

The IT skills shortage

A report on the Swedish digital sector's need for cutting-edge expertise

WANTED!
70 000
IT PEOPLE NEEDED
BEFORE 2022

How we become best in the world

Sweden has good potential for continued growth and competitiveness, and to be the best in the world with the opportunities of digitalisation, but it is now high time to act.

The digital sector

Much bigger than IT and telecom.

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Strong drivers for development.

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Who are the 70 000?

Occupations, competencies, backgrounds.

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This is how we do it!

Necessary measures in the short and long term

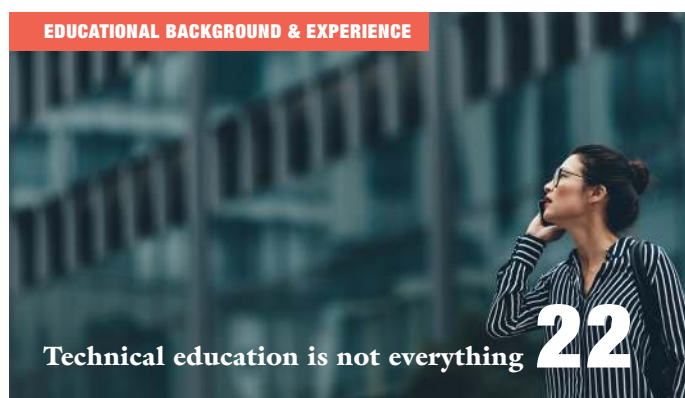
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The IT skills shortage

The Swedish digital sector's need for cutting-edge expertise

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The skills shortage threatens growth in Sweden

The comprehensive digitalisation taking place in Sweden and globally has led to the digital sector, i.e. the IT and telecom industry and other activities largely dependent on IT, becoming business's strongest force for growth. The continued growth of the sector is now threatened by the lack of cutting-edge expertise. A deficit in the order of 70,000 people with IT or digital-related competencies is feared by 2022 if no special measures are taken.

The integration of digital technology and digital services in the everyday work of virtually all companies and activities means that "IT" specialists now exist and are needed everywhere.

The global economy is increasingly moving from a position where the major scarce resource was physical capital to one where the major scarce resource is "human capital" in the form of qualified experts. This, together with the fact that large parts of the digitalisation process still lie ahead of us and that the need for skills in the area is increasing exponentially, makes the skills shortage in the IT sector/digital sector one of the biggest challenges of our time.

This report, initiated by Swedish IT & Telecom Industries' Skills Council¹, is our third survey of the skills shortage in the digital sector (previously called the IT sector). It shows that the challenges reported in 2012 and 2015 remain in 2017. Identifying and working for the implementation of measures to respond to them has, therefore, continued high priority among our member companies.

Through this survey we want, as a complement to information from the Swedish Public Employment Service, the National Institute of Economic Research and Statistics Sweden², which also points to the need for skills in IT and telecom as a growing constraint to growth, to provide policy-makers, the media, young people and adults close to young people such as teachers and study and career counsellors, with a clear picture of

the need for cutting-edge expertise in relation to digitalisation and a glimpse into a dynamic sector with great potential for the future.

More specifically, we are targeting our proposals for action at the parties who are responsible for ensuring skills provision in Sweden and who thereby play a crucial role in our future prospects and our continued competitiveness and welfare, namely:

- **The education system**, mainly universities and higher vocational education providers that offer IT education, together with their principal, the Ministry of Education and Research.
- **Authorities responsible** for matching in the labour market, such as the Public Employment Service, the Migration Agency, county administrative boards and municipalities and their principals, mainly the Ministries of Employment, Enterprise and Innovation and Justice.
- **The industry's own** training activities, i.e. professional education companies and internal training.

The need for skills in the IT and telecom industry and the entire digital sector is both acute and structural, which means that a series of measures and not just individual actions are necessary. If these measures are implemented, Sweden is well-placed for continued growth and competitiveness, and to live up to the government's aim to be the best in the world at exploiting the potential of digitalisation, but it is now high time to act.



Fredrik von Essen

Enterprise policy expert responsible for skills provision and sustainability issues at Swedish IT & Telecom Industries.

November 2017

SUMMARY

70,000 people needed by 2022

The comprehensive digitalisation taking place both in Sweden and globally has led to the IT and telecom industry becoming one of the main engines for employment and economic growth.



IT consultancy services, programming and related activities now account for the largest share of the total value added by business services in Swedish export production.

The biggest obstacle to the continuing growth of the digital sector is the lack of cutting-edge expertise in IT, telecom and other forms of digitalisation. A deficit in the order of 70,000 people is feared by 2022 if no special measures are taken.

The shortfall is found in most competence areas but, in terms of the numbers working in them, programming and systems architecture dominate.

Groups which are fewer in number today, but where need is strongly growing, are advanced data analysis and IT/information security.

IT&Telekomföretagen's action points

[= the Swedish IT & Telecom Industries']

To remedy the skills shortage, the Swedish IT & Telecom Industries recommend a number of measures in the short and long term, divided into four areas:



1. STRONGER GENERAL EFFORTS ON DIGITALISATION

- DEVELOP SKILLS AMONG DECISION-MAKERS
- ENHANCE COORDINATION BETWEEN MINISTRIES
- STREAMLINE INTERACTION BETWEEN AUTHORITIES



2. EFFORTS FOR SCHOOLS, YOUNG PEOPLE AND OCCUPATIONAL CHOICES

- RESOURCE COMMITMENTS FOR DIGITALISATION OF SCHOOLS
- REFORM THE TEACHER EDUCATION PROGRAMME
- CLOSER COLLABORATION WITH THE WORLD OF WORK



3. EFFORTS FOR HIGHER EDUCATION AND TRAINING DURING CAREER

- APPOINT CONTINUOUS EDUCATION COMMISSION
- SKILLS TRAINING FOR UNIVERSITY STUDENTS
- REWARD HIGH-QUALITY HIGHER VOCATIONAL EDUCATION



4. PROMOTION OF MIGRATION AND INTEGRATION

- NATIONAL STRATEGY FOR ATTRACTION OF TALENT
- AT LEAST 10,000 MORE TOP INTERNATIONAL STUDENTS

Much bigger than it and telecom

The comprehensive digitalisation taking place both in Sweden and globally has made the IT and telecom industry one of the main engines for employment and economic growth.



Part of the widespread evidence of the industry's importance is that during the period 2005-13 it accounted for 42 percent of production growth in Sweden.³ In addition, it has become all the more important for Swedish exports; the export of data services alone amounted to over 100 billion Swedish kronor in 2016. The export of other business services has also increased; IT consultancy services, programming and related activities now account for the largest share of the total added value of business services in Swedish export production. Moreover, this share has nearly doubled since the turn of the millennium.⁴

But the really defining feature for the development of digital products and services is that it is taking place both in what is traditionally counted as the IT and telecom industry and in a wide range of other industries and sectors. To only give an account of the need for skills in IT and telecom would therefore be misleading, so we are attempting to identify the needs of the entire digital sector.⁵

The digital sector includes all activities that in any form create, develop,

deliver and operate systems, services and products with digital content in the form of hardware or software, including both pure suppliers of hardware and software and associated services (that which is known as the IT and telecom industry) and other activities where the final products are not IT products in themselves but, for example, vehicles, financial services or travel where computer hardware and software are essential components.

The IT and telecom industry turnover in 2015 was 647 billion Swedish kronor and it employed about 202,000 people, distributed over four sub-sectors.⁶ In order to get an idea of the whole scope of the digital sector we have to add to these 202,000 people all the specialists in IT and telecom occupations in other sectors and industries - such as finance, commerce, industry and the public sector - where digital development is ongoing (illustrated by the outer circle).

According to Eurostat's survey, all together - i.e. the digital sector - this consisted of 308,100 people or 6.3 percent of the total work force in Sweden in 2016, which is the second highest share in Europe after Finland.

