



# Educate for future

## EDU4future

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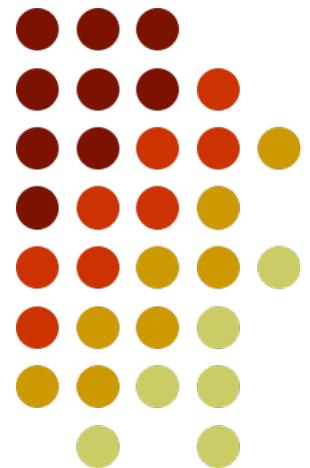
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October 2021)

# COUNTRY REPORT

**HOW ARE INDUSTRY 4.0 REQUIREMENTS IMPLEMENTED  
IN THE VOCATIONAL EDUCATION AND TRAINING SYSTEM OF  
YOUR REGION AND/OR COUNTRY?**





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# Country Report

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Please identify the author(s) and association of this Country Report:

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Please identify your country (and/or region):

Germany

Please identify your applicable industry sector(s) by providing the NACE (Nomenclature of Economic Activities) Code(s). For details, please check: <https://nacev2.com/en>:

(A), (B), C-J (similar developments in sectors A and B are more commonly referred to as “agriculture 4.0” and “mining 4.0” and are not considered in this report)

*Please note: This report focuses on the implementation of industry 4.0 requirements into the VET/education system. From a VET perspective, the concept of ‘occupations’ is more relevant than industry sectors, because electricians, mechanists etc. can work in various sectors. All of the workers relevant to industry 4.0 are trained in the dual VET system and the processes described in this report do not differ between the sectors mentioned above.*

You can add additional columns and answer options to provide sector-specific responses.

## 1 VET System in Germany

Which of these options best describe the VET system in your country (C) and specific to your sector(s) [INSERT applicable NACE code(s)]?

	C	C-J <sup>1</sup>
dual system or very similar	✓	✓
mostly school-based	✓ <sup>2</sup>	○
mostly work-based	○	○
differs greatly between sectors	✓	○
differs greatly between occupations	✓	○
other [insert here]	○	○

<sup>1</sup> Sectors identified as relevant for industry 4.0.

<sup>2</sup> There is a small number of VET courses, which are mostly school-based and have a smaller work-based learning component; thus these cannot be considered part of the “classic” dual system. However, the majority of VET (not just VET related to Industry 4.0) in Germany is organised in the dual system set-up.



Please provide an estimate on the approximate ratio between work- and school-based learning in the VET system of your country generally and your sector (if applicable).

	C-J
work-based learning	70 %
school-based learning	30 %
	100%

Which types of vocational schools exist to train workers in the industry sector in your country? Please provide detailed information for each type of vocational school in the following table (please copy and paste the table for further entries).

**Berufsschule, Berufsausbildung (i.e. apprenticeship):**

Training for occupation of following NACE sector(s):	C-J
Ratio between work- and school-based learning:	70/30
Initial or further education:	initial education
EQF Level of school-leaving qualification:	4
Entry requirements:	each company decides which qualifications a candidate needs; generally minimum 10 year school certificate is expected
Additional information:	The same level vocational education (training for a particular occupation - "Beruf") can be gained in shorter retraining courses covering the same technical learning contents (limited general contents) for people with work experience. These generally have varied work-based learning requirements.

Is VET regulated by law in your country?

yes	<input checked="" type="checkbox"/>
no	<input type="checkbox"/>

If applicable, provide details regarding the law(s) in place to regulate VET in your country and/or sector(s). Which aspects of VET are regulated?

"The German Vocational Training Act (Berufsbildungsgesetz [BBiG]) and the German Crafts and Trades Regulation Code (Handwerksordnung [HwO]) form the legal framework for the development of the German TVET system." (BIBB 2021b)

This law regulates:



- Who is eligible to provide vocational training and how do these institutions need to cooperate?
- What does a suitable training company look like?
- What defines a suitable trainer (personal and technical qualification)?
- Which occupations are recognised?
- What rights and obligations do trainees have?
- What is the procedure for exams?

“All parties involved act consensus-oriented according this framework. These two instruments [BBiG and HwO] set out fundamental standards for the company-based part of dual VET, including creation of the general conditions that apply to aspects such as vocational training and the examination system. The central element within the system is the training regulation prescribed by the BBiG/HwO. These are enacted for every state recognised training occupation by the relevant ministry responsible.

The training regulations have a central role in the Vocational Training Act. They form the framework for regulating the occupations. A training regulation regulates (article 5 paragraph 1 BBiG)

- the designation of the training occupation,
- the duration of the training – which shall be not less than two and not more than three years,
- the description of the training occupation – the typical “skills, knowledge and capabilities” of the profession in summary form,
- the framework training curriculum – a guide to how the teaching of skills, knowledge and capabilities is to be structured in terms of content and time,
- the examination requirements.

These provisions describe the minimum requirements for a modern course of training. They define the standards, i.e. the currently indispensable skills, knowledge and capabilities of a qualified specialist, as well the scope of his or her practical activity in order to be able to integrate additional qualifications as well as hitherto unforeseeable future developments in education and training.

The Board of the Federal Institute for Vocational Education and Training (BIBB) is the advisory board for the central government in all issues relating to vocational education and training.” (BIBB 2021b)

The school-based training falls under the responsibility of the Länder and their respective ministries of education. This includes the definition of the training content as well as teacher qualifications.

The number of regulated (state-recognised) vocational occupations has decreased from 606 in 1971 to 324 in 2020 (Statista 2021).

For further reading see: BIBB (2011)

### 1.1 *Workers’ competences needed for the Industry 4.0 work environment*

Workers need particular competences to succeed in the Industry 4.0 work environment. It is useful to organise competences into four overarching competency levels: technical skills, data and IT skills, social competence and personal skills. In a comparative analysis of 26 studies and research reports key



competences of relevance for Industry 4.0 were identified (see Schmid 2017). These are used in the following section as a basis for the questions. Regarding the occupation-specific competences, you can use the ESCO<sup>3</sup> classification of occupations for support.

**Technical competences** are all those skills that relate to basic and specialist knowledge from a particular discipline, sector or job profile (e.g. understanding of processes, production system knowledge, process management, quality assurance).

Related to your sector(s), which specific technical competences have been identified as particularly relevant to Industry 4.0?

General technical competences (please identify general technical competences, relevant to all occupations).

On a general level, the following technical competences have been identified as relevant to Industry 4.0 in a meta-analysis by Schmid (2017):

- process knowledge and responsibility, understanding production processes
- system knowledge and understanding
- ability to intervene in the event of incidents and problems
- monitoring and maintaining connected systems
- set-up, control and monitoring of complex systems
- communication with machines and interconnected systems
- operate and evaluate dashboards of cyber-physical systems and perform corrective measures
- process management
- process responsibility
- make decisions based on data
- quality assurance
- understanding of logistics requirements and delivery conditions
- interdisciplinary development of production systems

The extent to which these are relevant for specific occupations may vary.

Occupation-specific technical competences (please clearly identify these in relation to specific occupational profiles).

For example, for IT occupations, the following common, inter-professional skills, knowledge and competences ("Core qualifications") have been defined. They comprise 50 % of the content and are interlinked with the qualifications and to be taught over the entire training period:

- providing the services and completing the order.
- implement, integrate and check measures for IT security and data protection,
- implementing and documenting quality assurance measures
- developing, creating and maintaining IT solutions,
- assessing standard IT systems and customer-specific solutions,
- informing and advising customers.
- planning, preparing and carrying out work tasks in coordination with the customer-specific business and service processes.

<sup>3</sup> For more details see: [ESCO classification of occupations](#).



For the different IT occupations, the following technical competences were identified:

IT Systems Electrician:

- installing, configuring and repairing IT devices and IT systems
- connect IT systems and devices to the power supply, check electrical safety

IT Specialist for System Integration:

- plan, install and administer connected IT systems

IT Specialist for Application Development:

- developing software applications, quality assurance

IT Specialist for Data and Process Analysis

- develop and optimise data-based IT solutions for digital production and business processes

IT specialist for Digital Networking

- set up, optimise and operate the network infrastructure in cyber-physical systems

Salesman for Digitalisation Management

- analyse, develop and implement digital business processes

Salesman for IT System Management

- marketing and sales of IT services (hardware/software/services)

For other occupations such as electricians, a greater focus on system knowledge and understanding is considered crucial (see chapter 4.1).

**Data and IT competences** are all types of knowledge and skills that relate to data collection, analysis and protection as well as the monitoring, usage and maintenance of data-based systems (e.g. documentation, cloud-computing, use of analysis and digital tools, programming, software development, artificial intelligence, 3D printing, IT support, user experience design).

