, the device management services enable the integration of different smartphones as the basis for the mirroring of Apps. Through this use of the integration platform, the manufacturers have opened up the alternative, in addition to the mirrored Apps of the IT manufacturers to also bring further applications into the vehicle.

Basically, manufacturers have three options available to position themselves in the competition against IT providers. They could entirely rely on the mirroring or the smartphone-based way, thus leaving the management of customers to the IT providers. As a second option, they could independently develop Apps and establish a manufacturer's App store, including "customer ID", parallel to the existing stores of IT competitors. Finally, a third option would be to rely on the integration described above and to provide an open, attractive ecosystem for developers with APIs, training, and support, similar to Apple and Google, to promote crowdsourcing and open innovation in such a manner. Namely the third model offers high scalability, and a large number of innovative solutions can be created within a short time. Thus, there is a chance to keep up with the many App offers in the smartphone environment and to attract the attention of the customers. This is the reason why some manufacturers like Ford, Toyota and PSA are using this promising concept [Gra17], [Ber13].

The French manufacturer PSA is discussed below as a case example of Connected Services. The company is the second largest European manufacturer [PSA16], with a turnover of over 50 billion Euros annually and more than three million sold vehicles. In its focusing on innovation and the acceleration of the digital transformation, the company is relying on the "Customer Connected Company" and "Smart Company" initiatives. In their implementation, Connected Services are of great importance. PSA's goal is to create a new ecosystem around the fields of data services, smart services and mobility, which is attractive for customers and creates new purchasing incentives but also generates additional sales, as displayed in Fig. 9.5.

Category	Service	Value for customer	Business Model	Revenue for PSA Group
Data services	**Aftersales leads**	Time saving	Activated by default on new cars	Aftersales business
	Enhanced leads	Satisfaction improvement	Leads bought by dealers	Sale of leads Aftersales business
	Smarter Cities	Enhanced infrastructures	Partnering with IBM to supply anonymized traffic data	Revenue sharing
Smart services	**Car Locator** **Stolen vehicle tracking**	Convenience & Security	Subscription	Additionnal turnover
	Live traffic, speedcam info	Time saving & Security	Subscription (1st 3 years included)	Additionnal turnover
Mobility	**Fleet Management**	Reducing Total Cost of Ownership	Additionnal contract to fleet sales	Competitive edge Additionnal turnover

Fig. 9.5 Connected services at PSA [Col16]

The picture shows solutions from the area of Connected Service in three target areas. For each solution, customer benefit, the business principle and the affected sales area are listed. For example, an App is offered to locate stolen vehicles. This App is used by customers on the basis of a subscription, which leads directly to sales at PSA. The 'Smarter Cities' App is about an alliance manufacturer/city to offer parking facilities in advance and to avoid traffic jams by means of a proactive intelligent traffic management. For this purpose, an IT partner company compiles movement and infrastructure data, evaluates these and derives relevant traffic projections. The business principle is based on a sharing model for costs and sales.

When it comes to creating solutions, PSA relies heavily on crowdsourcing. Digital Natives are offered an interesting technological environment with exciting questions and challenging problems, and they are inspired to meet there with many other developers and to further generate topics together as well as to create new ideas. As the basis for this model, a high number of APIs from the development environment for Connected Services was published. These provide, for example, vehicle signals such as oil temperature, tyre pressure or movement data. To distribute the APIs, PSA has created a platform which also provides documentations, blogs and support functions. To encourage developments, PSA is organising 4-week competitions, so-called accelerator events [PSA17]. These take place under preset key topics, and all interested developers or developer groups can participate. The winners will be awarded a price money and also a coaching for the professionalization of their App, leading up to deployment. Through this crowdsourcing, many new ideas can be tested simultaneously with first Apps and implemented step by step through customer proximity.

Similar approaches are also pursued by other manufacturers. As a matter of fact, Ford has even arranged a comparable competition on a global basis as part of the implementation of its mobility strategy. As the overview in Fig. 9.6 shows, twenty-five initiatives were launched.

The picture shows the initiatives with their respective themes. A distinction was made between experiments with different innovation partners and an open competition between developers. The tasks are distributed throughout the world, so that all

Fig. 9.6 Development of solutions in the connected services environment [FOR16]

relevant regions with "start-up and IT spirit" as well as important Ford markets were involved. Experiments were conducted in the USA both in the Silicon Valley and in Detroit; the UK, Germany, China and India were also included. A broad spectrum of topics has been covered, focusing on car- and shuttle sharing in large cities. New business fields such as health and insurance and well-known topics such as parking and fleet management were the focus.

The program has several advantages for Ford. In a short time many solutions were developed in different markets to cover different customer expectations, but also many ideas for future projects. The open development environment was subject to a broad field test and was further enhanced by extensions and adaptations. The implementation of the projects resulted in high public visibility, which strengthened the manufacturer's image in terms of innovation, mobility and openness. Also, a wide developer community was formed which is also available for future tasks. Therefore, this approach is certainly worth considering for other manufacturers as well.

In summary, it is to be noted that almost all manufacturers are active in the field of Connected Services, however with very different degrees of maturity. The update of the embedded software of the vehicles "over the air" is established at Tesla Motors for instance, while most other manufacturers still have to make up ground here [McK16], [Bul14]. This so-called OTA function (over the air) provides the customer with many benefits and is expected for the other vehicles also. As an example, Fig. 9.7 shows the functionality of the current software updates of the Tesla vehicles.

The listed functions were available free of charge in 2017 with a software update per download, similar to the update of a smartphone App, even for older Tesla vehicles. These are not just simple functions, yet rather significant improvements, such as the more precise temperature control in the vehicle interior or the complex navigation via motorway junction points. Also the increased responsiveness from the monitoring of two preceding vehicles as well as the correction of the vehicle posi-

Functions Tesla Software Update Release 8.0

- ➢ Avoidance of Overheating of Vehicle Interior
- ➢ Improvement of Autopilot
  - Adjustment of cornering speed based on fleet data
  - Automated Correction of Position in Lane during Overtaking Manoeuvre
  - Improvement of Reactivity, Monitoring of the twoVehicles in Front
- ➢ Map Updates; improved Trip Planner
- ➢ Extention of Voice Control

Fig. 9.7 Functional scope of the software update "over the air" for Tesla vehicles [Gri16]

tion after overtaking in relation to the overtaken car are part of the update. With the offer, Tesla increases the comfort and safety of its customers by problem-free software updates and can be considered as the benchmark for many manufacturers. In other topic areas which were subject in Sects. 5.3 and 6.2.1, the established manufacturers should, in the author's opinion, also strive for progress in order not to be overtaken by the "newcomers" of the industry. Particular mention should be made of the following:

- Centralised architecture for embedded IT (cf. Sect. 5.3.5)

- Transformation of the heterogeneous infrastructure, which is difficult to operate safely with over one hundred control units and several bus systems, into a centralised approach (simplified according to Fig. 9.4), in order to facilitate operational safety and integrability, and to secure future viability
- Strengthening the integration platform
- Development of an open, cross-brand platform; integration of the mirroring, so that upon the user entering the vehicle, a complete synchronisation of Apps in the vehicle with the user's smartphone is made automatically. The success criterion is the omission of the mobile phone holder, as well as the automatic driver recognition when the user gets into the vehicle, and the mirroring of the personal Apps
- APIs with appropriate system environment
- Define API strategy, build developer platform with APIs, social media and support environment for developer communities and interested commercial users, such as insurance companies or retail companies
- Establishing a business model for digital new business

- Development of a business model for Apps, API and data including the necessary processes such as payment processing, distribution and regulation of data use with drivers

Fig. 9.8 Infotainment unit display with different offers [Bur16]

Connected services will be increasingly integrated into the environment of the vehicles with an increasing number of functionalities and thus become an important purchase criterion and differentiating characteristic [Kni15]. This trend is reinforced by announcements from General Motors and BMW for instance. Based on its long-standing proven OnStar connectivity platform with basic functionality, General Motors is partnering with IBM to bring an innovative application with cognitive capabilities into the vehicles [Bur16]. On the one hand, this solution is to be understood as a learning assistant who in the background proactively recognises technical problems and proposes actions to the driver or independently provides navigation information for the next appointment from the driver's calendar and address book. On the other hand, the software is a marketing and sales platform on which service companies, as shown in Fig. 9.8, present themselves with their offerings.