● EMPLOYMENT IN THE DIGITAL SECTORN

6.3 percent of the
total workforce
in Sweden

308 100

EMPLOYED IN THE DIGITAL SECTOR

132 693

SOFTWARE AND IT SERVICES

34 560

TELECOMMUNICATIONS

22 179

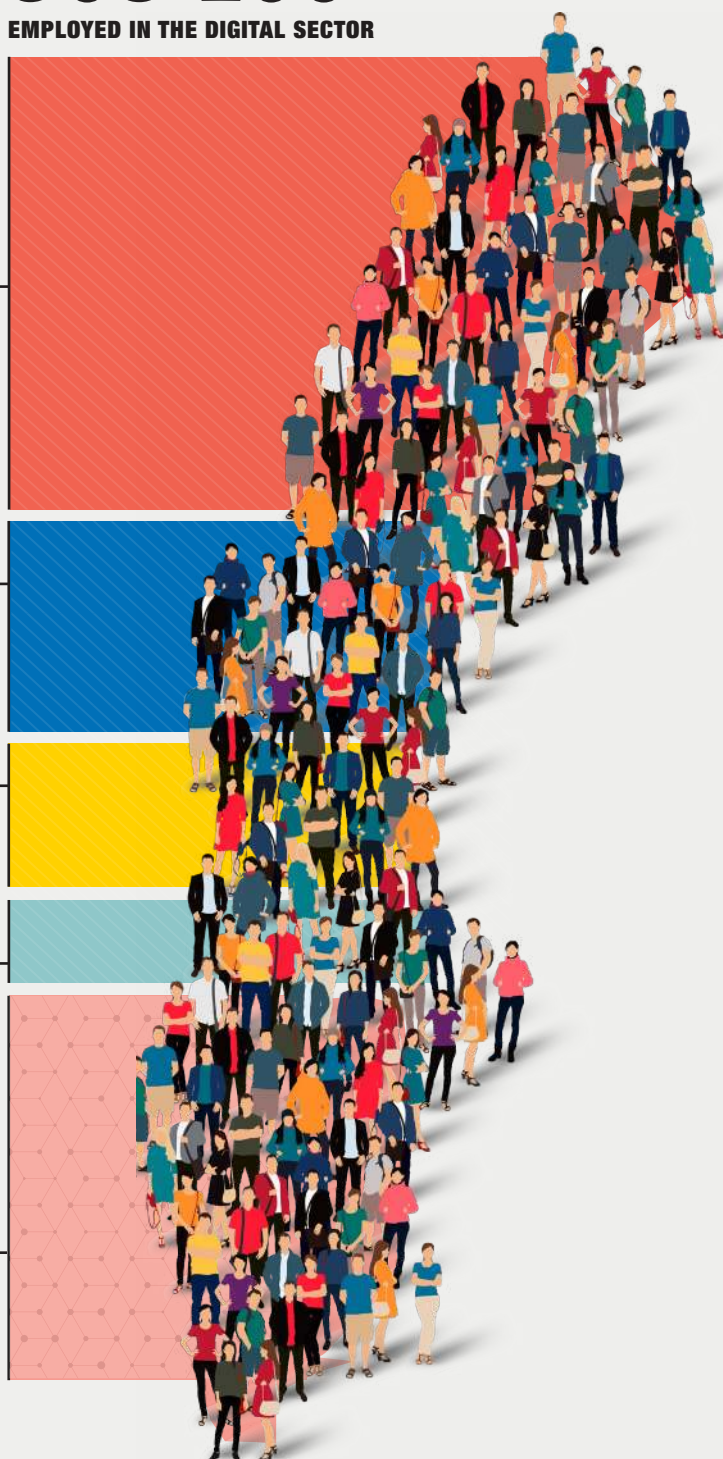
SALES AND SERVICE


12 722

PRODUCTION OF HARDWARE

105 946

IT IN FINANCE, COMMERCE, INDUSTRY
AND THE PUBLIC SECTOR





” DEVELOPING DIGITAL EDUCATION SERVICES, CONSTRUCTING FIBRE NETWORKS AND BUILDING INDUSTRIAL ROBOTS ARE ALL EXAMPLES OF ACTIVITIES THAT ARE CONNECTED TO DIGITALISATION, BUT WHICH REQUIRE VERY DIFFERENT TYPES OF SKILLS. ”

From fibre routing to game development – a strongly diversified sector

In addition to the difficulty of accurately defining and limiting what the digital sector is, the activities within the group of companies which class themselves as suppliers of IT/telecom/digitalisation solutions differ sharply. Developing digital education services, constructing fibre networks and building industrial robots are all examples of activities that are connected to digitalisation, but which require very different types of skills.

The categorisation⁷ below aims, despite this complexity, to pinpoint the skills shortage, i.e. to both identify it and estimate how much is needed in various areas, on the basis of the different types of products and services that are supplied. (With the proviso that the boundaries between the categories are flexible and that many enterprises are active in several of them.)

BUSINESS DEVELOPMENT IT

New developments of systems that support business, such as decision support, project management, etc.

BUSINESS SUPPORT IT

Development, operation and maintenance of administrative systems, such as financial systems, customer management, etc.

DIGITAL SERVICES

Development of services in education, healthcare, finance, commerce, transport, etc., where the service itself is physical or personal in nature, but where the essential components are delivered digitally.

IT INFRASTRUCTURE

Installation, operation and maintenance of organisation-internal, instead of public, infrastructure, such as servers, networks and databases.

AUTOMATION

Digitised development, manufacturing and distribution processes linked to industrial production, which is covered by the term “Industry 4.0”.

PUBLIC TELECOM INFRASTRUCTURE AND RELATED SERVICES

Development, operation and maintenance of telecommunications networks, both broadband/fibre and mobile networks, as well as the traffic transmitted.

MANUFACTURE OF IT AND TELECOM HARDWARE

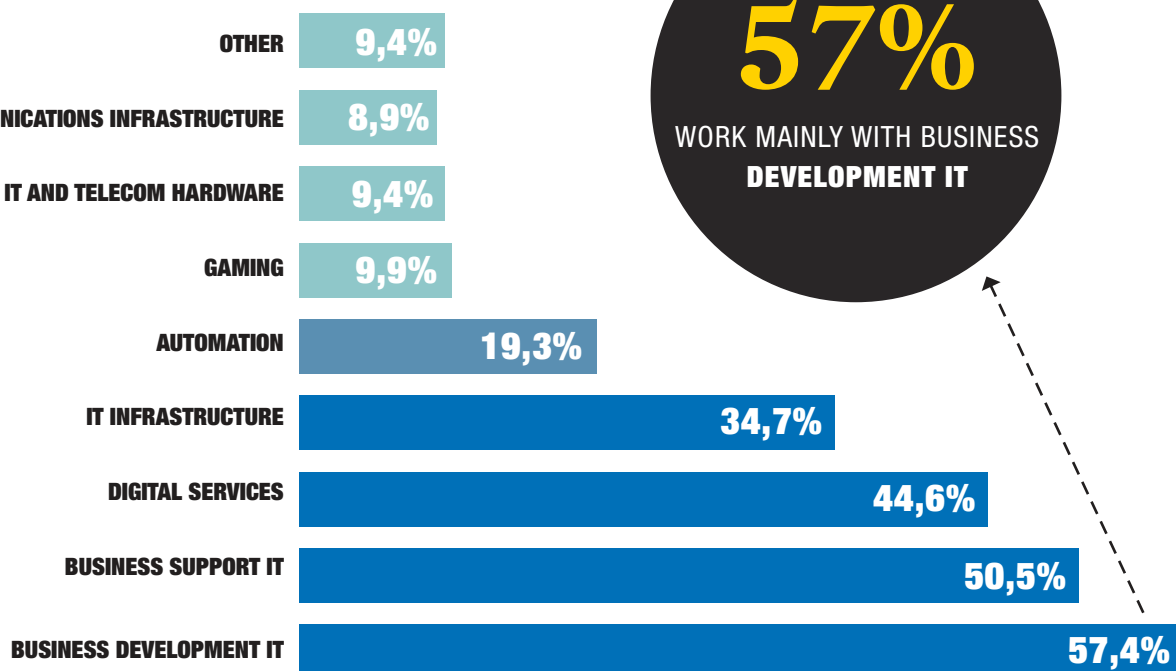
Manufacture of computers, network equipment, mobile telecommunications equipment and other components.

GAMES

Development of mobile games, console and computer games and related services, such as game engines and tools, as well as systems for design, graphics, animation, networks, user data, etc.

The main focus of activities for companies who identify as suppliers of IT/Telecom/digitalisation solutions.

Answer options in multiple-choice form



Pressure for change drives the need for skills

Businesses that develop digital products and services are strongly marked by development trends and a great pressure for change, which is not only to do with technology, but also about business where new ways of developing and distributing products and services are enabled, partly as a result of technological development.



The entire digital area is surrounded by buzzwords that give expression to these development trends, but they are often abstract and, to some extent, confusing even for those working in the sector. What do they mean and what trends are the most dominant drivers of consequence for skills needs in the next few years?

We have identified 13 drivers, which on the next page are presented in ranking order based on importance for skills needs (according to the respondents in our survey)



Flexibility, security and user focus

1 Demand for fast and flexible delivery of IT services and systems by continuous supply, cloud services, agile working methods, etc.

Working methods are developed to more quickly and more effectively support businesses changing needs for digital solutions. IT services and systems are updated and kept relevant without the customer/user being hindered in their activities.

