Case Study on

Readiness for the Future of Professional Driving

Country: Germany

prepared by: Claudia Ball & Matthias Ball, DEKRA SE

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Claudia.Ball@dekra.com

The professional driver qualification is one of the most suffering fields of work with regard to shortages of labour today and at the same time faces a very insecure future in the light of digitization and autonomous driving vehicles. This leads to a number of challenges that need to be addressed in order to at the same time tackle current deficits and prepare for a future that cannot be clearly described yet.

The FutureDRV project tried to give an insight view into potential future developments of the overall profession and training in the occupational field in order to prepare stakeholders concerned with professional drivers and their role in the supply chain for potential future scenarios. The case study at hand analysis the current situation for the EU member state Germany in the light of the FutureDRV project results and provides concrete recommendations on how to prepare national, industry and other stakeholder structures, initiatives and practices in a way that supports transport industry and professional drivers to get ready for a digitized future of transport. Major emphasis of this case study is given to labour market considerations, ensuring of a well-skilled workforce and employability of professional drivers over time.

Current state of play of professional driver qualification in Germany

Professional driver qualification in Germany is primarily build around the following vocational education and training schemes:

Initial qualification takes place through

- the 3-year apprenticeship scheme “Professional driver” (Berufskraftfahrer/ Berufskraftfahrerin[1]) leading to a skilled worker certificate,
- other programmes also leading to the skilled worker certificate and
- the initial qualification (Grundqualifikation) required by the Professional Driver Qualification Law (Berufskraftfahrerqualifikationsgesetz, BKrFQG[2]) implementing EU directive 2003/59/EC.

Continuous training for professional drivers is available through

- periodic training in the framework of the BKrFQG as well as
- other continuous non-formal (primarily implemented in corporate training contexts) training.

Upgrading/ advanced training in order to progress to a job of higher grade is offered through

[1] https://www.bibb.de/de/berufeinfo.php/profile/apprenticeship/67589062
[2] https://www.gesetze-im-internet.de/bkrfqg/BJNR195810006.html

- the certificate “Certified senior motor traffic services specialist” (Meister/Meisterin Kraftverkehr[3])

3-year apprenticeship scheme “Professional driver”

The 3-year *apprenticeship scheme* “Professional driver” is partially implemented through school-based learning in vocational schools and partially through work-based learning taking place in the company. The outline curriculum[4] entails the following elements (estimated weighting in weeks in brackets):

- Vocational training, labour and collective bargaining law (not specified, crosscutting)
- Structure and organisation of the training company (not specified, crosscutting)
- Safety and health protection at work (not specified, crosscutting)
- Environmental protection (not specified, crosscutting)
- Control, maintenance and care of the vehicle (32)
- Preparation and execution of transportation (26)
- Road safety, driving vehicles on public roads (22)
- Road traffic legislation (17)
- Customer-oriented behaviour (12)
- Behaviour after accidents and incidents (6)
- Operational planning and logistics (25)
- Transport related cost accounting and contract processing (12)
- Quality assurance measures (4)

The framework curriculum[5] for the school-based part of the apprenticeship entails the following learning fields (teaching hours in brackets):

- Representing the own company (40)
- Care and maintenance of vehicles (40)
- Loading goods (80)
- Checking readiness of motor and electrical system (120)
- Planning and carrying out routes and tours for domestic destinations (80)
- Using drive train, check chassis and wheels (80)
- Checking the functioning of the brake system (60)
- Designing the transport process to be order-optimized (60)
- Planning and carrying out routes and tours to foreign destinations (120)
- Using busses in scheduled and occasional services (80)
- Transporting special goods (40)

[3] https://www.bibb.de/de/berufeinfo.php/profile/advanced_training/rbn77hfd
[4] See https://www.bibb.de/tools/berufesuche/index.php/regulation/berufskraftfahrer_2001.pdf for more detailed information.
[5] See https://www.kmk.org/themen/berufliche-schulen/duale-berufsausbildung/downloadbereich-rahmenlehrplaene.html?type=150&tx_fedownloads_pi1%5Bdownload%5D=40505&tx_fedownloads_pi1%5Baction%5D=forceDownload&tx_fedownloads_pi1%5Bcontroller%5D=Downloads&cHash=6f723e32680725edc73601da15ceddbe for further information.

- Using and operating electronic devices (40)

The current training regulation dates back to 2001 (framework curriculum to 2000) when passenger and freight transport have been combined into one common training regulation (before that separate 2-year training schemes have been in place for passenger and freight transport dating back to 1973). In 2017 the training regulation as well as the framework curriculum have been specified in two points: extending route planning based on maps by digital systems and specifying passenger services according to the special requirements of passengers with reduced mobility.

Between 2015 and 2017 about 3.000 new apprenticeship contracts have been issues for this apprenticeship scheme[6] across Germany and also graduation numbers remained stable around 1.800 per year. However, those figures already indicate that this initial training scheme suffers from a very high dropout rate around 45%. Which is usually argued with the comparably low apprenticeship allowance and low demand for in this way certified professional drivers by industry which is assumed to lead to an early dropout from the apprenticeship scheme in favour of a full employment as soon as the apprentice fulfils all requirements (age, driving license).

The 3-year apprenticeship scheme includes the initial training according to BKrFQG and therefore the driver CPC. The skilled worker certificate is referenced to DQR level 4 which equals EQR level 4.

Other schemes leading to the skilled worker certificate "Professional driver"

Besides the above described 3-year apprenticeship scheme also other training pathways lead to the skilled worker certificate "Professional driver". This is for instance the *retraining scheme* for adults who are trained in a 2nd profession after having completed another one before. This is a primarily school-based system incl. internship following the same logic and structure as described for the apprenticeship and leading into the same final exam as the one for the apprenticeship scheme.