The logos of various companies appear as icons on the initial screen of the infotainment unit of a GM vehicle. Here the user can scroll through and make its selection. If, for example, the driver clicks the ExxonMobil icon, stations and individual fuel pumps appear in the vehicle neighbourhood. Payment after refuelling is made from inside the car. Mastercard facilitates the payment procedures, and Parkopedia guides to free parking spaces. The platform is open, so other interested companies can contribute. When these services are used, the manufacturer receives a commission fee.

BMW is marketing the new 5-series model exclusively by highlighting the functionality of Connected Services, pointing at the conquest of the digital world, and no longer refers to motorisation or fuel consumption values. In radio advertising and on YouTube it says:

> In a digital world, my car tells me when it's time to drive off. It understands my words, my gestures. And at the destination it is a search engine for free parking spaces … my car knows my name, my destinations, learns my routes – and supports me when I want it. Some call it progress, to me it means freedom. [NDR17]

The examples illustrate how Connected Services can help companies to differentiate themselves in the market and address potential customers. They underline the need to vigorously attend to this field in order to be close to the customer.

9.3 Mobility Services and Autonomous Driving

The second pillar of the digitisation framework includes mobility services and autonomous driving. Before a reference is presented, a brief overview on the current situation on the market and the developments is next, which also serve as a positioning aid for many new project ideas.

The market for mobility services continues to develop at high growth rates. Lyft, the challenger of Uber, was able to increase the number of handled journeys in the US to 162.6 million in 2016, thus tripling the 2015 results [Sol17]. Despite the considerable growth of its competitor, Uber remains the undisputed market leader with its presence in more than 70 countries. In January and February 2016 for instance, Uber completed more trips than Lyft throughout the whole year. However, the impressive growth goes in both Lyft and Uber along with significant losses [Haw17]. This does not prevent investors though from further infusions of capital, nor does it stop manufacturers from seeking participations. For example, General Motors has its own mobility service organisation named Maven and also holds a stake in Lyft. BMW operates DriveNow, Volkswagen holds a majority interest in the Israeli company Gett and Daimler has been involved with Car2Go for many years. After Toyota has significantly invested in Uber, Daimler is also entering into a strategic partnership with Uber to push autonomous driving as the basis for mobility services [Ger17].

In a further strategically important field, autonomous driving is promoted by all manufacturers, and a fierce competition has emerged for who will be the first to present this technology as ready for series production. The path to autonomous driving is divided into five technological steps or degrees of maturity (cf. Sect. 5.3.3). Up to Level Three, vehicles are already established in the market. With technology Levels Four and Five, first pilot tests are running since the middle of the 2010s, and manufacturers are exhibiting autonomously-driving vehicles at all relevant trade fairs [WELT17]. A summary of the market introductions planned by the manufacturers is shown in Fig. 9.9.

The introduction dates are shown over the time axis, classified according to demonstrators, mobility service providers and manufacturers. First pilots in limited road areas already run in Singapore, Greenwich and Pittsburgh. At Level Four with high automation, GM, Volvo and Audi are planning to be the first on the market, closely followed by Tesla. Daimler and Nissan announced the release of fully autonomous vehicles for the year 2020, followed by BMW for 2021. Uber foresees fully autonomous mobility services, so-called robotaxis, to be in use in the year 2030.

The availability of autonomously driving vehicles will trigger a further significant growth momentum for mobility services and car sharing models as shared use also promises cost advantages. Figure 9.10 shows a comparison of the costs to drive electric cars in different usage models in the years 2016 and 2025.

Driving costs in Dollar per mile for conventional taxis are between \$ 2.85 in 2016 and \$ 2.76 in 2025. In comparison, costs in sharing models are significantly lower, ranging from \$ 1.36 to \$ 1.32. The cheapest are private vehicles with driving costs of \$ 0.56 and thus well below those of the mobility services.

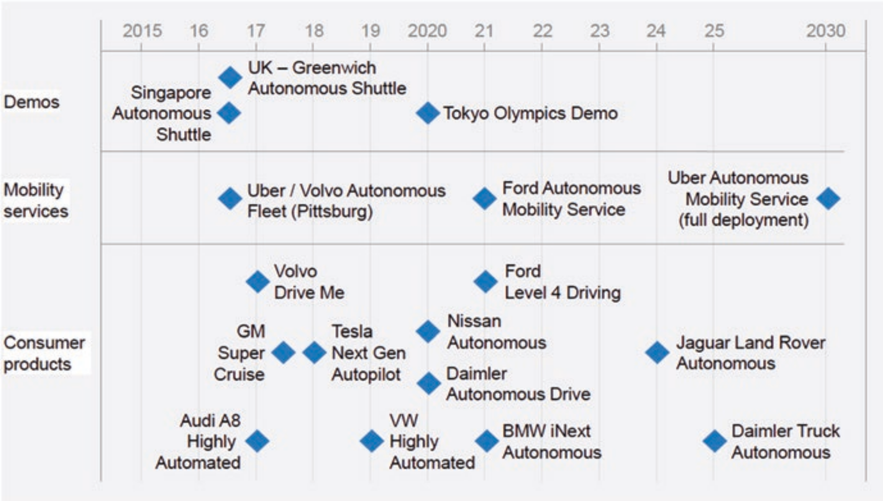

Fig. 9.9 Planned introduction dates of autonomous vehicles [Han16]

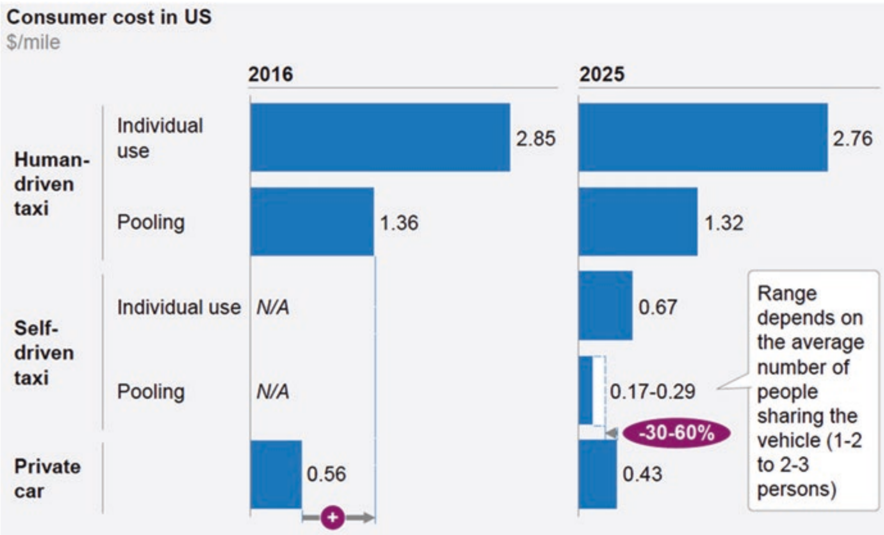

Fig. 9.10 Trend of costs to drive electric vehicles [Han17]

The situation is changing fundamentally with autonomously driving vehicles. In this way, in 2025 cost in the sharing model will drop to $ 0.17 when using the vehicles with two to three people, and to $ 0.29 in lower usage with one to two people. The cost advantage of 30%–60% versus private vehicles with $ 0.43 will bring a significant increase in the use of mobility services.