Related to your sector(s), which specific data and IT competences have been identified as particularly relevant to Industry 4.0?

General Data and IT competences (please identify general technical competences, relevant to all occupations).

- create order-related and technical documents with the aid of standard software
- maintain, exchange, save and archive data and documents
- enter, process, transmit, receive and analyse data
- use assistance, simulation, diagnostic or visualisation systems
- take into account the information technology protection goals of availability, integrity, confidentiality and authenticity.
- comply with company guidelines on the use of data carriers, electronic mail, IT systems and Internet sites.
- cloud computing



Occupation-specific Data and IT competences (please clearly identify these in relation to specific occupational profiles).

- apply IT safety regulations and data protection regulations
- identify anomalies and irregularities in IT systems and take measures to eliminate them.
- programming, software development
- artificial intelligence, algorithms
- 3d-printing
- collaboration software
- IT-supported troubleshooting

**Social competences** are all those skills that relate to communication and collaboration activities (e.g. interdisciplinary and intercultural collaboration, translation and transfer competences, user oriented engagement, motivate innovation and performance).

Related to your sector(s), which specific social competences have been identified as particularly relevant to Industry 4.0?

General social competences (please identify general social competences, relevant to all occupations).

- Cooperation / collaboration, teamwork and cooperation skills
- Communicative competences
- Interdisciplinary cooperation
- Intercultural competences
- Translation and mediation skills
- Participation in problem-solving and optimisation processes (Schmid 2017)

Occupation-specific social competences (please clearly identify these in relation to specific occupational profiles).

- management and leadership skills
- encouraging innovation, loyalty and performance

(Schmid 2017)

Based on the feedback of our external experts, these competences are generally cross-sectoral and cross-occupational.

**Personal competences** are all types of knowledge and skills related to personal dispositions and capacities (e.g. willingness for continuous improvement and lifelong learning; holistic, analytical and creative thinking; problem-solving; self-guided learning, recognition of transferable skills; tolerance of ambiguity; flexible).

Related to your sector(s), which specific personal competences have been identified as particularly relevant to Industry 4.0?



General personal competences (please identify general personal competences, relevant to all occupations).

- Continuous, lifelong self-directed learning / willingness to learn
  - Analytical thinking / skills / approach
  - Interdisciplinary thinking and acting / problem solving
  - Creative thinking and working
  - Self-organisation / management
  - Systemic thinking
  - Holistic thinking
  - Ability / willingness to innovate
  - Dealing with complexity
  - Transferability of competences
  - Reaction speed
  - Methodological skills
  - Dealing with unpredictable situations
  - Resilience in stressful situations
  - Bringing together different disciplines and mediation
  - Mobility
  - Tolerance of ambiguity
  - Flexibility
- (Schmid 2017)

Occupation-specific personal competences (please clearly identify these in relation to specific occupational profiles).

Based on the feedback of our external experts, these competences are generally cross-sectoral and cross-occupational.

## 1.2 Labour market requirements

This section is dedicated to collecting content related to labour market requirements on a general (European or even global) and country-specific or regional level.

If applicable, what labour market requirements related to Industry 4.0 have generally been identified **in your country / region?**

There are numerous publications detailing the specific competences or competence profiles needed in the job market; these are usually updated regularly (e.g. BIBB 2021c). Also the German Agentur für Arbeit (2021) provides current statistical data sets on staff shortages on their website:

<https://statistik.arbeitsagentur.de/DE/Navigation/Statistiken/Fachstatistiken/Gemeldete-Arbeitsstellen/Webanwendung-Nav.html>

Above all, the labour market in Germany related to Industry 4.0 requires skilled workers in the manufacturing sector, particularly metal and electrical industry (BMW 2019).

This draws attention to the question of how to best train those “skilled workers”, integrating vocational and academic education and assuring permeability. According to the Federation of Hessian Business Associations, Germany’s situation is somewhat different to that of other OECD countries. The comparably low study rate can be explained with Germany’s vocational education and training, which is anchored in law and closely linked



to the labour market through cooperative regulation by the social parties. Its degrees are subject to national standardisation. The VET system assigns its graduates to occupations that require academic degrees in other OECD countries. The relatively low study rates in Germany - and in some other European countries, such as Austria and German-speaking Switzerland - are related to the fact that the vocational training sector in Germany prepares people for very demanding occupations for which bachelor's degrees predominate in other OECD countries. For a new orientation in the education system occupational profiles such as mechatronics technician or financial services occupations can be found in other countries are reflected in skills profiles at the bachelor's level of a degree programme. (see VHU 2018, 99p)

Forecasts on the demand for skilled workers generally confirm the need for higher-level qualifications. The trend towards academisation and the increasing demands in dual vocational education and training therefore have a very real background despite considerable negative effects.

However, demand forecasts and actual developments such as the rapidly increasing share of dual study programmes also indicate that the labour market increasingly requires hybrid qualifications that combine both theoretical knowledge and the ability to implement it in practice. The Council of Science and Humanities summarises its analysis of future skilled labour needs as follows:

Translated from the original (WR 2014, 44): There is an increasing demand for skilled workers who have acquired both practical skills and in-depth knowledge of production and work processes, as well as the scientific and reflective competences to be able to contribute to innovations. People with such a profile are particularly flexible in adapting to new technologies.”

Translated from the original (VHU 2018, 112): The separation between vocational and academic qualifications is dysfunctional for the labour market. The education system favours - in the abstract - higher qualification levels, but not the educational careers that are most likely to provide the profiles urgently needed in the future. It leads more and more young people into the labour market via full-time schooling into academic training programmes that integrate practical experience only to a limited extent. This tends to marginalise the dual training system, which implements this integration of theory and practice in an ideal form.

Translated from the original (VHU 2018, 112): From an individual and economic perspective, the high dropout rates in higher education mean considerable misinvestment. The system therefore only provides the required qualifications to a limited extent and tends to prolong the duration of training. With declining numbers of career entrants, on the other hand, it is necessary to exploit the full potential at all times, to integrate new entrants into the labour market as early as possible and to keep the qualifications up to date keep qualifications up to date throughout their working lives.

### 1.3 Fair opportunities

This section provides space for descriptions of changes and/or trends in the labour market regarding the provision of fair opportunities and their relevance for Industry 4.0.

If applicable, which types of programmes have there been in the last 5-7 years that deal with the gender gap or changing demographics (particular focus on age) in relation to Industry 4.0?



Name of the programme:	Frauen in MINT Berufen (Women in STEM), since 2011
Initiator/creator of the programme:	Ministry of Economic Affairs, Labour and Tourism Baden-Württemberg
Which sector does the programme come from?	STEM
How does it address Industry 4.0 or relevant competences?	State initiative facilitating an alliance of 30+ local industry partners helping girls and young women find their way into STEM professions and supporting them at every stage of their careers. Various smaller programs and initiatives are connected, e.g.: networking events, STEM in kindergarten & school, girls digital camps, job coaching, mentoring programs for university and VET, summer schools.
Transfer potential of the GP:	high
What are the results achieved by or recommendations of this programme?	<p>An annual joint action programme creates a basis for advancing women in STEM bundles numerous individual measures and connects relevant actors in the field. Overall, slightly positive trend in STEM education and employment of women. Still challenges identified, particularly with regard to developing occupational aspirations, the compatibility of work and family life, professional career development and career opportunities for women. Also particular need for action in VET sector (e.g. IT) where more substantial structural interventions are needed to break with gender stereotypes.</p> <p>Recommendations:</p> <ul style="list-style-type: none"> <li>● Girls and women are more interested in the social and not only the functional references of technology. STEM learning content should therefore be more closely related to everyday life and the world in which we live.</li> <li>● Strengthen STEM profiles in schools.</li> <li>● Increase number of initiatives like Girls' Days and Girls' Digital Camps; increase female role models.</li> <li>● Adjust occupational profiles and work structures.</li> <li>● Facilitate migrant women (with STEM occupations) better access to the German labour market.</li> </ul>