Furthermore, the skilled worker certificate can also be obtained through the so called *partial qualification* (Teilqualifikation, TQ[7]) scheme. The partial qualification scheme divides the overall profession into six partial qualifications (TQ1 Transporting goods, TQ2 Vehicle maintenance and care, TQ3 Transporting passengers, TQ4 Transporting special goods, TQ5 Steering busses, TQ6 Planning and organising transports). The scheme is meant to give long-term unemployed, migrants and other adults the possibility to obtain a skilled worker certificate alongside working as (in this case) professional driver starting with the TQs that are necessary to start into the profession and step by step leading through all TQs. The path is meant to lead into the same final exam as the one for the apprenticeship scheme.

Initial qualification BKrFQG (CPC)

Initial qualification according to BKrFQG and therefore to obtain the driver CPC as required by EU directive 2003/59/EC can be obtained in three pathways:

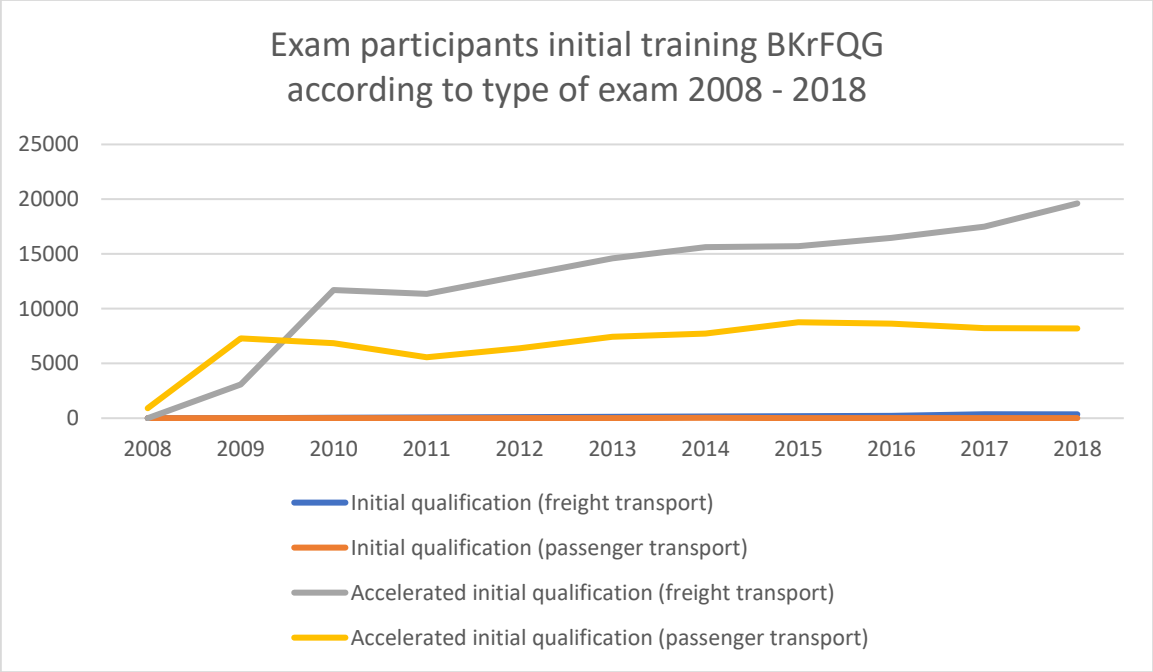
[6] See https://www.bibb.de/tools/dazubi/data/Z/B/30/52122010.pdf for further details.
[7] See also https://www.nachqualifizierung.de/tq/ and https://berufsabschluss.net/wp-content/uploads/2019/02/20181218_Protokoll_Fachgespr%C3%A4ch_Final.pdf for further information on partial qualifications.

(a) Initial qualification:
no training requirement, 240 minutes theoretical exam and driving exam 210 minutes
(b) Accelerated initial qualification:
140 teaching hours of 60 minutes theoretical training and a theoretical exam of 90 minutes
(c) Skilled worker certificate “Professional driver” (see above)
driver CPC is issued together with the skilled worker certificate “Professional driver”, graduates of the respective training schemes obtain the CPC automatically with their degree

Content of the training in pathway (a) refers to annex 1 of the Professional driver qualification regulation (Berufskraftfahrerqualifikationsverordnung, BKrFQV[8]) which covers the following topics / knowledge areas and equals annex 1 of EU directive 2003/59/EC:

- Improving rational driving behaviour on the basis of safety rules
- Application of provisions
- Health, traffic and environmental safety, services, logistics

Graphic 1 shows the progression of exam participants between 2008 and 2018. While the number of exam participants for the initial qualification did never exceed 354 (2018) for freight transport and 35 (2014) for passenger transport numbers for accelerated initial qualification for freight continuously increased over the years from 3.067 in 2009 to 19.615 in 2018. Similarly, also numbers in passenger transport increased up to 8.761 in 2015 but are slightly decreasing ever since.



Graphic 1: Exam participants initial qualification driver CPC training[9]

[8] https://www.gesetze-im-internet.de/bkrfqv/
[9] Source of data: https://www.dihk.de/branchen/verkehr/verkehrspruefungen/eu-berufskraftfahrer/ https://www.dihk.de/ressourcen/downloads/statistik-berufskraftfahrer-2018.pdf/at_download/file?mdate=1555502557091

Periodic training BKrFQG (CPC)

According to BKrFQG every professional driver has to follow 5 training modules each lasting 7 hours in a period of 5 years. The three areas of knowledge mentioned above (annex 1 of BKrFQV) need to be represented (but not covered) in the 5 modules followed by the individual driver. Besides this every training provider / employer is free to request accreditation for any kind of module by the regional authority. However, the majority of training providers seems to follow a fixed set of training modules either self-developed or provided by a publishing house. Table 1 shows samples of such modular offers by a selection of publishing houses and training providers.