Fig. 9.11 Electrically powered, autonomously driving shuttle bus (according to [Mol16])

Autonomously driving electric vehicles will thus push back private car ownership in the long term. From this point of view it is interesting to get to know the Minibus Olli which is shown in Fig. 9.11.

This shuttle bus for up to twelve persons was developed in 2015 under the leadership of Local Motors by voluntary co-developers in a public competition over 6 weeks. After the selection of the winning design, which gave the winner $ 28,000 of price money plus future royalties from the vehicle sale, it took only 3 months until the SOP (Start of Production) [IDE17]. Other than the windows and the aluminium chassis, the vehicle components are created using 3D printing techniques. In the relatively small number of pieces, this production process is economical. The vehicle does not have a steering wheel, is equipped with about thirty sensors and runs fully autonomously. At a speed of 20 km/h the range is 58 km, which is sufficient in shuttle operation. The cognitive platform is being taught, also via crowdsourcing, and is available to the passengers for dialogue. The ability to communicate is trained on the operating environment and further develops in self-learning. Several Ollis can also communicate with each other and at peak times organise themselves independently as a group. First vehicles are used for shuttle services in Washington DC, and there is great interest in the use of additional vehicles in the USA and Europe, initially as pilots on non-public grounds.

Both the cognitive platform as well as the structure and interior of the vehicles can be adapted to suit the requirements. In this way, Olli could mutate into a driving café or gym. Local Motors and its project partners also see the vehicle as a learning platform for further projects of this kind. The goal is to set up micro factories in all relevant markets in order to quickly identify and implement the specific customer requirements as well as to minimise the logistics costs for components and vehicle deliveries. As a vision, Olli is supposed to make its way to "his customer" on its own. Later he could wait outside the front door if the integrated cognitive platform sends the next available vehicle to the customer after a comparison of calendar functions, user behaviour and weather. Sure, this is still a vision, but it is in fact to be considered by manufacturers [Jun16].

The idea of grouping vehicles is also studied as "platooning" in the truck sector. This term describes the driving of several trucks as a convoy, following at close distance between each other a guidance vehicle. In the process, the trucks communicate with each other in near-real-time, so that braking manoeuvres of the guidance vehicle are directly carried over to the following vehicles for instance. The trucks are quasi connected by an electronic drawbar. Thereby, the following vehicles are intended to drive autonomously [Vol16]. The advantages of this concept are significantly lower fuel consumption and thus less pollution. Further benefits result from lower space requirement on the road due to the narrower between the following trucks, relieving the drivers by the even speed, and by fewer traffic jams due to the superordinate coordination. Currently, the process is being piloted in Singapore with the participation of Scania and Toyota [Eck17]. As far as potential readiness is concerned, similar as with autonomous driving, the statutory regulations for admission to public roads are to be enacted first.

The promising platooning could also be an option in the area of mobility services in passenger transport. If autonomously driving cars are on the same route, they could automatically join together, at least temporarily on longer stages, in order to use the aforementioned advantages of the concept. Further visionary aspects in this field extend towards the creation of offerings to make meaningful use of the passengers' time in the vehicle. If personal driving and the associated seating arrangement and orientation are no longer necessary, the interior of the vehicles can also look completely different. The Olli-café or the Olli-fitness-studio have already been mentioned. There could be a conference room or restaurant as well during the trip – there is no limit to the imagination. It is important that the manufacturers adapt themselves to these developments and build up a sufficient degree of expertise in order to be prepared for these new issues and be able to offer competitive solutions.

9.4 Efficient Processes and Automation

The third pillar of the digitisation framework is about the efficiency improvement of processes up to the complete automation through digitisation. The thesis of the "Digital Darwinist" Karl-Heinz Land applies to this context: "Everything that can be digitised, will be digitised. What can connected, will in fact form a network. And what can be automated, will in fact become automated. This applies to every process in the world "[Lan16].

Section 6.2.3 explained a general method on how to approach the digitisation of processes and developed specific initiatives for three business areas. The following innovative projects in this field complement the comments made there.

As a result of the German Federal Government's long-standing and broad-based initiative, the thematic area of 'Industrie 4.0' has become a focus of all manufacturing companies there since the mid-2010s, and many initiatives and projects have been launched. All in all, the goal is to achieve a horizontal and vertical process integration through digitisation, thus making companies more flexible and efficient. In addition to the increase in responsiveness and thus customer orientation, according to a Fraunhofer Study, direct savings of on average 10–20% can be achieved in the

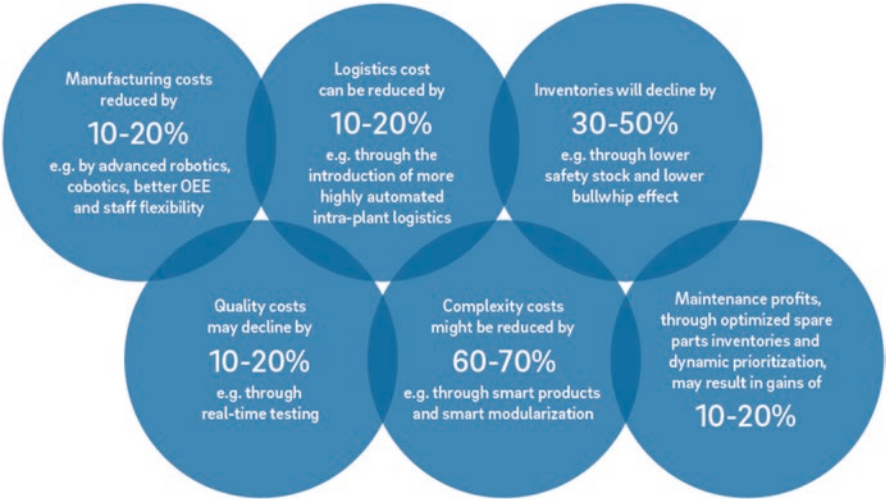

Fig. 9.12 Saving potentials Industrie 4.0 [Win16]

automotive industry. The breakdown into the organisational areas is shown in Fig. 9.12.

The reduction of complexity through modular and standardised products and the simplification of processes and interfaces allow the highest savings potential of up to 70%, while inventory reductions due to harmonised production processes and foresighted, tightly synchronised retrieval of supply materials reduce costs by up to 50%. In the other areas such as production, quality and maintenance, savings of up to 20% can be expected.

Manufacturers should apply these parameters in their projects. According to the author's experience, the highest potentials are at the intersection between organisational boundaries and process interfaces. However, the challenge to realise these is often not in technological problems, yet rather in cultural issues when motivation for cross-interface cooperation needs to be created. A technological platform which extends across these boundaries can be helpful. Figure 9.13 shows a simplified Industry 4.0 scenario with such a level, called Shop Floor Integration Layer here.

