

SKILLS GAP IN DENMARK:

INVESTIGATION OF BØRSEN'S TOP 1000

PREFACE

Background

The potential for a future talent shortage has not only attracted a lot of attention among academics and practitioners, but also received extensive media coverage. According to the Boston Consulting Group, a skills gap exists when a company is unable to fill positions offering a prevailing market wage that have been open for at least three months due to a lack of qualified candidates (based on educational, experience, and quality requirements).

Recently, several institutions and public organizations in Denmark have begun analyzing the supply side. However, we still know very little about the demand side. For example, how big is the shortage? Does it exist or is it just a media-boostered fad? What kind of skills will Danish companies seek in the future in light of their current strategies and business developments? How do companies deal with the shortage?

Given these questions, Copenhagen Capacity and the Confederation of Danish Industry's Consortium for Global Talent, on behalf of an expert group consisting of a broad range of stakeholders, approached the Human Capital Analytics Group (HCA) at Copenhagen Business School with a request to conduct a mixed-method study of Børsen's top 1,000 Danish companies. Companies are included in this list on the basis of their revenue. After removing cases affected by bankruptcy, mergers, and acquisitions, and companies with no activities in Denmark, our initial population included 900 companies. We obtained contact information for 789 companies, which constituted our final study population (see Appendix 1 for a description of the population).

The methodology used in this project consisted of four steps:

- A literature review. The purpose of the literature review was to identify established measurements of the skills gap and common approaches to its study. See Appendix 2 for the results of the literature review.
- Exploratory interviews with companies. We conducted eight interviews with representatives of seven Danish companies and one university. Those interviews provided an initial understanding of the skills gap in the Danish context as well as numerous examples of sought-after skills and hard-to-fill positions. The data were gathered through semi-structured interviews (see the interview guide in Appendix 3). Each interview lasted from 10 to 30 minutes.
- A web-based survey. We developed and conducted a web-based survey with the purpose of gathering data that would allow us to identify and quantify the acute skills gap among companies operating in Denmark (see the questionnaire in Appendix 4).
- Gathering of existing data from public datasets. To obtain the corporate data for the last five years we combined the primary data from the survey with data available from public datasets (ORBIS).

The report

In the report, we combine the insights from the four steps described above into four chapters:

- **The acute skills gap.** In this chapter, we define the acute skills gap, distinguish between the experienced skills gap (the shortage of qualified employees in the past 12 months) and the expected skills gap (expectations for the skills gap in the next 12 months). We also attempt to quantify the skills gap by determining the number of job openings that remained unfilled due to the skills gap.
- **Positions.** In this chapter, we explore how the shortage of qualified employees in Denmark is distributed across workforce segments. We delve into the types of positions are the most difficult to fill and why. On the basis of a regression analysis, we analyze whether there are certain positions in which growing demand actually causes the acute skills gap.
- **Skills.** In this chapter, we focus on particular skills that are in demand. To do so, we asked our respondents about the need for skills produced in Denmark/by the Danish educational system; skills related to languages, cultural insight, and market knowledge that are inherent in employing workers from a specific country; and high-level specialist skills that are in high demand but available only on a limited basis. We utilize a regression analysis to investigate the extent to which the shortage of certain skills explains the acute skills gap.
- **Performance impact and organizational actions.** This chapter examines how the skills gap affects performance, as well as the actions taken by companies to mitigate the impact. To understand whether the performance of the sample companies was affected by the skills gap, we asked our respondents whether a lack of qualified employees in Denmark had negatively affected their businesses. We also investigate how the companies in our sample deal with the skills-gap challenge and seek to mitigate the skills gap through a variety of measures.

This is the first study of the demand side of the story. Accordingly, we were forced to take some shortcuts and accept the limitations associated with perceptual measures. However, every limitation highlights an avenue for future research. Therefore, in the final chapter of this report, we reflect on the empirical limitations of our study resulting from our methodological choices and make suggestions for addressing such limitations in the future.

How to read this report

All direct quotes included in the report have been approved by our respondents. Moreover, some of our interviewees agreed to reveal their identities, while others asked us to use only their companies' names. Some respondents chose to remain anonymous.

Throughout the text, we refer to statistical significance (or statistically significant results) by reporting a p-value. A p-value reflects the probability of observing an effect given that the null hypothesis is true.

We mainly use three significance levels:

- $P < 0.001$, highly significant,
- $P < 0.01$, significant at 1%, and
- $P < 0.05$, significant at 5%.

Occasionally, we write that the results are approaching significance and report $p < 0.10$ (a less than 1 in 10 chance of being incorrect).

We also report correlations between various variables, the results of group tests (ANOVA) and, in two instances (“Explaining the gap by looking at positions” and “Explaining the gap by looking at skills”), the results of regression analyses (Tobit). When reflecting upon the results, please remember that correlations do not imply causality.

Acknowledgments

On behalf of the Human Capital Analytics Group, I would like to thank all of those who have helped carry out this research as well as the companies that have participated in this study. We are especially grateful to the companies that agreed to participate in the exploratory stage. A big "thank you" goes to all of the individual respondents who participated in the project by answering the online survey on behalf of their companies.

I would also like to thank the members of the Expert Panel for their initiative, their ongoing support throughout the process, and their comments on the final version of this report.

My biggest thank you goes to our team—especially Søren Lysemose Støvring, who conducted the study, as well as our project manager, Sara Vardi, and our research assistants, Jacob Jeppesen and Lærke Kristensen. Without you, this report would have never seen the light of day. I also would like to thank our editor, Tina Pedersen of In the Margins Editing, who made this report much easier to read and comprehend.

Happy reading!



Dana Minbaeva
Founder of Human Capital Analytics Group

EXECUTIVE SUMMARY

On the acute skills gap

The majority of Danish companies have experienced an acute skills gap. Within Denmark, the larger companies in our sample (in terms of both full-time employees (FTE) and revenue) find themselves less able to access the skills they require. The skills gap is highest in the Copenhagen area, followed by region Syddanmark. The extent of the experienced skills gap does not depend on whether companies operate internationally or are foreign owned.

The acute skills gap will remain and may grow, especially in professional, scientific, and technical activities industries. In contrast to the previously experienced acute skills gap (Figure 1), expectations regarding the future skills gap do not vary significantly across Danish regions, or in terms of whether companies have international activities or are internationally owned. Nor do these expectations vary significantly across firm size when measured in terms of FTE.

The experienced acute skills gap is relatively narrow, covering an average of only 10% of job openings. However, larger and growing companies experience a slightly wider gap.

The majority of the companies expecting growth in Denmark also expect an even greater acute skills gap in the future. Neither the experienced nor the expected acute skills gaps are correlated with expectations for international growth.

On positions

In terms of the skills gap across workforce segments, our findings suggest that the greatest shortage relates to scientists and engineers, followed by IT and IT-related workers, and skilled production workers. Regardless of the workforce segment, the more specialized the position, the harder it is to find the right employee.

On the basis of a factor analysis, we grouped positions into two groups: technical positions and business positions. We ran regression analyses in the form of Tobit estimations of experienced and expected skills gaps, while controlling for size (FTE), consecutive growth in revenue and size, international presence, region, and industry. For both the experienced skills gap and expectations for the future skills gap, we found that the shortage in “technical positions” predicts the evaluation of the skills gap (positive, $p < 0.05$), while the shortage in “business positions” is insignificant.

Some positions require the combination of the traits of two groups, such as technical, specialized knowledge and managerial capabilities. This particular combination is in high demand.

On skills

The majority of the companies in our sample have experienced a shortage of skills produced in Denmark. In particular, the manufacturing industry is experiencing a shortage of qualified employees in Denmark to a higher degree than other industries.

Our qualitative interviews generally show that personal skills, such as teamwork abilities, are valued and in demand, but they are not in short supply.

Our respondents do not report a significant shortage of qualified employees with specific knowledge of countries other than Denmark. According to our interviewees, such difficulties are primarily associated with recruiting internationally experienced, or “culturally fluid,” employees.

A few companies experience a shortage of high-level specialist skills with limited global availability in certain narrowly defined, highly specialized areas. A shortage of such specialists is primarily experienced by companies engaged in international activities.

We ran regression analyses in the form of Tobit estimations of experienced and expected skills gaps while controlling for size (FTE), consecutive growth in terms of revenue and size, international presence, region, and industry. These analyses allowed us to conclude that the undersupply of skills produced in Denmark/from the Danish educational system appears to have caused the experienced skills gap and drives expectations of a skills gap in the future.

On performance impact and organizational actions

The performance of 38% of our sample companies has been negatively affected by a lack of qualified employees in Denmark. The larger the company, the more severe the performance implications.

The shortage of qualified employees in Denmark matters a great deal for the domestic performance of the companies surveyed, but only rarely affects their international growth. The skills gap typically affects company performance by delaying strategic initiatives, limiting growth in Denmark, and hampering the ability to pursue market opportunities.

As a standalone factor, the skills gap only rarely leads to the relocation of core facilities to places outside Denmark. Instead, jobs and tasks are often moved across borders in such situations.

Companies rely on a variety of solutions to mitigate the negative impact of the skills gap. 82% agree that a focus on the retention and development of talent is one way of overcoming the skills gap. Companies also indicate that enhanced collaboration with educational institutions (50%) and a focus on recruiting younger talent (43%) are likely to be popular initiatives over the next three years.

To some extent, whether a company intensifies its recruitment efforts in Denmark or internationally is a question of size (measured in FTE terms)—the larger, internationally operating companies in our sample tend to look outwards to solve the skills-gap challenge, while smaller companies focus on Denmark.

Most successful companies do not have a single preferred method of addressing the skills gap. Instead, they employ a variety of solutions.

DANSK RESUMÉ

Den akutte kompetencekløft

Størstedelen af danske virksomheder har oplevet en akut kompetencekløft – dvs. ikke at kunne finde kvalificeret arbejdskraft til en opslået stilling inden for tre måneder. De større virksomheder i vores undersøgelse (både målt på omsætning og antal fuldtidsansatte) oplever, at de har sværere ved at anskaffe de kompetencer, de efterspørger. Kompetencekløften er størst i Hovedstadsområdet efterfulgt af region Syddanmark. Den oplevede kompetencekløft afhænger ikke af, hvorvidt virksomheder har internationale aktiviteter eller hovedsæde uden for Danmark.

Den akutte kompetencekløft vil fortsat være til stede og potentielt vokse, særligt i liberale erhverv og de videnskabelige og tekniske industrier. I modsætning til den *oplevede* kompetencekløft (Figure 1) varierer den *forventede* kompetencekløft hverken på tværs af de danske regioner eller i forhold til, om virksomheden har internationale aktiviteter eller internationalt ejerskab. Der er heller ingen signifikant variation på tværs af antal fuldtidsansatte.

Den oplevede akutte kompetencekløft er relativt smal; i gennemsnit er det blot omtrent 10 % af de udbudte stillinger, der ikke bliver besat inden for tre måneder. Større og vækstende virksomheder oplever dog en bredere kløft.

Størstedelen af de virksomheder, der forventer vækst i Danmark, forventer også, at den akutte kompetencekløft vil vokse i fremtiden. Hverken den oplevede eller den forventede kompetencekløft hænger sammen med forventninger til international vækst.

Stillinger og faggrupper

I forhold til faggrupper viser resultatet af vores undersøgelse, at virksomheder i Danmark har sværest ved at finde forskere og ingeniører efterfulgt af IT og IT-beslægtede kompetencer og faglærte produktionsmedarbejdere. Jo mere specialiseret en stilling er, jo sværere er den som udgangspunkt at besætte, uanset hvilken faggruppe, der er tale om.

På baggrund af en faktoranalyse blev faggrupperne inddelt i to overordnede kategorier – tekniske stillinger og erhvervsrelaterede stillinger. Herefter blev der udført Tobit-regressionsanalyser af den oplevede og den forventede kompetencekløft kontrolleret for virksomhedsstørrelse (målt i antal fuldtidsansatte), kontinuerlig vækst i omsætning og ansatte, international tilstedeværelse, samt region og industri. Resultatet viser, at både den oplevede og den forventede kompetencekløft bestemmes af manglen på tekniske stillinger (positiv korrelation, signifikant $p < 0.05$). Manglen på erhvervsrelaterede kompetencer alene har ikke signifikant effekt på den oplevede eller forventede kompetencekløft.

Nogle stillinger kræver en kombination af egenskaberne fra de to grupper, for eksempel specialiseret teknisk viden og gode ledelseskundskaber. Denne kombination er særligt efterspurgt.

Kompetencer

Størstedelen af de virksomheder, der har deltaget i vores undersøgelse, har oplevet en mangel på kompetencer, der er produceret i det danske uddannelsessystem. Særligt produktionsvirksomheder oplever en mangel på kvalificeret arbejdskraft uddannet i Danmark.

Med hensyn til personlige kompetencer, eksempelvis evnen til at arbejde i grupper, viser vores kvalitative interviews, at sådanne egenskaber er værdsatte og efterspurgt, men ikke en mangelvare.

Vores respondenter har ikke oplevet udpræget mangel på kvalificeret arbejdskraft med specifik viden forbundet med det at være fra et andet land end Danmark. Ifølge vores interviewdeltagere er sådanne udfordringer primært forbundet med at ansætte folk med bred international erfaring.

Det er også relativt få virksomheder, der oplever en mangel på kompetencer, der er så specialiserede, at de kun findes i begrænset globalt antal. Denne mangel opleves primært af de virksomheder, der har internationale aktiviteter.

Efter at have udført Tobit-regressionsanalyser af den oplevede og den forventede kompetencekløft og kontrolleret for størrelse (fultidsansatte), kontinuerlig vækst i omsætning og ansatte, international tilstedeværelse, samt region og industri, er konklusionen, at vores respondentes oplevede mangel på kvalificeret arbejdskraft lader til at være forårsaget af manglen på dansk-producerede kompetencer, hvilket også driver forventningerne til den fremtidige kompetencekløft.

Påvirkning af performance og løsninger

38 % af vores respondenter har oplevet, at deres virksomhed er blevet negativt påvirket af en mangel på kvalificeret arbejdskraft i Danmark. For større virksomheder mærkes den negative påvirkning tydeligere. En mangel på kvalificeret arbejdskraft i Danmark har stor betydning for firmaets performance i landet, men påvirker kun sjældent virksomhedernes forventninger til international vækst.

Kompetencekløften påvirker typisk virksomhedsperformance ved at forsinke strategiske initiativer, begrænse vækst i Danmark og begrænse evnen til at forfølge muligheder i markedet. Som enkeltstående faktor fører kompetencekløften sjældent til, at virksomheder flytter kernefaciliteter til udlandet. I stedet flyttes visse jobs og opgaver over grænsen, når kvalificeret arbejdskraft ikke er tilgængeligt i Danmark.

Virksomhederne har flere bud på, hvilke løsninger der er relevante i forhold til at minimere kompetencekløftens negative konsekvenser. 82 % er enige i, at et øget fokus på fastholdelse og udvikling af talent er én måde at konfrontere kompetencekløften. Virksomheder fremhæver også, at øget samarbejde med uddannelsesinstitutioner (50 %) og et øget fokus på at rekruttere yngre talent (43 %) er mulige løsninger over de næste tre år. Til en vis grad afhænger beslutningen om, hvorvidt en virksomhed vil intensivere sin rekrutteringsindsats i Danmark eller internationalt af størrelse (målt i fultidsansatte). De større internationale virksomheder blandt vores respondenter har en tendens til at søge udad for at løse kompetencekløftens udfordringer, mens mindre virksomheder fokuserer på Danmark. De fleste succesfulde virksomheder har ikke blot én foretrukken løsning. De bruger aktivt flere forskellige initiativer til at overkomme kompetencekløften.

1

THE ACUTE SKILLS GAP

We define the “skills gap” as the gap between the skills needed by Danish employers and those possessed by potential employees in Denmark. However, not every job opening is the result of a skills gap. In our study, the focus is on the “acute” skills gap, defined as the gap that exists when it takes a company at least three months to fill a position that offers a prevailing market wage due to a lack of qualified candidates (based on educational, experience, and quality requirements).

Does an acute skills gap exist?