Table 1: Modular structure of periodic training by sample provider

	Vogel Verlag (publishing house)	**Hendrisch Verlag** (publishing house)	**DEKRA Akademie GmbH** (training provider)	**Degener Verlag** (publishing house)
Freight	Eco-Fahren das Perfektionstraining	Wirtschaftliches Fahren	Wirtschaftlich Fahren	Kinematische Kette, Energie und Umwelt
Freight	Kontrollgeräte und Sozialvorschriften	Ladungssicherung	Vorschriften für den Güterverkehr	Ladungssicherung
Freight	Sicherheit im Fokus	Sozialvorschriften	Fahrsicherheit, Gefahrenlehre und Sicherheitstechnik	Sozialvorschriften
Freight	Der Kunde im Mittelpunkt	Recht und Dokumente	Fahrer und Image	Pannen, Unfälle, Notfälle und Kriminalität
Freight	Ladungssicherung optimieren	Sicherheit	Ladung sichern	Unternehmensbild und Marktordnung
Bus	Eco-Training alternative Antriebe	Wirtschaftliches Fahren	Eco-Training alternative Antriebe	Kinematische Kette, Energie und Umwelt
Bus	Lenk- und Ruhezeiten im Arbeitsalltag	Fahrgäste	Lenk- und Ruhezeiten im Arbeitsalltag	Sicherheit der Fahrgäste
Bus	Sicherheit für Fahrgast, Fahrer und Gepäck	Sozialvorschriften	Sicherheit für Fahrgast, Fahrer und Gepäck	Sozialvorschriften
Bus	Der Kunde im Mittelpunkt	Vorschriften	Der Kunde im Mittelpunkt	Pannen, Unfälle, Notfälle und Kriminalität
Bus	Stress vermeiden, Notfälle meistern	Sicherheit	Stress vermeiden, Notfälle meistern	Unternehmensbild und Marktordnung

Currently there are more than 1 Mio. driving licenses issued with a code 95 entry (driver CPC). Table 2 gives an overview when those driver CPCs need to be reissued / expire according to the 5-year periodic training cycle.

Table 2: Number of driver CPC holders in total and necessary renewals/ expiry of driver CPC per year[10]

Year	**Total**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Number	1.116.490	126.583	72.057	124.802	428.621	302.961	61.466

[10] Source: Kraftfahrt-Bundesamt, https://www.kba.de/DE/Statistik/Kraftfahrer/Fahrerlaubnisse/Berufskraftfahrer/fe_berufskraftfahrer_tabelle1.html;jsessionid=0904BC10B11CB3561AF79E4416F374DF.live11294?nn=1432998

Other continuous training offers

Besides the periodic training mentioned above a couple of training topics are regularly requested and offered for professional drivers. Those are for instance ADR training, load security according VDI, digital tachograph, mobile loading crane, swap body training and fork lifter operation for professional drivers (freight). For professional drivers (bus) training on providing support to passengers with reduced mobility, on telematic systems and communication with passengers are requested and offered.

Upgrading/ advanced training certificate "Certified senior motor traffic services specialist"

The formal education pathway for professional drivers foresees one additional career progression step leading to the certificate "Certified senior motor traffic services specialist" which has been referenced to level 6 of the DQR (equals level 6 EQR). There is no specific training programme attached to this certificate but an examination standard. However, a number of training providers offer related preparatory training to be followed prior to the exam. Holders of the "Certified senior motor traffic services specialist" certificate are expected to be able to[11]:

- Plan, control and supervise the use of vehicles and other operating resources in observance of technical, legal and economic requirements,
- Ensure the operational readiness of technical resources,
- Initiate and monitor the servicing of vehicles and other operating resources,
- Cooperate in the specification and procurement of technical systems,
- Control and monitor cost development and cooperate in area controlling,
- Participate in personnel planning and selection and ensure needs-based utilization of in-house and external manpower,
- Supervise staff and promote individual responsibility and professional development,
- Exercise responsibility for training,
- Encourage communication and cooperation,
- Cooperate in customer service; provide customer advice and promote customer satisfaction,
- Ensure compliance with regulations governing occupational safety, environmental and health protection and
- Implement quality objectives.

Formal qualification provided for professional drivers

As outlined above initial training for professional drivers is primarily provided in terms of the driver CPC and in the framework of the professional driver apprenticeship scheme in Germany. But both schemes need to be looked at from very different angles when it comes to their readiness to prepare drivers for future tasks.

[11] Source: Certificate Supplement "Certified senior motor traffic service specialist" https://www.bibb.de/tools/berufesuche/index.php/certificate_supplement/en/meister_kraftverkehr_e.pdf

Driver CPC

Due to its nature the driver CPC focusses on road safety in the first place and does therefore not have aspiration to ensure employability of drivers today or in the future[12]. The driver CPC therefore needs to be looked at from the perspective of road safety in the first place which has direct connections to some parts of the overall professional profile of the professional driver as described in the FutureDRV profile[13] (only). Especially when looking into technical innovations with regard to driving, the driver CPC and its underlying topics to be addressed in the training (should) play(s) a crucial role in the process to gain acceptance for but also competently handle driving assistance systems and related innovations aiming to increase road safety. Similarly, also for topics that are further ahead of current reality on German roads such as automation level 4, the driver CPC is and should be the first entry point in order to raise awareness, inform, train and gain acceptance of drivers already prior to the technologies' actual introduction in praxis. This also applies to innovative technologies that indirectly address road safety such as initiatives related to safe and secure truck parking in the framework of the ITS Action Plan[14] or innovations within load security or traffic infrastructure facilitating road safety.

There is unfortunately no information available to what extend driver CPC training in Germany indeed supports this kind of forward-looking approach besides fulfilling the fundamental requirements described in annex 1 of the EC Directive / the BKrFQV. This kind of approach would, however, be desirable especially in the context of the driver CPCs periodic training. The driver CPC, therefore, holds a lot of potential here to pave the way but also ensure safe introduction for/of innovations supporting road safety at small and larger scale and especially with regard to the human component fundamentally necessary to use those innovations full potential to increase road safety. A continuous revision and/or broad definition of the Directives/ Verordnung annex 1 in this regard therefore seems to be advisable to make use of this potential.