	<ul style="list-style-type: none"> <li>Increased and ongoing exchange and networking on regional and state level.</li> </ul> <p>(Ministerium für Wirtschaft, Arbeit und Wohnungsbau Baden-Württemberg, 2020)</p>
Link (website, where to find more information):	<a href="https://www.mint-frauen-bw.de/">https://www.mint-frauen-bw.de/</a>
Additional information:	-
Name of the programme:	Girls' Day
Initiator/creator of the programme:	Joint initiative launched by the Federal Ministry of Education and Research, the Federal Ministry for Family Affairs, Senior Citizens, Women and Youth, Initiative D21, the Federal Employment Agency, the Confederation of German Trade Unions, the Confederation of German Employers' Associations, the Association of German Chambers of Industry and Commerce, the Central Association of German Skilled Crafts and the Federation of German Industries
Which sector does the programme come from?	Cross-sectoral
How does it address Industry 4.0 or relevant competences?	Girls' Day is a yearly event with the aim to motivate girls and women to take up technical and scientific professions. It is intended to raise the proportion of female employees in so-called "male professions" and to reduce a shortage of skilled workers in industry that is assumed or predicted for the future.
Transfer potential of the GP:	high
What are the results achieved by or recommendations of this programme?	<p>Girls are for the most part very motivated and interested on Girls' Day. This is especially true for girls between the ages of ten and twelve.</p> <p>The experience of the action day increases the openness of the participants for the professions, that they have learned about.</p> <p>Girls' Day broadens the spectrum of career choices and supports career and study orientation. The positive effects of the action days can be sustainably strengthened by schools and companies (retention marketing).</p>



	<p>Girls' Day functions for the participating companies and institutions as an instrument for public relations and securing young talent. The following applies: The better the campaign days are integrated into a systematic strategy for recruiting young people and are carried out regularly, the more efficient they are.</p> <p>(Kompetenzzentrum Technik-Diversity-Chancengleichheit e. V. 2019)</p>
Link (website, where to find more information):	<a href="https://www.girls-day.de">https://www.girls-day.de</a>
Additional information:	There's also a Boy's Day ( <a href="https://www.boys-day.de/">https://www.boys-day.de/</a> )
Name of the programme:	Komm, mach MINT
Initiator/creator of the programme:	Kompetenzzentrum Technik-Diversity-Chancengleichheit e. V. (kompetenzz)
Which sector does the programme come from?	Cross-sectoral
How does it address Industry 4.0 or relevant competences?	<p>The National Pact for Women in STEM Professions "Komm, mach MINT" is a nationwide network initiative that inspires girls and women to take up STEM courses of study and professions.</p> <p>It connects more than 370 partners from politics, business, science, social partners, media and associations and translate the dialogue on the topic of women and STEM into innovative measures.</p> <p>High school and university students can find information on studies or careers in the STEM professions. Teachers and parents can find information on how to support girls and women in their career choices and businesses can find information on how to address future (female) employees.</p>
Transfer potential of the GP:	High
What are the results achieved by or recommendations of this programme?	The initiative connects over 370 partners and organises regular events across Germany.
Link (website, where to find more information):	<a href="https://www.komm-mach-mint.de">https://www.komm-mach-mint.de</a>



Additional information:	Dominant focus on Higher Education
Name of the programme:	Women Ressource [sic!] 4.0 (Research project)
Initiator/creator of the programme:	Fachhochschule Bielefeld (funded by Federal Ministry of Education and Research)
Which sector does the programme come from?	Cross-sectoral
How does it address Industry 4.0 or relevant competences?	<p>The overall objective of the Women Resource 4.0 project is to better exploit the potential of qualified STEM women, with and without an immigrant background, for shaping digitalisation and Industry 4.0 in companies and organisations.</p> <p>The following sub-objectives are to be achieved:</p> <ul style="list-style-type: none"> <li>• Motivation of young migrant and non-migrant women to engage in occupational fields of the new High-Tech Strategy (digitalisation and Industry 4.0),</li> <li>• Raising awareness, preparing and training (prospective) female STEM graduates for the tasks in digitisation and Industry 4.0,</li> <li>• Supporting a successful transition of women/immigrant women academically qualified in STEM subjects into the primary labour market, especially in companies involved in Industry 4.0,</li> <li>• Sensitising HR managers and executives in companies and organisations to the broader participation of women/migrants in shaping digitalisation,</li> <li>• sustainable networking of female STEM students, career starters and young professionals with successful STEM career women and executives in (regional) companies and associations,</li> </ul> <p>Communication and transfer of research results on special competences and the added value of women/migrants as shapers of digitalisation and Industry 4.0 to the economy, science and the general public.</p>
Transfer potential of the GP:	good (focus on practical parts like workshops of the project, undertaking the entire research analysis again, may not be necessary / feasible)



What are the results achieved by or recommendations of this programme?	Main finding: Industry 4.0 will require new type of leadership and organisational structures. By approaching issues and dealing with challenges differently than men, women enrich the diversity of opinion at the top management level and the search for successful problem-solving strategies. Women involve the operational level more in developing solutions and making decisions. (FH Bielefeld, 2020)
Link (website, where to find more information):	<a href="https://www.fh-bielefeld.de/wirtschaft/forschung/denkfabrik-digitalisierte-arbeitswelt/women-ressource-4-0">https://www.fh-bielefeld.de/wirtschaft/forschung/denkfabrik-digitalisierte-arbeitswelt/women-ressource-4-0</a>
Additional information:	-
Name of the programme:	Klischeefrei – Initiative zur Berufs- und Studienwahl
Initiator/creator of the programme:	Federal Institute for Vocational Education and Training
Which sector does the programme come from?	Cross-sectoral
How does it address Industry 4.0 or relevant competences?	<p>“Stereotype-free career and study options pursue the following goals:</p> <ul style="list-style-type: none"> <li>• Expanding the range of career and study options regardless of gender attributes,</li> <li>• Supporting career and study options based on individual strengths and interests,</li> <li>• Equal opportunities for entry-level careers, Identifying ways in which career goals can be achieved in the long term,</li> <li>• Providing information on the perspectives from occupations and sectors, in particular perspectives on working hours, the balance between work and home life, earning possibilities, career options and future options,</li> <li>• Considering the importance of gender, different life situations and individual interests as a universal principle, e.g. in the planning, implementation and evaluation of vocational orientation events,</li> <li>• counselling and company job vacancies, without further consolidating gender stereotypes.”</li> </ul> <p>(Klischeefrei 2020)</p>
Transfer potential of the GP:	High



What are the results achieved by or recommendations of this programme?	<p>Recommendations, amongst others include:</p> <ul style="list-style-type: none"> <li>• “Further development of instructions, documents, materials and media, including a stereotype-free presentation of careers through imagery and language.</li> <li>• Making examples of successful practice prominently accessible and rewarding them with the appropriately developed quality seals.</li> <li>• Including the promotion of individual potential in the political discourse surrounding career and study options and in the design of policies.”</li> </ul> <p>(Klischeefrei 2020)</p>
Link (website, where to find more information):	<a href="https://www.klischeefrei.de/de/klischeefrei_92804.php">https://www.klischeefrei.de/de/klischeefrei_92804.php</a>
Additional information:	-

## 2 Actors involved in VET reform processes

### 2.1 Decision-making bodies

Rank these decision-making bodies according to level of responsibility in the processes of transferring Industry 4.0 competences to the VET sector? (1 = most involved, x = not involved at all)

<b>Federal Government / Federal Ministry of Education and Research (BMBF)</b>	<b>1</b>
<b>ministry of economy</b>	<b>5</b>
<b>State Ministry of education and culture (i.e. KMK or Standing Conference of Ministers of Education and Cultural Affairs of the Länder)</b>	<b>5</b>
school board	x
<b>trade unions</b>	<b>3</b>
employer associations	x
agency of labour / employment office	x



advisory board of ...	x
teacher associations	x
student representation	x
VET providers (school-based)	x
VET providers (work-based)	x
<b>industry (representatives)</b>	<b>2</b>
<b>Federal Institute for Vocational Education and Training (BIBB)</b>	<b>4</b>
<b>State Governments</b>	<b>5</b>

## 2.2 Cooperation between different actors

In your desk research and exchange with stakeholders, which general and specific **strengths or achievements** have been identified in terms of collaboration and/or communication between the different actors involved in VET reform processes?

“The corporatist structure has been a key stabilising factor because employers’ associations and trade unions generally agreed on the main organisational principles of the dual model [...]. The social partners are involved at all levels of decision-making (national, regional, sectoral and firm) and social dialogue and co-determination shape the implementation of VET reforms” (Haasler 2020, 61)

The basic configuration of the participants in the regulatory process (Federal Government, States, social partners) shows that VET regulations must necessarily be an expression and result of successful consensus talks, since in addition to the educational and cultural authorities from the Federal Government and the States, key organisations of the employers and the trade unions are also involved (translated from the original source: Deißinger 2020, 12p).

In your desk research and exchange with stakeholders, which general and specific **challenges or barriers** have been identified in terms of collaboration and/or communication between the different actors involved in VET reform processes?