Yes, it does. The majority of Danish companies in our sample have experienced an acute skills gap. In fact, at the time of our survey, 58% of our respondents had experienced a skills gap to at least some extent within the preceding 12 months (see Figure 1). An additional 33% of the responding companies experienced an acute skills gap to a small extent.

TO WHAT EXTENT HAS YOUR COMPANY EXPERIENCED AN “ACUTE” SKILLS GAP AS A RESULT OF A SHORTAGE OF QUALIFIED EMPLOYEES WITHIN THE LAST 12 MONTHS?

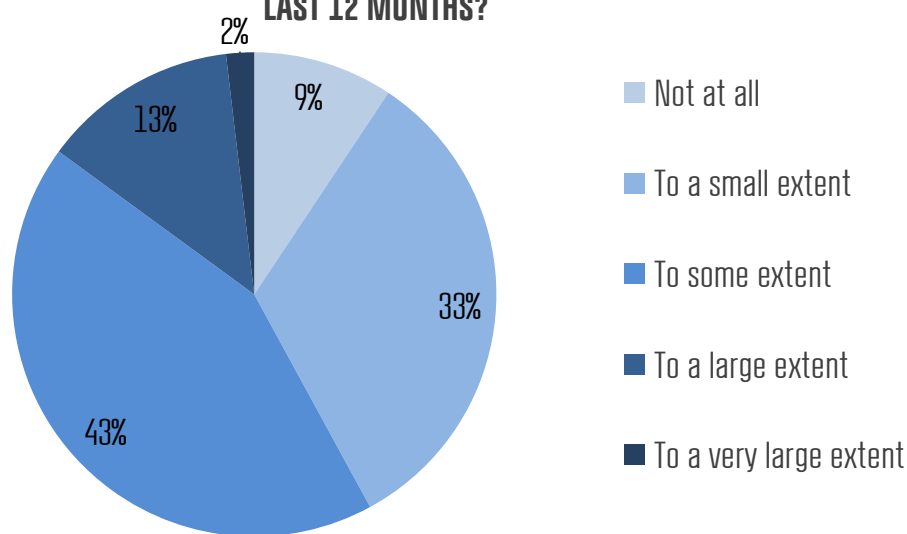


Figure 1

The highest proportion of companies that have experienced the skills gap to at least a large extent is found in the information and communication industry (43%), followed by the construction industry (22%), and the financial and insurance industry (20%). The difference between the information and communication industry and other industries is statistically significant: companies in Denmark operating within this industry field have, on average, experienced the skills gap to a significantly greater extent than companies in other industries.

Companies operating within the information and communication industry have experienced the skills gap to a significantly greater extent.

The presence of an acute skills gap is confirmed by our interviewees. Some interviewees made us aware of potential differences across firm size and degree of internationalization.



I think that I would be cautious to try and apply a unified view because depending on which companies you talk to, and about what, you will get some very different answers. There is a need in my mind to differentiate significantly between those more internationally oriented organizations and those who are less so. In a Danish context you would have different degrees of internationalization you might want to segment on when considering to which extent there is a significant skills gap.

—Alex Penvern, Partner and Leader of Reward practice, PwC Denmark

The degree to which companies in Denmark experience an acute skills gap varies with size, which we measure in terms of full-time employees (FTE). The correlation is positive and significant ($p < 0.05$). In other words, the larger the company in terms of the number of FTEs, the greater the experienced skills gap. The experienced acute skills gap also varies with company revenue. The largest 50% of the sample companies in terms of revenue tends to experience the acute skills gap to a greater extent than the smallest 50% ($p < 0.05$). It is important to remember that the sample, as a whole, represents the companies with the highest revenue in Denmark.

The larger the company, the bigger the gap

The extent of the experienced acute skills gap differs across regions (see Textbox 1). On Sjælland (Copenhagen and the island of Sjælland), 20% of the companies report either a large or very large acute skills gap. This is the highest in the country and significantly higher than the average of 16% ($p < 0.05$). Unexpectedly, we did not find any differences between Danish and internationally owned companies in this regard, nor did we find significant differences between those companies with international activities and those that only operate in Denmark.

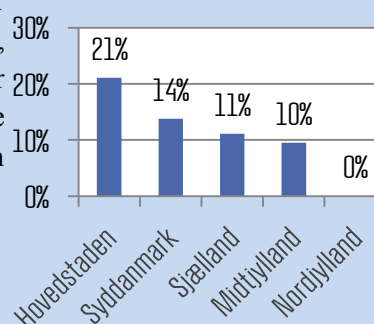
Quantifying the extent of the acute skills gap

When asked about job openings in Denmark that have remained unfilled due to a lack of qualified applicants, most companies (57%) replied that less than 10% were unfilled after three months (see Figure 2). Moreover, 8% of the surveyed companies had difficulties filling more than 25% of their positions.

Textbox 1: The acute skills gap across regions

In the Copenhagen metropolitan area, 21% of all companies in our sample experienced an acute skills gap to a large or very large extent in the year prior to the survey. This is the highest of any region. For region Syddanmark (Southern Denmark), the proportion is 14%, followed by 11% for Sjælland (Eastern Denmark) and 10% for Midtjylland. For the Nordjylland region (Northern Denmark), none of the companies in our sample had experienced a high or very high acute skills gap within the preceding year.

ANSWERED LARGE OR VERY LARGE ACUTE SKILLS GAP



While most companies have experienced an acute skills gap at least to some extent, the actual number of unfilled positions is typically less than 10%. There are several potential explanations for this. First, it could be that only certain positions are hard to fill (see Chapter 2). Second, it could be that companies only find it difficult to locate potential employees with less tangible skills not necessarily related to the job position (see Chapter 3). Third, the results presented in Figure 2 are related to the actual number of open positions, which means that firms in decline, such as those undergoing layoffs, may be active in industries with a shortage of qualified employees but still report that no positions were open for more than three months. Future research is needed to further explain the reasons behind such a narrow gap (see Chapter 5 for suggestions).

WITHIN THE LAST YEAR, WHAT PERCENTAGE OF YOUR TOTAL JOB OPENINGS IN DENMARK HAS REMAINED UNFILLED FOR AT LEAST THREE MONTHS DUE TO A LACK OF QUALIFIED APPLICANTS? (CHOOSE ONLY ONE ANSWER.)

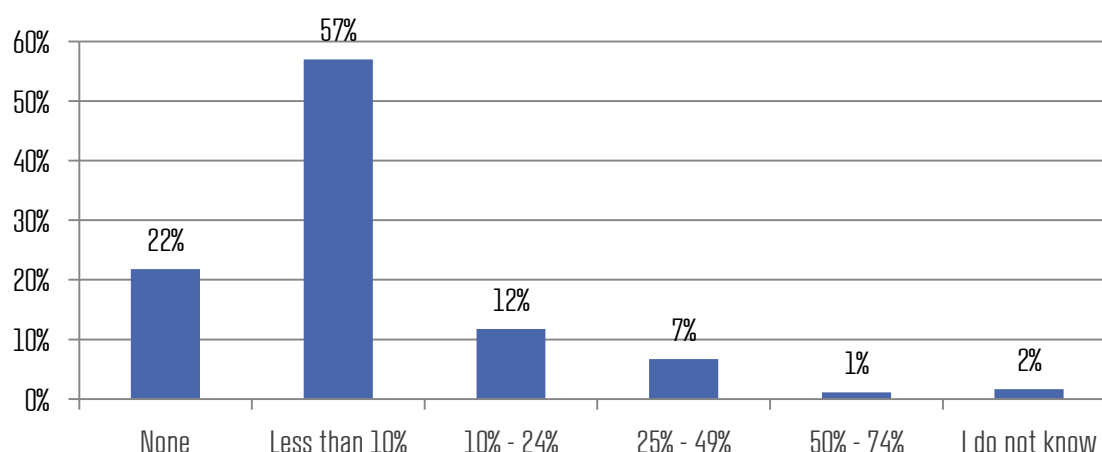


Figure 2

Table 1 shows a cross-tabulation of the degree to which companies have experienced an acute skills gap and the percentage of job openings they cannot fill.

To what extent has your company experienced an "acute" skills gap as a result of a shortage of qualified employees within the last 12 months?					
Within the last year, what percentage of your total job openings in Denmark has remained unfilled for at least three months due to a lack of qualified applicants? (Choose only one answer.)	Not at all	To a small extent	To some extent	To a large extent	To a very large extent
			1.1%	0.6%	
	None	6.7%	11.2%	3.4%	0.6%
	Less than 10%	1.7%	19.7%	29.2%	0.6%
	10% - 24%		1.1%	7.3%	0.6%
	25% - 49%	0.6%	0.6%	1.1%	1.1%
	50% - 74%		0.6%	0.6%	

Table 1

There is a highly significant positive correlation between the two ($p < 0.001$). Given the definition of acute skills gap, this strong correlation is to be expected. However, it also shows that in

The experienced acute skills gap is relatively narrow, on average covering only 10% of the job openings, although larger and growing companies experience a slightly wider gap.

terms of its extent, the acute skills gap is relatively narrow (covering mainly only 10% of the job openings). We also find that companies reporting constant revenue growth for the past five years tend to have a higher percentage of unfilled positions than others ($p < 0.01$). The same is true for companies based on Sjælland, which have a higher percentage of unfilled positions than companies in the rest of Denmark ($p <$

0.05). Finally, the larger companies (measured in terms of FTEs) have a significantly greater proportion of open positions than the smaller companies in our sample ($p < 0.01$).

Looking ahead

A major point of discussion is expectations in relation to the skills gap. Few companies in our sample expect the acute skills gap to decrease within the coming year (see Figure 3). On the contrary, 41% foresee an increasing mismatch between the demand for and supply of skills. Half of the companies in our survey expect the skills gap to remain at the current level.

In terms of the industries that expect an increase in the acute skills gap, the professional, scientific, and technical activities industries are in the lead. 53% of firms active in these industries expect some increase or a significant increase in the skills gap in the next 12 months, followed by the wholesale and retail industry (50%), construction

The acute skills gap will remain and potential grow, particularly for professional, scientific and technical activities industries

industry (44%), and the financial industry (43%). Generally, the variation across industries is insignificant. For the information and communication industry, which has the highest amount of companies that have experienced the acute skills gap to a large or very large extent, the proportion expecting growth is also 43%.

WHAT DO YOU EXPECT TO HAPPEN TO THE "ACUTE" SKILLS GAP WITHIN THE NEXT 12 MONTHS?

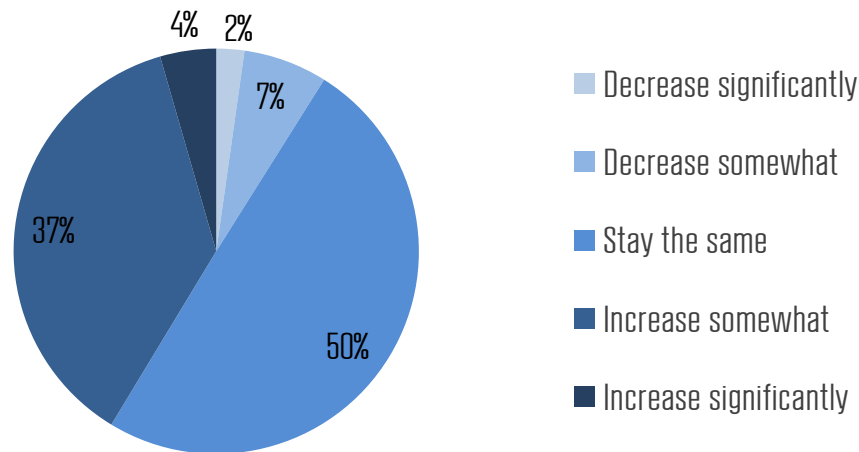


Figure 3

In contrast to the previously experienced acute skills gap (Figure 1), expectations for a future skills gap do not vary significantly across Danish regions, or in terms of whether the company has international activities or is internationally owned. Nor does this perception vary significantly across firm size when measured in terms of FTEs. Firms with higher revenue tend to have higher expectations of a future skills gap ($p < 0.05$).

Majority of the companies expecting growth in Denmark, also expect facing even greater acute skills gap in the future.

To better understand the outlook for our sample companies, we asked respondents about expected growth in headcount in Denmark (Figure 4) and internationally (Figure 5) for the year following the survey. The majority of our respondents (57%) expect growth in the number of FTE in Denmark. Only 14% percent expect a decrease in headcount. Just over 25% of our sample expect their companies' headcounts to stay unchanged. Among the companies in region Syddanmark, 73% expect headcount growth in Denmark. This is the highest proportion among the regions, and is followed by the Copenhagen region (60%) and region Midtjylland (53%).

We find a positive correlation between growth expectations and the extent to which a skills gap had been experienced within the previous 12 months ($p < 0.05$), meaning that companies that foresee headcount growth in Denmark tend to have experienced an acute skills gap in the past. Furthermore, companies expecting workforce growth in Denmark in the next twelve months also tend to expect the skills gap to increase ($p < 0.01$). Among the companies expecting growth, 53% believe that they will face an increasing skills gap in their Danish organizational units. For those that do not expect headcount growth in Denmark, the corresponding figure is only 31%. Interestingly, headcount growth expectations in Denmark differ significantly between the sample's larg-

est and smallest companies measured in terms of revenue. The larger companies tend to expect less growth ($p < 0.01$).

OVER THE NEXT 12 MONTHS, WHAT DO YOU EXPECT TO HAPPEN TO THE HEADCOUNT IN YOUR ORGANIZATION IN DENMARK? (CHOOSE ONE ANSWER.)

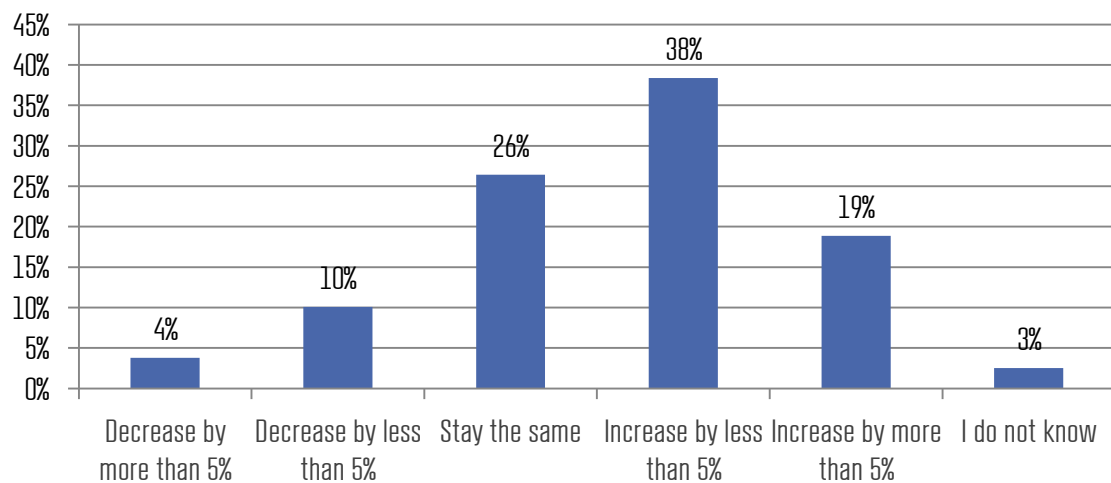


Figure 4

OVER THE NEXT 12 MONTHS, WHAT DO YOU EXPECT TO HAPPEN TO YOUR ORGANIZATION'S HEADCOUNTS IN THE FOLLOWING REGIONS?