2 Management of data/IT/information security

The fact that IT systems and functions are becoming increasingly business-critical places high demands on operational security and protection against various forms of attack. An important aspect is the management of identities of both physical users and the various machine elements that communicate with each other.

3 Demand for advanced user interface/user experience

Increasing digitalisation and technological development leads to greater focus on making digital products and services even more accessible to wider audiences.

4 Regulatory demands: the data protection regulation (GDPR) and other integrity regulations, copyright, etc.

Greater political awareness of the challenges in a digitised world, for example on integrity and security, leads to new and modified regulatory frameworks that require adaptability in both the private and the public sector.

5 Automation of production and processes, through for example robotisation, cloud computing and the Internet of Things (IoT)

Production chains are becoming more self-regulating through collected and analysed data. Information from different online products helps to develop and optimise both production and processes.

6 Mobile communications, through sensors, mobile networks and interconnections via the Internet of Things

More and more machine components can be connected in networks. More effective sensors and mobile communication enables more smart objects that interact with each other.

7 Advanced data analysis, incl. Big Data, deep learning, artificial intelligence and self-learning systems

Extensive access to data creates the conditions for new, potentially revolutionary, analysis tools. Both public data and user data from web-based and mobile services contribute to development.

8 Electronic commerce and development of payment methods

New payment methods facilitate financial transactions and make them more secure. A growing proportion of trade is electronic and physical currency – banknotes and coins – is used to a lesser extent than in the past.

9 New technology opportunities, like AR/VR (augmented reality/virtual reality), 3D printing/additive manufacturing, autonomous vehicles, image processing, voice control and other wearable technologies

Inventions and innovations that radically change how products and services are both produced and consumed. The effect can initially be small and hyped, and subsequently completely transform activities and sectors.

10 Economic effects of globalisation: changes in ownership, mobility in the labour force, etc.

Great pressure for change affects business. In order to cope with the competitive pressure and raise productivity, strong specialisation takes place with production separated along global value chains.

11 Performance demands on the telecom infrastructure

As the amount of communicated data increases, greater demands are placed on the performance and capacity of the telecom infrastructure.

12 Sustainability requirements - compliance with the UN's 17 development goals

The Swedish government has the ambition to become the best in the world at meeting objectives which aim to create economic, social and environmental sustainability. Increasing consumer awareness encourages market operators to make major adaptations.

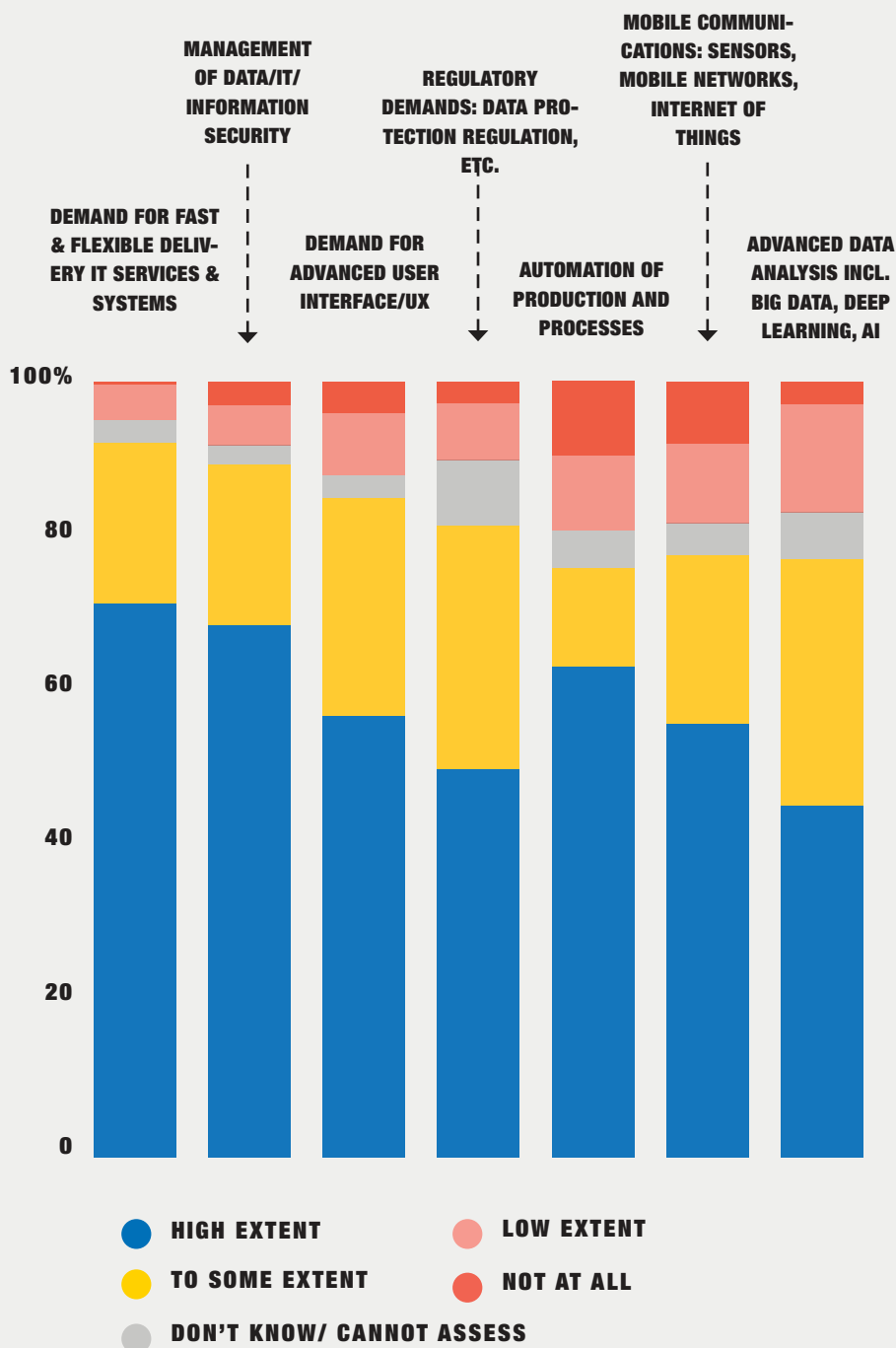
13 Sharing economy/collaborative consumption

With new digital tools and platforms, more and more people can exchange goods and services in new ways where different forms of intermediaries become unnecessary.

● DRIVERS THAT LEAD TO HIGHER SKILLS REQUIREMENTS

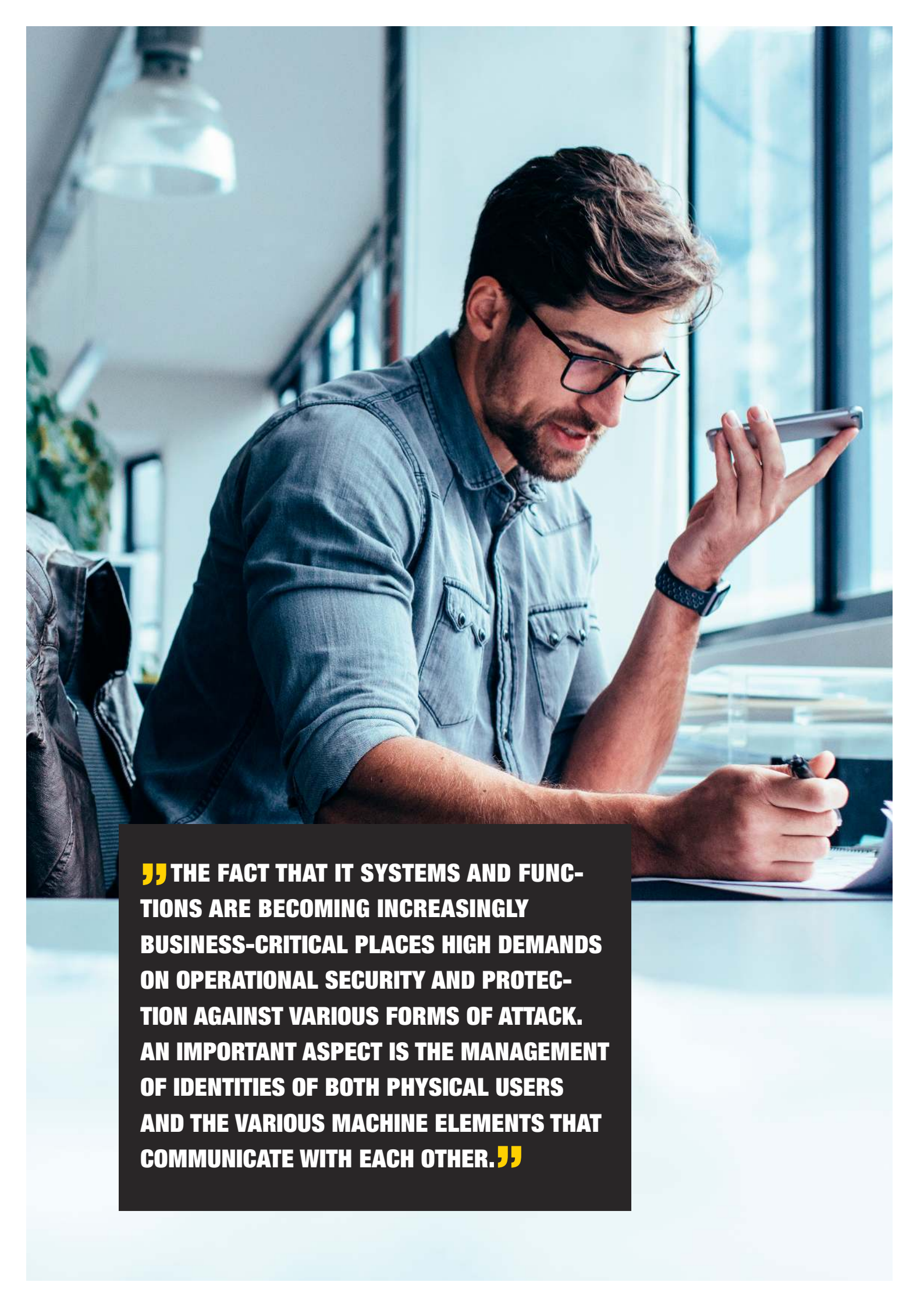
The seven drivers believed to most affect the need for skills