In the light of the FutureDRV results it seems, however, advisable to stress the high relevance and trend-setting character of this compulsory minimum qualification for professional drivers in Europe and in Germany in particular. Compared to the qualification schemes leading to the skilled worker certificate "Professional Driver" the driver CPC reflects a minimum qualification only. Although this needs to be considered a great improvement already compared to the previous situation of drivers usually working on the driving license only, the driver CPC is compared to the comprehensive skilled worker certificate "Professional Driver" a very low-level qualification only rather pointing towards a future low-skilled professional driver as outlined in the FutureDRV scenarios[15]. The FutureDRV results therefore only permit the conclusion that an increase in this minimum standard should be preferred to potential considerations of further reduction in order to address challenges related to the future of the transport industry and its driver workforce. Even though there might be current trends that rather suggest lowering of the entry requirements into the profession again under consideration of the current driver shortage the industry is suffering from.

[12] As shown in the ProfDRV project (www.project-profdrv.eu) the driver CPC is, however, to a certain extend perceived in Germany as alternative or even equivalent to the skilled worker (apprenticeship) qualification for professional drivers. It has therefore an ambivalent character at this point.
[13] See www.project-futuredrv.eu
[14] See https://ec.europa.eu/transport/themes/its/road/action_plan/intelligent-truck-parking_en.
[15] See www.project-futuredrv.eu

Skilled worker certificate “Professional Driver”

Contrary to the driver CPC, qualification schemes leading to the skilled worker certificate “Professional Driver” have the major intention to prepare learners for current and future requirements of their profession. It is therefore fundamentally important that curricula in this context clearly reflect not only current but also future professional requirements. The current training regulation in place for professional drivers in Germany dates back to 2001 (framework curriculum to 2000) and has been specified in two points in 2017: extending route planning based on maps by digital systems and specifying passenger services according to the special requirements of passengers with reduced mobility (see also the previous chapter of this case study for further information). This extension also reflects future requirements on professional drivers as described in the FutureDRV profile. In addition it should of course be assumed that training companies as well as vocational schools ensure the appropriate addressing of new technologies and trends in the curriculums framework adequately.

Taking this as given the FutureDRV results, however, suggest a reconsideration of the different topics weighting in the outline curriculum and in the learning fields. This applies especially to a reduced consideration of especially technical and maintenance related topics in favour of service/ customer orientation, operation of digital devices and digital skills in general as well as particularly for the field of professional driving (e.g. related to connected cars and related cyber threats) as well as the special characteristics and services related to concrete goods and transport orders. But also digital competence need to receive a high level of attention because of the continuously increasing level of digitisation of professional driving starting with the use of digital devices up to the need to understand functioning of cyber attacks when it comes to connected vehicles. All in all the FutureDRV results suggest a clear shift from a technical orientation of the professional driver profession towards a clear service oriented profession with a high level of digitisation which also needs to be reflected in the underlying curricula.

However, the FutureDRV scenarios clearly show a potential strong drifting apart of different profiles within the profession with regard to qualification requirements and in the course of further automation in the sector. This suggests a further differentiation of the profession in terms of specialisations/ modules building on a limited core profile of the professional driver that describes for instance minimum requirements on professionals in the field (see entry requirements in the FutureDRV profile) and adds additional qualification elements in terms of modules/ specialisations on top dependent on the selected profile. Such an approach to structure the overall profession would also pave the way for incorporating the trend to extend professional drivers tasks in future by adding services related to the transported good especially within short distance truck driving such as the installation of household appliances as it is already today the case. The FutureDRV research strongly underlined this trend and led to the conclusion that those add-on services will strongly influence the tasks and qualification requirements of/on professional drivers especially within short distance / last mile transport. Regardless to say that such a modular structuring of the professional driver qualification maybe even broadening the professions scope to other fields within and outside the transport sector can strongly support professional drivers employability as soon as autonomous driving level 5 comes into play that might lead thousands of drivers into unemployed with only limited

possibilities to build on their previously gained competences for an alternative career.[16] A modularised structuring of the professional driver profile that allows for specialisations in the overall field of professional driving but also with strong linkages to other professional fields can therefore be derived from the FutureDRV project as conclusion and recommendation for related qualification schemes.

Looking into the FutureDRV scenarios as described in the FuturDRV Exploration report also initiatives suggesting a decreasing of the qualification level of professional drivers (skilled worker certificate) into direction of the driver CPC only need to be looked at critically in this case studies context. In the light of todays shortage of professional drivers' it seems to be a logic solution to ask for and support qualification of drivers also below the skilled worker level. However, following the FutureDRV scenarios such a trend can have very undesirable consequences in future. While on the one hand such low-qualified drivers will not be able to fulfil competence requirements in high-skill scenarios that are especially likely within short distance (truck) and occasional services (bus) driving, low-qualified drivers are very likely to go into unemployment as soon as level 5 autonomous driving hits the road especially within long distance transport without sufficient qualification to build on in order to move smoothly into other professional fields. The FutureDRV results therefore underline the importance to take such future oriented aspects already today into consideration instead of focussing on the current situation only.

Lifelong learning of professional drivers

Lifelong learning of professional drivers is primarily based on the driver CPCs periodic training and other mandatory training needed to get permission for the performance of concrete job-related tasks such as ADR training to transport dangerous goods. Additional training beyond this scope is rather rarely available to and/or used by drivers which is also supported by the strongly SME-based structure of the transport industry and reflects a general lack of motivation towards learning within the professional driver workforce. Looking into the FutureDRV results, lifelong learning and particularly continuous vocational education and training will, however, be of crucial relevance for the transport industry in order to ensure employability of drivers in general and availability of the necessary competences to cope with the changes in qualification requirements that are related to the upcoming technical but also economical innovations such as higher levels of automated driving as well as additional services to be provided in future by drivers.

