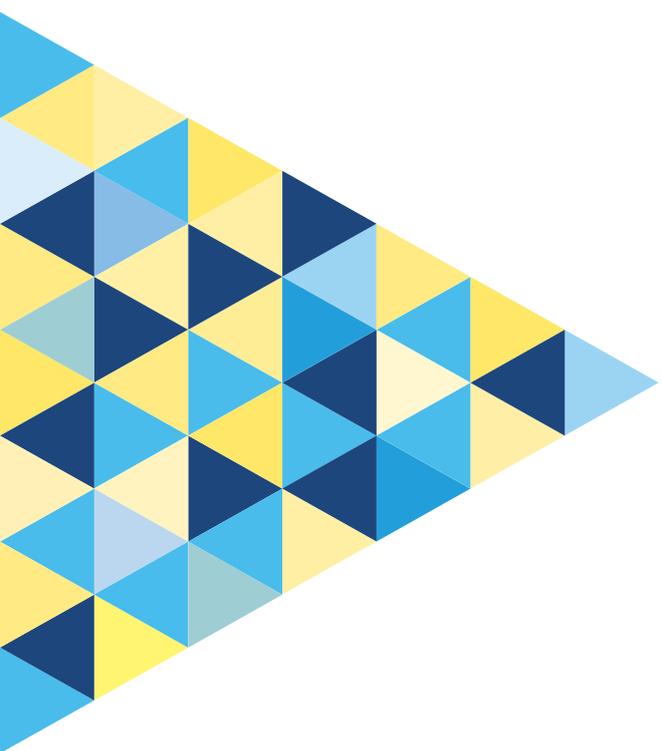


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Indicators for Estimating the Skilled Worker Situation in Occupations

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Indications:

The indicators for estimating the skilled worker situation in occupations serve to combine various key figures of the BIBB-IAB qualifications and occupational field projections (www.QuBe-Projekt.de) with each other and thus to enable a more accessible interpretation of the results.

The calculation of the indicators has not been completed, but will be updated in the case of new findings and versioned accordingly. The results of the recent Skilled Personnel Indicator can be viewed at www.qube-data.de.

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List of Abbreviations

FTE	full time equivalent
KldB2010	2010 Classification of Occupations
og	occupational group (three digit level KldB 2020)
omg	occupational main group (two digit level KldB 2020)
Q	professionally qualified workers in relation to number of employed persons
QI	qualification indicator
QuBe	qualifications and occupational field projections
S	substitutable share of activity by persons with a qualification in a different field
SI	substitution indicator
SKI	structural indicator
VA	work volume balance in absolute terms
VAI	indicator for work volume balance in absolute terms
VI	volume indicator
VR	work volume balance in relative terms
VRI	indicator for work volume balance in relative terms

1 Aim of the Indicator

The aim of the qualifications and occupational field projections (www.QuBe-Projekt.de) carried out by the Federal Institute for Vocational Education and Training (BIBB) and the Institute for Employment Research (IAB) in conjunction with the Institute of Economic Structural Research (GWS) is to identify labour market imbalances at occupational level. Labour demand for occupations is derived from relevant demand for goods and services. Labour supply is determined by participation in education and training, career choice and the employment propensity of the population.

The unique feature of the QuBe Project is that it is able to identify shortages in specific skills and areas of oversupply according to occupation by also taking account of the occupational mobility of the labour supply. In the case of occupation-specific bottlenecks, wage rises are modelled for the relevant task. The first consequence of this is that demand for workers in these occupations falls because production costs increase. Secondly, however, an incentive is also created for persons in possession of an occupation-specific qualification to remain for a longer period of time in the occupation in which they have trained or to return to such an occupation because remuneration opportunities rise in comparison to other occupations that they could possibly exercise (MAIER u. a. 2017).

These compensation processes are only mapped within the model context if wage adjustments have been displayed in the past and if a relevant change in mobility behaviour has been discernible. If the labour market statistics show that the number of persons available to an occupation does not meet demand, this therefore does not mean that it was actually not possible to find any persons to exercise an occupational task. The skilled worker situation of companies depends on a number of ancillary conditions (e.g. production processes or attractiveness of jobs) which cannot be resolved or can only be partially tackled within the model context. Evaluation of the labour market situation on the basis of the arithmetical imbalance which occurs at the person level thus falls short of requirements. For this reason, three further questions are posed in order to extrapolate the possible skilled worker situation in an occupation.