To what extent do you judge that your skills needs in the next three to five years will be affected by from left to right:



Several of the top seven are the same as in 2015, such as management of IT/information security, demand for advanced user interface and mobility. New entrants/ reformulated drivers are regulatory demands, automation and advanced data analysis.

The chart shows the responses for the seven drivers that 80-90 percent of the respondents in our survey believe will lead to an increased need for skills to a greater or lesser extent. The other six are also considered to lead to great needs, according to 40-60 percent. (See Appendix 1 for a more detailed presentation).

A man with dark hair, a beard, and glasses is sitting at a desk in a modern office. He is wearing a light blue denim shirt and a black watch. He is holding a smartphone in his right hand and looking at it. His left hand is resting on the desk, holding a pen. The background shows a large window with a view of a city and a staircase.

” THE FACT THAT IT SYSTEMS AND FUNCTIONS ARE BECOMING INCREASINGLY BUSINESS-CRITICAL PLACES HIGH DEMANDS ON OPERATIONAL SECURITY AND PROTECTION AGAINST VARIOUS FORMS OF ATTACK. AN IMPORTANT ASPECT IS THE MANAGEMENT OF IDENTITIES OF BOTH PHYSICAL USERS AND THE VARIOUS MACHINE ELEMENTS THAT COMMUNICATE WITH EACH OTHER.”

Programming, architecture and project management at the top



The term ‘competence’ refers to an individual’s ability to perform a task by applying knowledge and skills.

The difference to occupational role is that competence is the possession of skills in a certain area (such as programming), while an occupational role is about “working as”, followed by a of title or position (such as programmer). Competence and occupational role may not coincide; a person may have a particular competence in IT security, and at the same time have the occupational role of programmer.

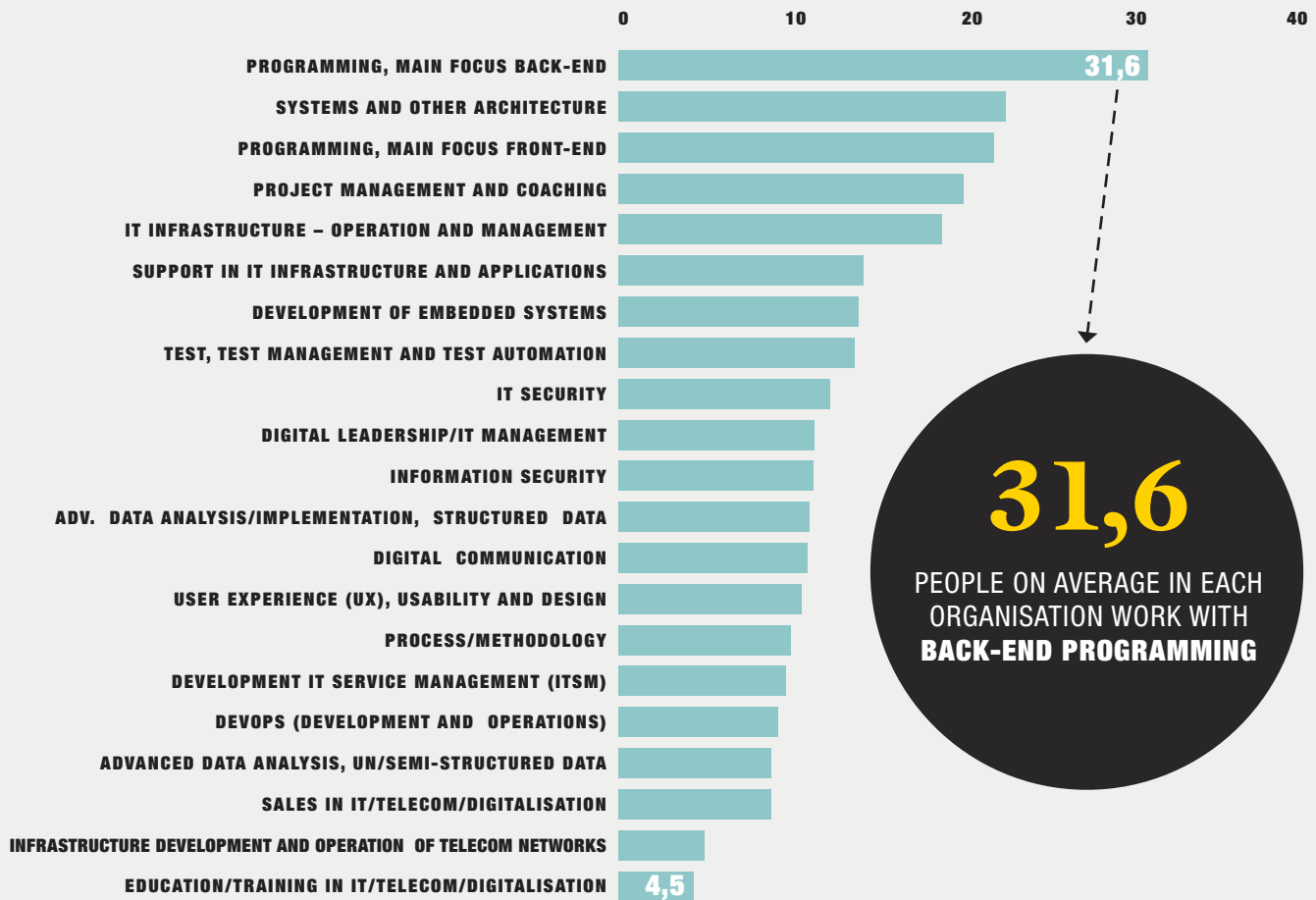
Our survey is based on 21 competencies⁸ of great relevance for the digital sector, and provides answers as to how many employees in the respective competencies the companies currently have and what competence needs look like today and in the next 3 to 5 years.

The overall picture of the total number working in different areas of competence, and the rate of increase of needs in these, show that the competencies in greatest demand in terms of numbers are programming (with a strong preponderance for back-end), architecture and project management.