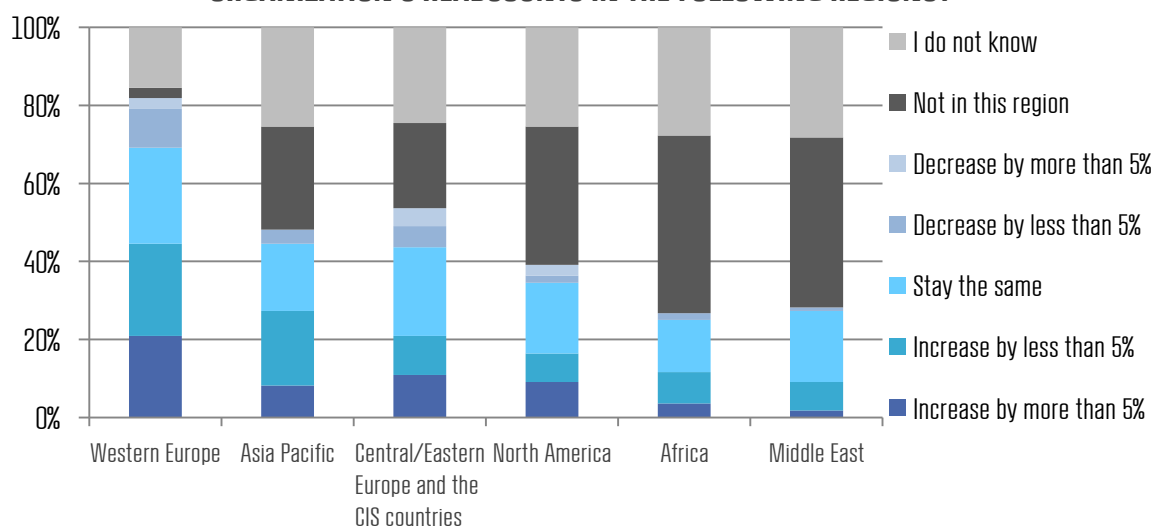


Figure 5

Expectations for growth in international headcount are less optimistic. Whereas 57% of our sample companies expect growth in Denmark, only 45% of those companies with international activities expect headcount growth in Western Europe (see Figure 5). For the rest of the regions, the

expectations are even lower. The regions for which growth expectations are lowest are the Middle East, where 9% of respondents with international activities expect growth; Africa (12%); and North America (16%).

Neither the experienced nor the expected acute skills gaps are correlated with expectations for international growth

Expected headcount growth in Western Europe varies across industry and size¹. Generally, companies active in the financial industry have a more positive view of their Western European growth than the average ($p < 0.05$). As with the growth expectations for Denmark, the smallest 50% of the companies (measured in terms of revenue) tend to have higher growth expectations for Western Europe than the largest 50% ($p < 0.05$).

Tables 2 and 3 show the cross-tabulation of the expected skills gap and growth expectations for Western Europe and Denmark, respectively. Generally, neither the experienced nor the expected acute skills gaps are correlated with expectations for international growth.

What do you expect to happen to the "acute" skills gap within the next 12 months?		Decrease significantly	Decrease somewhat	Stay the same	Increase somewhat	Increase significantly
Over the next 12 months, what do you expect to happen to your organization's headcount in Western Europe?	I do not know		1.8%	6.4%	6.4%	0.9%
	Decrease by more than 5%			0.9%	1.8%	
	Decrease by less than 5%		0.9%	6.4%	2.7%	
	Stay the same	0.9%	1.8%	12.7%	9.1%	
	Increase by less than 5%			9.1%	12.7%	1.8%
	Increase by more than 5%	2.7%	2.7%	4.5%	10.0%	0.9%
	We are not presently active in this region.			0.9%	1.8%	

Table 2

Putting the past and the future together

Table 4 presents a cross-tabulation of the experienced skills gap and the expected skills gap. We find a highly significant, positive correlation between these two variables ($p < 0.05$). Companies that have experienced an acute skills gap in the past also tend to expect that gap to increase.

¹ Only 3% of the companies in our sample with international activities are not present in Western Europe.

What do you expect to happen to the "acute" skills gap within the next 12 months?					
	Decrease significantly	Decrease somewhat	Stay the same	Increase somewhat	Increase significantly
I do not know		0.6%	1.3%	0.6%	
Decrease by more than 5%		0.6%	1.3%	1.9%	
Decrease by less than 5%		0.6%	6.3%	3.1%	
Stay the same	0.6%	1.9%	16.4%	7.5%	
Increase by less than 5%	0.6%	1.3%	16.4%	17.6%	2.5%
Increase by more than 5%	1.3%	1.3%	6.3%	7.5%	2.5%

Table 3

To what extent has your company experienced an "acute" skills gap as a result of a shortage of qualified employees within the last 12 months?

	Not at all	To a small extent	To some extent	To a large extent	To a very large extent
Decrease significantly	0.6%	0.6%	1.1%		
Decrease somewhat		0.6%	3.9%	1.7%	0.6%
Stay the same	7.3%	20.7%	16.8%	4.5%	
Increase somewhat	1.1%	10.6%	19.0%	4.5%	1.7%
Increase significantly			1.7%	2.8%	

Table 4

Based on the responses regarding the experienced and expected skills gap, we conducted a cluster analysis (utilizing the k-means algorithm and 10,000 iterations of the random initial groupings) on all companies in our sample. We identified five clusters of companies (see Figure 6).

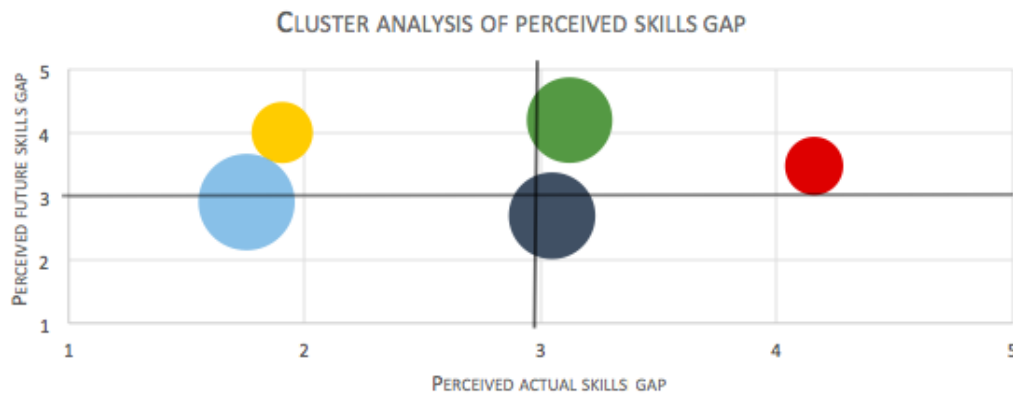


Figure 6

Cluster 1 (in red) contains those companies that experienced an acute skills gap to a very large extent in the past and that expect an almost equally large skills gap in the future. These companies are typically large employers (on average, 140% larger than the rest of the groups in terms of full time employees FTEs) with high revenues. These companies are primarily based in Copenhagen (63%) and Midtjylland (21%). Many of them are active in the financial and manufacturing sectors, but not significantly more so than the rest of the sample. 37.5% of respondents indicate that the lack of qualified employees in Denmark has negatively affected their companies' abilities to pursue market opportunities and their product development.

Cluster 2 (in green) contains those companies that experienced a medium skills gap in the past but expect the skills gap to increase in the future. They typically employ a number of employees that is close to the sample mean (84% of the mean size on average) and they also have revenue around the mean. They are primarily based in Copenhagen (41%) and Midtjylland (26%), but they are more spread out than the rest of the population across all of the regions. They are primarily active in the financial and manufacturing sectors, but not significantly more so than the rest of the sample. The highest percentage of transport firms is in this cluster (12%). Notably, 11% of respondents indicate that the lack of qualified employees in Denmark has negatively affected their companies' abilities to pursue market opportunities as well as their product development. 21% indicate that the gap has resulted in the delay of strategic initiatives.

Cluster 3 (in dark blue) contains those companies that experienced a medium skills gap in the past and expect a medium increase in the future. They typically employ a number of employees that is close to the sample mean (23% smaller than the mean size on average) and they have relatively low revenue (second lowest in the sample). They are primarily based in Copenhagen (61%) and Midtjylland (20%). They are primarily active in wholesale and financial sectors, and significantly more active in the wholesale sector than the rest of the sample. 32% indicate that the lack of qualified employees in Denmark has negatively affected their companies' abilities to pursue market opportunities, while 16% state that this factor has hampered product development. 26% indicate that the gap has resulted in the delay of strategic initiatives and restricted company growth outside Denmark.

Cluster 4 (in yellow) contains those companies that experienced a minor skills gap in the past and are expecting a significant increase in the skills gap in the future. They are typically a bit larger than the sample in terms of number of employees (2% larger than the mean size) and they tend to have a relatively high level of revenue (second highest in the sample). They are primarily based

in Copenhagen (52%), Midtjylland and Southern Denmark (24%). None of these companies indicate that the lack of qualified employees in Denmark has negatively affected their companies' abilities to pursue market opportunities, but 5% indicate that the skills gap has restricted product development. 10% indicate that the gap has had a negative effect on company growth in Denmark.

Cluster 5 (in light blue) contains those companies that experienced a minor skills gap in the past and expect a medium increase in the future. They are typically small employers and they tend to have the lowest revenue of the sample. They are primarily based in Copenhagen (48%), Midtjylland (25%) and Southern Denmark (15%). 4% indicate that the lack of qualified employees in Denmark has negatively affected their companies' abilities to pursue market opportunities, but None of these companies have experienced a negative effect on product development. 9% indicate that the gap has had a negative effect on company growth in Denmark.

Summary

Most companies in Denmark have experienced an acute skills gap to at least some extent. The experienced skills gap does not depend on whether companies operate internationally or are foreign-owned. Within Denmark, the larger companies in our sample (both in terms of FTE and revenue) find themselves less able to access the skills they require. The experienced skills gap is highest in the Copenhagen area, followed by region Syddanmark. When looking ahead, half of the companies in our sample expect the acute skills gap to stay at the current level, while another 40%, especially those anticipating employment growth in Denmark, expect it to increase.

2

POSITIONS

In this chapter, we explore how the shortage of qualified employees in Denmark is distributed across positions.

The skills gap across workforce segments

In line with several international reports,² we operate with seven workforce segment classifications: overall/general skills, senior management, administration (e.g., HR, finance), sales and marketing, IT and IT-related, scientists and engineers, and skilled production workers. We also included an “others” category in our employee classification, for which respondents could write in examples of alternative positions. More than 25% of our respondents made use of this option, typically highlighting highly industry-specific positions, such as fashion buyers, chefs, bakers, and quality/compliance controllers. We asked our respondents to rate the current shortage of qualified employees in each category in Denmark using a five-point scale ranging from “very significant shortage” to “no shortage.” We also included an “I do not know” option. Figure 7 presents the results.

According to our respondents, the shortage of scientists and engineers is the most significant. 32% report either a serious or very significant shortage of qualified employees in this segment. In the IT and IT-related workforce segment, 23% of our sample companies indicate a serious or very significant shortage. In addition, 27% report a moderate shortage of qualified IT and IT-related employees. For both of these workforce segments, 50% of all of the companies in our survey indicate that there is more than a slight shortage.

Retail companies report a significantly higher shortage of IT and IT-related employees than companies in other industries ($p < 0.05$), which might be explained by the growth in e-commerce in Denmark. Indeed, the Danish E-Commerce Association reports that e-commerce accounted for

² See, for example, PwC (2012): Delivering results. Growth and value in a volatile world; ManpowerGroup (2015): Talent Shortage Survey 2015; UK Commission for Employment and Skills (2013): UK Commission's Employment Skills Survey 2013: UK Results.

20% of total retail spending in Denmark in 2014 and is growing by more than 20% each year.³ Compared to the findings of international surveys, these results may be slightly surprising. For example, according to the Talent Shortage Survey, IT jobs within development, programming, database administration, and management, are the ninth hardest to fill, and that jobs as sales representatives, engineers, technicians, and drivers are harder to fill.⁴

Positions requiring skilled production workers are also among the most difficult to fill. In fact, 17% of our respondents say there is a serious or very significant shortage of potential employees in this segment. This gap is especially felt by the manufacturing companies, which report a significantly higher shortage than the rest of our respondents ($p < 0.05$).

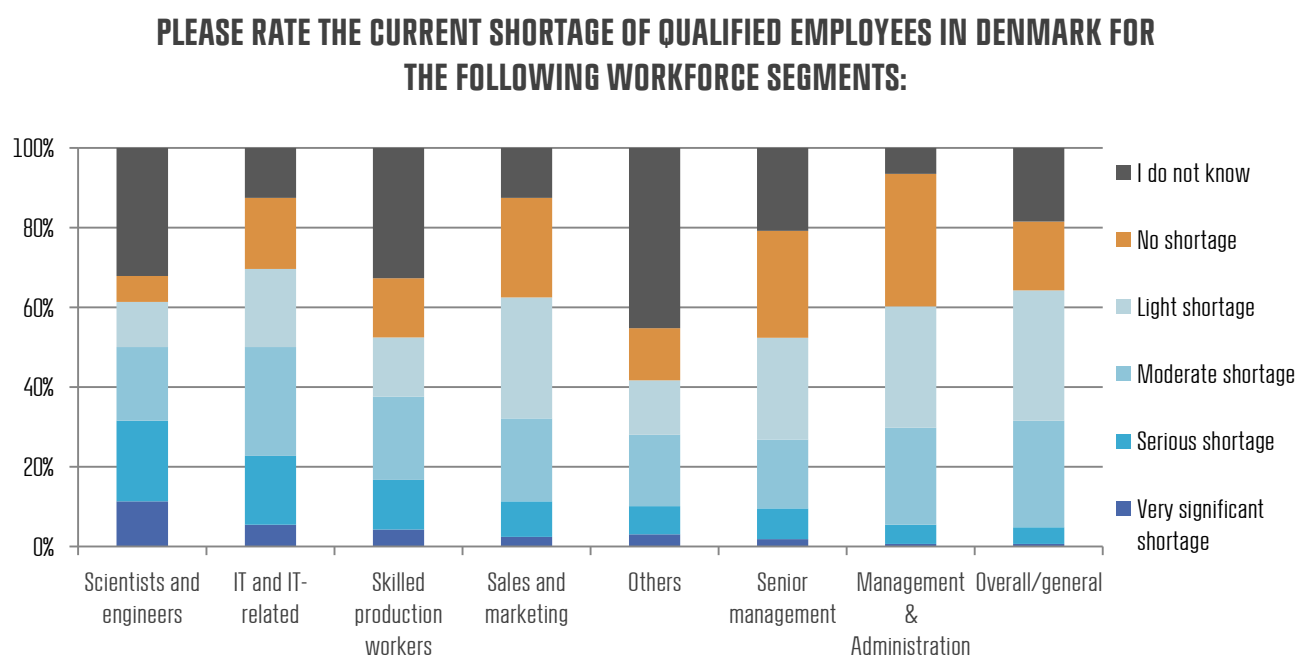


Figure 7

Among our interviewees, there is also general agreement that positions within these segments are the hardest to fill.



We experience to a high degree that positions are difficult to fill. It is positions with a technical background, typically skilled production workers and – to the

³ Danish E-commerce Association/Foreningen for Dansk Internet Handel (2015): Årsrapport 2014. See this report and others at: <http://www.fdi.dk/analyser/fdi-e-handelsanalyse/om-e-handelsanalysen>

⁴ ManpowerGroup (2015): Talent Shortage Survey 2015. According to the report, the ten hardest positions to fill, globally, are: 1) skilled trade workers, 2) sales representatives, 3) engineers, 4) technicians, 5) drivers, 6) management/executives, 7) accounting and finance staff, 8) office support staff, 9) IT staff, and 10) production/machine operations.

highest extent – engineering profiles. The special competences needed are those we call the technical competences.

—Siemens

At the same time, our respondents stressed the importance of not oversimplifying the descriptions of the positions for which potential employees were lacking. In the popular debate, one common theme is that there is a great need for engineers. While this is confirmed by our findings, it is important to distinguish among different types of engineers.



When discussing, for instance, the unemployment of engineers, we tend to focus on the aggregate level of 4%. This is far too imprecise because we lack some types of engineers, while we have too many of other types. We have to dig deeper into the subject to be sure we truly know what we are talking about. I think this applies to several professions. We have to be careful to avoid making too many generalizations.

—COWI

Our qualitative interviews offered interesting insight into the desired traits of employees with

The more specialized the position, the harder it is to find the right employee

technical skills. According to several companies, the positions that are particularly hard to fill are not only technical but also specialized. The degree of specialization affects the possibility of filling a position. The more specialized the position, the harder it

is to find the right employee. For one interviewee, finding qualified employees was difficult for 20% of open positions and even harder for the most specialized positions.