- (1) Which occupations show the greatest differences between labour supply and demand in absolute and relative terms?
- (2) How great is the possibility of acquiring trained skilled workers for the occupation?
- (3) What amount of resources is needed for the induction of persons with a qualification in a different field?

These three questions are aligned to specifically measurable key figures below. For linguistic differentiation, the metric values of the original values are referred to as key figures. The metrical characteristics of the key indicators are sub-divided into intervals and allocated points (scores).¹ The skilled personnel indicator is composed of the scores of the individual indicators. In contrast to

¹ In common parlance, the original metric values of the figures can also be referred to as indicators. The linguistic separation between key figure (metric original values) and indicator (with point value) is merely intended to facilitate understanding of the calculation.

relative scaling, this offers the benefit that the indicator also facilitates changes over the course of time and between occupations.²

The indicator consists of two components: A volume indicator (VI) and a structural indicator (Strukturindikator - SKI), which are equally weighted in the skilled personnel indicator (Fachkräfteindikator - FKI). The *volume indicator* ($VI = VAI + VRI$) combines labour force statistics by hours. A differentiation is drawn between absolute (VAI) and relative (VRI) values. The structural indicator (SKI) takes into account the qualification and access pathways in the occupation pursued. A *qualification indicator* (QI) compares labour demand in the occupation with the labour demand in possession of an occupation-specific qualification that emerges from the educational system. A *substitution indicator* (SI) shows the extent to which persons with qualifications in a different field may be considered for the exercising of tasks in an occupation. An indicator of the skilled worker situation in an occupation is calculated by addition of the individual indicators.

$$FKI = \underbrace{VAI + VRI}_{\text{Volume indicator}} + \underbrace{QI + SI}_{\text{Structure indicator}}$$

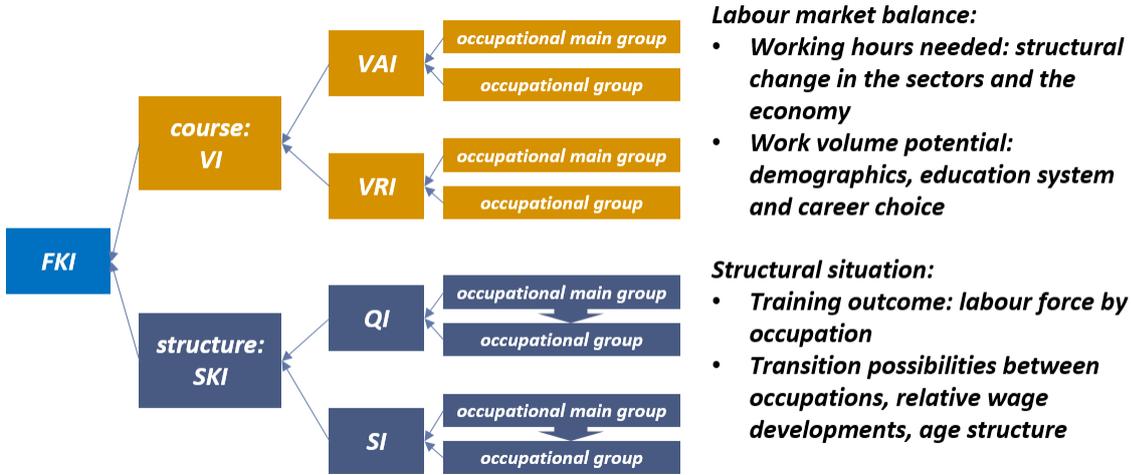
This skilled personnel indicator (Fachkräfteindikator - FKI) provides information on the skilled worker situation in the occupations. In the QuBe Project, calculation of the FKI takes place via 37 separate occupational main groups (omg) in accordance with the 2010 Classification of Occupations (KldB 2010) and pursuant to 141 occupational groups (og).³ The higher the score of the respective indicator, the easier it will be from the point of view of the employer to recruit skilled workers and the tougher the competition situation in the occupation will be for employees. Similarly, a low points score indicates the opposite. Overall, the occupation-specific indicator can take values between 1 and 100 points.

The determination of an indicator for an occupation is chosen in order to identify special developments of possible dynamics in the future in comparison to the historical characteristics of the indicator and to analyse them over time. As Figure 1 shows, the indicator system behind the skilled personnel indicator allows to draw conclusions about the cause of change and the model variables associated with it.

² This would, for example, not be possible if the key indicators were simply standardised on an annual basis and thus aligned to different mean values.