It is very unlikely that the periodic training according to BKrFQG will (alone) be able to provide the necessary framework in order to cope with those changes in the qualification requirements due to its focus on ensuring a minimum qualification of professional drivers related to road safety (see also considerations on potential future orientation of driver CPC periodic training above) and its general scope. Although there is of course also here a clear need to adjust periodic training contents continuously according to relevant changes (see also above). There is therefore a potential need for additional or extended qualification opportunities that allow drivers to upgrade their competences according to their particular field of work and alongside the introduction of technical innovations such as autonomous driving level 4 etc.! Components that need to be clearly highlighted here are among

[16] See also the Steer to Career project that focusses on this concrete question of using professional drivers competences in other fields of working after introduction of autonomous driving level 5, www.project-steertocareer.eu

others communication and customer service related skills as well as digital skills enabling drivers to handle digital tools and instruments that are playing a growing role in this regard but also cope with consequences of digitisation on driving such as connected cars.[17] The previously proposed modular approach to the overall qualification ideally also including qualification opportunities beyond the core tasks of professional drivers and oriented on the FutureDRV profile should be considered as a possible way to cope with this overall shift in the profession and address learners within initial training as well as experienced drivers to ensure their employability over time.

The introduction of additional training for professional drivers is of course strongly dependent on the availability of such training but also on the financing of such additional training. At this point solutions involving employers, education providers, public authorities as well as manufacturers in certain cases need to be explored in order to overcome such obstacles related to financing and providing training opportunities.

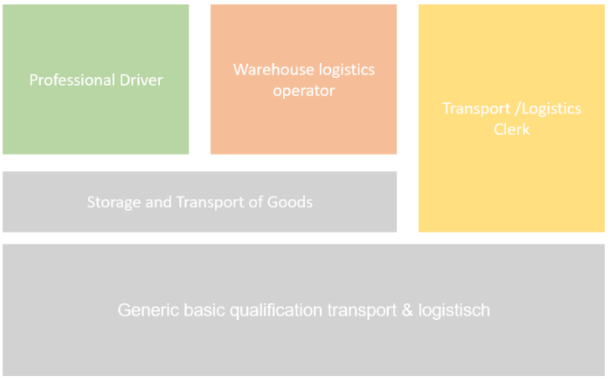
However, besides those factors also the overall learning culture within the field of professional driving needs to be taken into consideration at this point. So far the professional driver workforce rather needs to be considered as a difficult target group with regard to learning motivation and learning history which is also reflected in the rather negative perception of driver CPC periodic training. Any kind of learning offers provided to professional drivers should clearly take this challenge into consideration and address it with for instance innovative training methods integrating learning into work[18] through digital learning approaches or using other modern and potentially digital learning approaches such as the gamified learning solutions developed by the FutureDRV project for mobile use as well as use in classroom setting. This appears to be especially crucial when considering the different FutureDRV scenarios that in the final instance lead into the need to change into other career pathways in the light of automation level 5.

Correlation with neighbouring and other occupational fields

So far the skilled worker scheme “professional driver” has minor informal interrelations with other related professional qualifications within neighbouring occupational fields although of course links to related professions such as within warehouse logistics exist through the design of the overall curriculum and also the company-based training elements lead through neighbouring fields such as warehousing, mechanics, etc.. Asked about career prospects, drivers for instance often state warehouse jobs as potential career steps beyond driving. Career prospects into other fields are rather rare. The “Certified senior motor traffic services specialist” scheme being the next potential vertical career step for professional drivers within the formal education system has strong links into related commercial, technical and logistics qualifications/ occupations and allows drivers to move forward into neighbouring occupational fields such as dispatching or fleet management.

[17] See also the FutureDRV future learning survey results at www.project-futuredrv.eu.
[18] See also www.projekt-lasidig.info.

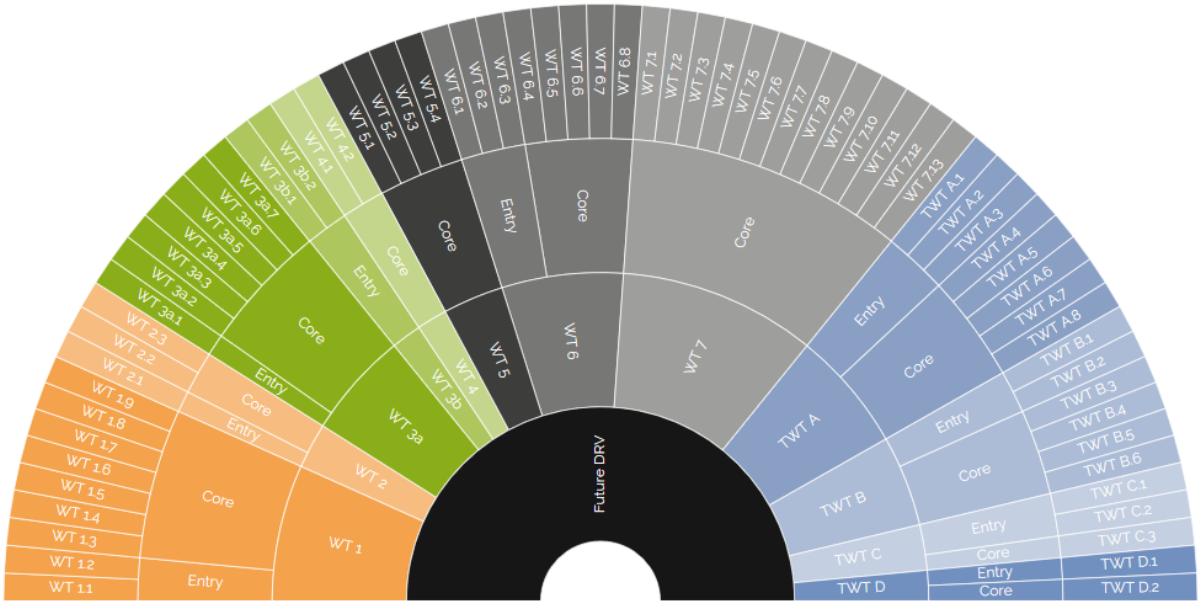
Under consideration of the potential future development in the field of professional driving it should be strongly considered to intensify those links and interfaces to other professions. This can for instance be done through a combination of the skilled worker qualification "Professional Driver" with other related occupational fields that share certain areas of work such as qualifications within warehouse logistics, commercial qualifications in the transport field or even technical or more service-related professions. In this way on the one hand professional drivers would become more flexible with regard to their career prospects beyond professional driving. This is especially essential when taking level 5 of vehicle automation into consideration and supports keeping of a sufficient qualification level among professional drivers enabling career prospects beyond professional driving. On the other hand a broader (modular) qualification offering specialisations into different fields could help to attract more young people into the profession because of better career prospects and also facilitate the integration of younger apprentices. Graphic 1 provides a rough and not yet further elaborated draft for such a model.