We have positions that are hard to fill within specialized fields. Currently, we lack engineers who can work with acoustics. We also lack engineers who can work with fire protection, and we lack senior HVAC [heating, ventilating, and air conditioning] engineers. These are professions that are relatively narrow and professions in which there are not many graduates.

—COWI



For approximately 20% of our positions, we have to make more noise through, for instance, campaigns. This often relates to machine operators, laboratory technicians, trainees, graduates, all of which we recruit in higher volumes. The hardest people to find are, for example, specialized engineers and quality-assurance people who have knowledge of pharma production. These employees represent 5-7% of our workforce. They include biostatisticians experienced in research, people who can do pharma modelling, and scientists active in specialized therapeutic areas.

—Novo Nordisk

The interviewees stressed two important points. First, specialization in itself is not what is required. Some specializations are in high demand, while others are less desirable. Second, special-

ization is not only needed in the technical positions. It is also necessary for various other professions and positions. One interviewee gave the example of supply-chain management, which is considered a management position but contains highly technical and specialized elements as well.

The percentage of companies in our sample reporting a serious or very significant shortage of administrative, sales/marketing, and managerial workers is smaller than the corresponding figure for technical employees. Nevertheless, 33% of our sample companies report a moderate, serious, or very significant shortage of sales and marketing people. Interestingly, both globally and in Europe, positions within this segment are among the most difficult to fill.⁵ Notably, however, only one of our interviewees mentioned a shortage of sales and marketing candidates.

Only one company in our survey responded that there is a very significant shortage of managerial and administrative employees. This segment also has the highest proportion of “no shortage” responses, with 33% of respondents say that filling positions within these segments is not a problem.

The total percentage of companies indicating some kind of shortage among senior management is smaller than the proportion of companies reporting shortages among management and administration. However, for those reporting a shortage in the former segment, a higher percentage find the shortage severe or very significant.

A very important finding from our qualitative study is that some positions require the combination of the traits of two groups, such as technical, specialized knowledge and managerial capabilities. This particular combination is in high demand.



It is something that goes against the traditional career ladder in which you either go the management route or the technical route. What is really hard to find is technical specialists who have a management understanding or management specialists who have broad technical skills.

—Alex Penvern, Partner and Leader of Reward Practice, PwC Denmark

Combination of technical, specialized knowledge and managerial capabilities is in high demand

The road to this sought-after combination of competences can be from technical to managerial or vice versa. However, according to CBS’s full-time MBA career manager, one route is typically more favored than the other.



The people who seem to do quite well and seem to be sought after are those with quite technical backgrounds, such as engineers, biochemical engineers, mechanical engineers, and chemists. They have a highly specialized background. If they come from more of a marketing background or an arts background, it becomes a bit harder for them.

—CBS full-time MBA career manager

⁵ ManpowerGroup (2015): Talent Shortage Survey 2015.

Apart from the ability to couple the major characteristics of the two groups together, companies in our survey also highlighted the importance of being able to work across professions to avoid tunnel vision.

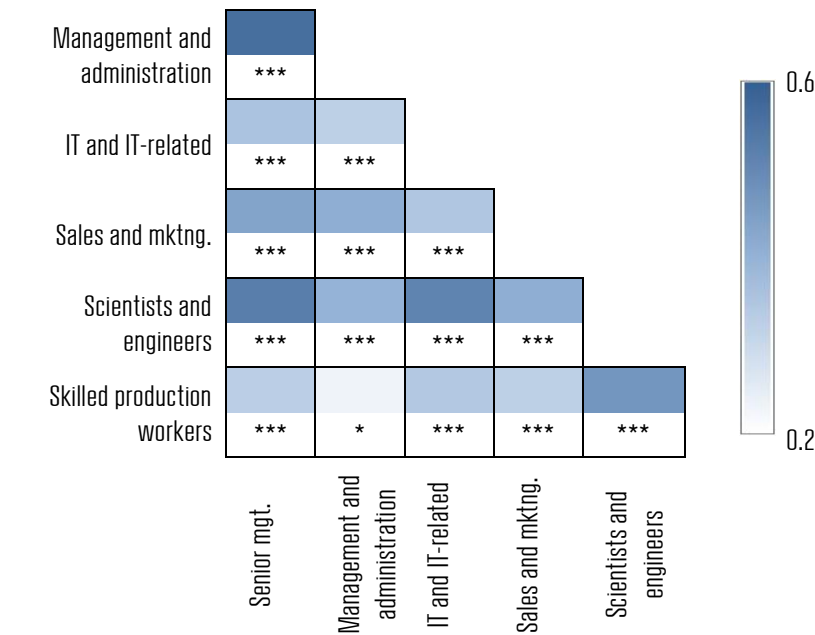


The good thing about specialists is that they have deep knowledge of their area, but this also means that they can have a blind spot in terms of being able to see some broader connections. The complexity arises when you look outside your own field, so we need an ability to apply a broader perspective to what you are doing. Learning ability and collaboration—these factors are quite important.

—LEO Pharma

Grouping the workforce segments

We find significant correlations among the different workforce segments. Each possible combination of two workforce segments is positively correlated at the highest significance level ($p < 0.001$). The only exception is management and administration, and skilled production workers, which have a weaker correlation at $p < 0.05$. Table 5 shows the significance levels as well as the correlation coefficients, which range from just over 0.2 to just under 0.6. Cells shaded darker blue indicate strong correlation coefficients, while a white cell indicates a weaker coefficient. A strong correlation coefficient combined with a high significance level suggests that the reported shortages in the two workforce segments tend to follow each other.



*** Correlation is significant at the $p < 0.001$ level.
** Correlation is significant at the $p < 0.01$ level.
* Correlation is significant at the $p < 0.05$ level.

Table 5

The highest correlation coefficient is between the management and administration segment and the senior management segment. In other words, those respondents reporting a high shortage of senior management also tend to report a high shortage of management and administration employees and vice versa. Moreover, the scientists and engineers segment generally correlates strongly with the other segments, especially senior management, IT and IT-related, and skilled production workers.

High degree of correlations between workforce segments reported in Table 5 makes it impossible to explore the data for particular patterns and use it in regression analyses. It is common in such situations to use factor analysis to collapse a large number of variables into a few interpretable underlying factors. We undertook a factor analysis of the current shortage of qualified employees in seven segments (omitting “overall” and “do not know” answers). Through this exercise we identified two main factors, which we label “technical positions” and “business positions” (see Table 6).⁶

Factor Analysis Results

Component	Measure	Factor loading	Cronbach's alpha
Business positions	Senior managers	0.6715	0.7480
	Management and administration (e.g., HR, finance)	0.7742	
	Sales and marketing	0.5179	
Technical positions	Scientists and engineers	0.6220	0.7237
	Skilled production workers	0.5729	
	IT and IT-related skills	0.4498	

Table 6

We averaged individual items and created separate variables for each of the two groups. We then correlated those with operating revenue (last available year; source: ORBIS) and firm size (FTE; source: ORBIS) as well as indicators of consecutive FTE and revenue growth (year-on-year growth in each of the last five years; source: ORBIS) and international activity (source: own survey). We also tested for differences across industries (source: ORBIS) and in terms of international ownership (source: ORBIS). Our analysis showed no significant differences in terms of company size or international ownership.

Interestingly, the shortage “technical positions” is significantly higher for companies with consecutive growth in FTEs ($p < 0.05$). Moreover, this shortage is positively and highly significantly correlated with the experienced skills gap ($p < 0.001$) and approaching significance with the expected skills gap ($p < 0.10$). “Shortage of business skills” is positively and significantly correlated with the experienced skills gap ($p < 0.05$) and insignificant for the expected skills gap.

⁶ To test for the plausibility of using factor analysis on the chosen variables, we utilized the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and the Bartlett test of Sphericity (BTS). A KMO value greater than 0.7 is considered very good, while a rejection of the H_0 hypothesis in BTS indicates that the variables are significantly inter-correlated. “Overall” and “I don’t know” were not removed from the sample.

Explaining the gap by looking at positions

To understand whether the shortage of business and technical skills causally determines the respondents' evaluation of the acute skills gap, we ran regression analyses in the form of Tobit estimations of experienced and expected skills gaps, while controlling for size (FTE), consecutive growth in revenue and size, international presence, region, and industry. We found that for both experienced skills gap and the expectations about the future skills gap, the shortage in “technical positions” predicts the evaluation of the skills gap (positive, $p < 0.05$), while shortage in “business positions” is insignificant.

*Shortage in “technical positions”
causes the acute skills gap.
Shortage in “business positions” is
insignificant.*

Those who “do not know”

For some workforce segments, 33% of the respondents answered that they did not know the current shortage in Denmark. For other segments, only 5% percent gave this answer. To understand this difference, we dug into the missing answers.

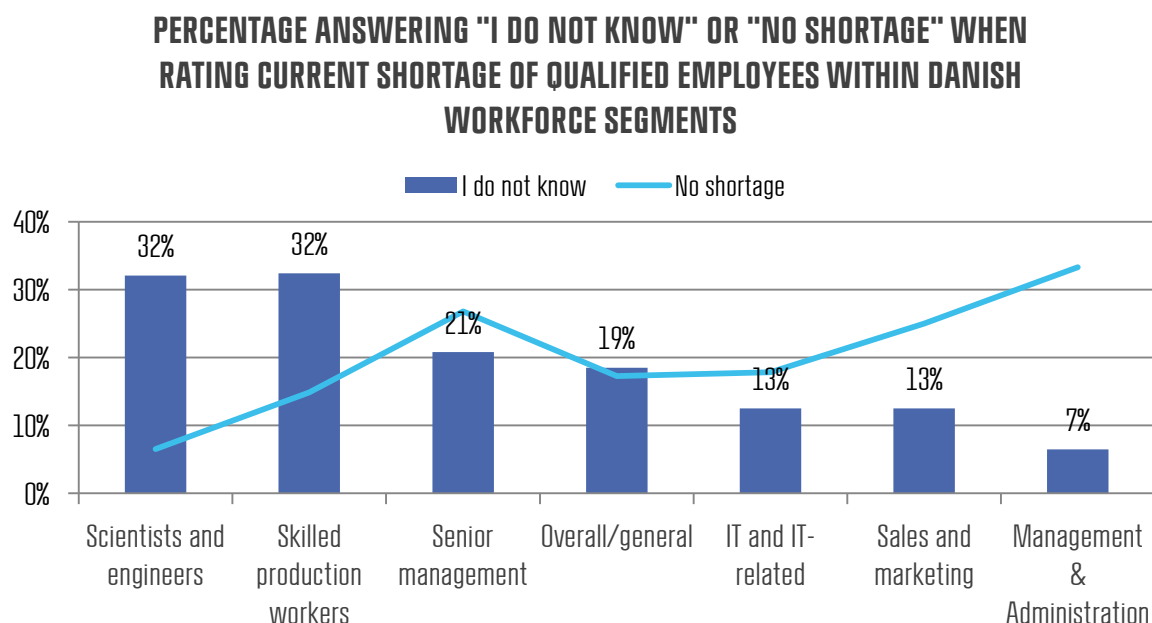


Figure 8

We found significant variation across industries (ANOVA $p < 0.05$) for those who answered “I don’t know” when rating the shortage of scientists and engineers. The same was true for skilled production workers (ANOVA $p < 0.05$). While the ANOVA analysis on unbalanced groups is only statistically indicative, the variation also makes sense intuitively: Every company has some variation of a management and administrative body, a marketing and sales department, and an IT infrastructure. Skilled production workers, scientists, and engineers, on the other hand, are not employed in every type of industry. Among our survey’s IT/communication companies, more than 80% answered “I don’t know” when asked about the current shortage of skilled production workers. For manufacturing companies, only 18% selected this answer.

Summary

In terms of the skills gap across workforce segments, our findings suggest that the greatest shortage relates to scientists and engineers, followed by IT and IT-related workers, and skilled production workers. On the basis of a factor analysis, we grouped these as “technical positions” and found that companies with consecutive employee growth in Denmark over the past five years generally reported a greater shortage of such skills. Positions within sales and marketing, management, and administration appear to be less difficult to fill, but there is still a shortage of qualified potential employees. These segments constitute the other group of positions, which we named “business positions.” We found that for both experienced skills gap and the expectations about the future skills gap, the shortage in “technical positions” predicts the evaluation of the skills gap (positive, $p < 0.05$), while shortage in “business positions” is insignificant

3

SKILLS

In the previous chapter, we discussed the distribution of the skills gap across workforce segments. In this chapter, we focus on particular skills that are in demand.

Skills produced in Denmark

When asked about the skills produced in Denmark, i.e., the output from the Danish educational system, more than 50% of the companies in our sample indicate that they have experienced a shortage of such skills to at least some extent. Only 14% have not experienced a shortage of this kind at all. As seen in Figure 9, 19% of the respondents have experienced a large or very large shortage of qualified employees possessing skills produced in Denmark. Another 35% have experienced such a shortage to some extent.

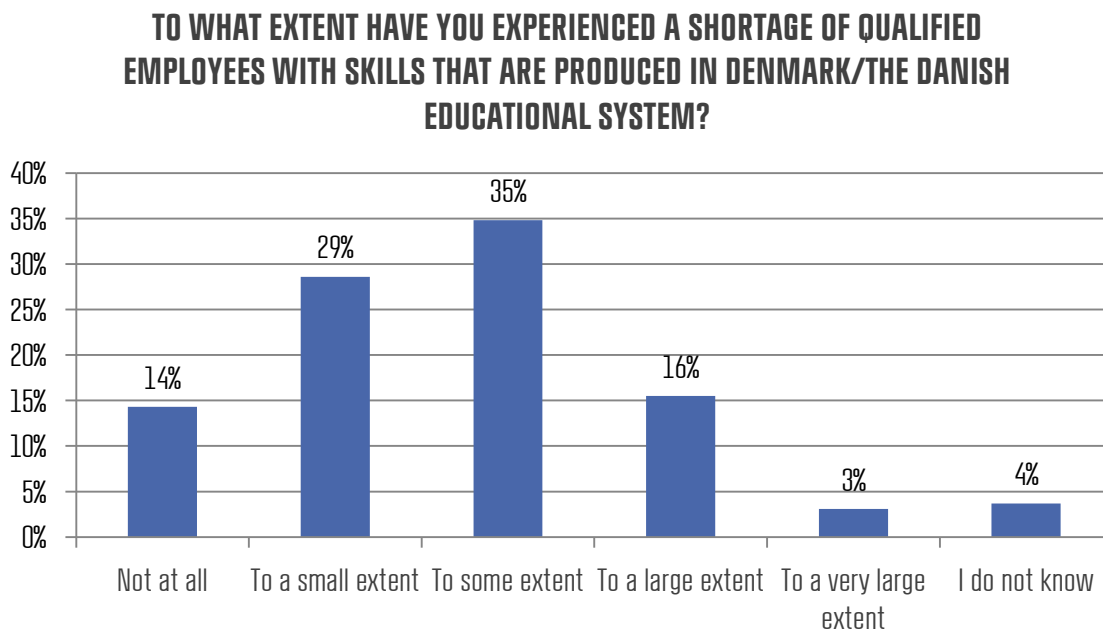


Figure 9

To what extent have you experienced a shortage of qualified employees with skills that are produced in Denmark/the Danish educational system

To what extent has your company experienced an "acute" skills gap as a result of a shortage of qualified employees within the last 12 months?	I do not know	Not at all	To a small extent	To some extent	To a large extent	To a very large extent
		5.0%	1.9%	0.6%	0.6%	
	2.5%	7.5%	14.9%	6.8%	0.6%	1.2%
	1.2%	1.2%	9.3%	21.7%	8.1%	1.2%
		0.6%	1.9%	5.0%	5.6%	
			0.6%	0.6%	0.6%	0.6%

Table 7

Table 7 shows the similarity between the shortage of skills produced by the Danish educational system and the general acute skills gap for the past 12 months (see Chapter 1). The correlation between these two questions is highly significant and positive ($p < 0.001$). This could indicate that the experienced skills gap is closely related to the skills produced in Denmark or by the Danish educational system.

To what extent have you experienced a shortage of qualified employees with skills that are produced in Denmark/the Danish educational system?