³ The KldB 2010 indicates 144 occupational groups. However, because no rank differentiation is made in respect of members of the regular armed forces, results are only shown for 141 occupations.

Figure 1: Indicator System and Influencing Variables



Source: Qube-Projekt.de, fifth wave

The following presentation of the individual indicators is sub-divided by meaningfulness of the key indicator, calculation of the key indicator and score allocation for the respective indicator. The subscript *o* in the formulae acts as a place holder for occupational main group (*omg* ~ two digit level KldB 2020) and occupational group (*og* ~ three digit level KldB 2020) respectively. Finally, the combined skilled personnel indicator is presented and possible interpretations of the characteristics of the indicator are stated.

2 Volume Indicator - VI

Meaningfulness of the key figure – in order to take account of potential workers, the labour supply refers both to supply in numerical terms and to the number of working hours offered by the persons making up the labour supply. The microcensus, a 1 percent random sample of all households in Germany, uses number of weekly hours of work wished for in order to calculate this so-called *potential work volume* insofar as this lies above hours of work actually regularly performed (ZIKA u. a. 2012: S. 8). Particularly in areas where there is a large proportion of part-time activities, this produces a labour supply that is higher than demand. For this reason, we assume that the higher the potential work volume in hours in an occupation compared to the demand for working hours, the easier it is for enterprises to recruit skilled workers. This labour supply can be measured in terms of both absolute values VA_o and relative values VR_o .

Calculation of the key figures:

$$VA_o = \text{Potential work volume (in millions of hours)}_o - \text{Work volume (in millions of hours)}_o$$

$$VR_o = \left(\left(\frac{\text{Potential work volume}_o}{\text{Work volume}_o} \right) - 1 \right) * 100$$

Score allocation for the indicator – whereas high-employment occupations display higher values with regard to number of hours, greater weighting is accorded to relative over or undersupply in occupations with low numbers of workers. Because a relative consideration facilitates better comparability, it is given a slightly higher significance. For this reason, the value range of VA_o is subdivided into 20 intervals, whilst the value range of VR_o contains 30 intervals. The relative consideration is thus accorded greater significance in the ratio of 60:40. Because the indicator is intended to reflect both the employer and employee perspective, differentiations are also permitted in the negative range. If $VA_o \leq -100$ million hours, one point is awarded in VAI_o . If $VA_o > 350$ million hours, 20 points are given. Points are added up in intervals of 25 million hours (approximately 17,000 FTEs) between the two extreme values stipulated. Table 1 shows the allocation of the indicator values to the point values of the indicator according to occupational main groups (two-digit code) and occupational groups (three-digit code).⁴

Table 1: VA_o – Key Figures Characteristics and Indicator Values by Occupational Differentiation

Occupational main group (two-digit code)		Occupational group (three-digit code)	
Key figure	Indicator	Key figure	Indicator
VA_{omg}	VAI_{omg}	VA_{og}	VAI_{og}
under -100	1	under -100	1
-100 up to under -75	2	-100 up to under -75	2
-75 up to under -50	3	-75 up to under -50	3
-50 up to under 25	4	-50 up to under 25	4
-25 up to under 0	5	-25 up to under 0	5
0 up to under 25	6	0 up to under 25	6
25 up to under 50	7	25 up to under 50	7
50 up to under 75	8	50 up to under 75	8
75 up to under 100	9	75 up to under 100	9
100 up to under 125	10	100 up to under 125	10
125 up to under 150	11	125 up to under 150	11
150 up to under 175	12	150 up to under 175	12
175 up to under 200	13	175 up to under 200	13
200 up to under 225	14	200 up to under 225	14
225 up to under 250	15	225 up to under 250	15
250 up to under 275	16	250 up to under 275	16
275 up to under 300	17	275 up to under 300	17
300 up to under 325	18	300 up to under 325	18
325 up to under 350	19	325 up to under 350	19
over 350	20	over 350	20

The choice of the range of the characteristics is based on the values realized in the past. The ranges are chosen in such a way that in principle it is possible to "cross" the entire range in the future, so that changes also become visible. This also applies to the scoring scales of the other sub-indicators.

In the case of VR_o , the maximum number of points awarded is 30. If $VR_o \leq -14\%$, VRI_o receives the value 1. VRI_o is increased by one point every 1.5 percentage points. Values of $VR_o > 28\%$ result in $VRI_o = 30$.

⁴ For 2015, the median of VAI_{omg} is nine. In the case of VAI_{og} it is six.