Three stations of a painting line are shown as an example. In the first processing step, the body is painted by robots, followed by manual-assembly and then a final inspection for quality control. On the line are various robots with their respective controls, sensors, cameras as well as tablets for the workers. The various IT components are integrated into the business IT via the Shop Floor Integration Layer. On the software level, basic services are available, for example, for communication and data handling (cf. Sect. 6.2.3.3). The integration layer can connect the entire painting line and also other production areas so that access to sensors and controls of other areas is possible to perform overarching data analyses. The layer provides standardised APIs for use by application solutions that are successfully implemented at different manufacturers. The following is an overview on the solutions mentioned in the picture:

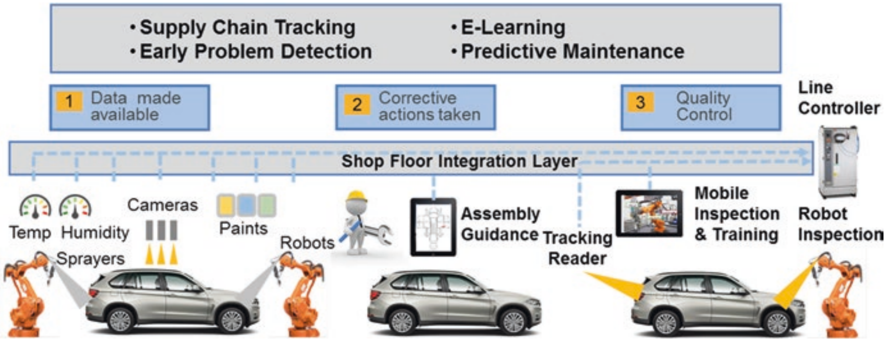

Fig. 9.13 Shop Floor Integration Layer example (Source: author)

- Supply chain tracking
- This application monitors the logistics chain in order to identify supply shortfalls at an early stage and initiate countermeasures. For critical parts, monitoring goes beyond the direct supplier, right up to their provider.
- Early problem detection
- This analytical solution combines a large number of sensors, plant- and order data, analyses them and, with the aid of forecasts, identifies production stations where problems may arise, for example due to missing parts.
- E-learning
- For the operation of complex machines or also for complex service work on machines, QR code labels can be read out there using a tablet and thus the special error situation can be localised. From a learning management system, the worker then loads the learning modules onto his tablet, which he can work through and thus obtain information on how to carry out the work.
- Predictive maintenance
- The application for preventive maintenance is about avoiding machine failures through proactive service measures and thus achieving a consistently high output performance. For this purpose, machine data are continuously being recorded, trends and deviations from specifications are identified, forecasts are made using models, and actions are proposed.

Such solutions can be effectively developed on the basis of an integration layer, since this simplifies the application development by using the platform basic services. More importantly, the replacement of machines can be easily depicted in the integration layer, and the application does not require any adjustments so that it can continue to grow step by step, even across organisational areas. Similarly, the roll-out of the applications to other production locations is facilitated and quasi becomes a download, even if there the integration layer is installed as the basis.

Another subject area which is being driven forward within the context of Industry 4.0 initiatives, is the direct collaboration of workers and robots, as already described in Sect. 4.8. This is not like in the 1980s, when it was about integrating robots into the flow production and to have them perform the same work steps routinely as reliably as possible. Rather, the goal is to exploit the high flexibility from advances in sensor technology, kinematics and software.

Robots today are much more sensitive, more responsive and more mobile than the first pick and place- or welding robots. With these capabilities, robots can also be useful in a wide range of other areas. Uses in the household, nursing and also in the operating room of a hospital are just as conceivable as teaming with workers in automobile manufacturing [Buc17]. Here the robot is used according to its strengths in a targeted way to support humans. A comparison of the abilities of humans and robots and an application example is shown in Fig. 9.14.

In the assembly of complex components, flexible decision making in the manufacturing process and also in the balancing of tolerances and insertion movements, humans certainly have an advantage over their iron colleagues. Robots play their advantages when it comes to handling heavy and sharp-edged loads, repeatability and endurance. Stoically they carry out the same work steps over and over with the same quality. As a team, both partners are even stronger, as the example of the hardtop assembly in Fig. 9.14 demonstrates. The robot brings the bulky and heavy component precisely to the nearest assembly position above the body. The worker then undertakes the final orientation and insertion of the roof.

The utilisation potential of robots continues to grow with the increasing performance of the software. Today, programming is relatively simple through teach-in procedures or graphical configuration on a tablet. Due to that, IT specialists are no longer needed for programming which rather is made by employees from the production department. It is foreseeable that production robots will have cognitive abilities in the future which will open up even more flexible application possibilities. Thus, the stand-in on the final assembly line, as well as the scheduler for the fine-tuning of the occupancy planning, could soon be a robot in order to absorb the fears of a looming skilled workers shortage.

Not only in manufacturing is under the heading Industry 4.0 the subject of process optimisation through digitisation a hot topic, but also in all other divisions. In

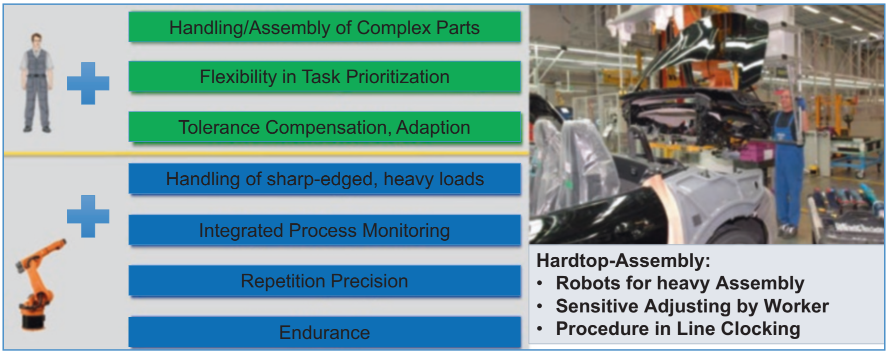

Fig. 9.14 Comparison of the skills of workers versus robots in hardtop assembly (According to [Kos14])

development for instance, to increase the reuse of parts by means of intelligent search systems or the prototype-free testing of new products up to the feasibility test with Augmented Reality is imaginable. In human resources, machines run the applicant screening, and employees use Apps to maintain personal master data more easily.

In the future though, cognitive solutions are expected in totally different areas as well by which robots can independently further expand their capabilities. The example of Pepper is shown in Fig. 9.15.

Pepper is a humanoid robot that, with the help of the cognitive IBM platform Watson, is able to find its way around and communicate with people. The system has to learn the surrounding details and also the subject area for the dialogues in a first training phase. Based on this basic knowledge, the system then learns from the feedback in the interaction. At present, Pepper is active in shopping malls for customer reception and guidance [Ada17]. Further uses are also thinkable at motor shows or at the dealership in order to answer questions concerning vehicle models.

These uses, which have already been implemented several times, are not further deepened here. Instead Blockchain is presented as a means to increase efficiency with possible application examples in the automotive industry. Background and function of the Blockchain technology were explained in Sect. 4.7. It is often referred to in the Internet as “the next big thing” [Bre16]. Simplified and summarised, these are encrypted data records for the documentation of transactions, which are continually updated, including verifications of correctness, through a transaction chain called “blockchain” and are stored in a distributed database. The process ensures the worthiness and flow of Bitcoins and forms the heart of this Internet means of payment.

Although the Blockchain technology is closely linked to the Bitcoin currency, it is irrespective of that also transferable to many other applications independently, and has a disruptive potential as the application processes and structures change entirely. For example, no bank is needed to process a payment between two parties using Blockchain technology. The transfer takes place directly, quickly and cost-effectively through a web-based secure process running in the background. Personal data protection is also not an obstacle, since no open names appear, rather each user

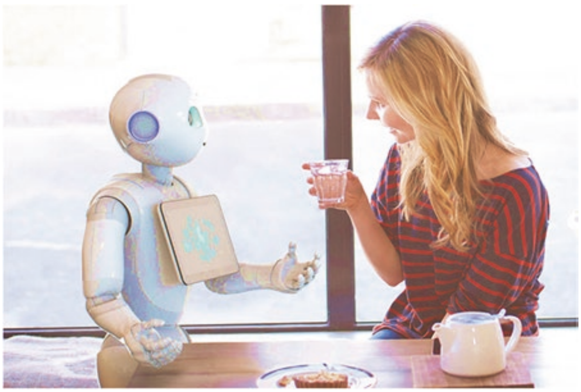

Fig. 9.15 Robot Pepper in conversation [Ada17]

is assigned a separate code made up from numbers and letters. Further protection is provided by the use of distributed databases on which many copies of the transaction chains are stored. Manipulations become almost impossible.

The main advantages of the procedure are the high security, the simplicity in the verification of the transaction and the potential to simplify processes, since additional control functions, for example for invoicing or checking contracts can be dropped. The disadvantages are the extent of the growing blockchains, limitations in performance, in throughput, and the effort needed for authorisation management.