The recommendations and implementation guidelines issued by the main committee of the Federal Institute for Vocational Education and Training do not have a legal character. The formulated criteria for the recognition and continuation of training occupations and their essential characteristics offer a wide scope for interpretation, which is left to the judgement of all involved participants. It can be assumed that a multitude of objectives are being pursued at the same time. Differences and alignment of interest between the actors exist during, but also before, the opening of the procedure and can lead to long consultation loops and thus to delays in the process. The influence of the different perspectives ensures the relevance and acceptance of a revised training occupation in professional practice, but is based on a very general formulation of objectives. (translated from the original source: Lohse 2017, 141)



According to stakeholder feedback: The various actors involved in the process of reorganising VET regulations work together effectively.

In your desk research and exchange with stakeholders, what **suggestions and/or recommendations** were identified with the aim of improving collaboration and/or communication between the different actors involved in VET reform processes?

No suggestions and/or recommendations were identified.

### 3 Processes

This section focuses on the various processes involved in the (re)shaping of the VET sector across your country / region more generally as well as your particular sector(s).

#### 3.1 Revision and reform processes

Under revision and reform processes we mainly understand the processes involved in revising existing VET programmes and reforming it with new VET programmes.

In your sector, which actors are generally the **drivers of innovation** (e.g. instigating change and making proposals for VET reforms)? Please assign the approximate percentages to show the different levels of contribution from the various actors.

ministry of education	0 %
<b>ministry of economy</b>	<b>10 %</b>
<b>Federal Government / Federal Ministry of Education and Research (BMBF)</b>	<b>5 %</b>
school board	0 %
<b>trade unions</b>	<b>25 %</b>
agency of labour / employment office	0 %
advisory board of ...	0 %
teacher associations	0 %
student representation	0 %
<b>VET providers (school based)</b>	<b>5 %</b>
VET providers (work based)	0 %



<b>industry (representatives)</b>	<b>30 %</b>
<b>other: Federal Institute for Vocational Education and Training (BIBB)</b>	<b>25 %</b>
	100%

What mechanisms are in place to ensure the revision of **existing VET programmes** in your country?  
Do revisions take place regularly and at specified intervals?

Revision processes are ongoing and ensured via various mechanism, i.e. committees representing key stakeholders (e.g. German Employers' Organisation for Vocational and Further Training, BIBB, Confederation of German Trade Unions)

- the initiation of new or revision of existing occupations is tied to the development of parameters defining training occupations; generally these are created by the social partners headed by German Employers' Organisation for Vocational and Further Training (Kuratorium der Deutschen Wirtschaft für Berufsbildung, KWB) and usually the Confederation of German Trade Unions (Deutsche Gewerkschaftsbund) (BIBB 2011);
- proposals for the introduction of new or revision of existing parameters "can emerge in different ways:
  - o out of preliminary talks held by the social partners (employers and trade unions),
  - o from the findings of research projects conducted or advisory opinions drafted by the Federal Institute for Vocational Education and Training (BIBB),
  - o from instructions issued by the responsible ministry." (BIBB 2011, 27)
- "vocational training research as a prerequisite for designing, revising and adapting training regulations to keep pace with economic, technological and societal change" (BIBB 2011, 17), undertaken by the Federal Institute for Vocational Education and Training (BIBB)
- "The push for new professions to be introduced or existing ones to be modified usually comes for the employers' associations. Once all the parties involved – especially the trade unions – have been heard, the competent minister (in most cases the Federal Minister for Economic Affairs and Energy) coordinates with the Länder, which have jurisdiction over the vocational schools, and decides whether or not the initiative is to be implemented." (BMW 2017a, 1)

Briefly describe the review and revision process of **existing VET programmes** in your country. In which way(s) are adjustments brought forward, considered, implemented? How long can these process(es) take? Are the conditions set for it in the law or by-laws? Feel free to visualise this process in a flow chart.

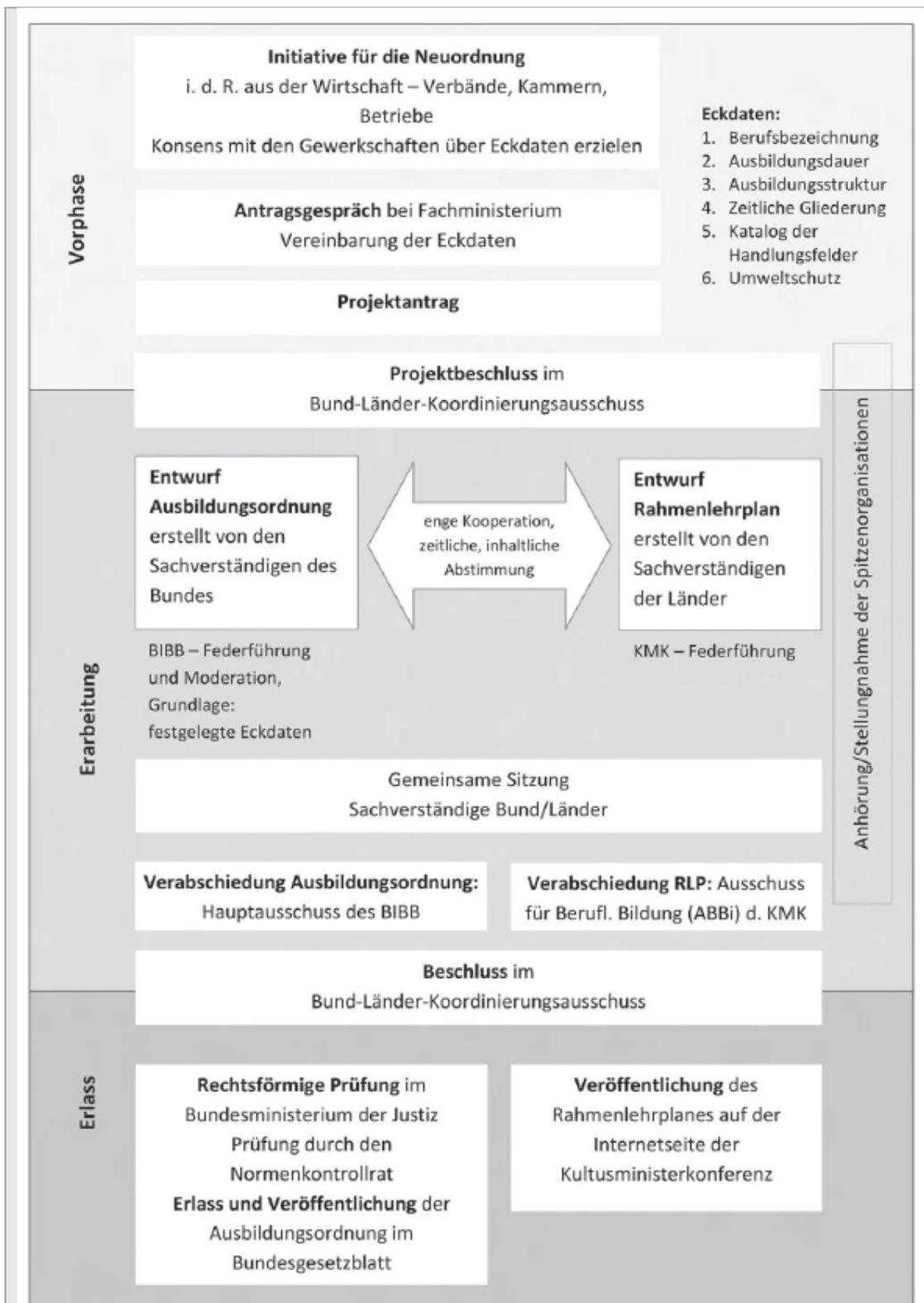


- following systematic procedure participants involving the federal government, the Länder governments, employers, trade unions and the VET research community. (BIBB 2011)

BIBB outlines three main steps (2011, 28pp):

1. Definition of training regulation parameters (incl. designation of occupation, length of training, structure of initial VET, form of examination, time allocation, environmental protection; list of skills, knowledge and capabilities).
2. Drafting and coordination (development of training regulation and corresponding framework curriculum)
3. Issuing the training regulation (training regulation and curriculum approved by the Federal-Länder Coordination Committee for Vocational Training Regulations / Framework Curricula (KoA); then the different German states adopt the framework curriculum or adapt to local curricula)

Lohse (2017, 142) provides an illustrated overview of the process:



Deißinger (2020, 14) identifies the same three steps in the process but adds the research (identification of needs) phase as the first of a total four steps.