Graphic 1: Generic qualification model

Alternatively, but also complementary to this kind of model the FutureDRV profile suggests under consideration of the FutureDRV scenarios[19] and the potential future developments of the professional driver profession with implementation of automation level 4 driving especially on highways a strong modularisation of the professional driver qualification/ profile. This starts with an entry qualification containing the very basic competences necessary in order to enable a learner (which could serve as a future reference for the driver CPC as well) to accompany a level 4 truck or bus on the road and adds additional core qualifications according to the actual field of work of the driver. This approach allows a very strong specialisation within professional driving, moving to other fields within the profession through further qualification but also the connection with other related qualifications that share similar task and/or competence areas such as dispatching, warehousing, more technic or service oriented fields, etc.. It would therefore make professional drivers with regard to their qualification far more flexible as the case today and would make moving from and to other professions far easier as it is today the case but will be needed for professional drivers ones further automation of trucks and busses realises. This kind of qualification model seems, however, at the moment not integrable with the overall German vocational education and training system and would require major changes to be supported by all stakeholders in charge of vocational education and training in this field.

[19] See research report on the development of the FutureDRV profile at www.project-futuredrv.eu.



Graphic 2: FutureDRV profile divided by work areas and into entry and core requirements

"New Learning" within professional driver qualification

As the FutureDRV research work showed modern and especially digital learning formats are nearly not existing within professional driver qualification in Germany so far. This is primarily due to the legal framework that does not allow for the implementation of non-classroom-based learning within regulated training schemes such as the driver CPC or ADR training. However, also the previously conducted ICT-DRV survey[20] on technology-supported learning within professional driving raised major doubts especially from the side of VET providers but also employers if remote digital learning would meet the drivers needs with regard to learning. This primarily draws back to the assumption that the professional driver workforce has a rather low learning motivation and low self-directed learning competences and therefore needs trainer support in order to learn. The publicly funded project LaSiDig[21], that builds on promising results from the ICT-DRV[22] project, currently researches this topic by developing and testing a digital app-based learning platform for professional drivers integrating learning into practical work (tasks). The project results will be available in summer 2020.

So far the European Directive (2003/59/EC) limited periodic training to its implementation in regular classroom setting but since the Directives revision also in Germany discussion started on allowing e-learning in terms of learning outside the classroom. No decision has been taken so far with regard to permitting this kind of modern/ new learning formats in the Directives implementation. However, in the past especially questions like identification of learners within distance learning settings linked to the clear input-oriented specification of the Directive (specification of a concrete learning time to be

[20] See www.project-ictdrv.eu.
[21] www.projekt-lasidig.info
[22] www.project-ictdrv.eu

followed rather than learning outcomes to be achieved) have been pointed out as major hindering aspects which is certainly also in the current discussion one of the major aspects to be dealt with.

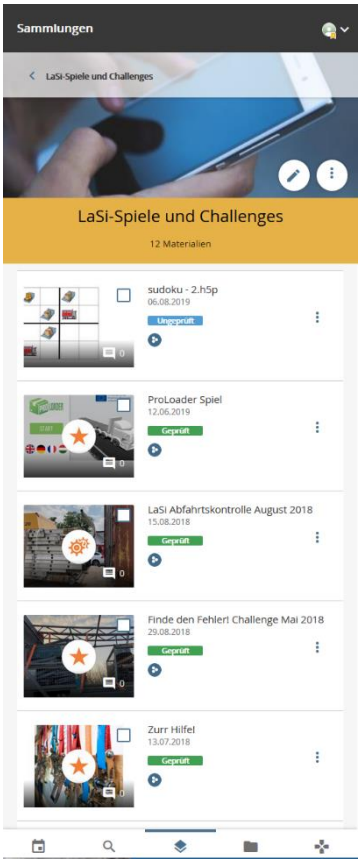
Considering that also during classroom training neither actual learning within the given timeframe nor the identity of the learner can be guaranteed, this should not hinder the implementation of modern learning formats outside the classroom. This is especially the case because modern digital learning formats implemented in learner centred and learning outcome oriented learning designs have the potential to make a major contribution to the target groups attitude towards learning. So far learning in the classroom especially on Saturdays after a whole week of work is very often considered to be rather a burden by professional drivers than a real enrichment for their professional self-understanding, their professionalism and their everyday work. Modern and innovative learning design making use of the opportunities provided by digitalisation can facilitate this so important shift in professional drivers' perception towards learning. This shift is so important because learning will become more and more important for professional drivers because their field of work is already today rapidly changing. It requires today and will even more in future require professional drivers to learn in order to remain employable but also to ensure technical innovations and all the assets it brings to road safety etc. can actually come into effect and do not fail due to the lack of competence of the humans having to deal with it.