Table 2 shows the points awarded in the indicator for the relevant value range of the key indicator.⁵

Table 2: VR_o – Key Figures Characteristics and Indicator Values by Occupational Differentiation

Occupational main group (two-digit code)		Occupational group (three-digit code)	
Key figure	Indicator	Key figure	Indicator
VR _{omg}	VRI _{omg}	VR _{og}	VR _{og}
Less than -14 %	1	Less than -14 %	1
-14 % to under -12.5 %	2	-14 % to under -12.5 %	2
-12.5 % to under -11 %	3	-12.5 % to under -11 %	3
-11 % to under -9.5 %	4	-11 % to under -9.5 %	4
-9.5 % to under -8 %	5	-9.5 % to under -8 %	5
-8 % to under 6.5 %	6	-8 % to under 6.5 %	6
-6.5 % to under 5 %	7	-6.5 % to under 5 %	7
-5 % to under -3.5 %	8	-5 % to under -3.5 %	8
-3.5 % to under -2 %	9	-3.5 % to under -2 %	9
-2 % to under -0.05 %	10	-2 % to under -0.05 %	10
-0.05 % to under 1 %	11	-0.05 % to under 1 %	11
1 % to under 2.5 %	12	1 % to under 2.5 %	12
2.5 % to under 4 %	13	2.5 % to under 4 %	13
4 % to under 5.5 %	14	4 % to under 5.5 %	14
5.5 % to under 7 %	15	5.5 % to under 7 %	15
7 % to under 8.5 %	16	7 % to under 8.5 %	16
8.5 % to under 10 %	17	8.5 % to under 10 %	17
10 % to under 11.5 %	18	10 % to under 11.5 %	18
11.5 % to under 13 %	19	11.5 % to under 13 %	19
13 % to under 14.5 %	20	13 % to under 14.5 %	20
14.5 % to under 16 %	21	14.5 % to under 16 %	21
16 % to under 17.5 %	22	16 % to under 17.5 %	22
17.5 % to under 19 %	23	17.5 % to under 19 %	23
19 % to under 20.5 %	24	19 % to under 20.5 %	24
20.5 % to under 22 %	25	20.5 % to under 22 %	25
22 % to under 23.5 %	26	22 % to under 23.5 %	26
23.5 % to under 25 %	27	23.5 % to under 25 %	27
25 % to under 26.5 %	28	25 % to under 26.5 %	28
26.5 % to under 28 %	29	26.5 % to under 28 %	29
Over 28 %	30	Over 28 %	30

The volume indicator VI is calculated by addition of the two individual indicators VAI_o and VRI_o and can exhibit theoretical values between 1 and 50.⁶

$$VI_o = VAI_o + VRI_o$$

⁵ For 2015, the median of VRI_{omg} is 15. In the case of VRI_{og} it is 21.

⁶ For 2015, the median of VI_o over the 141 occupational groups is 21. Across the 37 occupational main groups, it is 25.

3 Structural Indicator – SKI

The structural indicator consists of the qualification and substitution indicator. Both indicators depend on each other in terms of content and are presented separately below.

3.1 Qualification Indicator - QI

Meaningfulness of the key figure – if labour supply is unable to cover demand once occupational flexibilities (changes between learned and practised occupation) have been taken into account, changes to work organisation, working conditions or training behaviour need to take place. In the case of occupations in which the amount of training exceeds labour demand, it should be easier to recruit qualified staff than in occupations in which there is less training in relative terms. At the same time, the labour supply in occupations with a potential oversupply of persons with the same level of professional qualification will be subject to a higher level of competition. The qualification indicator QI takes account of these imbalances in occupation-specific education and training behaviour and sets the supply of persons who have completed training in an occupation in relation to the available labour demand in the relevant occupation (cf. STUTH 2017).

Calculation of the key figure

$$Q = \frac{\text{Amount of labour supply with occupation specific qualification}_o}{\text{Amount of labour demand}_o}$$

Score allocation for the indicator – For QI_o , Q_o is sub-divided into 25 intervals with a factor of 0.08. Each interval is ascribed one point. $QI_o = 1$ if $Q_o \leq 0.08$. The highest value of $QI_o = 25$ is awarded if $Q_o > 12,5$.