“As a rule, the initiative for updating the content or structure of a training occupation or for developing an entirely new occupation comes from industry associations,



from the top-level employers' organisations, from trade unions or the Federal Institute for Vocational Education and Training. After hearing the views of all the parties concerned, the responsible federal ministry decides in consultation with the Länder governments whether to proceed. In many cases, BIBB issues an advisory opinion or, particularly when larger-scale revisions are being considered, conducts a research project before the ministry takes its decision" (BIBB 2011, 24).

After the training regulation is drafted (including provisions section and general training plan) and revised in the draft and coordination phase, the "Federal-Länder Coordination Committee for Vocational Training Regulations / Framework Curricula (KoA) finally approves the new vocational training regulation and the framework curriculum" (BIBB 2011, 34).

"The responsible ministry in conjunction with the Federal Ministry of Education and Research subsequently issues the training regulation and publishes it in the Federal Gazette. The date that a new regulation goes into force is usually the start of the next training year – i.e. 1 August in Germany. As a rule, the individual Länder adopt the framework curriculum for the particular occupation or incorporate it into their own specific curricula for part-time vocational schools." (34)

"The federal and Länder governments have agreed as a matter of principle to limit the duration of this procedure to one year. As a rule, the experts should complete their work within eight months following the decision by the coordinating committee (the body in which the federal and Länder governments resolve any differences)" (BIBB 2011, 24).

- Federal experts = nominated by social partners and support the draft process of training regulations
- State experts = nominated by Kultusministerkonferenz (KMK, Standing Conference of Ministers of Education and Cultural Affairs of the Länder) and develop framework curricula

Haasler (2020, 59) conflicts this account in terms of length:

"Any revision or new enactment, however, tends to take several years because of the consensus-based corporatist system, which requires the agreement of the social partners (employers' associations and unions) and the state (see the section The institutional context of vocational education and training). In the context of the rapidly changing demands of the knowledge economy and the digitalisation of work, the slow adaptation capacities of the dual system are thus of growing concern".

Briefly describe the introduction process of **new VET programmes** in your country. How long does this process (usually) take? Please include any relevant laws, regulations and stakeholders. Feel free to visualise this process in a flow chart.

The process for introducing a new VET programme in principle follows the same procedure undertaken for the revision or adaptation of existing VET programmes (BIBB 2011).

Which of the following aspects are **taken into consideration** in the revision and reform processes of the VET sector in your country / region generally and your sector(s) more specifically?

	<b>C</b>
infrastructure	<input type="radio"/>



technology	<input checked="" type="checkbox"/>
staff availability	<input type="checkbox"/>
staff competences	<input type="checkbox"/>
wording of job descriptions	<input type="checkbox"/>
European standards (e.g. ESCO, ISCO....)	<input checked="" type="checkbox"/>
VET provider needs	<input type="checkbox"/>
industry / labour market needs	<input checked="" type="checkbox"/>
staff needs	<input type="checkbox"/>
student needs	<input type="checkbox"/>
evidence-based research	<input checked="" type="checkbox"/>
European trends	<input type="checkbox"/>
international trends	<input type="checkbox"/>
local / regional / national politics	<input checked="" type="checkbox"/>
other [insert here]	<input type="checkbox"/>

Which three of the above mentioned aspects receive the **most attention** in the transfer processes in your country or sector(s)?

technology, industry / labour market needs, evidence-based research (based on our stakeholder feedback)

Which three of the above-mentioned aspects receive the **least attention** in the transfer processes in your country or sector(s)?

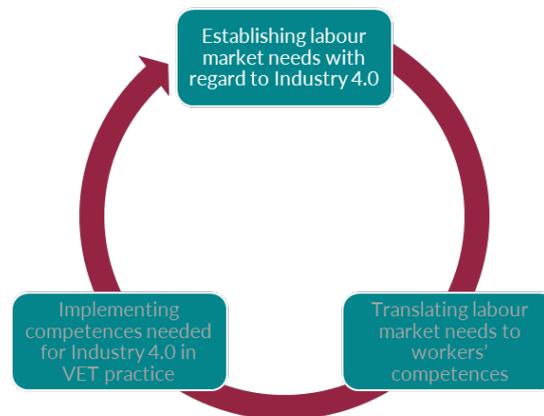
infrastructure, staff needs, European and international trends  
(based on our stakeholder feedback)

What mechanisms are in place to ensure the **needs of VET providers, teachers and students** are met and their voices are heard? How are their perspectives translated to policy?

Based on the desk research and stakeholder feedback it seems there are no mechanisms in place to ensure the needs of VET providers, teachers and students.



### 3.2 Mechanisms for establishing labour market needs with regard to Industry 4.0



Which of the following actors are predominantly responsible for the mechanisms in place to establish labour market needs in your country and in your specific sector(s)?

	<b>C</b>
ministry of education	<input type="radio"/>
ministry of economy (i.e. Federal Ministry for Economic Affairs and Energy)	<input type="radio"/>
Federal Foreign Office	<input type="radio"/>
school board	<input type="radio"/>
<b>trade unions</b>	<input checked="" type="checkbox"/>
<b>employer associations</b>	<input checked="" type="checkbox"/>
<b>agency of labour / employment office (i.e. Agentur für Arbeit)</b>	<input checked="" type="checkbox"/>
advisory board of ...	<input type="radio"/>
teacher associations	<input type="radio"/>
student representation	<input type="radio"/>
VET providers (school-based)	<input type="radio"/>
VET providers (work-based)	<input type="radio"/>
industry (representatives)	<input type="radio"/>



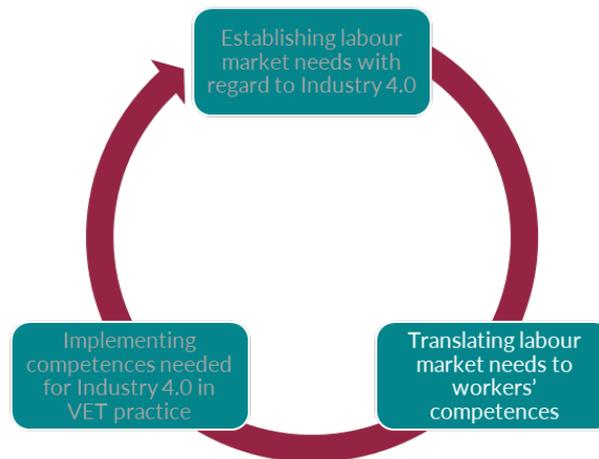
What **general mechanisms** are in place to establish labour market needs in your country and in your specific sector(s)?

As part of the ongoing revisions of the VET sector, institutions like the Federal Institute for Vocational Education and Training (BIBB 2021c) and Agentur für Arbeit (2021) establish current labour market needs (in terms of skilled workers' shortages). In addition, employers' organisations and trade unions publish reports on the needs of their sectors in terms of workers' skills or trained workers in general.

If applicable, which **specific mechanisms** were used to establish labour market needs with regard to Industry in 4.0 in your country and in your specific sector(s)?

No specific mechanisms were introduced; existing mechanisms focused their research effort accordingly: e.g. multiple studies and investigations on Industry 4.0 undertaken or initiated by BIBB (e.g. 2021a/d, 2017b).

### 3.3 Processes for translating labour market needs to workers' competences



Which of the following actors are predominantly responsible for translating labour market needs to key competences in VET practice of your country and your specific sector(s)?

	<b>C</b>
ministry of education (i.e. Federal Ministry of Education and Research)	✓
ministry of economy (i.e. Federal Ministry of Economy and Energy)	✓
other: Federal Institute for Vocational Education and Training (BIBB)	✓
school board	○
trade unions	✓



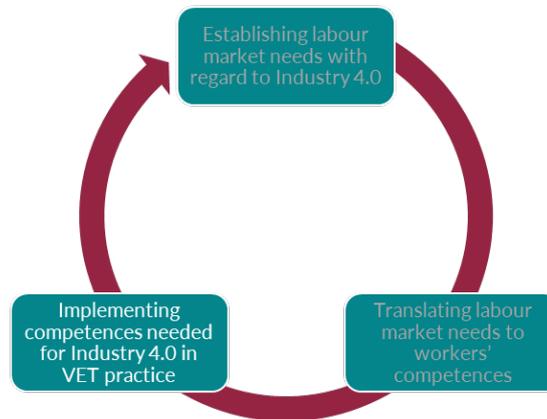
employer associations	<input type="radio"/>
agency of labour / employment office	<input type="radio"/>
advisory board of ...	<input type="radio"/>
teacher associations	<input type="radio"/>
student representation	<input type="radio"/>
VET providers (school-based)	<input checked="" type="checkbox"/>
VET providers (work-based)	<input type="radio"/>
industry (representatives, i.e. independent research)	<input checked="" type="checkbox"/>

What processes **generally regulate or organise** the translation of labour market needs to competences in your country and in your specific sector(s)?