Modern learning design at this point needs to take the work reality as well as the learning characteristics of professional drivers strongly into account. The ICT-DRV project has researched this and came up with a couple of recommendations what to take into account for this particular target group. It can therefore just be a logic and urgently necessary step to open up periodic training of professional drivers for the implementation of training also outside the classroom. This must of course entail requirements on clear and strict quality standards that especially take learning design components into the centre of attention such as consideration of learner characteristics in the learning design and clear orientation of the learning design on the learning outcomes to be achieved with the learning.

But „new learning" does not only concern learning taking place outside the classroom. Also classroom based learning can strongly benefit and increase sustainability of learning when "new learning" approaches are applied as it has for instance been shown with the FutureDRV learning solutions. Piloting experiences clearly showed that also in classroom settings new learning formats such as the digital game-based learning solutions by the FutureDRV project bring a totally new dimension to professional driver training. So far regular classroom-based training for professional drivers is dominated by a very trainer-oriented approach based on a pre-defined set of slides enriched by dialogue- and discussion-based elements in order to bring some variation into training day. In (rather rare) best practice examples praxis training elements such as the practical securing of an available load on a trailer or related simulations with load security training sets are implemented.

The FutureDRV learning solutions show in a very impressive way how learning motivation as well as learning itself can be intensified also in pure classroom-based learning settings. The ProLoader and ProComm pilot participants have been very quickly attracted by the new (digital) learning solutions and picked up the gamification and competition like character of the "games" very quickly. Although no actual measuring has taken place, the trainer feedback clearly suggests that the learning outcome after using those innovative training tools in the classroom was far higher than after approaching the games' topics with regularly applied training methods. Another examples of new learning technology in the classroom that showed promising results is for instance the augmented reality application Simpliquity[23] that also let to promising piloting results in classroom settings with professional drivers. An already widely used new learning technology for professional driver training is driving simulation in its different variations. Driving simulators are around for many years already[24] and today first efforts to simulate driving in virtual reality settings are entering the market. It can therefore be concluded that also classroom-based training should make use of "new learning" methods be it digital or analogues in order to make learning on the one hand more attractive and on the other more sustainable in terms of learning transfer into praxis.

Graphic 3: Screenshot ProLoader



Graphic 4: Screenshot of LaSiDig App

Also the learning solution survey implemented by FutureDRV unterlines such a trend towards digital learning solutions alone standing as well as in combination with praxis-oriented classroom settings. Simulation is given the highest importance here with regard to the upcoming 10 years, directly followed by mobile learning solutions such as apps, highly praxis oriented face-to-face learning and work-based learning approaches integrating learning into everyday work. Those trends are taken up by the BMBF-funded digital learning project LaSiDig[25] (see graphic 4) developing and testing an app-based learning solution that integrates learning into the process of work with results being expected for summer 2020.

All those considerations on new learning within professional driver qualification does of course not only apply to periodic training in the driver CPC context but equally also to initial qualification and non-regulated continuous vocational training offers. Vocational education providers but also employers, social partners and legislation are here in duty to make major efforts in order to initiate and implement

[23] See www.sipmpliquity.com.
[24] See also the contribution by Bart Kappé on the future of simulator-supported learning in the ICT-DRV project and conference proceedings at https://project-ictdrv.eu/index.php?id=88
[25] See www.projekt-lasidig.info.

a very clear shift towards new learning within professional driver qualification as a major indispensable milestone into the future of professional driver qualification.

Teachers, trainers and tutors within professional driver qualification

Experience and research show that teachers, trainers and tutors are one of the major factors when it comes to the implementation of quality training but also when it comes to innovating training. Research activities in the ICT-DRV as well as in the FutureDRV project showed over and over again a reluctance from the side of trainers towards new learning methodology and especially technology. But there is a clear positive trend to be recognisable in the observations made within the ICT-DRV project between 2012 and 2015 and within the FutureDRV project between 2016 and 2019. In both projects researchers have been continuously and intensively in touch with different CVET trainers in the field of professional driving from all across Germany and over the 7 years in question trainers attitude clearly changed from clear rejection of alternative modern training methods and tools for classroom as well as self-directed learning of drivers to an attitude that rather shows insecurity in the handling of such new methods and tools within classroom settings as well as in blended learning settings. Also a strong curiosity towards digital learning tools such as the LaSiDig app and the FutureDRV learning solutions is observable among trainers who have been confronted with the learning tools in the scope of both projects.

These observations hint towards a major information and training need among professional driver trainers with regard to their own media competence as well as with regard to the handling of digital training tools in the classroom. Therefore, initiatives that have already put in place at project level to close this gap are responding to a clear need for the integration of digital learning elements into training. Especially vocational education and training providers are in the duty now to take the next step and equip their trainers with the necessary tools but also competences to deal with digital training solutions in the classroom and in blended learning setting. This requires a clear shift in attitude amongst trainers from being previously the experts in their field toward becoming facilitators of learning in the classroom and beyond.

But nevertheless, also the training contents play a major role in the qualification of trainers. As said above already especially driver CPC periodic training can and should become an enabler of innovation within professional driving. This of course implies that especially those trainers providing training in this area should not only have a very good understanding of the current situation but should be a step ahead of time with regard to their subject-matter expertise. The recently implemented further education duty for CPC trainers is therefore an important step into this direction. It would, however, be advisable to add here although digital and methodical training competence to the areas of further training to be attended by professional driver trainers within driver CPC training.