Table 3: QI_o – Key Figures Characteristics and Indicator Values by Occupational Differentiation

Occupational main group (two-digit code)		Occupational group (three-digit code)	
Key figure	Indicator	Key figure	Indicator
Q_{omg}	QI_{omg}	Q_{og}	QI_{og}
Under 0.08	1	Under 0.08	1
0.08 to under 0.16	2	0.08 to under 0.16	2
0.16 to under 0.24	3	0.16 to under 0.24	3
0.24 to under 0.32	4	0.24 to under 0.32	4
0.32 to under 0.40	5	0.32 to under 0.40	5
0.40 to under 0.48	6	0.40 to under 0.48	6
0.48 to under 0.56	7	0.48 to under 0.56	7
0.56 to under 0.64	8	0.56 to under 0.64	8
0.64 up to under 0.72	9	0.64 up to under 0.72	9
0.72 up to under 0.80	10	0.72 up to under 0.80	10
0.80 up to under 0.88	11	0.80 up to under 0.88	11
0.88 up to under 0.96	12	0.88 up to under 0.96	12
0.96 up to under 1,042	13	0.96 up to under 1,042	13
1.042 up to under 1.136	14	1.042 up to under 1.136	14
1.136 to under 1.25	15	1.136 to under 1.25	15
1.25 to under 1.389	16	1.25 to under 1.389	16
1.389 up to under 1.563	17	1.389 up to under 1.563	17
1.563 up to under 1.786	18	1.563 up to under 1.786	18
1.786 up to under 2.083	19	1.786 up to under 2.083	19
2.083 to under 2.50	20	2.083 to under 2.50	20
2.50 to under 3.125	21	2.50 to under 3.125	21
3.125 up to under 4.167	22	3.125 up to under 4.167	22
4.167 to under 6.25	23	4.167 to under 6.25	23
6.25 to under 12.50	24	6.25 to under 12.50	24
Over 12.50	25	Over 12.50	25

Tasks within an occupational main group (two-digit code) of the 2010 KldB are similar to one another, thus meaning that employment opportunities of persons who have trained in an occupation in an occupational group (three-digit code) within the occupational main group are greater than outside the occupational main group. When calculating QI_{bg} , therefore, the number of persons making up the trained labour supply and labour demand from the relevant occupational main group (QI_{omg}) are also taken into account. The weighting used is

$$QI_{og}^* = \left(\frac{1}{3}\right) QI_{og} + \left(\frac{2}{3}\right) QI_{omg}.$$

QI_{omg} is given greater weighting because the information regarding the occupation-specific qualification is reconstructed by BIBB via the highest professional or vocational qualification and the main field of study of the last vocational qualification (MAIER/ HELMRICH 2012). Although such an alignment is undertaken for types of occupation (five-digit code) of 2010 KldB, any misclassifications cannot be completely ruled out at this level of detail. However, it can be assumed that a lower level

of detail, such as at the level of main occupation groups (two-digit), reduces the probability of possible misallocations.⁷

3.2 Substitution Indicator - SI

Meaningfulness of the key figure – acquisition of skilled workers is also reliant on the extent to which a professional certificate is necessary in order to exercise tasks rather than merely depending on the number of persons who have undergone training in the occupation. Activities for which a licence is needed, for example in fields such as healthcare, cannot therefore be replaced by using persons with a different qualification or persons who have not completed a full professional or vocational certificate (vgl. HAUPT 2016). A similar restraint applies in the case of specific tasks which require long periods of induction from lateral entrants. This permits the conclusion that it is harder to resolve skilled worker shortages in occupations with a high proportion of appropriately qualified persons because those who hold a qualification in a different field will need more induction time or will have to be retrained in order to exercise the occupation in question. The substitutability of the occupation-specific labour demand is approximated by the occupation-specific labour supply, since only for the latter we know the occupational mobility in the model. Calculation of the substitution proportion therefore involves identifying the number of the labour supply with a relevant professional or vocational qualification as a proportion of total labour supply for the occupation.

Calculation of the key figure

$$S_{beruf} = \left(1 - \frac{\text{Amount of labour supply with occupation specific qualification for the occupation}_o}{\text{Amount of labour supply}_o} \right) * 100$$

Score allocation for the indicator – S_o is between 0 and 100%. This value range is sub-divided into 25 intervals, each with a range of 4 percentage points. Each interval is allocated one point in SI_o . $SI_o = 1$ if $S_o \leq 4\%$. $SI_o = 25$ if $S_o > 96\%$.

⁷ One of the reasons for this is the fact that courses of study allow more than one specialism to be chosen. Because no reference data exists, it is difficult to check correctness of alignment at the lowest level. However, if a lesser degree of detail is applied, the structure of the occupations in which training has taken place corresponds with other surveys (with a lower sample size), such as the BIBB/BAuA Employee Survey.