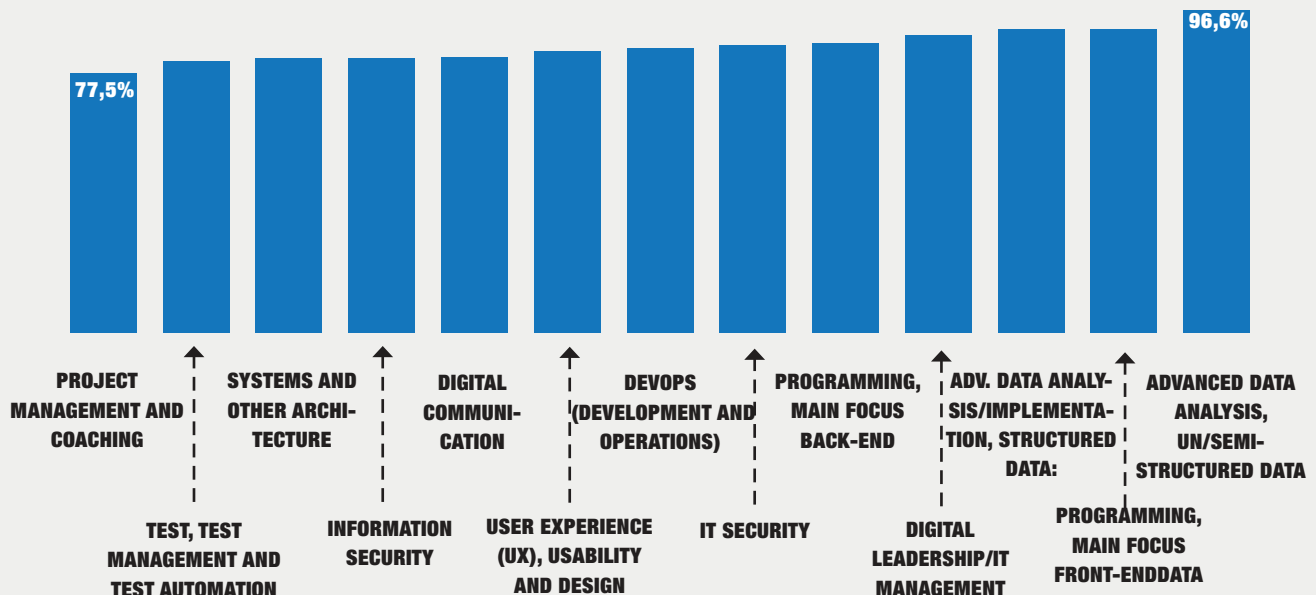
The need for competence in advanced data analysis and IT security is sharply rising, (top of the competencies that have the greatest increase in demand for the next 3 to 5 years) but from relatively low starting levels.

21 COMPETENCIES

Approximately how many people in your organisation currently have their main competence in this area? (number of persons on average)



The 13 areas of competence in which demand is expected to increase most **in the next 3 to 5 years** (see Appendix 1 for a more detailed description).



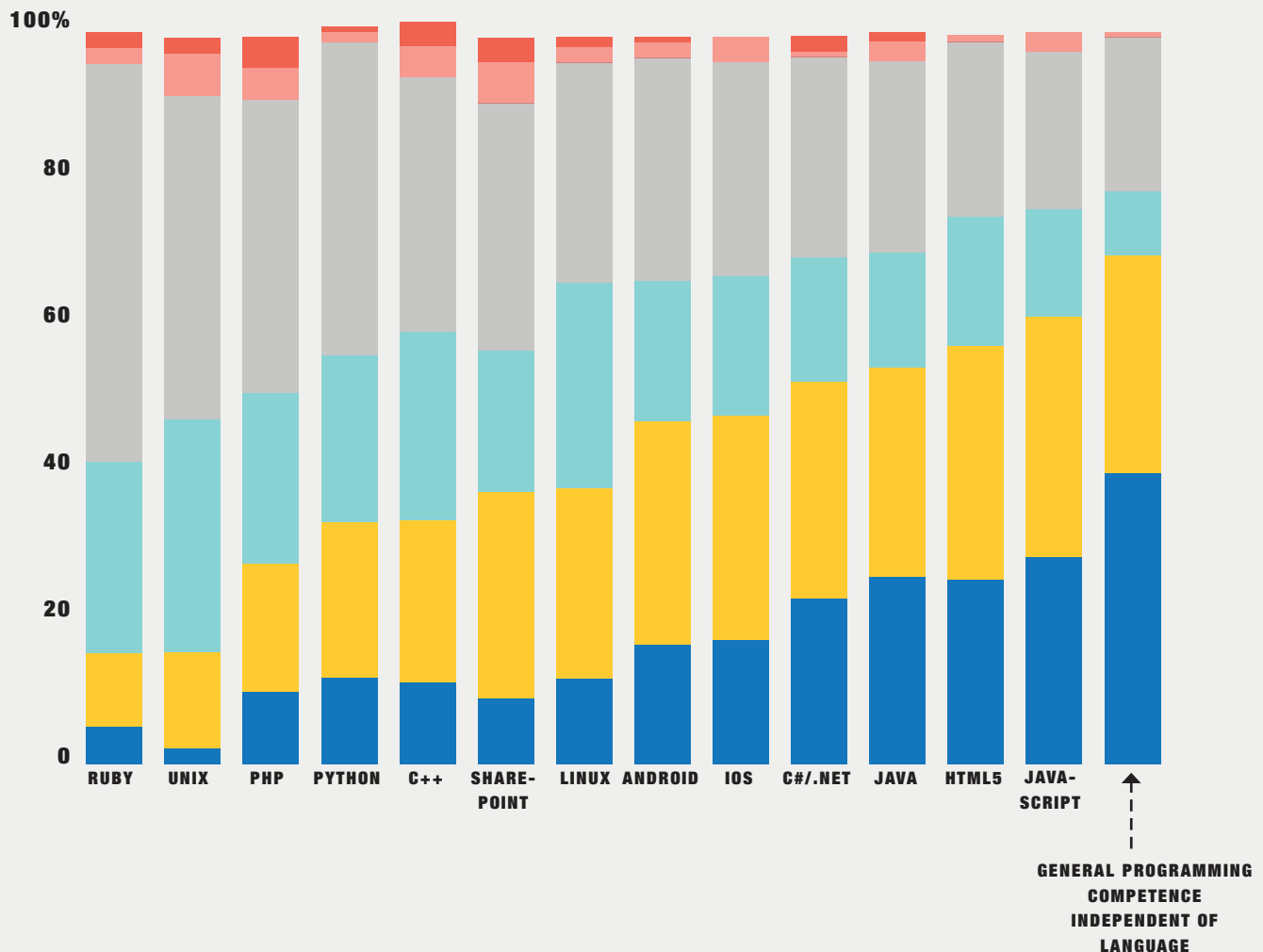
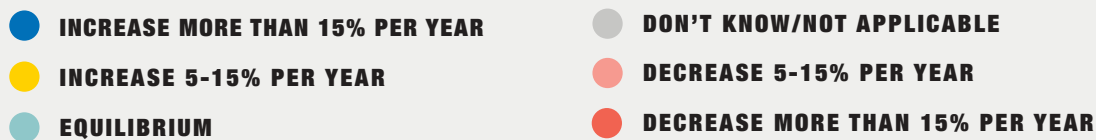
● PROGRAMMING LANGUAGES

General programming competence regardless of language tops the list

The survey also highlights the need for competencies in specific programming languages and other digital tools, as well as in various database technologies. The option “General programming competence regardless of language”

age” that comes out on top confirms what many actors want to highlight: it is programming competence in itself, rather than specific languages, that is demanded.

What will your need be for competence in the following **in the next 3 to 5 years?**



A man with glasses is looking at a computer screen. The background is blurred, showing what appears to be a modern office or home workspace with large windows.

70%

SEE THE NEED FOR **GENERAL
PROGRAMMING COMPETENCE**
INCREASING BY UP TO
15% A YEAR

**”IT IS PROGRAMMING COMPETENCE IN
ITSELF, RATHER THAN SPECIFIC LANGUA-
GES, THAT IS DEMANDED.”**

Who are the 70,000 that are needed?



The whole digital sector is relatively young and strongly developing, which means that many occupational roles have no uniform definitions and also change over time.

The whole digital sector is relatively young and strongly developing, which means that many occupational roles have no uniform definitions and also change over time.

Our survey, and the companies' estimates of current numbers of employees and future needs, is based on 16 identified categories of occupational roles, four of which have been added since our last survey⁹:

- Advanced data analysts and database developers
- Digital leaders/IT managers
- Trainers in IT/telecom
- Digital communicators

Our assessment of the skills shortage in the digital sector, with a five year perspective, is that we can count on an increased need of at least 70,000 people by 2022.

The table on the right shows an estimate of how many more people will be needed per occupational role in the next 3-5 years, which results in an estimated increased need of approximately 63,000 people in the middle of the time period

(i.e., within four years). The estimate is based on answers to the questionnaire reproduced in the chart on page 15 and in Appendix 1.

In order to arrive at a credible total figure the following has been taken into account:

- **The statistical sustainability** of the survey. The reliability of the survey cannot be fully guaranteed, for example the response rate was under 50 percent and selection was not random (see Appendix 1 for a more detailed description). The respondents were made up of groups that had registered competence needs, which means that companies that may not have had needs did not participate in the survey. This has been offset by a deduction of 30 percent from the increased need, in line with what both the Confederation of Swedish Enterprise recruitment questionnaire of 2016 and the Economic Tendency Survey show, namely that about 70 percent of IT companies need to recruit.¹⁰

- **The Swedish classification** of occupations (SSYK), which formed the basis for the calculations, does not capture

many of the competencies and roles covered by this survey, which leads to an underestimation of needs. A clear example: according to the occupational register there are currently about 1,400 active IT security experts, while the more than 200 companies who responded to our survey stated that they (i.e., not even the whole industry) have almost 5,000 employees who have either IT or information security as their main competence today. The same discrepancy between the answers in our survey and the information in the occupational register is visible in the number of usability experts, trainers and communicators.