Validation of learning and career beyond driving

Even though the current labour market situation for professional drivers is characterised by a massive shortage of (professional) drivers in Germany, this can rapidly change once level 4 or even level 5 of autonomous driving hit the road. With this being already on the horizon it will be of fundamental importance that drivers have a sufficient level of competence and can also proof it in order to move on to other professional fields beyond driving. Although today – thanks to the driver CPC - professional driving cannot be taken up purely based on the driving license as the only qualification needed, the lack of a skilled worker qualification can under such circumstances lead into a dead end for those having worked as professional drivers over many years and therefore gained a lot of competences on the job that cannot be proven so far.

The German education system primarily knows (besides a number of other new initiatives in this field) the external examination in order to receive recognition for competences gained outside the formal education system in a concrete profession. However, the attendance and passing of this examination can be a very high hurdle if the identification and documentation of competences is primarily concerned. New and innovative methods and approaches are needed at this point in order to cope with future challenges not only in the field of professional driving.

Although such a situation seems very far away (potential) solutions should be found and gotten on their way already today. Potential solutions aiming to overcome a decreasing competence level of professional drivers that will challenge the moving into other professions beyond driving have been outlined above. But especially because the share of formally qualified professional drivers (skilled worker qualification) remains low, there might be a need in future to also identify, document and recognise professional drivers' competences in order to move based on these informally gained competences into other professional fields. The German vocational education and training system is not ready for this yet although initiatives are of course under way on this topic but the discussion on how to deal with such challenges resulting from increasing automation of processes and tasks especially in the field of professional driving should be taken up in the near future in order to have the necessary measures in place when needed.

Summary

As outlined already above todays labour market for professional drivers is remarkably challenged by a shortage of drivers which already today jeopardises the transport industry and therefore a crucial part of our economy. It is therefore of major importance to find solutions in order to on the one hand attract more young people (as well as job changers) into the profession and on the other hand ensure there employability in a rapidly changing professional field that might lead at a certain point into the replacement of professional drivers by autonomous vehicles. Potential solution approaches have been drafted above with regard to broader initial qualifications, possibilities to specialise within specific fields of professional driving through modularisation of the profession, introduction of forward-looking CPC periodic training as well as modern learning methods and technologies into professional driver training to foster an improved learning culture within the professional driver workforce in Germany.

Nevertheless, the current threatening shortage of professional drivers more and more often leads to calls for even lower (entry level) qualification requirements for drivers. Language barriers need to be overcome in order to reach drivers having migrated / recruited from other countries and more and more drivers leave the profession because working conditions are better in other fields and jobs are available due to the generally increasing shortage of workforce. All this makes it difficult to find solutions that at the same time correspond to the current situation but also take into consideration the future ahead that has been described by the FutureDRV consortium in their extreme scenarios. Although the actual future will most likely be somewhere in between those extreme scenarios that have been researched within the project, a clear need for action can be derived from the research results.

Here of course the *government* is in demand to give direction and give a clear forward-looking message to the industry and to professional driver workforce. Forward-looking should in this particular case clearly mean to drive innovation within qualification of professional drivers in all areas concerned (contents, structure, methodology). Only in this way it will be possible to ensure the necessary qualification level of drivers in order to keep track of technological innovations within road and passenger transport as well as ensure drivers employability also beyond level 4 of autonomous driving. This includes first and foremost the fostering of a real learning culture among the professional driver workforce through meaningful and innovative training (pathways) offered to professional drivers at all stages of their career. This applies equally to driver CPC training as well as to formal initial qualification and fostering of continuous training of drivers within and beyond the framework of the driver CPC.

Employers have a key role here of course as well. So far the strongly by SMEs dominated road transport industry in Germany has investigated into training and retention of professional drivers rather moderately. Widely it has been taken for granted that professional driving is a job that can be done without initial or further training. The driver CPC has given a clear disapproval of this approach although its set-up and implementation has still room for a lot of improvement to become a real game-changer for the industry and road safety in this regard. However, it is on the transport industries' employers to make a significant contribution to professional drivers continuous learning in order to keep up with the rapidly changing competence requirements. This requires certainly in many cases in the first place a change of mind and attitude with regard to the level of competence really required by professional drivers in order to perform a job that is characterised by a clear trend towards digitisation and service-orientation. Related to this is of course also the will to invest into the initial and continuous training and retention of professional drivers who will for the time being still remain to be key factors of the value creation in transport.

All of this will, however, only be possible if supported by *drivers, their representing workers councils and unions*. Only if they see the whole picture of todays needs on the one hand and future developments (threats and opportunities) on the other, measures as described above can actually unfold their potential. This includes a proactive approach towards the changes ahead of the transport industry due to autonomous driving and other innovations and the call for appropriate measures to ensure drivers employability at all stages of those future developments. The FutureDRV results make an effort in order to give direction in this regard and allow all parties involved to have a look into the future of professional driving in order to prepare themselves for potential future scenarios.

Last but clearly not least it is on *vocational education providers* (vocational schools and private continuous training providers equally) to contribute to shaping the future of professional driver qualification within the framework given to them by the stakeholders addressed above. Content wise the FutureDRV profile and further results give some indications on what future training of professional drivers needs to focus on content wise. Digitisation and service-orientation are leading topics here that require further attention than the case today already. It is up to vocational education and training providers to strengthen those components within their curricula and training offers for professional drivers (within the given legal framework). However, the core competence of education providers is of course the provision of high-quality training. At this point the continuous introduction and implementation of innovative (digital) training methods with a high level of quality in order to meet the drivers needs and characteristics plays a crucial role here as outlined above. Although also here the legal framework still gives limitations at this point, also within the given framework innovations are possible (as described above) in order to make training more attractive and sustainable for professional drivers.

Finally, it will need to be a joined effort by all stakeholders concerned to lead professional driver qualification and therefore also the professional driver workforce into a sustainable and learner-oriented future. The FutureDRV research and development results intend to provide at this point initial guidance and orientation for decision making and steps to be taken. Each of the stakeholders has its own field of responsibility in this effort and a relevant share to contribute to prepare professional drivers for their role within the fourth industrial revolution and its innovations within road transport.