As the advantages are predominant, there is a great interest in the topic, and many manufacturers are starting their first projects, often in the area of so-called Smart Contracts. These are computer protocols and software-based algorithms which map contract contents. The processing and fulfilment of the contracts is automatically monitored and documented so that the paper form is no longer required, and lawyers are unnecessary in the drafting of contracts and supervision of execution [Kal16]. Blockchain is also the basis for the use of technology in the usage processes of vehicles, Fig. 9.16.

The picture shows the life cycle of a vehicle from the transfer of the car from the manufacturer to the dealer, which involves a lessor to finance the purchase, so that the car is handed over to the customer (Lessee) on the basis of a leasing contract. At the end of the usage, a used car dealer takes over the car, and the lease ends on the basis of an expert appraisal. The entire process is documented in a Blockchain, stored step by step in distributed databases (nodes). In addition to the vehicle transfer, the contractual vehicle status is also directly checked in the Smart Contract

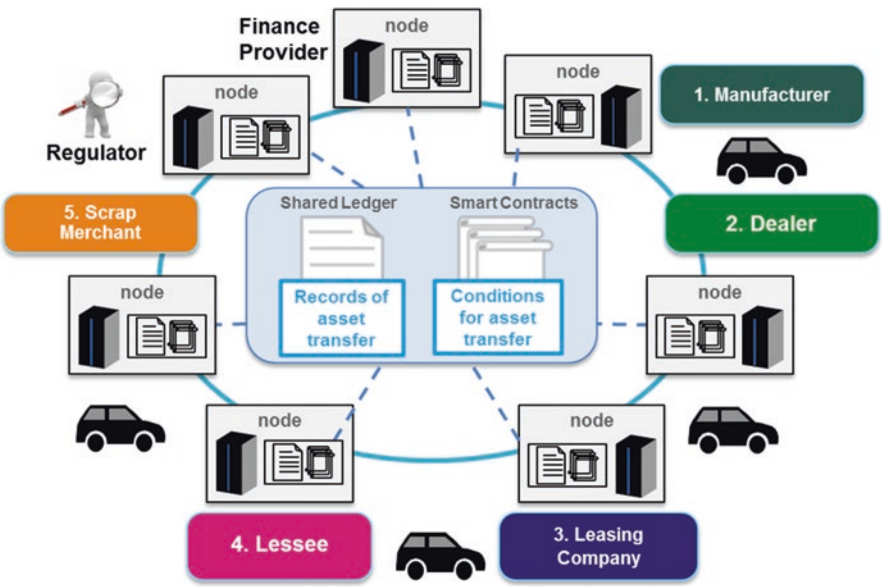

Fig. 9.16 Blockchain technology in the life cycle of a vehicle [Hon16]

method and stored in the information blocks of the chain. The simple sequential procedure results in a complete documentation of the vehicle condition, which can also be used when changing users or exchanging parts, in order to secure the use of original parts, for example.

Another example of the use of Blockchain technology in the automotive domain comes from electric vehicles. The refuelling is carried out at charging points which are often supplied by different electricity suppliers and mostly also use different methods of payment. These range from coin-operated machines, customer and credit cards to payment via smartphone App. Partially, electricity is also only sold to contractual customers of the supplier. In order to simplify procedures, the Blockchain method based on Smart Contracts is also suitable here. During each charging process, the customers conclude a contract with the respective supplier by identifying at the station, whereupon the transaction including the payment is processed in the background [Roe16].

In a similar way, a wide range of possible applications are available, such as the processing of:

- Payment transactions, orders, invoice processing
- Supply chains
- Rental agreements incl. issuing of smartkeys for opening the vehicle
- Services
- Repairs
- Solar power (feeding back and supply)
- Mobile phone usage at different providers (roaming).

These examples illustrate the potential of the blockchain technology, especially since the use often also brings a process simplification by the elimination of control functions or intermediaries and thus an increase in efficiency.

Another technology to simplify procedures are so-called Chatbots, derived from “chat” and “bot” (second syllable of ‘robot’). They include automated communication, for example in software applications as a service offer to answer queries regarding usage or as an information system in public transport. Communication can be in writing via dialogue boxes or via language. The solutions work according to the principle of pattern recognition. The requested characteristics are used to search for suitable matches in databases and to derive an appropriate response from the information found. The demand for these solutions is growing with increasing performance and simplicity of use, which are known from using the chatbots of smartphones such as Google or Apple [Frü16]. Enriched by cognitive possibilities, the performance of the solutions will continue to increase and the utilisation extend to further areas.

Another application area of chatbots is as personal digital assistants in the office or in the private sphere, realised for instance in Amazon’s Echo or by Microsoft with the Cortana Platform [Jun17]. These systems are capable of learning and answer user queries by accessing Internet data, remind their owners of their respective appointments as per the diary, or initiate the playback of desired music.

In a next development stage, it is expected that chatbots will be used to control different applications via voice control and then learn to perform certain work procedures automatically. A possible usage scenario is shown in Fig. 9.17.

The Chatbot solution works with access to databases of different applications and is in direct dialogue with applications of a specific business area, such as the finance department. However, a chatbot could also be addressed directly in order to perform certain activities in interaction with the connected IT systems. For example, it could display outstanding delivery items or settle a specific invoice under deduction of a cash discount. The working steps are listed on the right in the picture. After input via voice or via dialogue window, the chatbot identifies the user and checks authorisations, interprets and understands the task and subsequently performs the necessary steps to display the desired results or to report the execution of the task. To perform this transaction manually, the user might have had to approach three different systems to find the invoice, check the goods delivery and settle the bill.

This little example already illustrates the potential for increasing efficiency in process execution. It is particularly useful in the handling of financial transactions, travel bookings, help desk services and also in the area of purchasing and personnel. Solution examples are already known for mobility services to book trips or to search for intermodal transport connections [Jun17]. Since the integration of chatbots into existing solution fields is relatively easy, operation is intuitive and the added value is high, this technology is suitable for many digitisation projects, such as in the next major topic area.

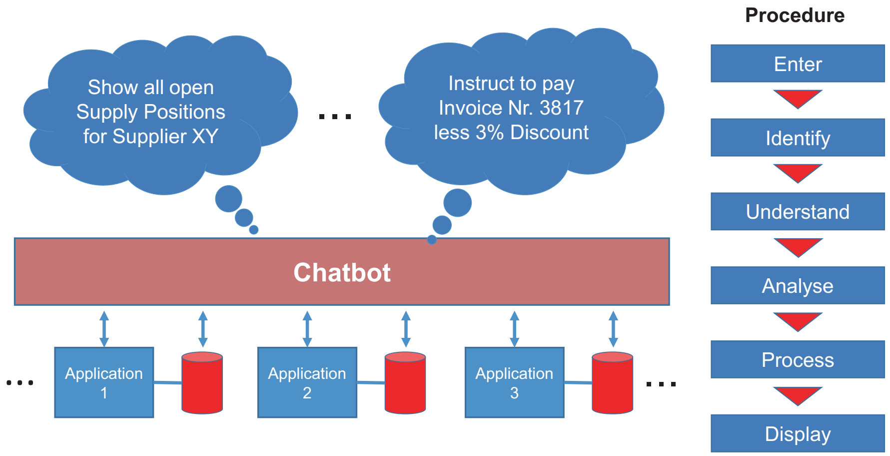

Fig. 9.17 Example of use and work steps of a chatbot (Source: author)

9.5 Customer Experience – Marketing, Sales, After-Sales

Digitisation and the change in the automotive business lead to a shift in the existing sales structures towards an Internet-based multichannel distribution. At the same time, the direct contact points with the customers in the areas of marketing, sales and service change through the use of innovative digitisation technologies. Drivers for this are the customer expectations, stemming from the familiar handling of Apps on mobile end devices such as smartphones and tablets. For the details of the transformation and a possible road map, see the comments in Sects. 5.3.7 and 6.2.4. The current situation and the future changes in the sales structure are summarised in Fig. 9.18.