What do you expect to happen to the "acute" skills gap within the next 12 months?	I do not know	Not at all	To a small extent	To some extent	To a large extent	To a very large extent
		0.6%		1.2%		0.6%
	0.6%		1.2%	2.5%	1.9%	
	2.5%	11.8%	15.5%	12.4%	5.0%	1.2%
	0.6%	1.9%	10.6%	17.4%	6.2%	1.2%
			1.2%	1.2%	2.5%	

Table 8

Table 8 shows a cross-tabulation of the extent to which companies experience a shortage of skills produced in Denmark and the expected skills gap. There is no significant correlation between the two variables.

The experienced acute skills gap is strongly correlated with the skills produce by the Danish educational system. This is especially true for manufacturing companies.

In the responses to the question presented in Figure 9, we find no significant statistical difference across the background variables with the exception of the manufacturing industry. Companies in this industry indicate a shortage of qualified employees with skills produced in Denmark to a higher extent than compa-

nies in other industries ($p < 0.05$). One possible explanation for this difference is the fact that a change in Danish demographics is resulting in fewer young people completing educational programs designed to create skilled production workers.⁷ Furthermore, the manufacturing industry is among the most globalized, such that companies in this industry can often obtain access to employees with the required skills in other countries at prices below the Danish level. In addition, the outsourcing of manufacturing jobs is a politically sensitive topic in Denmark—more so than outsourcing in such industries as professional services. For these reasons, manufacturing companies might feel it is more important to find the workforce they need within Denmark (see Chapter 4 for a discussion of company actions aimed at overcoming the skills gap).

Textbox 2: Recruiting internationally at COWI

COWI is the second-largest engineering consultancy in Denmark. It is headquartered in Copenhagen and has more than 6,200 employees spread across the world. Recently, CEO Lars-Peter Søbye elaborated on the company's struggle to fill positions locally, stating that the lack of qualified candidates in Denmark was most evident within tunnel engineering, structural engineering, railway engineering, city planning, and construction engineering. According to Mr. Søbye, the lack of natural-sciences graduates is a major problem for both his company and Danish society as a whole. When the company wins major contracts, the associated job openings cannot be filled with Danish citizens. Therefore, COWI is forced to source employees internationally. According to Mr. Søbye, "many of these jobs could have been Danish and part of Denmark's social development."

Sources:

COWI (2015): *Annual Report 2014, February 2015*; Børsen (2016): *Disse job kunne have været danske job*, published January 21, 2016.

Personal skills

The Economist Intelligence Unit⁸ reports that in large American companies, critical thinking and problem solving are the most important workplace skills for employers when joining a company. The second most important skill is the ability to collaborate in a team. These skills are viewed as more important than technical skills associated with the job.

⁷ See, e.g., Arbejderbevægelsens Erhvervsråd (2011): Mangel på kvalificeret arbejdskraft og målsætninger for uddannelse, http://www.ftf.dk/fileadmin/Bruger_filbibliotek/Uddannelse_og_ledelse/AE-fremskrivning_060911_-_Endelig.pdf.

⁸ The Economist Intelligence Unit (2014): Closing the Skills Gap. Companies and colleges collaborating for a change.

Denmark is traditionally known as a country characterized by low levels of hierarchy, good team work abilities, and a critical and reflective approach to problem solving. These values are reflected in the Danish educational system and have been prioritized for several decades. While our questionnaire did not directly ask about these skills, we asked our interviewees to reflect upon the need and availability of such skills. Indeed, several interviewees stressed the importance of these skills.



Most importantly, what we are ultimately looking for is personality ...In the end, whether a person fits into the organization and its culture in that regard is decisive. We focus on the ability to work in a team-oriented and network-based manner. In some jobs, employees have to pay attention to detail. In others, it is important that they do not. However, certain skills, such as team orientation, team complementarity, and the ability to see the broader picture, are some of our general priorities.

—**Large Danish manufacturing company**

While these skills are important, they might not necessarily be in as dire need as the technical skills. Several interviewees highlighted that these personal skills are readily available in Denmark.



The ‘soft’ competences, such as team orientation and the ability to work in diverse settings with different cultures and nationalities, are something we demand, but we do not regard these competencies as hard to find. There are a lot of good candidates possessing those competences.

—**Siemens**



In terms of ‘softer’ skills, such as good leadership, I do not think there are any challenges. I think these are easier to find. There is more of a challenge with finding the international background—the ability to be ‘culturally fluid’—and those specific skills for which there is traditionally undersupply and overdemand.

—**Alex Penvern, Partner and Leader of Reward Practice, PwC Denmark**

The terms “international background” and “culturally fluid” mentioned in the quote above are less related to education and technical skills than they are related to the ability to maneuver in today’s global environment. In this regard, we also asked companies about the shortage of employees with international backgrounds.

TO WHAT EXTENT HAVE YOU EXPERIENCED A SHORTAGE OF QUALIFIED EMPLOYEES WITH ADDITIONAL LANGUAGES, CULTURAL INSIGHT, AND MARKET KNOWLEDGE, ALL OF WHICH ARE INHERENT WHEN EMPLOYING WORKERS FROM A SPECIFIC COUNTRY?

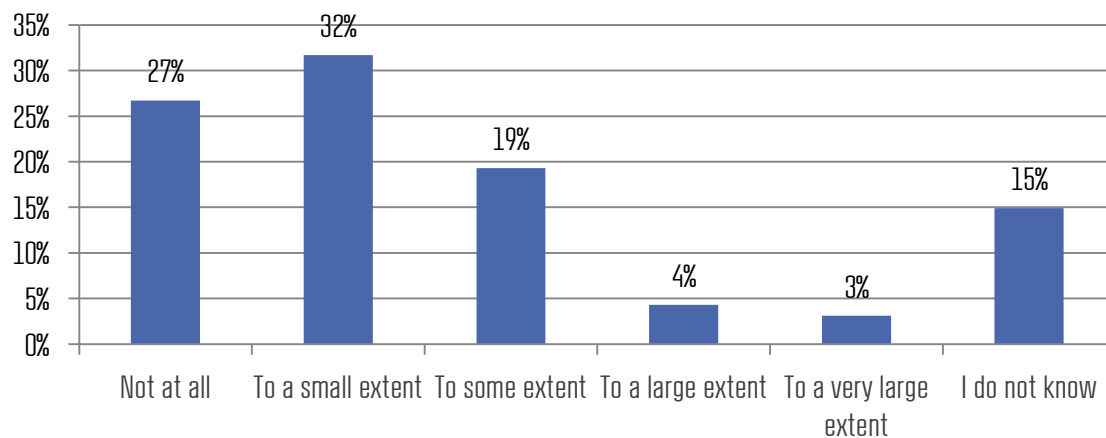


Figure 10

Although positively correlated with the experienced acute skills gap ($p < 0.05$), the extent to which our sample companies experience a shortage of qualified employees with cultural insight is lower than their experience of a shortage of skills produced in Denmark. 59% of the respondents report that these skills are lacking only to a minor extent or not at all. However, we find a difference between companies with international activities and those without. For companies active outside Denmark, the extent to which they experience a shortage of workers with country-specific knowledge is significantly higher ($p < 0.01$). Our qualitative interviews nuanced this finding by distinguishing between management positions and other positions.

“Soft skills” are not difficult to find: we have a great many Danish managers in Denmark



We find it hard to fill many different positions—specialist positions in research and development, as well as qualified management and leadership positions on a higher level. We are a global company and we have a great many Danish managers here in Denmark. However, filling managerial positions, preferably with non-Danes, is a challenge.

—LEO Pharma

Generally, the survey results and our qualitative interviews suggest that accessing skills associated with employees from a specific country does not seem to be a major problem. This challenge primarily arises among companies seeking managers with a global mindset and international experience.



Because Denmark is a relatively small country ... it can be harder to attract what I would call ‘internationally mobile executives.’ If you consider Europe,

people tend to think of London, they think of Paris, or maybe Berlin and Frankfurt. Copenhagen is less prominent on the map.

—Alex Penvern, Partner and Leader of Reward Practice, PwC Denmark

Beyond the pond

In Chapter 2, the qualitative interviews highlighted the importance of specialization, particularly with regard to qualified technical employees in Denmark. Figure 11 shows the answers to a question that takes this situation to the extreme. The question aims to investigate the shortage of highly demanded skills that are available only to a limited extent on a global scale. 20% of our respondents experience such a shortage to a large or very large extent.

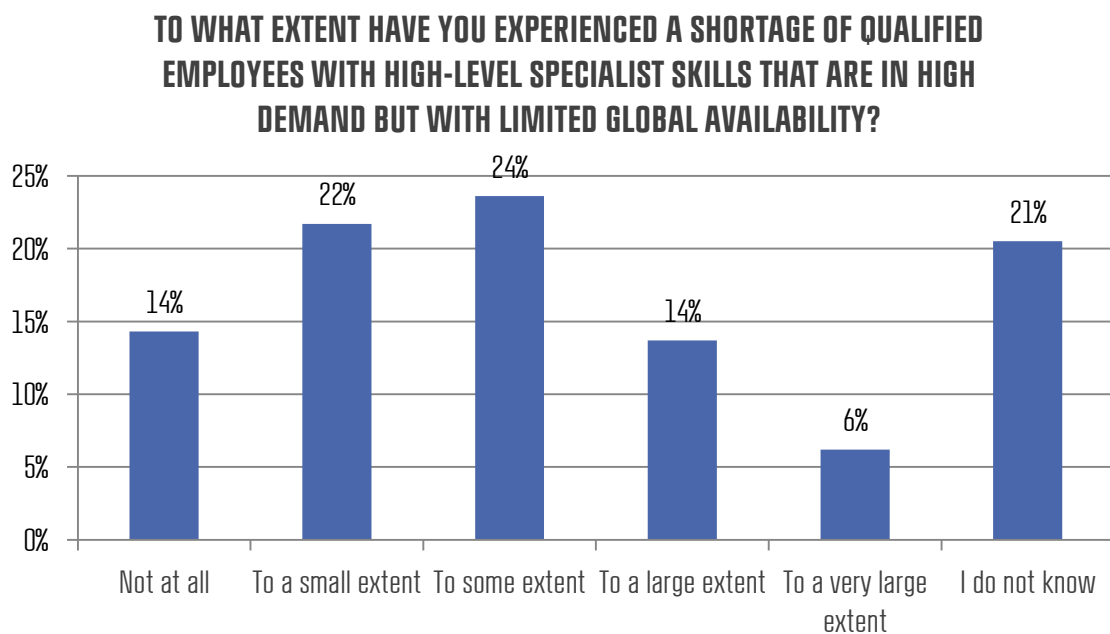


Figure 11

Like the results presented in Figures 9 and 10, the results presented in Figure 11 are positively correlated with the experienced acute skills gap ($p < 0.001$). Interestingly, companies reporting consecutive revenue growth over the past five years experience higher shortages than the rest ($p < 0.05$). Likewise, companies with international activities tend to experience a shortage of specialists with limited global availability to a greater extent than those that only have activities in Denmark ($p < 0.05$). Finally, our respondents in the Sjælland and Copenhagen regions report higher shortages than those found elsewhere in Denmark ($p < 0.01$). This is not because all of the companies with international activities are located in these regions. In fact, the percentage of companies with international activity is relatively stable across regions.

In our qualitative interviews, some interviewees elaborated on the broad range of requirements for this narrow group of specialists.



Their knowledge is different, but they are all specialized within their areas. They have to have pharmaceutical experience, but that in itself is not enough. They must have worked specifically with the processes that we are developing

and researching. Sometimes there are only 50 people in the world with the abilities needed to do a certain job.

—Novo Nordisk

Explaining the gap by looking at skills

To what extent does the shortage of certain skills explain the acute skills gap? To answer this question, we ran regression analyses in the form of Tobit estimations of experienced and expected skills gaps while controlling for size (FTE), consecutive growth in terms of revenue and size, international presence, region, and industry. We found that “skills produced in Denmark” and “high-level specialist skills with limited global availability” determine the degree of the experienced skills gap (positive, $p < 0.001$ and $p < 0.05$, respectively). For the expected skills gap, the variable “skills produced in Denmark” is approaching significance ($p < 0.10$), while the other variables are insignificant. In other words, the undersupply of skills from the Danish educational system appears to have caused the experienced skills gap and drives the expectations of skills gap in the future.

The experienced and expected acute skills gaps are caused by the undersupply of skills from the Danish educational system.

Summary

The majority of companies in our sample have experienced a shortage of skills produced in Denmark. In addition, the manufacturing industry is experiencing a shortage of qualified employees in Denmark to a higher degree than other industries. With regard to personal skills, such as teamwork abilities, our qualitative interviews generally show that these skills are valued and in demand, but they are not in short supply. Moreover, our respondents do not report a significant shortage when asked about access to qualified employees with specific knowledge of countries other than Denmark. According to our interviewees, such difficulties are primarily associated with recruiting internationally experienced, or “culturally fluid” employees. Finally, companies experience a shortage of specialists when only a few specialists with certain skills exist on the global scale. The shortage of such narrowly defined persons is primarily experienced by companies engaged in international activities and that have grown consecutively over the past five years.

4

PERFORMANCE IMPACT AND ORGANIZATIONAL ACTIONS

This chapter examines how the skills gap affects performance and the actions taken by companies to mitigate the impact.

Does the skills gap affect firm performance?

To understand whether the performance of our sample companies was affected by the experienced skills gap, we asked whether a lack of qualified employees in Denmark had negatively affected them. To this question, only 38% answered yes.

HAS A LACK OF QUALIFIED EMPLOYEES IN DENMARK NEGATIVELY AFFECTED YOUR COMPANY?

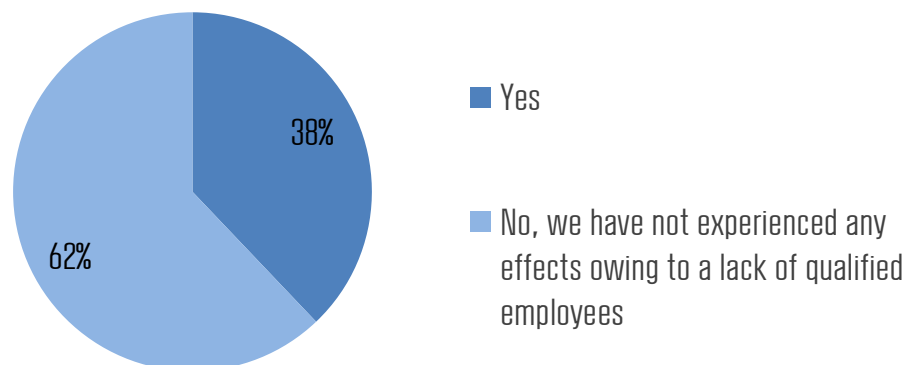


Figure 12

There is a strong, positive correlation between the degree of the experienced acute skills gap (Figure 1) and the perception of being negatively affected by a lack of qualified employees ($p <$

0.001). For the companies that, at least to some extent, experienced an acute skills gap within the past 12 months, 52% report a negative impact caused by the lack of qualified employees.

Among the larger companies in our sample (measured in terms of FTEs), performance of 48% of the companies have been negatively affected by a lack of qualified employees. The corresponding figure for the smaller companies in our sample is only 29%, which represents a significant difference ($p < 0.05$).

In terms of geography, the companies based in the Sjælland and Copenhagen regions are negatively affected by a lack of qualified employees (57% and 46%, respectively) to a higher extent than those based in other places in Denmark. The corresponding figure for Syddanmark is 35%, while it is 28% for Midtjylland and 11% for Nordjylland. This resembles the pattern discussed in Chapter 1.

Lack of qualified employees hits the performance of large companies much harder

Investigating effect on performance

Reduced firm performance can materialize in many ways: financially, temporally, morally, or strategically. To learn more about the consequences for the 38% of our sample indicating that performance has been negatively affected by a skills gap, we asked them to provide additional information.