Table 4: SI_o – Key Figures Characteristics and Indicator Values by Occupational Differentiation

Occupational main group (two-digit code)		Occupational group (three-digit code)	
Key figure	Indicator	Key figure	Indicator
S_{omg}	SI_{omg}	SI_{og}	SI_{og}
Less than 4 %	1	Less than 4 %	1
4 % to under 8 %	2	4 % to under 8 %	2
8% to under 12 %	3	8% to under 12 %	3
12 % to under 16 %	4	12 % to under 16 %	4
16 % to under 20 %	5	16 % to under 20 %	5
20 % to under 24 %	6	20 % to under 24 %	6
24 % to under 28 %	7	24 % to under 28 %	7
28 % to under 32 %	8	28 % to under 32 %	8
32 % to under 36 %	9	32 % to under 36 %	9
36 % to under 40 %	10	36 % to under 40 %	10
40 % to under 44 %	11	40 % to under 44 %	11
44 % to under 48 %	12	44 % to under 48 %	12
48 % to under 52 %	13	48 % to under 52 %	13
52 % to under 56 %	14	52 % to under 56 %	14
56 % to under 60 %	15	56 % to under 60 %	15
60 % to under 64 %	16	60 % to under 64 %	16
64 % to under 68 %	17	64 % to under 68 %	17
68 % to under 72 %	18	68 % to under 72 %	18
72 % to under 76 %	19	72 % to under 76 %	19
76 % to under 80 %	20	76 % to under 80 %	20
80 % to under 84 %	21	80 % to under 84 %	21
84 % to under 88 %	22	84 % to under 88 %	22
88 % to under 92 %	23	88 % to under 92 %	23
92 % to under 96 %	24	92 % to under 96 %	24
Over 96 %	25	Over 96 %	25

In order to calculate the substitution proportion at occupational group level (three-digit code), the same approach used for the calculation of QI_{og}^* is adopted. The number of persons making up the labour demand who have trained in an occupation within the relevant occupational main group ($SI_{(omg)og}$) are also taken into account because the assumption is that a professional or vocational qualification in the superordinate occupational main group is more likely to facilitate performance of a task in a subordinate occupational group than a professional or vocational qualification outside the corresponding occupational main groups.⁸

$$SI_{og}^* = \left(\frac{1}{3}\right)SI_{og} + \left(\frac{2}{3}\right)SI_{(omg)og}$$

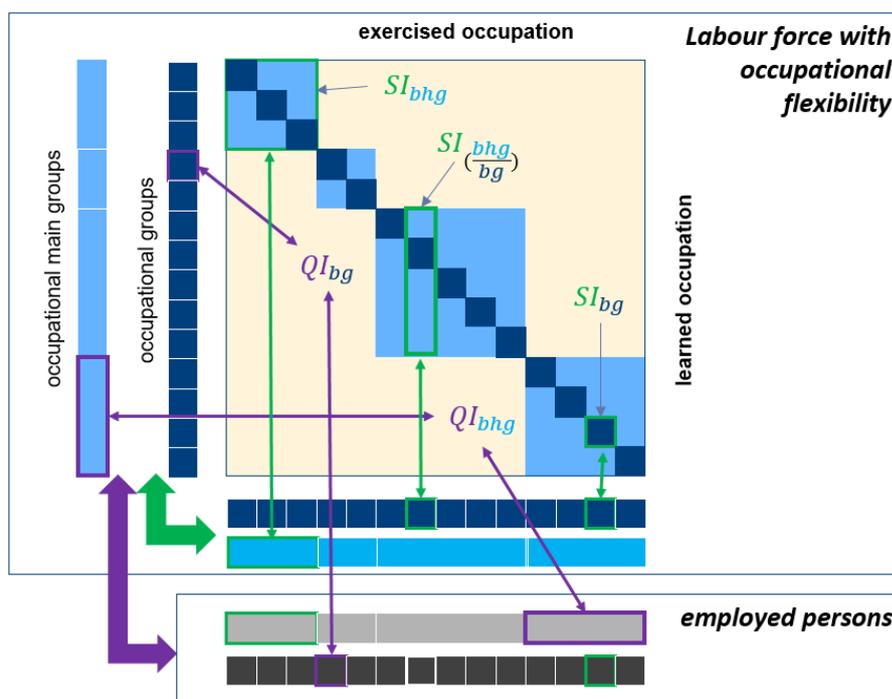
3.3 Mutual Dependencies of Structural Indicators

In order to better understand the procedure for calculating the structural indicators, the relationship between occupational main groups, occupational groups and the respective comparison level is shown in Figure 2 within the framework of flexibility for the QI and SI indicator.