As can be seen in the illustration on the left, the manufacturers in sales and service do not have a direct connection to the end customer so far. Importers and dealers handle the sale and the services of the vehicles and shield all direct customer contacts like a “trade secret” from the manufacturer. They provide marketing materials, market information, technical support for the service facilities and more and more also customer relationship management (CRM) functions such as campaign- and lead management.

With the future digital services, direct relationships between manufacturers and customers will develop. These also include Connected Services or the reading and analysing of vehicle data in order to give the customer driving instructions or to diagnose and communicate preventive service requirements via diagnostics. For the upcoming online sales of vehicles, a direct interaction between the manufacturers and the end user takes place. In the course of the following business transactions, the established manufacturers at present usually involve the existing sales structure [Tan12]. It remains to be seen if this will continue or whether the intermediary lev-

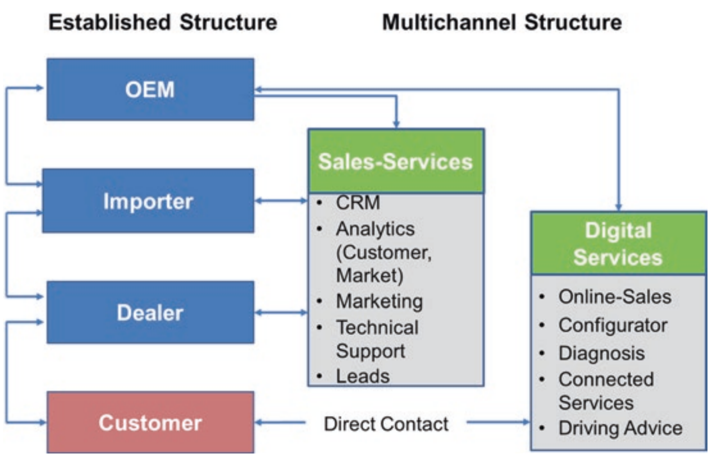

Fig. 9.18 Future change in the car sales structure (Source: author)

els will cease in the long run, or at least change considerably. Tesla, for example, operates outright directly online in sales without any levels of trading.

In the future, a direct communication and business relationship between the customer and the manufacturer will be established in order to transact business via this additional distribution channel and to gain more customer information. The case of General Motors which was presented by Fig. 9.8, again serves as a practical example for such solution. In this way, the drivers receive via the infotainment unit service offerings from ExxonMobil, Parkopedia or Mastercard for instance. To handle these transactions, an integrated service platform is implemented, which is shown in a simplified depiction in Fig. 9.19.

The vehicles are connected to the different services via a public API gateway. As an alternative to the infotainment unit, customers can also use a smartphone App or a web portal solution for the processing. A data management level prepares, for instance, the user, vehicle and motion data, continuously analyses these and identifies suitable offerings for the drivers from the portfolio of the connected providers (merchants), stored in the target marketing Cloud. The results are recorded by the service department which generates specific offers.

Thus the system could detect that the remaining tank content of the vehicle only has small reserves. The information is provided along with the current localisation data of the vehicle to the service platform. This processes the information and, together with the partner Exxon, creates an offer with price and a potential discount as an incentive for a nearby petrol station and displays it on the infotainment unit. The driver can accept the offer by clicking and then refuel at a pre-reserved pump. The payment is made via the further partner Mastercard, without the driver having to enter the cash till area of the service station.

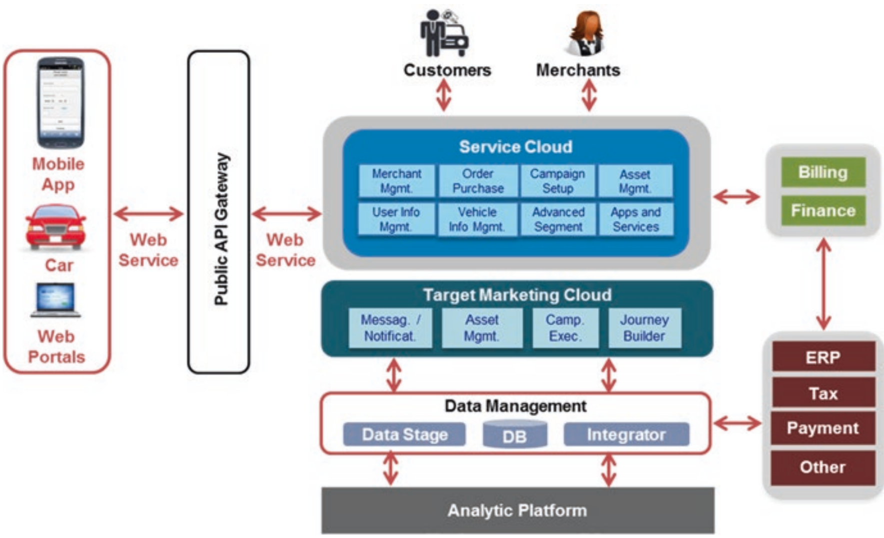

Fig. 9.19 General Motors' platform for handling of third-party business (According to [Sat16])

The service Cloud provides the services required to process these transactions and also manages customer, vehicle, and vendor information. Another component of the platform, the Target Marketing Cloud, runs customer-specific marketing campaigns. Within an as narrow customer segments as possible, the system analyses data from various sources and converts them into customised offers in order to achieve a high acceptance rate. The entire solution is integrated into the manufacturer's back-end systems, so that, in addition to the master data management, the accounting and payment of taxes is also done there. The solution is operated by a service partner. The business model is based on the risk sharing approach in which manufacturers, IT service providers and vendors participate in a proportionate share of the sales revenue of the transaction. The platform is open in order to include further partners in the future or to expand the solution into further markets and to involve local partners there.

All in all, GM has built up a direct sales and communication channel between the manufacturer and the customer, which means additional convenience for the customers and at the same time provides additional business for the platform parties.

Another important subject in this sales transformation is the development of an internet-based sales channel. This is also confirmed by studies which assume that in 2020 every third vehicle is traded online [Kal16]. Leading in this field is Tesla, which exclusively rely on online sales. However, other manufacturers are also working hard to offer similar solutions [Kai15, McN15]. BMW for example has set up a dialogue-oriented option on its Internet site for online purchase in the UK, which is summarised in Fig. 9.20.

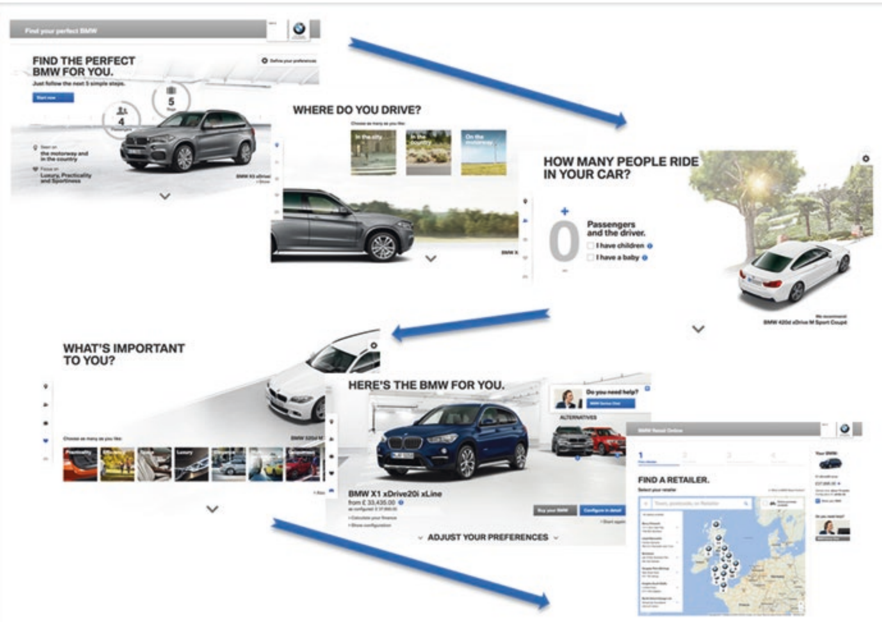

Fig. 9.20 Process of BMW online purchase in the UK (According to [BMW17])