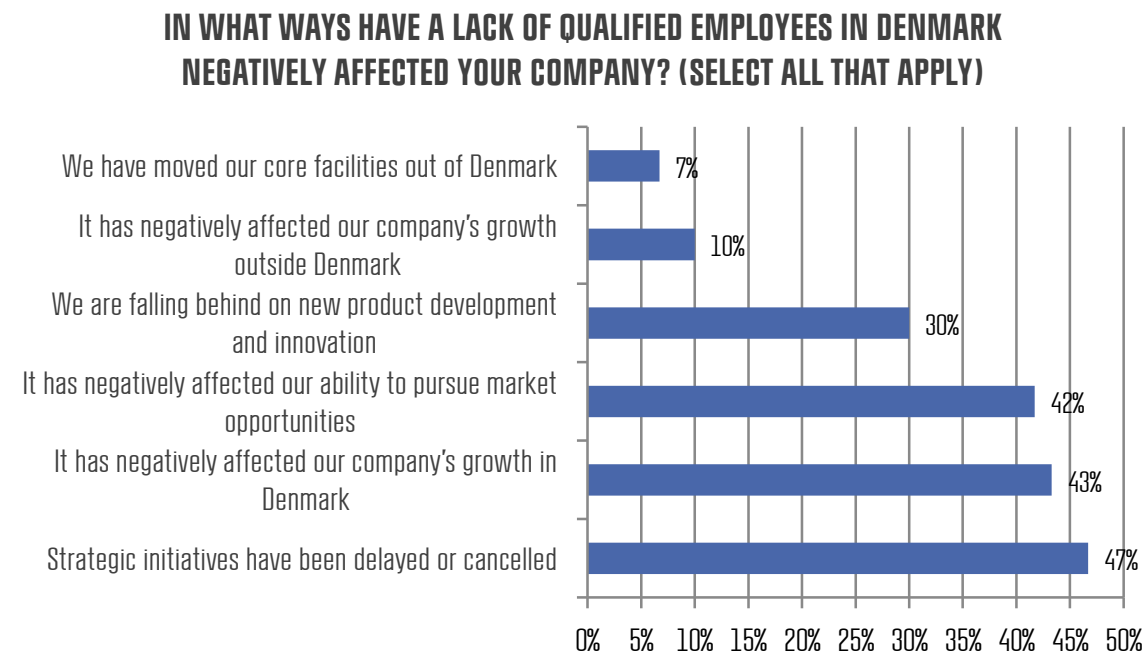


Figure 13

The responses show that firm performance is primarily affected in three ways: strategic initiatives are delayed, market opportunities become more difficult to pursue, and growth in Denmark is not as high as it could have been. According to our survey, a shortage of qualified employees only rarely results in the actual relocation of core facilities to other countries (7% of those negatively affected by the skills gap), although the threat is there (see Textbox 3). Likewise, a lack of qualified employees in Denmark has only rarely had a negative impact on growth outside the country.

35% of the companies indicating that performance has been negatively affected by a lack of qualified employees in Denmark also highlighted additional consequences when filling out the survey. One of these additions is the impact of open positions have on existing employees. Six companies reported increased stress on employees and management due to a lack of available, qualified employees in Denmark. Some qualified employees even leave their organizations because of this increased pressure.

Shortage of qualified employees in Denmark matters a lot for domestic performance, and only rarely affects international growth

Two trends regarding the performance impact were confirmed in the interviews. First, the interviewees stressed that a lack of qualified employees in Denmark delays projects and affects overall performance. Second, despite the performance impact, core facilities are “sticky.” In other words, they are rarely moved out of the country for skills-gap reasons. We elaborate on these two trends below.

Textbox 3: Strategic relocation of non-core facilities by Novo Nordisk

Novo Nordisk has grown its headcount and revenue consecutively over the past five years. It is among the largest employers in Denmark, where it is headquartered, and it expanded its global workforce by 8% in 2014. Such growth rates necessitate access to qualified employees who can support and sustain the expansion. In Denmark, Novo Nordisk has experienced a skills gap when trying to fill newly created positions. In mid-2015, the company was struggling to fill 100 engineering positions, and the company spoke publicly of this struggle in the press. Henrik Wulff, Executive Vice President for Product Supply, argued that the problem had grown to such an extent that some activities might have to be relocated to areas outside Denmark for strategic reasons.

When looking ahead, potential relief was hard to spot. Economic projections show a potential undersupply of 10,000 engineers and 4,000 scientists in Denmark by 2025.

Yet, in the autumn of 2015, the company announced plans to build one of the two new production plants in Denmark, as well as an expansion of its R&D facilities in Denmark. In November 2015, it announced an investment in a new insulin-producing facility in Denmark, creating additional 450 jobs.

Sources:

Børsen (2015): Ekstrem ingeniørmangel får Novo til at se udenlands, May 22; Novo Nordisk (2015): Novo Nordisk planlægger at investere 2 mia. dollars i nye fabrikker i USA og Danmark, press announcement, August 26; Novo Nordisk (2015): Novo Nordisk invests DKK 2.1 billion in new insulin filling facility in Denmark, creating 450 new jobs, press announcement, November 4; Ingeniørforeningen, IDA & Dansk Industry (2015): Prognose for mange på ingeniører og naturvidenskabelige kandidater i 2025.

Delayed projects and suboptimal performance

Just like the 47% of the companies in Figure 13 reporting delays of strategic initiatives, our interviewees spoke of delays and the importance of being able to fill positions in order for projects to succeed.



Our activities might take more time, but we have not experienced a full stop. We have, however, realized that careful consideration is needed when deciding how to move and prioritize our resources. When we look forward, and extrapolate our current growth and the products we need to take to market, recruiting skilled employees is a significant factor, one that can determine whether we will succeed in getting a product to market.

—Novo Nordisk

However, delays affect more than strategic initiatives. They can also impact everyday activities and production. Often such activities are not stopped or left incomplete, but are handled in a less-than-optimal way.



The lack of qualified hands undoubtedly results in some projects progressing slowly. Some things are delivered later than expected. Hence, if recruiting and onboarding the right people takes a long time, we will see a negative effect in terms of our ability to deliver. This does not mean that things stop altogether, but that they are not running at the desired pace.

—Large Danish manufacturing company

The ability to adjust and continue producing, although sub-optimally, was also mentioned by several of our interviewees. Flexible solutions are developed in order to keep meeting demand. One interviewee argued that flexibility is easier for larger organizations because they have more room for maneuvering.



My general observation is that an organization will find a way around a skills gap, either by reorganizing itself or by prioritizing something else. For most companies, I guess, the answer is often that ‘We had to do something that was less optimal, but we still did it.’ I think organizations would rarely say ‘We were not able to do it.’ That would usually be more likely for a small organization or an organization with a more limited hiring budget that could not look in different geographies.

—Alex Penvern, Partner and Leader of Reward Practice, PwC Denmark

Mobile jobs and sticky facilities

In Denmark, as in most other advanced economies, the relocation of core facilities to places with more readily available factors of production is a sensitive subject. Our findings indicate that a lack of qualified employees in Denmark is not a significant contributor to companies’ decisions to move facilities out of the country, even though that lack of employees negatively affects performance. At least, this is not the case in the short to medium term. Our interviewees provided some insights into why this is the case.

Companies’ decisions to move facilities out of the country are driven by many factors. Skills gap may be one of them, albeit not the main one.



I do not think that there are many organizations which would consider moving based on these considerations. I think that is unlikely and unrealistic. Generally, if an organization is to move, it is more likely to be from a financial tax perspective. What may happen is that you open an office ... and then it is more about having different parts of the organization located in different places. The trend would thus be increased business travel, increased remote working, and increased virtual teams.

—Alex Penvern, Partner and Leader of Reward Practice, PwC Denmark

Several companies emphasized the time aspect. The skilled labor market, like most other markets, experiences fluctuations, but those fluctuations do not make companies relocate immediately. Instead, companies look for the required competences elsewhere and, if possible, bring them to Denmark.



Increasingly, we are forced to change our recruitment strategy from hiring Danish employees to hiring international employees. The latter is simply a more time-consuming and complicated process. Therefore, we often experience delays or, even worse, are forced to have the work done in other parts of our organization. We have offices in many other markets, which makes that possible.

—Siemens



If positions are open for a long period of time, we start searching for other solutions. If we cannot find the right person via ordinary search, we buy a specialized search, move the job abroad, or look in our network, to name a few potential solutions.

—Grundfos



The obvious statement would be: if you cannot get access to certain competences in Denmark, maybe those jobs should be located somewhere else in the world.

—Large Danish manufacturing company

*Moving jobs,
not facilities*

Exploiting the flexibility of jobs rather than facilities is one way of “closing” the skills gap. In the next section, we look at the various actions taken by companies to overcome the negative impact of the skills gap.

Company actions: Bridging the skills gap

Rather than passively accepting the lack of skills and competences crucial for their performance, most companies actively take up the challenge and seek to mitigate the skills gap through a variety of measures. All of our sample companies, including those for which performance has not been

affected by a lack of qualified employees, provided input on which solutions are the most applicable.

WITH REGARDS TO THE CHALLENGE OF FILLING CERTAIN POSITIONS DUE TO A LACK OF QUALIFIED APPLICANTS IN DENMARK, PLEASE SELECT THE SOLUTIONS YOU BELIEVE WILL BE THE MOST APPLICABLE FOR YOUR COMPANY OVER THE NEXT THREE YEARS (SELECT UP TO THREE)

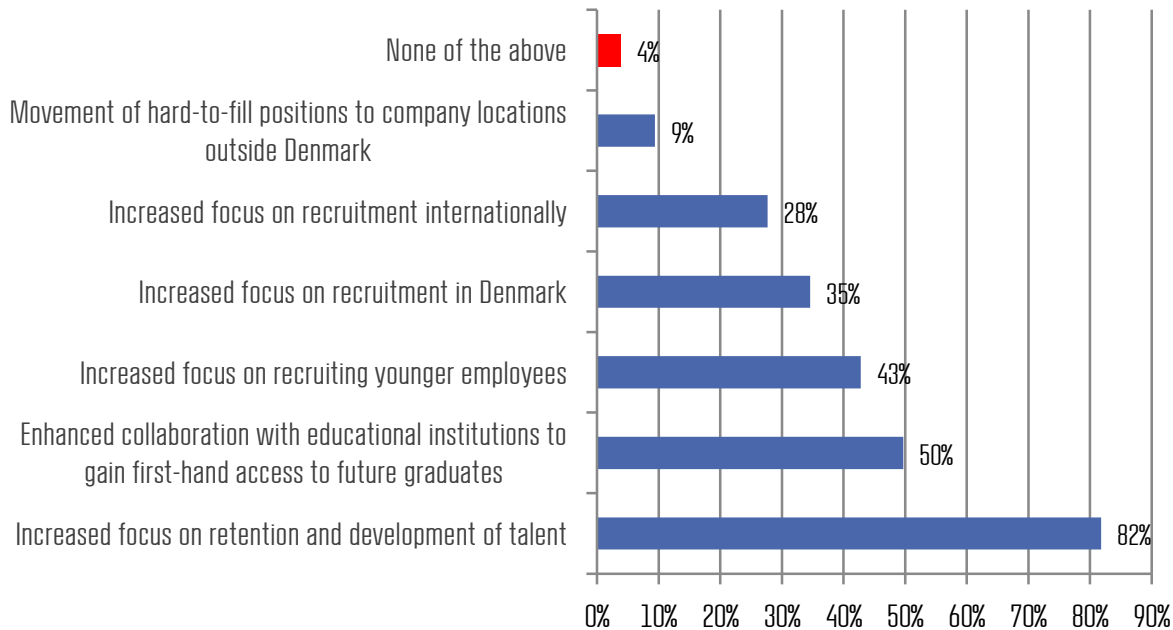


Figure 14

More than 60% of the companies in our sample chose the maximum of three solutions, 24% chose two, and only 4% found none of the solutions applicable. To face the skills-gap challenge, 82% would like to increase the focus on retaining and developing talent, while half of our sample would like to increase collaboration with educational institutions. An increased focus on recruiting younger employees (43%), recruiting in Denmark (35%), and recruiting internationally (28%) are also among the solutions believed to be applicable for filling open positions.

*It's not what you do
(which single solution).
It's how much you do
(the variety of solutions)*

Three of the solutions shown in Figure 14 are related—they all concern increasing the focus on recruitment (of younger employees, in Denmark, and internationally). Two of these solutions are particularly interesting. We find a highly significant *negative* correlation between an increased focus on recruitment in Denmark and an increased focus on recruitment internationally ($p < 0.001$). This means that the companies that view an increasing focus on recruiting in Denmark as an applicable solution typically do not view international recruitment as an applicable solution and vice versa. When testing for differences between these two groups across our background variables, we find significant results. Among the companies with international activities, 35% view an increased focus on international recruitment as a preferred solution. Among those companies only operating in Denmark, the corresponding figure is 10%, which is significantly lower ($p < 0.001$). Furthermore, the companies that expect the skills gap to grow are more likely to view international recruitment as an applicable solution ($p < 0.05$). Finally, we find strong positive correlations between company

size and revenue, and the tendency to view international recruitment as a sound solution (size is measured in terms of FTE ($p < 0.001$) and revenue ($p < 0.01$)).

The above potentially points towards a difference between larger, internationally operating companies and companies only present in Denmark. Larger companies have the resources and networks required to reach out and recruit internationally, whereas smaller companies typically focus on recruiting in Denmark.



I expect a development in which we have to look at the ability to attract to a greater extent. In fact, this is already emerging. We have to improve our communication, especially outside Denmark. We have to recruit from other pharma companies—in that regard, Denmark is nearly depleted. Many of the people active in this area work for us already, and others are difficult to move.

—Novo Nordisk

To understand how the best performing companies bridge the skills gap, we focus on those companies with consecutive growth in full-time employee count in each of the five years preceding the survey as well as those that expect headcount growth in Denmark and Western Europe. Our analysis shows that the best-performing companies favour international recruitment as a viable solution ($p < 0.05$). In addition, their increased focus on younger employees and enhanced collaboration with educational institutions approaches significance ($p < 0.10$). Companies expecting growth in Denmark feel that an increased focus on recruitment in Denmark is an applicable solution ($p < 0.05$) to a greater extent than other companies. Generally, large, successful companies look for more than one solution, according to our survey. The largest 50% of the companies in our survey generally viewed more solutions as applicable than the smallest 50% ($p < 0.05$).

Internal and external development of competences

However, increasing retention and thereby decreasing employee turnover cannot, in itself, mitigate the acute skills gap. An inflow of employees is not ensured by stopping the outflow. An increased focus on retaining and laterally developing the talent already at hand is, by far, the most popular solution among our respondents. In this regard, several Interviewees commented on the possibility of collaborating with educational institutions and co-developing ways to bridge the skills gap by drawing on each other's strengths. Such partnerships offer benefits to both sides.



We are in close dialogue with the university, where we make sure to highlight the special competences we need. When we are able to express a concrete need, marketing the related programs and specializations becomes easier for the institutions. When they market and advertise their programs, they have a tendency to highlight the value of the five years spent at university, but that is not what is exciting. What is really exciting is what you are able to do and work with afterwards. For this reason, some of our youngest employees have helped promote engineering as a career at the university by participating in video interviews and speaking about their jobs.

—COWI

This is in line with the findings from an international report “Closing the Skills Gap,” published by The Economist Intelligence Unit in 2014. The report has dug deeper into the collaboration between companies and educational institutions and provides comprehensive insights into US companies’ efforts to engage with colleges and universities. It finds that key characteristics of a successful collaboration between business and higher-education institutions include a solid value-proposition for all parties, a shared vision, and continual improvements.

In addition to the long-term strategy of changing educational patterns, some interviewees mentioned short- to medium-term solutions, such as reeducating current employees internally (exemplifying the solution found most applicable by our respondents, i.e., an increased focus on development of talent). Such initiatives help keep jobs in Denmark.



We also rethink our requirements. Could we use another person or reeducate someone who does not have all of the required competences? Typically, this is an investment with a longer scope—hiring or moving unqualified persons and retraining them internally. In such cases, we are operating with a timeline measured in years.

—Large Danish manufacturing company

As mentioned in the quote above, reeducating employees to increase competences within a specific area does not necessarily mean moving current employees, nor does retraining have to be done internally. Both education and training can occur externally by teaming up in larger networks, as explained by another interviewee.



In such situations, we have recruited people who are specialized in something else and then provided additional training, even if they have 10 years of experience. We have a great collaboration with the nearby university, the local job center, and the professional association for engineers. We have built a model in which, if we really need someone, we team up with unemployed people, who then take specialized courses at the university while doing an apprenticeship with us or another company. In this way, we can cover unmet competency demands.