The translation of labour market needs to competences is somehow a part of the 3-step revision process described in 3.1. However, there's no specific or centralised mechanism ensuring a standardised (or uniform) translation of labour market needs to specific competences, which has also been confirmed in the stakeholder feedback. Federal as well as industry funded research initiatives have developed varied understandings of "Industry 4.0" competences (e.g. acatech 2016, BMWi 2018, Hartmann 2017, Schmid 2017, Pfeiffer et al. 2016).



### 3.4 Processes for implementing competences needed for Industry 4.0 in VET practice



Which of the following actors are predominantly responsible for the processes regulating or organising the implementation of key competences in VET practice of your country and your specific sector(s)?

	C
<b>Federal Government / Federal Ministry of Education and Research (BMBF)</b>	<input checked="" type="checkbox"/>
ministry of economy	<input type="checkbox"/>
ministry of ...	<input type="checkbox"/>
school board	<input type="checkbox"/>
trade unions	<input type="checkbox"/>
employer associations	<input type="checkbox"/>
agency of labour / employment office	<input type="checkbox"/>
advisory board of ...	<input type="checkbox"/>
teacher associations	<input type="checkbox"/>
student representation	<input type="checkbox"/>
VET providers (school based)	<input type="checkbox"/>
VET providers (work based)	<input type="checkbox"/>
industry (representatives)	<input type="checkbox"/>
other [insert here]	<input type="checkbox"/>



What processes **generally regulate or organise** the implementation of new competences in your country and in your specific sector(s)? How are competences usually transferred from policy to VET practice?

This would happen in the drafting and coordination phase of introducing or revising new training regulations. "BIBB asks the top-level employers' and trade union organisations to nominate representatives of company-based training practice who, acting as experts for the federal government (since company-based vocational training falls within its purview), work jointly with BIBB to develop new training regulations or revise existing training regulations.

Proceeding in concert with the work done by the federal government's experts, the experts delegated by the Länder develop a draft curriculum for instruction at [...] vocational schools. At the end of the drafting phase, the two groups of experts meet to discuss the two drafts and bring their respective content and timetables into alignment" (BIBB 2011, 30).

- "In addition, the designated experts drafted a EUROPASS certificate supplement for each occupation to accompany the final certificate" (31).
- According to the Vocational Training Act, vocational competence is equated with the DQR's (Deutscher Qualifikationsrahmen, German national qualifications framework) understanding of competence. In all training regulations developed from 2015 onwards, the four competence dimensions of the DQR should systematically be taken into account. (translated from the original source: BIBB 2017a, 23)

Also BIBB initiated the modernisation / revision of the Standardberufsbildpositionen (standard occupational profile elements = are contents that are anchored in the respective occupational profile and WBL plan in addition to the skills, knowledge and competences that determine the occupational profile. All companies providing training must ensure that these are taught and include them in the WBL plan. They are also subject to examinations. [BIBB 2021a, 5])

- translated from the original source BIBB 2021a, 6: The item "digitalised workplace" was included as a completely new standard. It deals with the handling of digital media and data, the consideration of data security and data protection as well as the ability to obtain and check information, which is becoming increasingly important against the background of an increasing flood of information and "fake news". In addition, communicative and social competences in the digital work environment are also taken into account with regard to social diversity and mutual appreciation. The latter requirements are not exclusively geared to digital cooperation, but are particularly prominent in the digital workplace, where appropriate communication rules are of particular importance.

If applicable, which **specific processes** regulated or organised the implementation of competences needed for Industry 4.0 in VET practice of your country and your specific sector(s)? What technical, infrastructural and personnel measures were provided and by whom to implement these changes at VET institutions?

National initiative "Industrie 4.0"

"Industrie 4.0" (Industry 4.0 [140]) is a national strategic initiative from the German government through the Ministry of Education and Research (BMBF) and the Ministry for



Economic Affairs and Energy (BMWI). It aims to drive digital manufacturing forward by increasing digitisation and the interconnection of products, value chains and business models. It also aims to support research, the networking of industry partners and standardisation. I40 is pursued over a 10-15-year period and is based on the German government's High Tech 2020 Strategy. The initiative was launched in 2011 by the Communication Promoters Group of the Industry Science Research Alliance (FU) that was convened and organised by BMBF and adopted through the High-Tech Strategy 2020 Action Plan. I40 has become institutionalised with the Platform Industrie 4.0 (Platform I40) that now serves as a central point of contact for policy-makers. BMBF and BMWI have jointly allocated €200 million in funding. [...] five working groups ensure the thematic work on reference architecture and standardisation, research and innovation, security, legal framework and training." (EC 2017, 3)

Translated from the original (BMBF 2017a): The national initiative "Berufsbildung 4.0" (Vocational Education and Training 4.0) is an initiative launched by the Federal Ministry of Education and Research (BMBF) in cooperation with the Federal Institute for Vocational Education and Training (BiBB) in 2016. It aims at creating new measures for sustainable, attractive and competitive VET and bring them together with other BMBF initiatives on digitalisation. One of the key elements of "Berufsbildung 4.0" is the new research initiative "Skilled Worker Qualifications and Competences for the Digitised Work of Tomorrow", which is jointly funded by the BMBF and BiBB. In dialogue with companies, the jobs affected by digitalisation are being examined in selected occupations with regard to work processes, activities and qualification requirements. The aim is to identify the changing requirements for the qualifications of skilled workers at an early stage, to record the quantitative and qualitative effects and to establish an early identification system. The initiative is also investigating the importance of digital competences of trainees as well as trainers for the successful completion of vocational training. The activities of "Berufsbildung 4.0" also include the BMBF programme "Digital Media in Vocational Education and Training". This programme contributes to the modernisation and strengthening of vocational education and training. Innovative, digitally supported education, communication and information solutions are being developed to meet the requirements for learning and working in the digital society. In addition, the development of concepts to strengthen the media competence of employees and organisations is promoted in order to optimally use learning with digital media. In addition to the target group of learners, the focus is also on the concrete qualification of educational professionals.

The varied funding opportunities / initiatives under this programme are described in detail in BMBF (2017b).

## 4 Examples of good practice (GP)

This section is dedicated to the collection of specific examples from your region and/or country.

### 4.1 Revisions of existing VET programmes

How specifically (if at all) did the new labour market needs and requirements of Industry 4.0 translate into changes to existing VET programs in the last 5-7 years? Please identify existing programmes that have been revised to accommodate Industry 4.0 labour market requirements.



Please note, that in most cases the Federal Institute for Vocational Education and Training (BIBB) does not provide short summaries of the new elements or changes that have been added to or revised in a programme. Rather, it provides detailed accounts of the new or revised programmes in the form of multiple documents (e.g. information brochures or handbooks, curricula frameworks, training regulations, press releases, recommendations for VET providers, presentations etc.), which are freely available here:

[https://www.bibb.de/dienst/berufesuche/de/index\\_berufesuche.php/new\\_modernised\\_occupations\\_by\\_year](https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/new_modernised_occupations_by_year)).

Name of the VET programme:	Reform of the trade electrician professions
Initiator/creator of the revised programme:	Federal Institute for Vocational Education and Training (BIBB)
Which sector does the programme come from?	multiple
What new elements have been added to this programme that address Industry 4.0 or relevant competences?	<p>Increasing digitalisation as well as changed work processes and tasks in the trades of electrical engineering, information technology and electrical engineering were the triggers for this. Trends towards smart installations and increasingly comprehensive networking require vocational training that focuses more on the understanding of systems among future skilled workers, enables them to work digitally and strengthens their personal skills. The ability to act flexibly in a changing work environment is increasingly in demand in companies.</p> <p>Therefore, the training contents of the skilled electrical occupations were modernised and examination regulations were largely standardised.</p> <ul style="list-style-type: none"> <li>- The occupation "electronics technician for building systems integration" was created. It is aimed in particular at craft enterprises that act as system providers (see chapter 4.2).</li> <li>- In the future, the occupation of "electronics technician" will focus on the two specialisations of energy and building technology and automation and systems technology.</li> <li>- The occupation "information electronics technician" will in future combine four areas of application: Equipment, IT and office systems technology, transmission, reception and broadband technology, fire</li> </ul>