- **Only those with general** non-IT specific occupations, such as business developers who are employed by IT and telecom companies, have been included in the calculations, not those engaged in (digital) business development in other sectors.

Overall, this points to an underestimation of increased need. We therefore consider that, in a five year perspective, we should reckon on an increased need of at least 70,000 people by 2022.

● **OCCUPATIONAL ROLES: CATEGORISATION AND TOTAL**

Future need is based on 16 identified categories

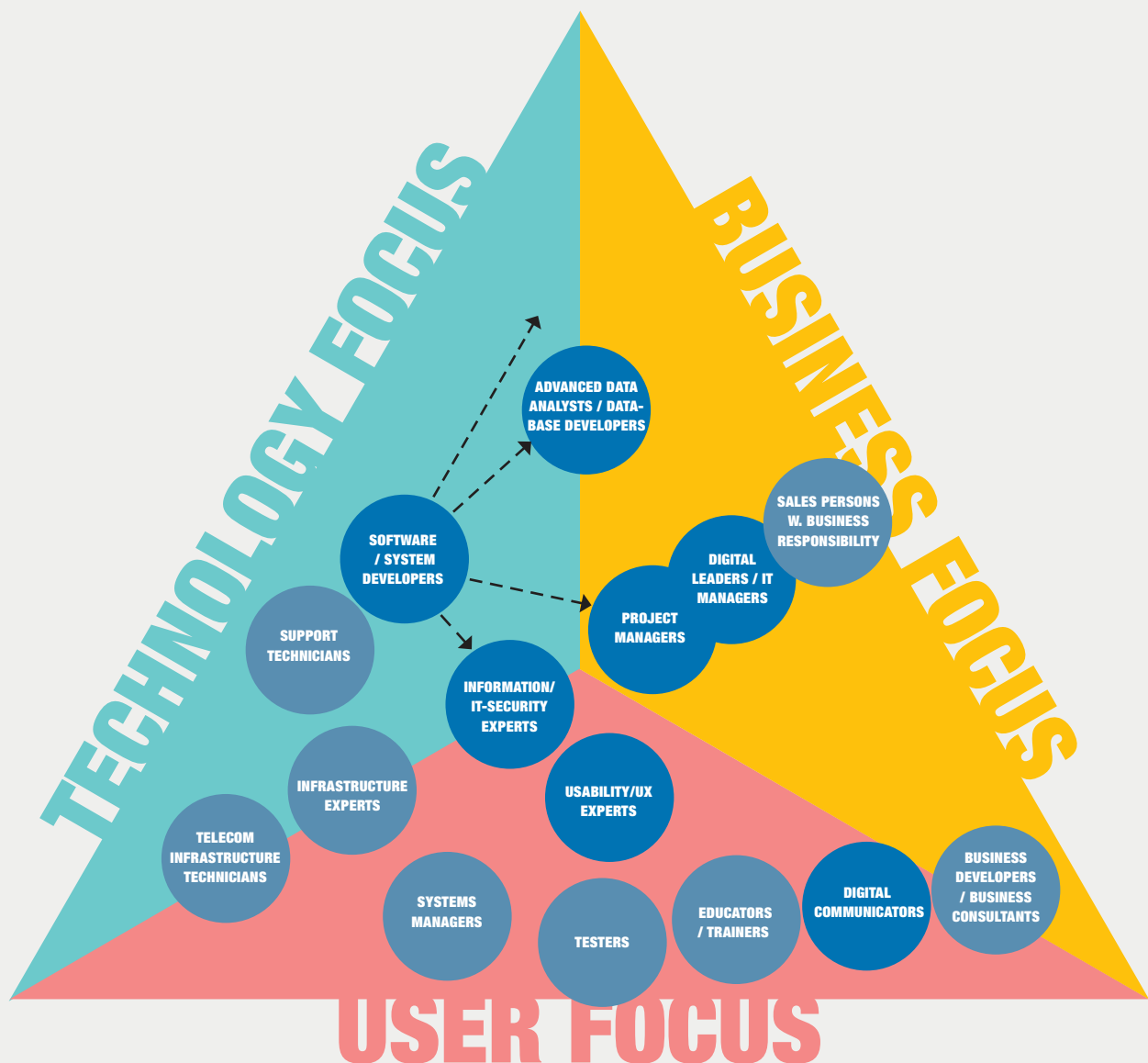
OCCUPATION*	CURRENTLY WORKING ESTIMATED TOTAL	INCREASED NEED IN FOUR YEARS TIME ESTIMATED TOTAL
SOFTWARE / SYSTEM DEVELOPERS	54 200	24 300
PROJECT MANAGERS	14 300	4600
IT ARCHITECTS	9900	3400
ADVANCED DATA ANALYSTS AND DATABASE DEVELOPERS	13 000	5200
BUSINESS DEVELOPERS / BUSINESS CONSULTANTS	4400	1200
TESTERS	4800	1700
SYSTEMS MANAGERS	11 100	2300
INFRASTRUCTURE EXPERTS, BOTH IT AND TELECOM	3400	1100
SUPPORT TECHNICIANS, IT	27 500	6700
INFRASTRUCTURE TECHNICIANS, TELECOM	12 300	3100
SALES PERSONS WITH BUSINESS RESPONSIBILITY	8600	2500
INFORMATION/ IT-SECURITY EXPERTS	1400	500
USABILITY EXPERTS IN IT	2000	800
DIGITAL LEADERS/IT MANAGERS	12 700	4800
TRAINERS IN IT/TELECOM	140	40
DIGITAL COMMUNICATORS	1700	800
TOTAL	181 400	63 200

* The occupational roles have, in most cases, their equivalents in Statistics Sweden's official occupational register SSYK (Swedish Standard Classification of Occupations, which is in turn based on the international standard). Appendix 2 presents these equivalents, as well as which competencies the different occupational roles cover, in a more detailed table.

● OCCUPATIONAL ROLES: DISTRIBUTION

A sector with many opportunities

There are many development paths, for those who do not wish to remain programmers there are lots of opportunities for a career with a wider focus. The digital sector needs a wide range of different occupational roles, and that does not just apply to technological skills. User and business focus are also of great importance.



A woman with short brown hair and glasses, wearing a blue denim jacket and jeans, stands in a modern office. She is smiling and has her hands on her hips. The office has a high ceiling with exposed pipes and large pendant lights. In the background, other people are working at desks with computers. There are plants on the desks and a whiteboard in the distance.

**”THE DIGITAL SECTOR NEEDS
MUCH MORE THAN JUST TECHNOLOGICAL
SKILLS. USER AND BUSINESS FOCUS ARE
ALSO OF GREAT IMPORTANCE.”**

Technical education is not everything



Our survey shows that higher education is important and in demand, but that academic titles are far from all that matters.

As well as the right education, qualified roles often demand many years of experience of user-centred business development. All roles also place great importance on a high level of social and personal skills.

It is natural that those with cutting-edge expertise in the digital sector are expected to have a solid educational background, mainly in the technical field. At the same time, there is now a development where the increasing importance of the digital sector for the whole of society also increases the importance of those who develop and implement digital products and services having a wider range of skills than purely technical ones.

Users are increasingly demanding that services should be user friendly, provide clear benefit and be secure and flexible, which requires broader competencies and experience of a more personal nature from those who develop products and services.

Given the large number of competencies and roles, the constant development and usage of technology and, not least, the fact that the digital sector is global, the relationship between academic title and occupational role is no longer an obvious one-to-one relation: there are many paths to the various occupational roles that the digital sector has need of.

● EDUCATIONAL BACKGROUND

Weighted towards higher education

It is difficult to give a clear picture of the responses given the large number of parameters; 21 competencies, each with seven response options. The reader is referred to Appendix 1 and the chart presentation published in August 2017¹¹, slides 33-35.