—COWI

Recruitment and employer branding

Our interviewees also talked about the fact that for them the increased focus on recruitment involves better communication. This element was also mentioned in the survey responses, where respondents had the opportunity to supplement the solutions presented in Figure 14 with additional actions they would find applicable for meeting the skills-gap challenge. In this regard, seven companies mentioned employer branding. Some focused on branding their company as a great place to work, while other mentioned the branding of Denmark in an effort to attract international employees (see Textbox 4).



Some cluster organizations are already working on uniting interests and branding Denmark as a country known for pharma and other areas. This increases our ability to attract international talent.

—Novo Nordisk

Textbox 4: Copenhagen Capacity. The evolution of regional and employer branding

Copenhagen Capacity, founded in 1994, is a private organization that links the interests of companies with those of governmental institutions. Funded primarily by public stakeholders, it seeks to brand the Greater Copenhagen region in close cooperation with such organizations as Invest in Denmark (run by the Danish Ministry of Foreign Affairs) and Wonderful Copenhagen (a networking organization). Originally, Copenhagen Capacity focused on attracting and retaining foreign investments by branding industrial clusters (e.g., Medicon Valley), and highlighting the benefits of operating in and around Copenhagen. Over the years, Copenhagen Capacity has expanded its list of services, which are offered to both Danish and international companies. Recently, it has added tools to help attract international talent, including an employer-branding toolbox, a recruitment-campaign service, and advice on relocating to Denmark. With more than 60 employees, Copenhagen Capacity exemplifies the evolution of regional branding—growing from a narrow focus on attracting foreign direct investments to cluster branding to helping local and international companies attract talent and skills from around the world.

Sources:

Copenhagen Capacity (2015): Annual Report 2014; Copenhagen Capacity (2016): Find the right talents for your business, accessible via <http://www.copcap.com/our-services/finding-talent>.

For the largest companies, the ability to attract international talent is crucial for filling positions. In the immediate future, meeting demand by only recruiting in Denmark does not appear to be an option.



For us, it is a war for international talents. Of course, part of the long-term solution is to have more people educated within certain areas, and some initiatives are already focused on this. However, right now and for the next 5-10 years, the fight will be fought outside Denmark.

—Novo Nordisk

For smaller companies, recruiting internationally may be too expensive. Moreover, these companies seldom attract international talent that is already located in Denmark. This may be – among other things – due to their own inability to brand themselves as an international workplace. For example, with the increase of internationalization of university education, Danish universities are having more and more international graduates: foreign citizens who obtained their bachelor and/or master's degrees elsewhere and have some professional experiences from abroad. Upon

graduation, the international graduates are looking for the “usual suspects” – large international companies with English as corporate language. They seldom consider small and medium companies as their potential employers.



Every year in Råvarebygning [executive MBA building at CBS] we have 40-50 hand-picked international talent - carefully selected professionals with solid education (lots of engineers, IT-specialists, physicians, etc.), who decided to take a year off to do a full time MBA at CBS. These people chose CBS as a place for their MBA because they would like to work in Denmark. Ironically, half of those people have to leave Denmark after their graduation, because they could not find job within the three months after the end of their studies, the time allowed by their residence permit. This period is too short to get jobs for which all classmates are competing.

—CBS faculty at full time MBA

While the skills gap might be bridged in the short to medium term by retraining or recruiting internationally, some interviewees explain that this is not a viable approach in the long run.



If the skills gap continues, an increasing proportion of our jobs will be moved outside Denmark. We wish this was not the case, but that is unfortunately the consequence if the required competences are not available.

—Siemens

Summary

38% of our sample companies have been negatively affected by a lack of qualified employees in Denmark. For the largest 50% of the companies in our sample (measured in terms of FTE), the proportion is 48%. The skills gap typically affects company performance by delaying strategic initiatives, limiting growth in Denmark, and hampering the ability to pursue market opportunities. As a standalone factor, the skills gap only rarely leads to the relocation of core facilities to places outside Denmark. Instead, in such situations, jobs and tasks are often moved across borders. Companies find a variety of solutions relevant for mitigating the negative impact of the skills gap. 82% agree that a focus on the retention and development of talent is one way of overcoming the skills gap. Companies also indicate that enhanced collaboration with educational institutions (50%) and a focus on recruiting younger talent (43%) are likely to be popular initiatives over the next three years. To some extent, whether a company intensifies its recruitment efforts in Denmark or internationally is a question of size (measured in terms of FTE)—the larger, internationally operating companies in our sample tend to look outwards to solve the skills-gap challenge, while smaller companies focus on Denmark.

5

INSTEAD OF CONCLUSION

As the first investigation into the demand side of the skills gap, this project relied almost exclusively on perceptual data collected from interviews and a survey. Perceptual evaluations provide us with a general picture and highlight some areas in which future research is needed. What we learned from the project led us to consider how the skills gap should be studied in the future.

The implications of a persistent skills gap are significant for both society and the competitive advantage of Danish firms. Accordingly, future research needs to focus on developing, collecting, and combining objective information (instead of relying on perceptual measures) from **both** the supply (available human capital) and demand (employers search) sides. Furthermore, **calculations of the skills gap should be undertaken separately for each job cluster and each particular region**. Early on in this process, the focus could be on jobs requiring advanced STEM (science, technology, engineering, and math) skills.

The calculation of the skills gap would allow users to match and predict demand and supply for particular job in a particular region of Denmark. With such a tool, any actor in Denmark (e.g., public and private organizations, NGOs, individuals) or internationally (e.g., businesses interested in investing in Denmark, international talent) could gain access to unique knowledge about the skills and competences that are in demand now and those that will be in demand in the future. Such knowledge will provide policy makers with data that can guide talent supply/demand discussions in Denmark, and help specify the types of talents that must be attracted from abroad to ensure the competitiveness of Danish companies.

Three steps are necessary in this process:

1. Identification of the supply of human capital

To identify the supply of human capital, publicly available educational data and data accumulated by various public organizations must be gathered, integrated, and made accessible. On the basis of predictive analytics and a visualization platform, an aggregated mapping of human capital available in a particular region of Denmark could be presented. It could consist of the current and predicted supply of human capital for each region.

2. Identification of the demand for human capital

To identify the demand for human capital, we need to carry out text mining of job advertisements to determine skill requirements and job tasks. Companies can be invited to submit descriptions of their job vacancies together with the job listings' opening and closing dates. Job advertisements can then be analyzed using text analysis. From this exercise, a list of "skills in demand" can be identified. On the basis of predictive modelling, we can then forecast the "skills in demand" for various job clusters.

3. Combination of supply and demand

An online tool that offers a **calculated skills gap** (demand versus supply) **for a job cluster of the user's choice in a given region at any given time** needs to be developed. On the basis of predictive analytics, the gap can be continually determined by integrating data purchased from Danmarks Statistik regarding the mobility of human capital (e.g., movements among firms) and available data on highly skilled migration gathered by e.g. Copenhagen Capacity and its network. The current and predicted skills gaps in various regions of Denmark will be presented using the analytics and visualization platform.

A clear understanding of the actual skills gap—instead of a reliance on proxies and perceptions—would have significant policy implications (e.g., public education), highlight significant economic opportunities for newly established companies, and ensure greater productivity and competitiveness for existing Danish companies. Such an understanding would also make it possible for the general public to efficiently process very large amounts of previously sporadic data.

*It is time to
stop guessing and start knowing*

APPENDICES

Appendix 1: Population

The initial sample population was created using Børsens Top1000, which is an overview of the 1,000 companies in Denmark with the largest revenue. 100 companies were removed from the initial sample set owing to:

- Bankruptcy,
- Merger/acquisition with another company on the list,
- Fewer than 15 employees, or
- No significant activities in Denmark.

This resulted in a population of 900 companies eligible to take part in the survey. For companies with subsidiaries, only the Danish headquarters unit was contacted. For holding companies, the largest business unit was selected as representative. Respondents were primarily executive HR managers or HR partners responsible for recruitment. In some industries, such as construction and automobile retail, recruitment responsibility is highly decentralized with no single person/department having an overview of the aggregate skills gap. In these cases, a person with recruitment responsibility for one of the larger warehouses/construction sites was contacted. In total, we gathered contact information on and distributed the questionnaire to 789 companies. The remaining companies were either not reachable or did not want to participate. The survey was open from October 21, 2015, to January 13, 2016. After a series of reminders, we received 179 responses, of which 159 were fully completed. We achieved the response rate of 22.7% (with 95% confidence interval).

Non-response bias

When testing for non-response bias, all original Børsen Top1000 companies were included based on the assumption that the illegible companies were evenly distributed. On the basis of the CVR number (central Danish company register number) provided in the Børsen Top1000, we acquired background data on each company in our sample set from ORBIS. This data consists of revenue for the past five years, full-time employee count for the past five years, primary industry code (using NACE rev. 2), and the country code for each company's global ultimate ownership.

Testing for non-response bias showed an overrepresentation of larger companies in terms of both FTE and revenue. This is not surprising given our original sample (Børsen Top1000). This can be attributed, in part, to the fact that larger companies tend to have dedicated HR managers with an overview of and interest in the skills gap, and hence willing to answer the survey.

We found no non-response biases in terms of geography or industry.

Firm size

The sample consists of 179 companies with 20 to 46,832 FTE. The size distribution is illustrated on a logarithmic scale in Figure 15. FTE data is missing for nine companies.

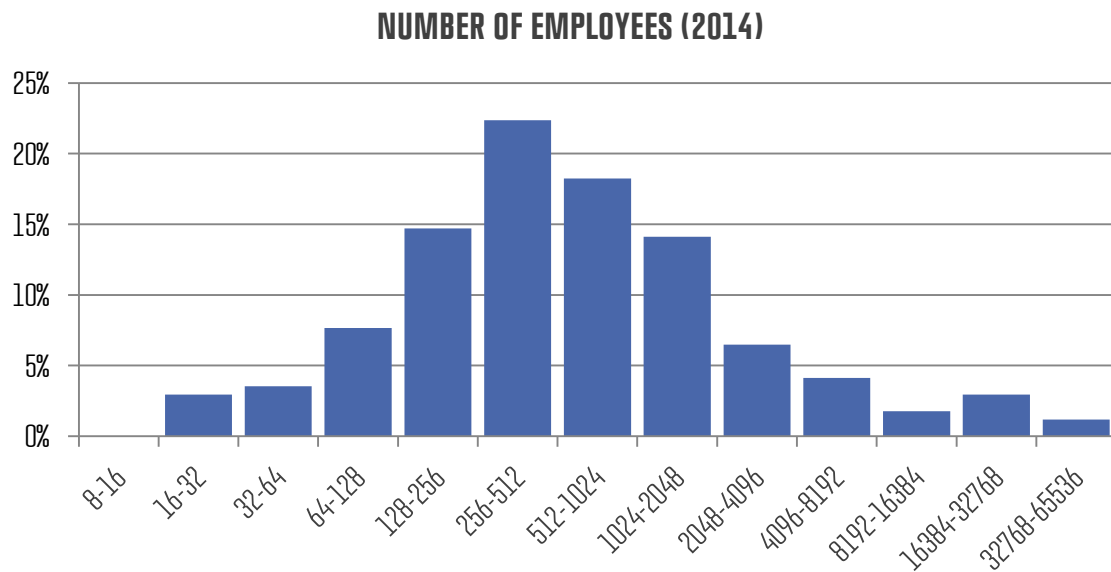


Figure 15

Revenue

The 2014 revenue for the companies in the sample ranged from DKK 130,282 to DKK 89,576,000. 2014 revenue data are missing for five companies.

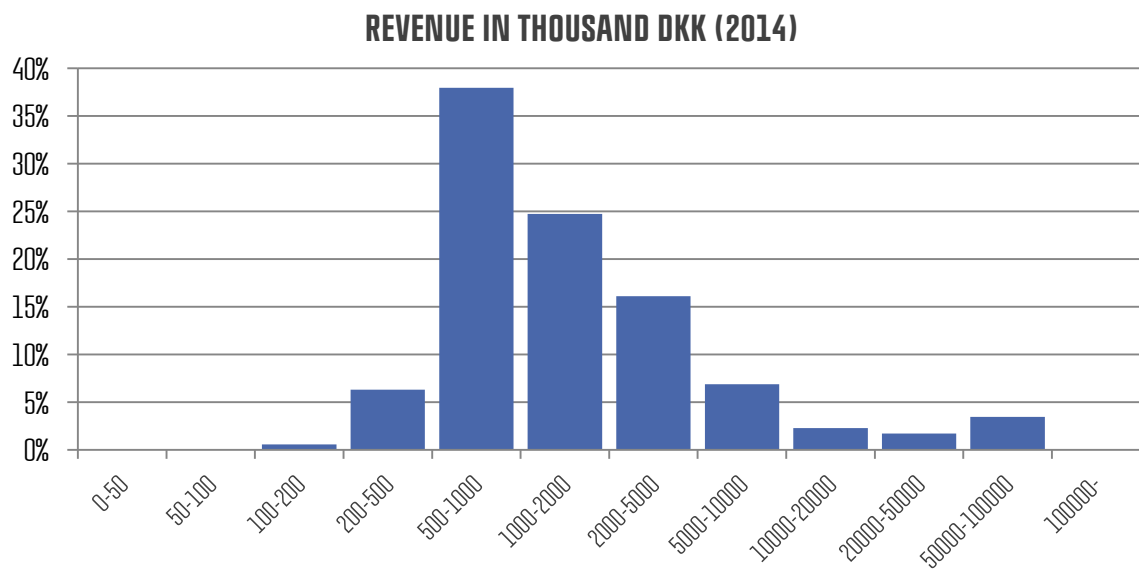


Figure 16

Industries

The majority of the companies in our sample are active in the financial, manufacturing, or wholesale and retail trade industries. Together, these three industries account for 70% of the respondents. Other well-represented industries include:

- Professional scientific and technical activities,
- Transportation and storage,
- Construction, and
- Information and communication.

Other industries include administrative and support services, and real-estate activities. The industries represented in the sample are illustrated in Figure 17.

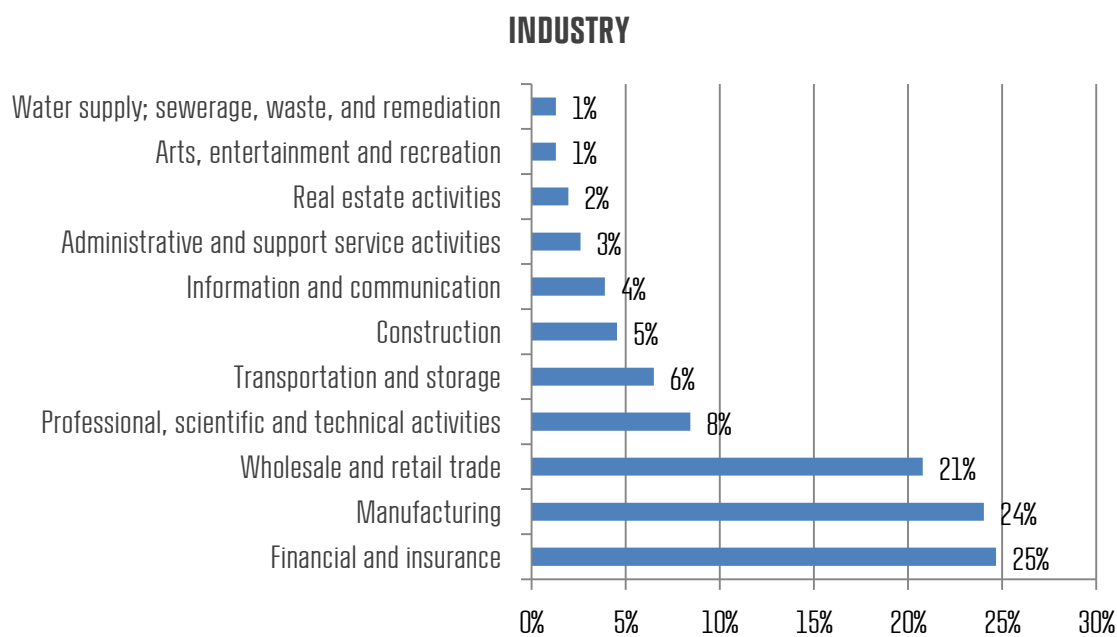


Figure 17

Geography

The companies in our sample were located using the addresses and regional codes of their headquarters in Denmark, which were provided by Børsen's Top1000. Of the 1,000 companies in Denmark with the highest revenue, almost 50% are located in the Copenhagen region.