	<p>protection and hazard alarm systems and telecommunications technology.</p> <ul style="list-style-type: none"> <li>- The occupation "systems electronics technician" will be abolished in return.</li> <li>- The occupation "electronics technician for machines and drive technology" has been modernised in terms of content, but due to different examination regulations it has been reorganised into two occupations - one in accordance with the Vocational Training Act (BBiG) and the other in accordance with the German Crafts and Trades Regulation Code (Handwerksordnung [HwO]).</li> </ul> <p>Common learning fields continue to enable joint training for the first year of training - also with the industrial electrical occupations. In cooperation with experts, implementation aids were developed for each occupation and will be published at the beginning of the 2021/2022 training year in the BIBB series "Designing Training".</p>
<p>What makes this initiative a GP?</p>	<ul style="list-style-type: none"> <li>- updated occupation, with particular focus to meet demands, which are changing due to industry 4.0</li> <li>- together with the revised curricula, BIBB provides various resources to assist with the implementation of the new contents and structure: <a href="https://www.bibb.de/de/136121.php">https://www.bibb.de/de/136121.php</a></li> </ul>
<p>Transfer potential of the undertaken revisions:</p>	<p>limited, as tailored to German VET system; certain elements could potentially be reused but the profiles in their entirety would have to be adapted significantly</p>
<p>What are the results achieved by or recommendations of this programme?</p>	<p>too early to say</p>
<p>Link (website, where to find more information):</p>	<p><a href="https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/profile/apprenticeship/elan21">https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/profile/apprenticeship/elan21</a></p> <p><a href="https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/profile/apprenticeship/elekauto">https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/profile/apprenticeship/elekauto</a></p>



	<a href="https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/profile/apprenticeship/kiu51uu">https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/profile/apprenticeship/kiu51uu</a>
Additional information:	revised in 2021
Name of the VET programme:	Vehicle interior mechanic
Initiator/creator of the revised programme:	Federal Institute for Vocational Education and Training (BIBB)
Which sector does the programme come from?	multiple
What new elements have been added to this programme that address Industry 4.0 or relevant competences?	Digitisation had a major influence on the design of vocational training, both on the product side (connectivity, networked systems, high-tech seats) and on the production side (networked production, documentation and diagnostic systems, 3D printing of equipment parts). Assembly techniques for the interior moved more and more into the foreground for this occupation, alongside classic equipment topics. (translation from BIBB, for more information see link below)
What makes this initiative a GP?	<ul style="list-style-type: none"> <li>- updated occupation, with particular focus to meet demands, which are changing due to industry 4.0</li> <li>- together with the revised curriculum, BIBB provides various resources to assist with the implementation of the new contents and structure</li> </ul>
Transfer potential of the undertaken revisions:	limited, as tailored to German VET system; certain elements could potentially be reused but the profile in its entirety would have to be adapted significantly
What are the results achieved by or recommendations of this programme?	too early to say
Link (website, where to find more information):	<a href="https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/profile/apprenticeship/780999po">https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/profile/apprenticeship/780999po</a>
Additional information:	revised in 2021



Name of the VET programme:	<p>in 2020, 4 programmes were revised under the same premise:</p> <ul style="list-style-type: none"> <li>- IT Specialist for Application Development</li> <li>- IT Systems Electrician</li> <li>- Sales Specialist IT Systems</li> <li>- Sales Specialist Digitisation Management</li> </ul>
Initiator/creator of the revised programme:	Federal Institute for Vocational Education and Training (BIBB)
Which sector does the programme come from?	multiple
What new elements have been added to this programme that address Industry 4.0 or relevant competences?	<ul style="list-style-type: none"> <li>- IT Specialist for Application Development: additional specialisation areas digital networks as well as data- and process analytics.</li> <li>- IT Systems Electrician: revision of contents related to electric technology.</li> <li>- Sales Specialist IT Systems: particular focus on providing and marketing IT services as well as the management and administration of IT systems.</li> <li>- Sales Specialist Digitisation Management: particular focus on Digitisation of business processes at the operational level.</li> <li>- overall: particular focus on IT security and data protection</li> </ul>
What makes this initiative a GP?	<ul style="list-style-type: none"> <li>- updated occupations, with particular focus to meet demands, which are changing due to industry 4.0</li> <li>- together with the revised curriculum, BIBB provides various resources to assist with the implementation of the new contents and structure</li> </ul>
Transfer potential of the undertaken revisions:	limited, as tailored to German VET system; certain elements could potentially be reused but the profile in its entirety would have to be adapted significantly
What are the results achieved by or recommendations of this programme?	too early to say



Link (website, where to find more information):	<a href="https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/new_modernised_occupations_by_year/2020">https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/new_modernised_occupations_by_year/2020</a>
Additional information:	revised in 2020
Name of the VET programme:	<p>in 2018, 10 programmes in the metal industry and electronics were revised under the same premise:</p> <p>Systems Mechanic</p> <p>Industrial Mechanic</p> <p>Construction Mechanic</p> <p>Tools Mechanic</p> <p>Metal Cutting Mechanic</p> <p>Specialist Electricians (for automation, industrial electronics, building and infrastructure systems, equipment and systems, information and system technology)</p>
Initiator/creator of the revised programme:	Federal Institute for Vocational Education and Training (BIBB)
Which sector does the programme come from?	multiple
What new elements have been added to this programme that address Industry 4.0 or relevant competences?	<p>There were some adjustments to the contents, not the entire occupational profiles were revised.</p> <p>The integrative occupational profile element "Digitisation of work, data protection and information security" was included in the common core qualifications. The occupational profile element "Operational and technical communication" was marginally changed. In the occupational profile element "Business processes and quality assurance systems in the field", the letter "I) Evaluate life cycle data of orders, services, products and operating resources and develop proposals for optimising procedures and processes" was added.</p>
What makes this initiative a GP?	<ul style="list-style-type: none"> <li>- updated occupation, with particular focus to meet demands, which are changing due to industry 4.0</li> </ul>



	- together with the revised curriculum, BIBB provides various resources to assist with the implementation of the new contents and structure
Transfer potential of the undertaken revisions:	limited, as tailored to German VET system; certain elements could potentially be reused but the profile in its entirety would have to be adapted significantly
What are the results achieved by or recommendations of this programme?	too early to say
Link (website, where to find more information):	<a href="https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/new_modernised_occupations_by_year/2018">https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/new_modernised_occupations_by_year/2018</a>
Additional information:	revised in 2018

#### 4.2 New VET programmes

Which new VET programs with a particular focus on Industry 4.0 have emerged in the last 5-7 years in your country? Please copy and paste the table for additional entries.

Name of the VET programme:	Electrician for building systems integration
Initiator/creator of the new programme:	Federal Institute for Vocational Education and Training (BIBB)
Which sector does the programme come from?	multiple
How does it address Industry 4.0 or relevant competences?	Manufactured goods as well as operational, service and customer structures are developing significantly, especially in the area of building and infrastructure systems, and this will continue in the coming years as a result of digitisation. This new apprenticeship was prepared to meet the demand for skilled workers, especially in the market segments of smart home, smart building, energy management and building system integration, and to qualify skilled workers who were already involved in the planning and projecting of new systems and system modifications. (translation from BIBB, for more information see link below)



What makes this programme a GP?	<ul style="list-style-type: none"> <li>- new occupation, established specifically to meet demands, which are changing due to industry 4.0</li> <li>- programme has very practical approach; including in examination (e.g. candidates process and document a customer order from their company and will justify and answer questions about their approach in a follow-up technical discussion with the examination board)</li> <li>- together with the new curriculum, BIBB provides various resources to assist with the implementation of the new contents and structure</li> </ul>
Transfer potential of the GP:	limited, as tailored to German VET system; certain elements could potentially be reused but the profile in its entirety would have to be adapted significantly
What are the results achieved by or recommendations of this programme?	too early to say
Link (website, where to find more information):	<a href="https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/profile/apprenticeship/857plo7">https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/profile/apprenticeship/857plo7</a>
Additional information:	introduced 2021

### 4.3 Other Projects / Initiatives

What projects or initiatives have taken place in the country aimed at the VET sector at national, regional and/or sectoral level, which for example:

- identify competences relevant to Industry 4.0 (perhaps with a focus on a particular sector),
- analyse new labour market requirements with regard to Industry 4.0,
- provide instructions on how to implement Industry 4.0 relevant competences in VET teaching.

Which GP (projects, initiatives or similar) are you perhaps already aware of or have you identified in your desk research and exchange with stakeholders? Please copy and paste the table for additional entries.