⁸ In addition, as described above, the assumption may be made that results regarding occupation in which training took place by occupational main groups are more robust than at the occupational group level.

As Figure 2 shows, QI is strongly influenced by the educational behaviour and career choices of the labour force. SI , on the other hand, focuses on the occupational mobility behaviour of the labour force. Content dependencies exist between QI_o and SI_o . It is only possible for a profession or occupation to be solely exercised by persons with the appropriate qualifications (as is the case, for example, in “human medicine and dentistry”) if the trained labour supply is at least equal to the labour demand. For this reason, training is always above requirements in occupations with a low level of substitution potential. There are, however, also occupations in which training exceeds demand but in which tasks can also be exercised by persons with different or no vocational qualifications. The result is that companies enjoy a simpler skilled worker situation in these occupations.⁹

Figure 2: Calculation of the Qualification- and Substitution Indicator in the Occupational Flexibility Matrix



Source: QuBe-Projekt, fifth wave

Insofar as there are no legal restrictions to access and given differing dynamics of training provision from the educational system (see Table 4), both QI and SI will change in the same ratio as the labour demand. The greater the number of persons who have an occupation-specific qualification, the less necessary it will be to recruit persons qualified in a different field to exercise the occupation. In such cases, it is also possible to speak of a professionalization of the occupation.¹⁰

⁹ In 2015, for example, this was the case in the occupational groups “(281) Textile making” ($QI_{og}^* = 21$, $SI_{og}^* = 21$), “(931) Occupations in product and industrial design” ($QI_{og}^* = 18$, $SI_{og}^* = 16$) and “(934) Ceramics and glassware design” ($QI_{og}^* = 18$, $SI_{og}^* = 19$).

¹⁰ Such a development can, for example, be observed in the information technology occupations, in which supply from the educational system is growing strongly.

The structural indicator is calculated by:

$$SKI_{omg} = QI_{omg} + SI_{omg}$$

$$SKI_{og} = QI_{og}^* + SI_{og}^*$$

4 Skilled Personnel Indicator - FKI

Calculation of the indicator – the indicator for the skilled worker situation (FKI) is produced by adding the individual indicators together.

$$FKI_{omg} = VI_{omg} + SKI_{omg}$$

$$FKI_{og} = VI_{og} + SKI_{og}$$

Interpretation of the indicator – the theoretical value range of FKI is between 1 and 100. The more points an occupation displays, the easier the skilled worker situation will be for the companies and the higher the competition situation will be for employees. The fewer the points, the more difficult recruitment will be. For the survey year 2015, the empirical range at occupational group level lies between 33 (“Human medicine and dentistry”) and 73 (“Cleaning”). The mean value is 52.7.¹¹ Alongside “Human medicine and dentistry”, the FKI for 2015 also showed recruitment difficulties in “Occupations in police and criminal investigation, jurisdiction and penal institutions” (FKI_{og} = 36), “Teachers in schools of general education”, “Occupations in veterinary medicine and non-medical animal health practitioners”, “Vehicle operation in aviation” (FKI_{og} = 37), “Occupations in legal services, jurisdiction, and other officers of the court” (FKI_{og} = 38), “Vehicle operation in shipping” (FKI_{og} = 40), “Occupations in plumbing, sanitation, heating, ventilating, and air conditioning” and “Technical occupations in medicine, orthopaedics and rehabilitation” (FKI_{og} = 42).¹² Alongside “Cleaning”, an easier recruitment situation was, for example, also revealed in “Sales (without product specialisation)” (FKI_{og} = 65). In 2015, around half of the occupational groups exhibited an FKI between 47 and 55.¹³ This means that the theoretically possible value spectrum is not fully exploited in the empirical implementation. On the one hand, this is due to the corresponding definition of the volume indicator: No fewer working hours can have been worked in an occupation than were offered. In the past, therefore, the value range in the negative range could not be achieved by definition. For the projection, however, such a theoretical situation is permitted in order to be able to identify bottlenecks. On the other hand, the structural indicators are interdependent in terms of content. Theoretically, however, it is also possible to exhaust the value range here. Nevertheless, when interpreting the results, the value range observable in practice must also be taken into account. If the empirical values of the past are linked with the assumptions of the QuBe basic projection, the characteristics of the SPI may be interpreted as in Table 1.