For the vast majority of computer, an academic background primarily in data/systems science and technology is very relevant (response shares of over 50%), and a background in vocational college slightly less so, though it is still relevant (response shares between 20 and 50 percent). Two groups diverge from this pattern:

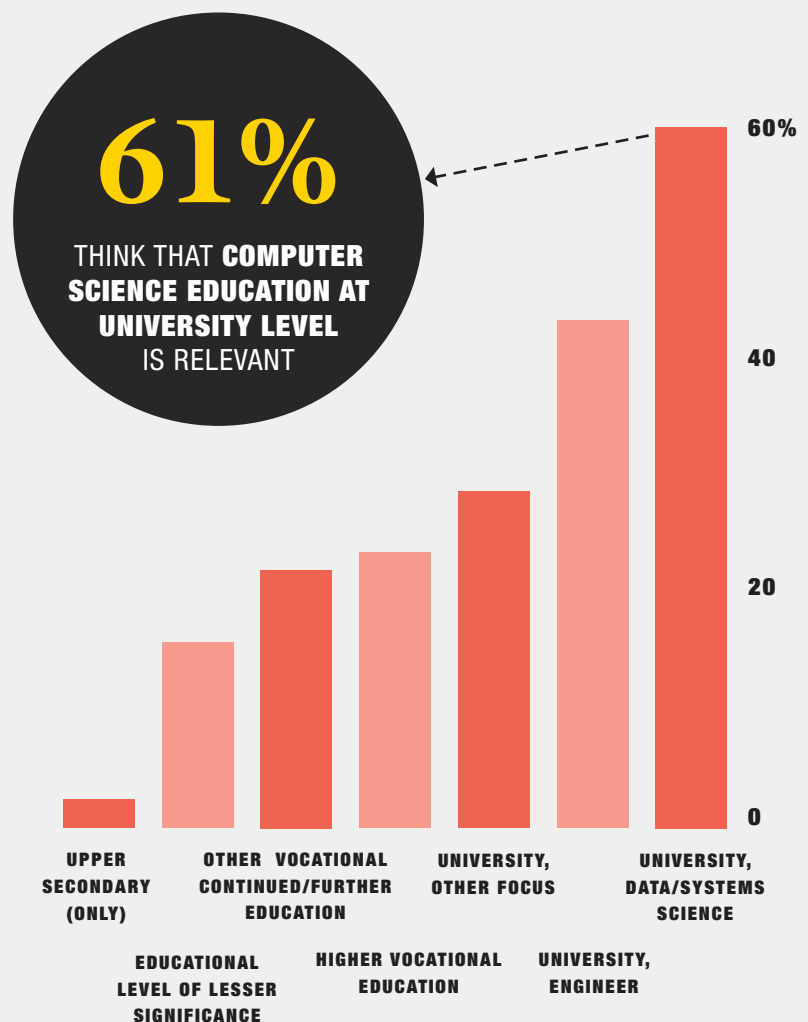
The engineering or computer science options are considered to be very relevant while the vocational options (vocational college or other continued/further education) are considered to be less relevant (response shares under 20%) for:

- Advanced data analysis, with a focus on unstructured and semi-structured data
- Advanced data analysis and system implementation, with a focus on structured data
- Digital leadership/IT management

Both engineering/computer science options and the vocational options (higher vocational or other continued/further education) are considered relevant with response shares up to 50 percent:

- Support in IT infrastructure and applications
- IT infrastructure – operation and management
- Sales in IT/telecom/digitalisation
- Education in IT/telecom/digitalisation
- Digital communication

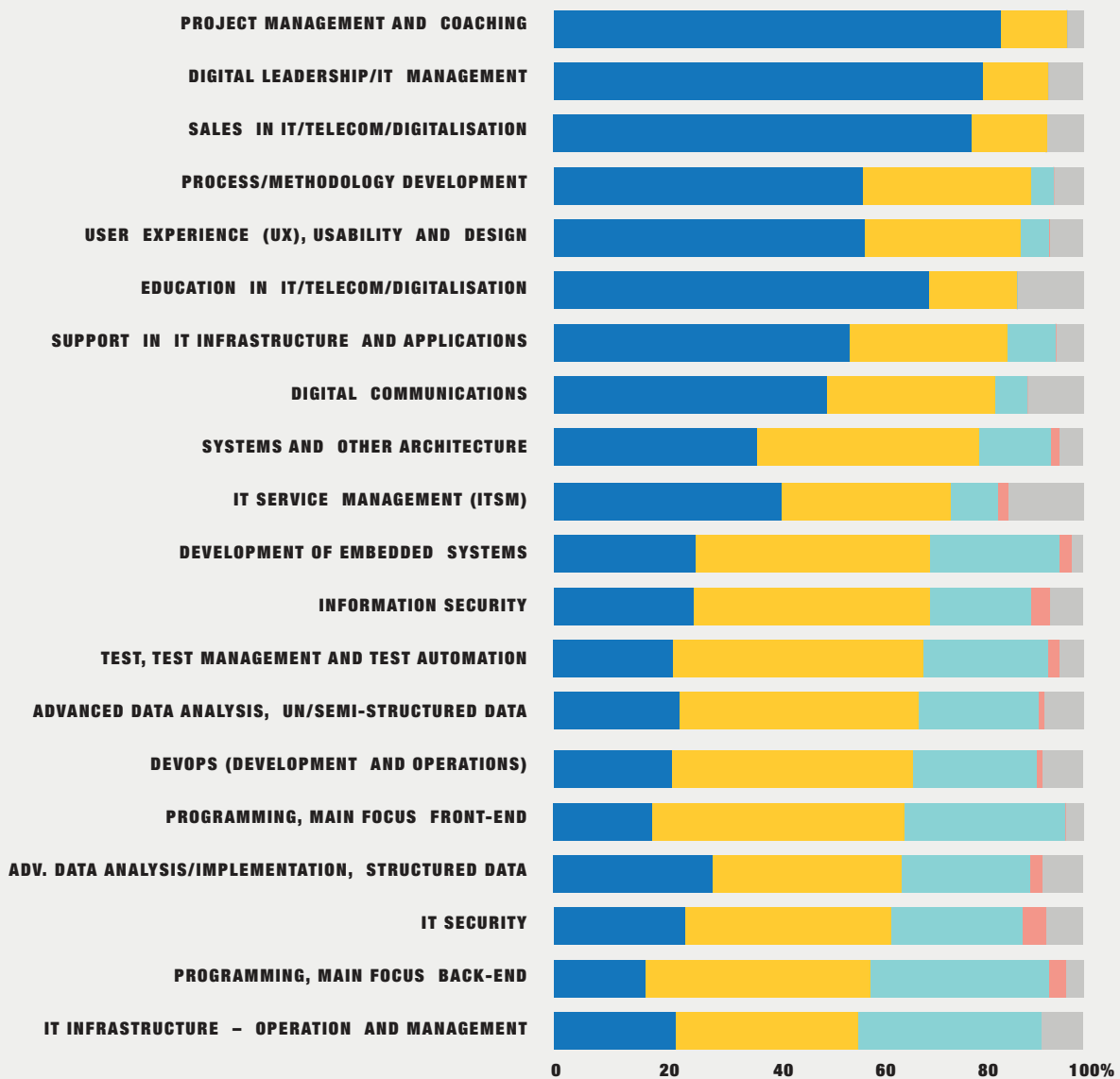
What educational background is relevant for the people you are looking for in this area of competence? Average for all 21 competencies:



● SOCIAL AND PERSONAL SKILLS

Competencies other than technical ones are highly valued

To what extent are social and personal skills (creativity, teamwork and problem solving skills, etc.) so important that they should be integrated in education?



The survey clearly shows that social and personal skills, such as creativity and teamwork skills, are of great importance for the vast majority of occupational roles.