Name of the GP:	Festo Lernfabrik
Initiator/creator of the GP:	Festo Group
Which sector does the GP come from?	various, specialising in automation technology and technical educational solutions



Which general topics or topic areas does this good practice cover?	<p>The learning factory is an integrated training facility and an integral part of a technology factory in Scharnhausen. The production of valves, valve terminals and electronics for the customers takes place directly next to the training stands. The quick and immediate change between theory and practice demonstrably ensures better educational success. A deeper understanding develops, which is essential for the complex processes of Industry 4.0. importance.</p> <p>(BMW 2017b)</p>
What makes this initiative a GP?	<ul style="list-style-type: none"> <li>- close interconnection between practice and theory</li> <li>- provision of additional educational offers on implementation of Industry 4.0 characteristics in operational processes</li> <li>- Another special feature of the Lernfabrik is that it is largely run by apprentices. In the trainee office, industrial-technical and commercial trainees take on and administrative tasks and run the learning factory like a small training and consulting company. They book the training courses, procure the equipment, prepare teaching units, create and update the teaching media and maintain the premises (BMW 2017b).</li> <li>- Since the learning factory is designed as a process facilitator for the technology factory, managers and employees name potential learning topics once a year. Learning objectives, number of people, trainer, duration, repetition and desired methodology are specified in individual letters, duration, repetition and the desired methodology of a training of a training measure are formulated. The goal is a standardised but continuously updated training catalogue. So far, around 100 different training contents have been defined (BMW 2017b).</li> </ul>
How does it address Industry 4.0 or relevant competences?	Particular focus on Industry 4.0 and provision of seminars on various aspects of Industry 4.0.
Transfer potential of the GP:	high



What are the results achieved by or recommendations of this GP?	Festo is a global leader in automation technology and the world market leader in technical education and training. Recommendation: keeping theory and practice as closely aligned as possible with ongoing feedback and exchange
Link (website, where to find more information):	<a href="https://www.festo-lernzentrum.de/unsere-leistungen/seminare/lernfabrik/">https://www.festo-lernzentrum.de/unsere-leistungen/seminare/lernfabrik/</a>
Additional information:	-
Name of the GP:	Digitalisierung@SPE
Initiator/creator of the GP:	Siemens AG
Which sector does the GP come from?	various, specialising in automation and digitisation technology
Which general topics or topic areas does this good practice cover?	Siemens identified 25 key digitisation competences and analysed 50 typical Industrie 4.0 use cases. On this basis, Siemens education experts recorded around 20,000 competence entries in a database and identified all relevant competence shifts per SPE training course, which were then transferred to develop the teaching content. (Siemens 2021)
What makes this initiative a GP?	The requirements for competences predicted in the comprehensive analysis are covered by newly developed learning sequences. The learning sequences complement the existing training plans within the scope of freedom granted to companies by the training regulations. Simply adapting the learning content is not enough for Siemens. (BMW 2017b)
How does it address Industry 4.0 or relevant competences?	see above
Transfer potential of the GP:	medium (process would have to be adapted)
What are the results achieved by or recommendations of this GP?	Siemens Training is now adapting the training plans for 15 IHK-certified occupations (i.e. occupations certified by the Chamber of Commerce and Industry). Learning methods, learning material and the training of trainers



	and lecturers were also conceptually integrated by the experts. The first teaching sequences developed - on 3D printing, for example - have already been integrated into the training plans and are being implemented. A wide variety of educational products are being developed to train the young people accordingly. Through the project, Siemens is acting as a pioneer in this area. (Siemens 2021)
Link (website, where to find more information):	<a href="https://www.plattform-i40.de/PI40/Redaktion/EN/Use-Cases/398-siemens-training-center/article-siemens-training-center.html">https://www.plattform-i40.de/PI40/Redaktion/EN/Use-Cases/398-siemens-training-center/article-siemens-training-center.html</a>
Additional information:	-
Name of the GP:	Berufenet
Initiator/creator of the GP:	Agentur für Arbeit (Federal Employment Agency)
Which sector does the GP come from?	all
Which general topics or topic areas does this good practice cover?	search tool / databank listing all types of occupational pathways and options in Germany, providing details, information resources and relevant (intra)links
What makes this initiative a GP?	provides an overview of occupational pathways and can be used for people to decide which occupation they'd like and/or are suitable for (links to skills/interest assessment tools)
How does it address Industry 4.0 or relevant competences?	offers specific section on trends and digitalisation topics in relation to respective occupations (demonstrates future trends and potential relevance of occupation)
Transfer potential of the GP:	high
What are the results achieved by or recommendations of this GP?	n/a
Link (website, where to find more information):	<a href="https://berufenet.arbeitsagentur.de/">https://berufenet.arbeitsagentur.de/</a>



Additional information:	-

## 5 Conclusion

Reflection on some of the insights gained in the description process. An overview of the way Industry 4.0 requirements are implemented in (insert your country/region's) VET system and can support the development of recommendations that could improve transfer and implementation processes.

Regarding the effectiveness of the conditions and processes described, what works really well (e.g. cooperation between actors) and why?

The fact that many actors are involved in the ongoing review and revision processes ensures that multiple perspectives can be considered. Due to the structured regulations there are clearly defined processes and responsibilities leading to the effective cooperation between all involved actors.

The relatively slow modernisation processes of curricula and thus of school-based training can in some cases be absorbed in company-based training, as the training companies are often already familiar with newer equipment, work processes, etc. before these find their way into vocational school curricula. However, as this is highly dependent on the dedicated efforts of individual VET providers, this is not a structured approach that can guarantee the successful transfer of labour market requirements into VET as a whole.

Regarding the effectiveness of the conditions and processes described, what do you think could be improved and how?

Due to the status/reputation of the German VET system, there seems to be a degree of overconfidence in the processes involved, which in some cases leaves little room for critical reflection. The belief that Germany could only learn little from other countries' approaches to VET (generally and with regard to industry 4.0) may have a negative impact on staying connected with international developments. This is, for example, reflected in the stakeholder feedback on section 3.1 – there are too many aspects that not considered when it comes to the revision of VET offers (e.g. student, teacher and VET provider needs).

There seems to be an over-reliance on an established system which often struggles to keep up with the multitude and speed of transformations. This is problematic in multiple ways. For example, the fact that VET does not present an attractive educational/occupational career path for many young Germans is likely related to the lack of consideration for their needs when these courses are revised/created. There is an enormous mismatch between the VET offers available and the candidates interested in taking up VET courses (see 1.2).

In regards to the involved actors, the statements/feedback of some of the stakeholders conflicts the official descriptions provided by BIBB (2011); this indicates that the processes are perhaps not as transparent and straightforward as they are officially described. There may be room for optimisation (a fact also raised by the stakeholders) of the process to clarify the responsibilities of all involved actors.



With view on the labour market needs for skilled workers and the two different and practically separated systems (VET and fully school-based/higher education), a political approach for an overarching reform is currently not evident, although the overall system is not geared to the structural changes that will occur in the labour market as a result of demographic developments and the upheavals that are still to come under the heading of Industry 4.0. The crucial step is the interlocking of the systems and thus the opening of access to higher education in accordance with the performance level of dual vocational education and training. The preferential treatment of full-time school-based training paths for access to higher education no longer corresponds to the performance level in many dual training occupations. (VHU 2018, 113p)

Did you come across any aspects that are not sufficiently taken into consideration when changes in the VET sector are implemented (see 3.1)?

VET institutions' needs (incl. student, teacher & staff, available infrastructure etc.) are only rarely considered in the VET revision processes, which may contribute to the mismatch between supply of and demand for particular VET offers.

The resistance to learning from and interest in impulses, ideas and approaches from other countries is also problematic. Many current issues are global and rarely disconnected from the challenges other nations are facing; solutions found elsewhere should be considered more and can surely be adapted and applied to the German VET context.

It is also a problem that there is very little consideration for the specific mechanisms that are used to 1: establish labour market needs and 2: translate labour market needs to VET competences. These approaches seem unclear and somewhat arbitrary.

Which existing changes have you identified and how difficult was their implementation (see 3.1)?

There seem to have been a significant amount of changes to existing VET offers, i.e. rather than the creation of new occupational profiles, many old profiles have been revised and updated to suit better the new labour market requirements.

In light of the limited consideration for student, teacher and VET provider needs, there seems to be less focus on the practical implementation side of VET reform. Many of the ideas and changes may be great on paper; however, in reality many VET institutions struggle to implement changes. On one hand, the infrastructural and technological requirements cannot always be met straight away and require additional resources. On the other hand, VET schools are often chronically understaffed and staff have limited capacities to engage in meaningful training to further their skills and expand their teaching repertoire. Consequently, to ensure the envisioned change can be implemented on all levels, more practical measures also need to be in place, e.g. improving teaching conditions as well as ensuring provision of technologies and training to support Industry 4.0 ready VET offers.



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