¹¹ Calculation of the mean value takes place on the basis of weighting using labour volume by occupation.

¹² The occupational groups with the greatest recruitment difficulties thus approximately correspond to the results for shortage occupations of the (BUNDESAGENTUR FÜR ARBEIT (2015)). The shortage analysis conducted by the BA is based on job vacancies reported to the BA, the lengths of time that these vacancies go unfilled and entries to and exits from unemployment.

¹³ 80 percent of the occupations had an FKI between 43 and 57.

Table 1: Possible Interpretation of the Skilled Personnel Indicator *FKI* Taking the Assumptions of the QuBe Basic Projection into Account

Value <i>FKI</i>	20 to 38 50 62 to 80
Title	Very high skilled worker shortage	Skilled worker shortage	Balanced skilled worker situation	Oversupply of skilled workers	Very high oversupply of skilled workers
Possible interpretation	Employer view Worker recruitment is difficult within the scope of the development pathway going forwards. Further adaptations are necessary, such as immigration, training, increasing attractiveness or company restructuring.	Worker recruitment is possible within the scope of the development pathway embarked upon, but could be considerably improved via divergent measures such as immigration, training, increasing attractiveness or company restructuring.	Worker recruitment is possible within the scope of the development pathway embarked upon.	Worker recruitment is relatively easy to implement if educational behaviour and mobility tendencies remain the same.	There will be a multitude of workers to choose from if educational behaviour and mobility tendencies remain the same.
	Employee view There will be a multitude of companies for the worker to choose from if educational behaviour and mobility tendencies remain the same.	Workers will find it relatively easy to obtain a new job if educational behaviour and mobility tendencies remain the same.	Jobs are available within the scope of the development pathway embarked upon.	Although jobs are available within the scope of the development pathway embarked upon, employees are exposed to fiercer competition situations. These can be considerably improved by, for example, adapting professional or vocational qualifications or job wishes.	There is a high degree of competition with regard to the job search. This means that changes in behaviour are required, such as adapting professional or vocational qualifications or job wishes.

The example measures listed in Table 1 for the securing of skilled worker requirements or employability are not comprehensive, neither are the needs for action restricted to the value range depicted. Changes to recruitment practice or occupational objectives may also be useful in occupations, which do not fall within the relevant value range of the *FKI*. The tendency is, however, for adjustments to become more necessary the further the *FKI* moves away from the mean value.

A difficult skilled worker situation for companies also does not mean that stable and/or attractive employment prospects will result for persons who have completed training in a relevant occupation. Working conditions which are unappealing from an employee point of view may also be a cause of recruitment difficulties at the company level.

In order to be able to portray changes over the course of time and between occupations, the metrical values of the volume in absolute (*VA*) and relative (*VR*) terms, of professional or vocational training provision (*Q*) and of the possibility of substitution (*S*) are transferred to a points scheme.

5 Skilled Personnel Indicator in regions

At the federal level, the structural indicators at the level of 141 occupational groups also take into account the labour supply of the higher-level 37 occupational main groups (*omg*). Since no occupational groups are shown in a regional presentation of results by federal states or labour market regions, this weighting is not applicable. Instead, only the structural information of the occupational main group is used. Furthermore, the structural indicators are not calculated on a region-specific basis because they show a high degree of volatility due to other region-specific factors such as commuting and relocation behaviour. Instead, the structural information of the *omg* is transferred from the Federal Republic to the regions (federal states or labour market regions).

In contrast, region-specific information is used to calculate the volume indicator

$$VA_{omg,r} = \text{Potential work volume (in millions of hours)}_{omg,r} \\ - \text{Work volume (in millions of hours)}_{omg,r}$$

The allocation of the working hours in $VAI_{bhg,r}$ is proportional to VAI_{bhg} in the Federal Republic. Thus, for a region, the borders as well as the margin of the intervals (*Int*) are reduced by the region's share of employed persons in the Federal Republic.

$$Int_r = (\text{labour demand}_r / \text{labour supply}_{Federation}) Int_{Federation}$$

For $VR_{omg,r}$ such a correction is not necessary, since the values are relative. The regionally specific skilled personnel indicator ($FKI_{omg,r}$) differs from the skilled worker indicator at the federal level ($FKI_{omg,r}$) accordingly by the region-specific calculation of $VI_{omg,r}$:

$$FKI_{omg,r} = VI_{omg,r} + SKI_{omg}$$

6 Literature

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