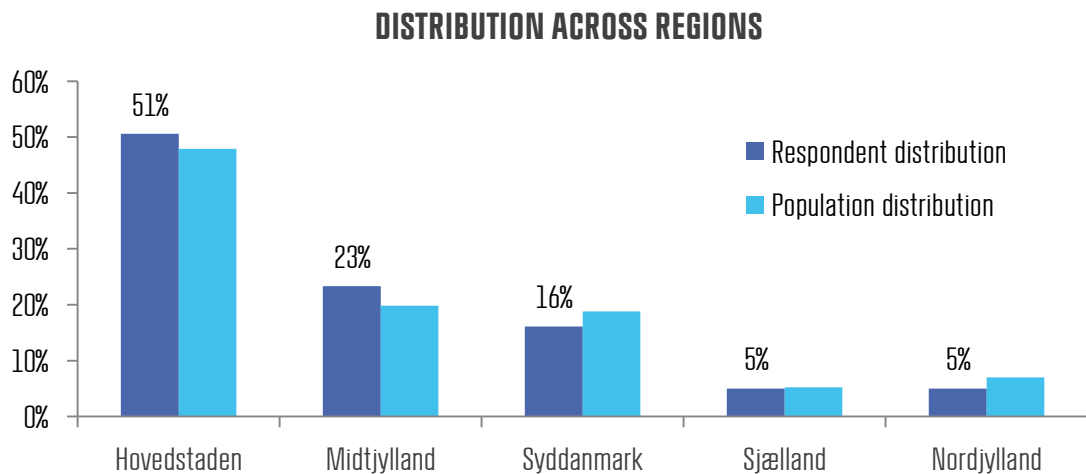


Figure 18

Internationalization and global ultimate ownership

From the responses to one of the survey questions, we know that 69% of the companies in our sample have activities outside Denmark (see Figure 19). Figure 20 shows the location of the ultimate ownership of each company. The majority of companies in our sample are ultimately owned by entities in Denmark (64%). The runner-ups are from the US (7%), Sweden (5%), Germany (5%), and the United Kingdom (4%). In total, companies from 30 different countries are represented.

DOES YOUR COMPANY HAVE ACTIVITIES OUTSIDE DENMARK?

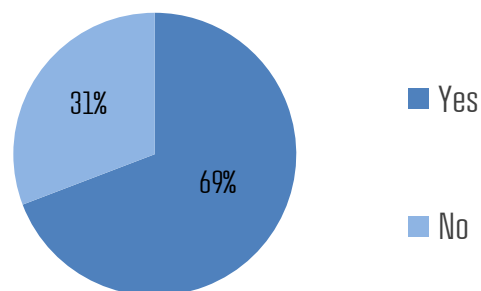


Figure 19

LOCATION OF ULTIMATE OWNERSHIP

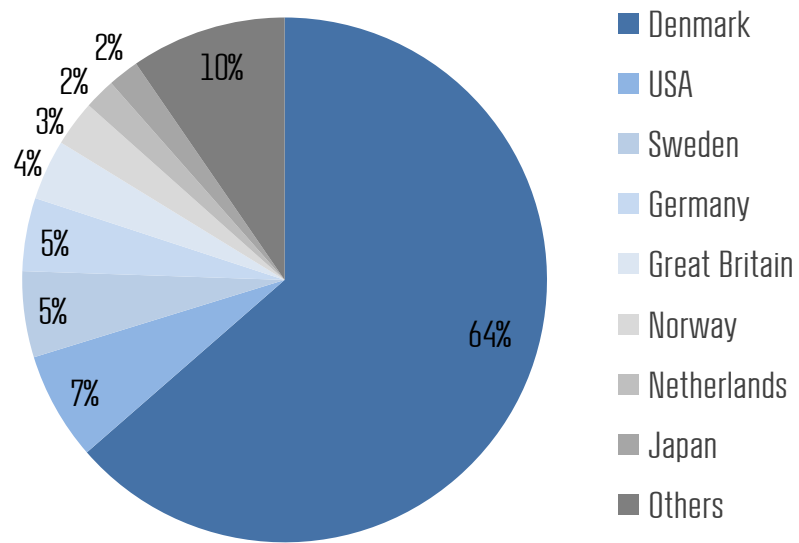


Figure 20

Appendix 2: Background and literature

Characteristics of the skills gap

The skills gap is generally understood as the disequilibrium between the supply and demand of skills for a given workforce. As economies and societies change, so too does the demand for skills. From an economic point of view, there is typically a lag between changes in demand and the corresponding realignment in supply resulting adjustments in the complex web of private and public educational institutions and programs.

Methods for studying the skills gap

No unified method for measuring the skills gap exists. Generally, the approaches to studying the phenomenon can be divided into two clusters, while a third method is under development.

The first method examines the skills gap by focusing on the demand side. This typically includes surveying the organizations demanding skills and using their difficulties in filling positions as an indicator of the skills gap. This is the method employed in our study and several of those presented in the additional readings.

The second method is rooted in economics. It uses regional or national panel data on supply and demand, typically collected and made available by government institutions, to calculate and project the skills gap.

A third method, which is under development, is based on analyses of online job databases. Instead of relying on reporting by employers, this method uses text mining, and the time between the creation and removal of job openings published online to estimate the skills gap.

The skills gap in Denmark

In Denmark, the skills gap has primarily been examined by think tanks and government institutions using public register panel data on, for example, employment and graduation rates.

Key governmental actors include the Danish Ministry of Employment and its Agency for Labor Market and Recruitment (Styrelsen for Arbejdsmarked og Rekruttering), as well as Statistics Denmark. Examples of think tanks and interest organizations studying the skills gap include the Danish Confederation of Enterprise (Dansk Erhverv),⁹ the Economic Council of the Labor Movement (Arbejderbevægelsens Erhvervsråd),¹⁰ the Confederation of Danish Industry (Dansk Industri),¹¹ and the Danish Society of Engineers (IDA).¹²

⁹ See, e.g., Dansk Erhverv (2014): Flaskehalse i erhvervslivet. Notat, July 7.

¹⁰ Arbejderbevægelsens Erhvervsråd (2013). Danmark i en krisetid – Velstand kræver uddannelse.

¹¹ Dansk Industri (2013). Stort mis-match mellem udbud of efterspørgsel på universitetsuddannede.

¹² IDA/Engineer the Future (2015). Prognose for mangel på ingeniører og naturvidenskabelige kandidater i 2025, May 2015.

Related readings

In the following, we highlight reports that will be of interest to those examining how the skills gap is measured and discussed around the world. While direct comparisons between our report and results from, e.g., US studies are not straightforward due to slight differences in methodology, terminology, and scope, the following reports can nuance the skills-gap discussion, and provide recommendations and inspiration. The list should not be seen as exhaustive.

- ManpowerGroup (2015). 2015 Talent Shortage Survey

The ManpowerGroup Talent Shortage Survey is conducted annually. The 2015 study covered more than 41,700 hiring managers from 42 countries. Given the study's global reach, the report can aggregate results to the regional and global levels. The report has been undertaken for 10 years. It tracks the talent shortage, which is similar to the skills gap, and allows for temporal as well as spatial comparisons.

- UK Commission for Employment and Skills (2014). UK Commission's Employment Skills Survey 2013: UK Results, January 2014

Spanning almost 200 pages, the UK government's report on employment skills is among the most comprehensive studies of the skills gap. It draws on answers from 91,000 businesses. On the basis of a slightly different terminology than most other studies, it defines the skills gap as existing when a *current* employee is not fully proficient. However, it also examines skill-shortage vacancies (the equivalent to our definition of a skills gap). Overall, the report, which is the second edition following a similar report from 2011, presents a detailed overview of UK employment trends and skill gaps, and offers a framework able to capture many details and nuances.

- The Economist (2014). Closing the skills gap: Companies and colleges collaborating for change

Drawing on 343 responses to a survey distributed to executives in the US who were familiar with their company's workforce-development strategies, this report provides an extensive analysis of the collaboration between industry and educational institutions from a business perspective. It also presents a short history of the skills gap, and recommendations for future collaborations between industry and educational institutions.

- Labor & Economic Analysis Division, North Carolina Department of Commerce & North Carolina Association of Workforce Development Boards (2014). 2014 Employer Needs Survey, August 2014

Based on responses from 779 public and private sector employers with 10 to 499 employees, this report examines hiring difficulties in North Carolina. It oversamples manufacturers on purpose and compares them to non-manufacturers throughout the report. Interestingly, the report employs a broad definition of its subject matter by studying "hiring difficulties" rather than only skills gaps. This opens up for discussions of explanatory factors, such as commuting distance, unwillingness to accept work conditions, and criminal records among applicants. However, the findings suggest that a skills gap, as defined in our report, is the primary reason for hiring difficulties.

- Boston Consulting Group & Washington Roundtable (2013). Great jobs within our reach: Solving the problem of Washington state's growing job skills gap, March 2013

At the request of The Washington Roundtable, Boston Consulting Group (BCG), a global consultancy, has estimated the size of the skills gap in Washington state and proposed solutions for eliminating it. On the basis of an analysis of publicly available data, the consultancy found that roughly 25,000 jobs were “acutely” unfilled, where the definition of “acute” was the same as that used in this study (i.e., job opening not filled for at least three months). 80% of these positions were believed to be within science, technology, engineering, and mathematics (STEM). On the basis of projections regarding the supply-demand imbalance, BCG found it likely that the skills gap would double by 2017. The report includes a section on economic opportunities related to eliminating the skills gap. In this regard, it proposes increasing STEM throughput at colleges/universities and expanding international immigration opportunities.

- PriceWaterhouseCoopers (2012). Delivering results: Growth and value in a volatile world. 15th Annual Global CEO Survey

In its 2012 Annual Global CEO survey, PwC, a global consulting company, presented findings based on interviews with 1,258 leaders from 60 countries. One of five main themes is the talent challenge. According to the report, CEOs across all industries say it has become more difficult to hire, especially in pharmaceuticals and life sciences, technology, and insurance. The study finds that a revision of strategies for managing talent is the number one priority for CEOs, surpassing organizational restructuring and risk management. In developed economies, the largest recruiting challenge relates to high-potential middle managers and skilled production workers.

- Institute for the Future & University of Phoenix Research Institute (2011). Future Work Skills 2020

Although it does not directly examine a skills gap, this report is relevant for discussing the disequilibrium between the supply of and demand for skills. It analyzes key drivers that change the work landscape and, in doing so, identifies key work skills needed in the future. On the basis of a “signals” methodology in which data analysis, expert interviews, and trend research help locate local innovation and disruption signals with the potential to grow in scale and geographic distribution, the report finds six broad drivers of change. These drivers, in turn, have implications for the skills of the workforce in the future. According to the report, key skills for the future workforce include computational thinking, social intelligence, and transdisciplinarity. The implications of the ten skills of the future workforce for educational institutions, businesses, and government are elaborated upon in the final section.

Appendix 3: Interview guide

1. Currently, do you experience that there are certain positions that are “hard to fill”?
2. Could you give examples of such positions? What do those positions have in common? Any particular skills that are hard to get?
3. What kind of skills do the “hard to fill” positions require? (not only “hard” skills like math, science etc. – softer skills? Mindset)
4. How often do the “hard to fill positions” remain open for the period of time over 3 months because of the absence of qualified candidates?
5. Have you experienced that the difficulties you have filling the “hard to fill” positions constrained your company’s growth and profitability over the past 12 months? In what ways?
6. Assuming that during the next 3 years you continue experiencing “hard to fill” positions in Denmark, what do you feel is more likely to occur?
7. What did I not ask you about that you find relevant?
8. Would you have liked the interview questions prior to the interview?

*If mentioning talent, ask for a definition of it.

Appendix 4: Questionnaire

We define the “skills gap” as the gap between the skills needed by Danish employers and those possessed by potential employees in Denmark. However, not every job opening is the result of a skills gap. Therefore, when responding to the questions, we ask that you think about the “acute” skills gap – the gap that exists when it takes a company at least three months to fill a position that offers a prevailing market wage due to a lack of qualified candidates (based on educational, experience and quality requirements).

Q1 - To what extent has your company experienced an "acute" skills gap as a result of a shortage of qualified employees within the last 12 months?

- ☐ To a very large extent
- ☐ To a large extent
- ☐ To some extent
- ☐ To a small extent
- ☐ Not at all
- ☐ I do not know

Q2 - What do you expect to happen to the "acute" skills gap within the next 12 months?

- ☐ Decrease significantly
- ☐ Decrease somewhat
- ☐ Stay the same
- ☐ Increase somewhat
- ☐ Increase significantly

Q3 - Within the last year what percentage of your total job openings in Denmark has remained unfilled for at least three months due to a lack of qualified applicants? (Choose only one answer.)

- ☐ None
- ☐ Less than 10%
- ☐ 10% - 24%
- ☐ 25% - 49%
- ☐ 50% - 74%
- ☐ 75% or more
- ☐ I do not know

Q4 - Please rate the current shortage of qualified employees in Denmark for the following workforce segments.

	Very significant shortage	Serious shortage	Moderate shortage	Light shortage	No shortage	I do not know
Overall	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Senior management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Management and administration (e.g., HR, finance)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IT and IT-related	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sales and marketing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scientists and engineers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skilled production workers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q5 - Please indicate the workforce segments in which you experience a current shortage of qualified employees if not mentioned above:

Q6 - To what extent do you experience a shortage of qualified employees?

	To a very large extent	To a large extent	To some extent	To a small extent	Not at all	I do not know
... with skills that are produced in Denmark/the Danish educational system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... with additional languages, cultural insight and market knowledge that is inherent with employing workers from a specific country	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... with high-level specialist skills that are in high demand but with limited global availability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q7 - Have a lack of qualified employees in Denmark negatively affected your company?

☐ Yes

☐ No, we have not experienced any effects owing to a lack of qualified employees

Q8 – In what ways have a lack of qualified employees in Denmark negatively affected your company? (Select all that apply.)

- ☐ We are falling behind on new product development and innovation
- ☐ It has negatively affected our ability to pursue market opportunities
- ☐ Strategic initiatives have been delayed or cancelled
- ☐ It has negatively affected our company's growth in Denmark
- ☐ It has negatively affected our company's growth outside Denmark
- ☐ We have moved our core facilities out of Denmark
- ☐ Other – please specify: _____

Q9 - With regards to the challenge of filling certain positions due to a lack of qualified applicants in Denmark, please select the solutions you find the most applicable for your company over the next three years (select up to 3 solutions)

- ☐ Increased focus on recruitment in Denmark
- ☐ Increased focus on recruiting younger employees
- ☐ Increased focus on retention and development of talent
- ☐ Increased focus on recruitment internationally
- ☐ Enhanced collaboration with educational institutions to gain first-hand access to future graduates
- ☐ Movement of hard-to-fill positions to company locations outside Denmark
- ☐ None of the above

Q10 - In addition to the potential solutions listed above, are there any other solutions that might be applicable in dealing with the challenge of filling hard-to-fill positions in Denmark?

- ☐ Yes. Please specify: _____
- ☐ No

In the following question(s), we are interested in knowing more about your company's expectations regarding overall headcount growth within the next 12 months.

Q11 - Over the next 12 months, what do you expect to happen to the headcount in your organization in Denmark? (Choose one answer.)

- ☐ Decrease by more than 5%
- ☐ Decrease by less than 5%
- ☐ Stay the same
- ☐ Increase by less than 5%
- ☐ Increase by more than 5%
- ☐ I do not know

Q12 - Does your company have any activities outside Denmark?

- ☐ Yes
- ☐ No

Q13 – Over the next 12 months, what do you expect to happen to your organization’s headcounts in the following regions?

	Decrease by more than 5%	Decrease by less than 5%	Stay the same	Increase by less than 5%	Increase by more than 5%	We are not presently in these regions	I do not know
Western Europe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Central/Eastern Europe and the CIS countries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
North America	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Asia Pacific	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Middle East	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Africa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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