After the start of the process, the customer is guided by an intuitive configurator, which is characterised rather by a recording of the planned vehicle use and personal preferences than by often deterrent technical matters in traditional solutions. First, the customer selects his driving environment from the options city, country, long distance, then the future passenger number and the typical luggage type. Finally, the system asks for the lifestyle that the vehicle should meet, ranging from luxury over pragmatic through to sporty. Subsequently, under evaluation of previous configuration sequences and learning from these, a vehicle with the best match, including the price and delivery date, is proposed. In addition, a second configuration appears, in which in 80% of the cases the initial proposal is accepted [BMW17]. Finally, the customer can select a dealer. The final commercial steps, if desired, including a leasing option and, if necessary, the takeover of any existing vehicle, are then carried out also online in the system environment of the selected dealer without a system break for the customer.

This solution provides customers with a comfortable environment for the online purchase of a car. The processing is carried out in a network of manufacturer and dealers. As dealers in this case do not lose any turnover, and there is no competition between the parties, the acceptance on part of dealers is very high. Almost all BMW dealers in the UK are using this solution [McN15].

A further example of Audi is presented below. In addition to online sales, Audi has developed an innovative showroom solution for its car dealerships. An impression is provided in Fig. 9.21.

The “Audi City” solution offers a virtual customer experience. All Audi models appear on high-resolution large screens in almost real size. The vehicle can be displayed in different driving situations and one can enter the car virtually. Operation is done via gesture control or multitouch tables. The customer can, for example, call up a previously selected configuration via his online ID by smartphone, view “his” vehicle in different situations, make changes to colour, equipment and motorisation and watch these changes directly online in the virtual world. Complementary, the systems are equipped with augmented reality devices as well as sound machines to make the experience even more realistic.

Fig. 9.21 Virtual AUDI showroom [AUDI16]

The comprehensive system technology necessary for this purpose has been installed by Audi in its flagship stores in the inner cities of large metropolises such as London, Berlin and Beijing. At these locations, there would not be enough space anyway for the physical presentation of several models. The challenge of finding a balance between the available showroom space and the scope of exhibits is on all dealers. Due to the growing model range and the increasing variant diversity, the "virtual showroom" is an alternative. Parts of the solution, such as virtual vehicle models, are also available to smaller dealers. The next version of "Audi City" includes the integration of learning configurators who already know a customer upon entering the showroom from the social media and their history with the manufacturer, and then pro-actively load configuration suggestions on the screens.

Both solutions presented as well as in many other situations there are different business contacts with the customer. The customer could be the owner of several vehicles of different brands of the same manufacturer or a customer of the finance area, have already completed different test drives and have had a guarantee claim as a customer of the service organisation. All of these situations generate customer data, which from different systems go beyond the sales structure, without being put together in an integrated view at least within the manufacturer. In addition, the same customer may express himself in the social media about his experiences with the vehicles or discuss his future vehicle interests with friends or in public forums. This information also provides valuable information to the manufacturers and should therefore be combined with the integrated manufacturer-internal information.

The need for action is evident to many manufacturers, and corresponding data consolidation projects are in progress. Typical technologies used in the course of this are master data management, Data Lake and Hadoop database technologies. For a deepening of the technological topic using tried and tested architectures, reference is made to the relevant literature, e.g. [LaP16]. It is important to actively address this issue in order to be able to respond to customers consistently and develop them. Typical further digitisation projects in the field of marketing, sales and after-sales are:

- Cognitive solutions in customer service, for example digital assistants at the repair workshop reception or the customer help desk
- Online workshop booking and repair tracking
- Control of digital marketing; reporting of customer feedback
- Social media monitoring; customer segmentation; next best action in marketing
- 3D printing for local customised spare parts production [Lec16]
- Big Data-based long-term forecasting for parts stockage in spare parts management
- Demand-oriented pricing based on market trends

To sum up, the digital transformation at the customer interface is at all manufacturers in progress with much dedication. However, successes in individual projects should be secured with an overall strategy and the integrated roadmap derived from it.

9.6 Corporate Culture and Change Management

In addition to structured holistic planning, as was already detailed in Chap. 7, a fresh agile corporate culture with the appetite for change and digitisation as well as an efficient change management are important preconditions for a successful transformation. Therefore, some examples and experiences from this area are given below.

The digital transformation must be accompanied by clear communication from part of the company management about its necessity and goals in order to encourage the entire work force to participate with full commitment. They are the ones who have to implement the individual projects and thus directly determine the success of the journey. Communication starts at the top of the company through authentic behaviour and is an important success criterion [Stö16]. The executive team is at times of change under particularly close observation by the employees. The leadership must radiate the willingness for digitisation, the motivation for innovation, and the determination to implement it, for instance by using new communication channels, exemplifying an open dialogue and by proving new partnerships. Other aspects to consider in the communication are:

- Mobilise the leadership team and involve opinion-formers
- Formulate clear objectives as to what is to be achieved in the individual fields with the digital transformation, why it is important and what it means to the employees
- Define performance figures for the targets
- Create roadmap for implementation with milestones
- New values and behavioural patterns to become an integral part of the corporate culture
- Support multi-dimensional yet consistent communication using multiple channels
- Stimulate dialogue and feedback and embrace it in actions
- Aim for and highlight swift successes; also accept and name failure
- Maintain continuous communication with no break-off

It is essential that innovative solutions and ways are used to communicate in accordance with these rules. In addition to established tools, in-house videos, wikis, forums, chats and collaboration tools are expedient. The rule however is: Not too much at once, but rather take the chosen path in a consistent manner to a breakthrough. It is crucial that the management is actively involved – in fact, personally and the matter not delegated to any assistants.

The introduction of a collaboration platform, for example at Coca Cola or Bayer AG, became a success only after the executives were actively involved in the dialogue. Further examples of how to convincingly exemplify the role model in communication are: [Wes14]:

- Societe Generale

- Mobilising sixteen thousand employees in nineteen countries in an exchange of views on an internal social media platform to underpin the digitisation roadmap with suggestions for initiatives and to specify the elements of IT equipment

- Pernod Ricard
- Development of the digitisation roadmap in internal crowdsourcing
- IBM
- Innovation jam for the adjustment of the company's basic values (cf. Chap. 7)
- Virgin Group
- Exemplifying the customer orientation; CEO Richard Branson invites customers via Twitter under the hashtag #AskRichard to enter into direct dialogue

The examples illustrate that creative ideas, authentic input and dialogue are equally important to success. It is important to avoid the very common mistake of putting the focus of the communication on new IT tools. When implementing collaboration tools, the effort and costs for training and change management must be taken into account, and the project does not end with the installation. The continuous use of the tools, including the involvement of executives and opinion leaders, as well as the transparent change in working behaviour through the use of the new tools, ensures sustainability and thus influences the corporate culture.

The culture is also significantly changed by interdisciplinary cooperation among employees, using agile methods such as Scrum in development projects and Design Thinking in innovation workshops. The methods were explained in detail in Sect. 7.2. There are many positive references namely with respect to Design Thinking [deS16]. Bosch, Telekom, SAP, Volkswagen, Bayer and Lufthansa, among others, apply this method. The success is particularly due to a strong customer orientation and interdisciplinary cross-divisional cooperation. Practical experiences of the author may encourage the application of this approach illustrated by 6 steps in Fig. 9.22.

In this case, three groups with a total of fifteen participants from the areas of purchasing, the organisation of the CDO and IT worked on the situation in the purchasing area of a manufacturer. The goal was to find new ideas for digital transformation. In preparation for the workshop, the workflows were recorded in the department, and in a "day in a live" format – which meant to identify a purchaser's daily work with his tools – presented at the beginning of the group work, along with the case study of another company. In the first step of the process, the situation of

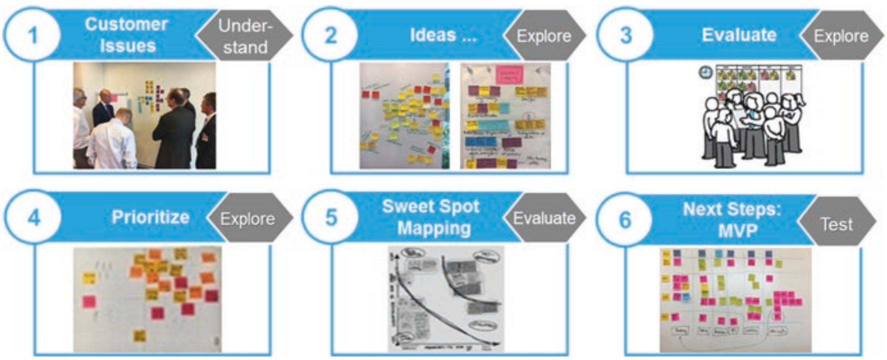

Fig. 9.22 Adaptation of the Design Thinking method for a one-day innovation workshop (Source: author)

the purchasing department was analysed, followed by the identification of the deficits, requirements and needs for the improvement of workflows.

Based on this, innovation ideas were developed in further steps using the moderated metaplan method to simplify workflows. After examining the concrete benefits and the feasibility (duration, effort), a list of priorities with a little more than ten ideas was achieved. For the two best ideas, the team decided to present them in a simple prototype as an App for the purchasers and to be used as a basis for joint follow-up workshops. All in all, the day was considered very successful and, in addition to the ideas developed, especially the overarching cooperation was seen positively.

From experience, as a result of the method and the pragmatic approach, a new behaviour and an open exchange and dialogue will establish and can in future live on in collaborative tools in the community. Namely the use of innovative tools stimulates the motivation to participate and to promote new ideas off the beaten track as well. For example, the creative process of graphic recording can also be used to document workshops and meetings instead of the text form or the traditional PowerPoint images, Fig. 9.23.

There are two graphs which summarise the results of two workshops. Both depictions were made during the event and serve as a basis for the final documentation. The impressively designed pictures remain a lasting memory and give the events an innovative character. The creation is done by designers or can after some training be produced by the "keeper of the minutes" as a personal contribution. Various easy-to-use Apps are available for this task.

A practical example from the field of workplace of the future with the focus on office equipment may serve as a further element for influencing corporate culture. From the point of view of the "war for talents", i.e. the competing for well-trained IT staff, and to initiate the motivation of the employees, the offices have to be designed with new requirements in mind. Future work structures are much more open and flexible than previously. Fixed workplaces and inflexible, regulated working hours are a matter of the past. An impression of such solutions is given in Fig. 9.24.

Fig. 9.23 Usage examples of graphic recording [DD17]

Fig. 9.24 Innovative office environment at Google in Zurich [BW17]

The photos show office areas of Google at its Zurich location. There are shared-desk concepts with large displays next to team rooms with can be flexibly partitioned. Retreat zones in planted areas and the use of hanging chairs with a view of the mountains offer varied environments for undisturbed and creative work. All workstations are connected to high-performance networks, thus securing access to data and modern IT solutions for work support. In the future, digital assistants are supposed to take on routine tasks such as travel bookings and coordination of appointments in the background.

The design of the workplace of the future is a central theme of the upcoming transformation in the enterprises. What does "Work 4.0" look like tomorrow, and what are the framework conditions which must be created for this? How can IT solutions help to make processes in human resources more efficiently and support them, and how take successful initiatives in education and recruitment to attract the right employees for successful digital transformation? It is important to find convincing answers to these questions, make them an integral part of the digital road map and thus contribute to a change in the corporate culture.

In order to make progress in the field of innovativeness and the ability to innovate, many companies have established so-called "labs", the name often being combined with additions such as innovation, digitisation or mobility, or other sector-specific terms. In Germany, there were more than 60 of such facilities in 2017 [Kel16]. "Labs" are separate organisations located outside the enterprise location, usually in attractive IT-affluent cities. Hip office equipment as well as many free spaces give the teams a start-up feeling and should increase creativity and innovation speed. Reports on the "Labs" of almost all manufacturers are available on the Internet as a report and also on YouTube.

Moreover, many manufacturers have scouting units installed at the international "IT melting points", such as Silicon Valley, Tel Aviv, London, and Bangalore, as well as incubator units to promote collaboration with new partners, relevant universities and research facilities. At the same time, temporary assignments of employees are sent to these organisations, or in-house fairs are held for the presentation and dissemination of the ideas.

The very challenge for the Labs is in many cases the transfer of the work and findings out of the Labs, and especially the start-up culture, into the existing organisation. It is vital to successfully bring a digital spirit into the business and to make it part of the culture. The organisation should be motivated and appropriately prepared and equipped to quickly and sustainably benefit in business from the new digital possibilities, it should acquire a "digital dexterity" [BW17], [Sou16].

This property can be characterised by four thematic fields, which are shown in Fig. 9.25. Digital solutions are always preferable when changes are pending or new technical possibilities are emerging. The goal should always be a full process automation. Wherever possible, data from a variety of sources must be used to derive improved decisions or new initiatives. Comprehensive collaborations based on innovative tools should be common practice. Building knowledge on digitisation should be of high priority to every employee, and the commitment to digital projects must be considered and advanced in the sense of new business models, cross-functionally as well as across company boundaries.

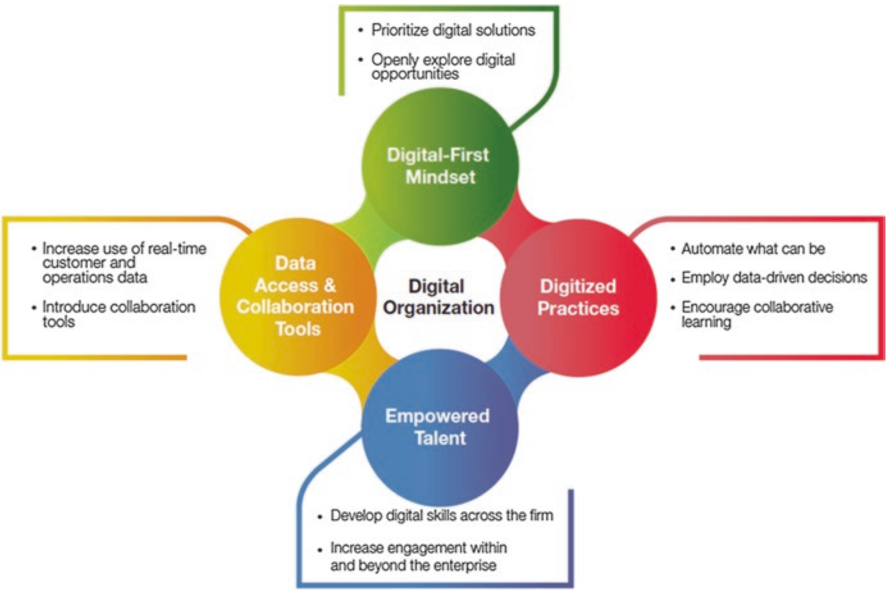

Fig. 9.25 Core competencies of a digital organisation [Bon17]

In conclusion, the innovative projects presented in this chapter from the individual fields of digitisation show that there are already many successful projects and references. From the author's point of view, the potential for improvement is in the speed of implementation and the width of the projects.

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