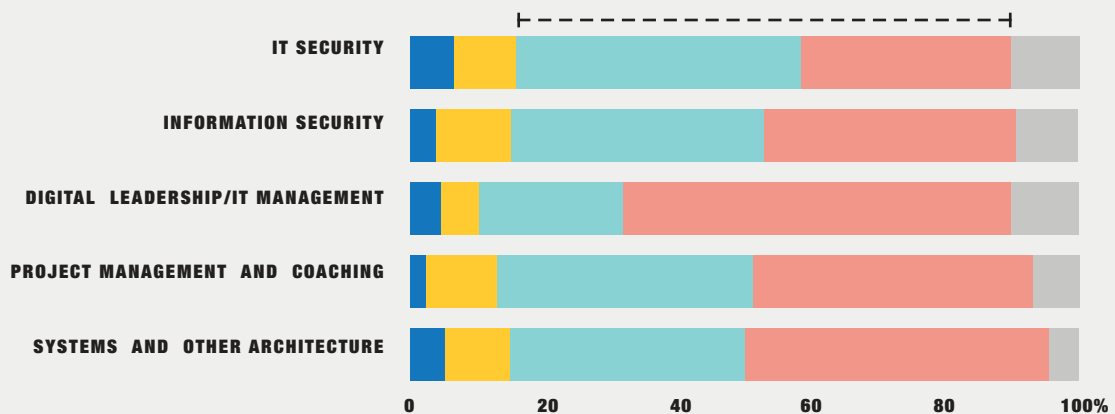


● OCCUPATIONAL EXPERIENCE

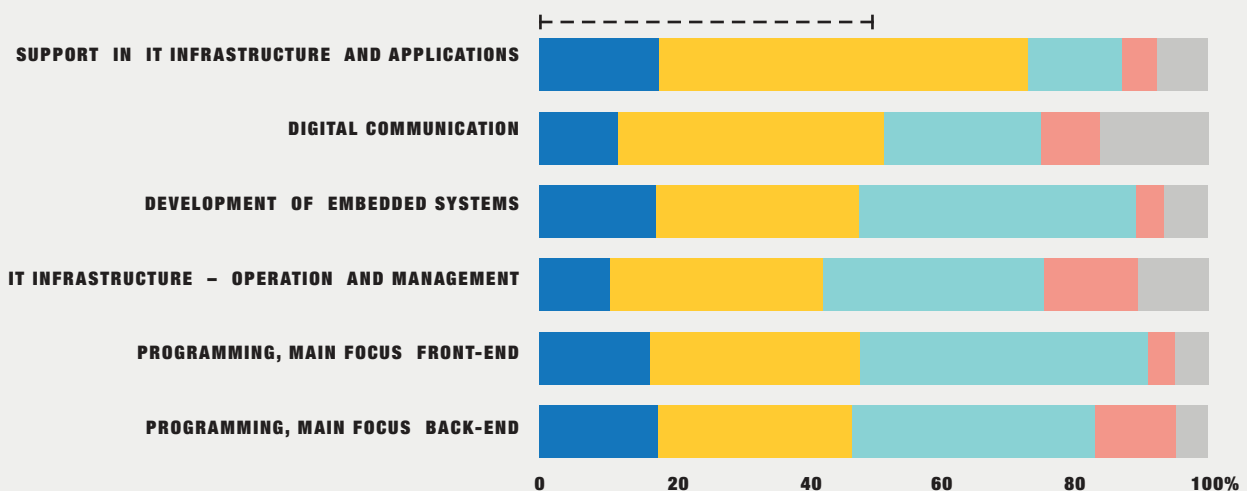
Generally high demand for experience – but not to the same extent everywhere

How much occupational experience should people with competence in the following areas have?

COMPETENCE AREAS WHERE OVER 75% DEMAND MORE THAN 3 YEARS' EXPERIENCE



COMPETENCE AREAS WHERE NEARLY 50 % DEMAND AT MOST 2 YEARS' EXPERIENCE



Requirements for occupational experience are generally high, but not uniformly high everywhere: in the case of several of the competencies most in demand, such as programming and support, half or more reply “no special requirements” for experience or “1-2 years”.¹²

- NO SPECIAL REQUIREMENTS
- 1-2 YEARS
- 3-4 YEARS
- AT LEAST 5 YEARS
- DON'T KNOW

Small differences between regions, types of activity and size of company

In the survey that is the basis for this report, we have for the first time looked to see if competence needs differ between geographical regions, type of activity or company size.

The main conclusion is that there are no substantial differences. It is in the details that the answers differ (more extensively described in the chart presentation published in August 2017¹³):

STOCKHOLM REGION (EXCLUDING MÄLARDALEN)

- General requirements for longer experience in Information Security and IT Security.
- Requirements for experience in Development of Embedded Systems: response option “3-4 years” has a significantly higher response share than the overall total.

WEST SWEDEN

- Lower demand for vocational college background in IT Service Management, Project Management/Coaching and Process/Methodology Development.
- Higher demand for university background, in particular with data/systems science focus, in Development of Embedded Systems.
- Personal and social skills: a greater emphasis on “very important” for Systems and Other Architecture, and a greater emphasis on “to some extent” for IT Infrastructure and Support in IT Infrastructure and Applications.

SOUTH-WEST SWEDEN

- Higher demand for higher vocational education background in Support, Test/Test Management/Test Automation and User Experience (UX), Usability and Design.

ACTIVITIES IN DIGITAL SERVICES

- Higher average number active in the following competencies: Programming Back-End (46.5 people), Programming Front-End (34.0) and Project Management/Coaching (32.6).
- Higher demand for vocational college background in IT Service Management and lower demand for vocational college background in Project Management/Coaching and Process/Methodology Development.
- Higher demand for university background in general in IT Service Management, Project Management/Coaching and Process/Methodology Development.

COMPANY SIZE 1-50 EMPLOYEES

- Generally lower demand for vocational college background, except for the following competencies where demand is higher: Process/Methodology Development, Digital Leadership and Digital Communication.
- Generally lower demand for university background in most competencies.



A woman with dark hair tied in a bun, wearing glasses and a black and white vertically striped shirt, is shown in profile from the chest up. She is holding a black mobile phone to her ear with her right hand. The background is a blurred teal color.

Comment on the need for telecom technicians

It is difficult to get a full overview of the need for telecom technicians, and unfortunately there has not been the space for a more in-depth survey in the framework of this report. There are currently about 5,000 telecom technicians working in companies with membership in Swedish IT & Telecom Industries. In addition, there are many working for subcontractors and in municipal infrastructure companies, but, as there is rarely any clear distinction drawn between technicians working in telecom/IT and other infrastructure (electricity, heating, water, sanitation, etc.), it is very difficult to estimate the total. As both larger and smaller operators are active in a great number of geographically dispersed projects, the possibility of getting a full overview of the need for skills is made even more difficult.

The dominant telecom infrastructure providers¹⁴ confirm, however, that there is a serious shortage for most telecom technician roles, including: fibre optic technicians, fibre installers, fibre welders, broadband technicians, metropolitan area network engineers, drafters, project managers, supervisors fibre/telecom, cable technicians and planning managers in telecom.

Necessary measures in the short and long term



The need for skills in the IT and telecom sector is both acute and structural, which means that a series of measures and not just individual actions are necessary. The proposed measures we present are aimed to have an impact on both acute and structural needs, that is to say in both the short and long term.

SUMMARY OF THE MEASURES WE PROPOSE:



1. STRONGER GENERAL EFFORTS ON DIGITALISATION



2. EFFORTS FOR SCHOOLS, YOUNG PEOPLE AND OCCUPATIONAL CHOICES



3. EFFORTS FOR HIGHER EDUCATION AND TRAINING DURING CAREER



4. PROMOTION OF MIGRATION AND INTEGRATION

1. Stronger general efforts on digitalisation

Sweden has so far done well in international comparisons of IT maturity in populations. However, the lack of attention given to digitalisation issues by Swedish politicians carries a very great risk of us falling behind – which is already beginning to be seen in international comparisons.¹⁵ We noted this in 2015, in the predecessor to this report¹⁶, and unfortunately it still applies today.

We see that our politicians still lack a real understanding of the force for change digitalisation and globalisation brings, and see just as great a need for measures in the area.

The government's presentation of a five part digitalisation strategy¹⁷, of which digital skills is a part, is certainly a step forward. However, the strategy is formulated in too general a manner, and the need for cutting-edge expertise and how to meet it is only mentioned in passing in a few sentences.

We maintain that a mobilisation by the government is needed, and submit that the following measures are essential for ensuring skills provision in our digital sector:

- **Develop skills among all decision-makers in the public sector so that they understand how digitalisation affects their activities, and how these can be developed with the aid of innovation.** By better understanding the opportunities offered by digitalisation, and through proactive efforts in innovation, decision-makers can lead development rather than be overwhelmed by it.

- **Enhance coordination between the Ministries of Education and Research, Employment and Enterprise and Innovation.** Those responsible for educational policy should guard the free formation of knowledge and at the same time guarantee students a knowledge base relevant for a working life that even now is strongly influenced by digitalisation and globalisation. The Ministries of Employment and of Enterprise and Innovation must, on their part, focus on people in work, rather than on those out of work, further developing through edu-

cational measures (see the proposal for an continuous education commission in the section on higher education). Training of existing workforces automatically creates opportunities for job seekers, as well.

- **Streamline interaction between authorities – start by redefining the role of the Public Employment Service.** The hunt for skills in the digital field exposes many shortcomings in cooperation between, for example, the Public Employment Service, the Migration Agency, the Tax Agency and the municipalities. The silo mentality in Swedish public services has been criticised for decades, and is now starting to have major negative consequences in the form of a lack of streamlining and poor skills matching. A first step is to completely transfer the Public Employment Service's non-functioning) matching service to private providers, and streamline the role of the agency to the payment of remuneration.

Measures



**DEVELOP SKILLS
AMONG DECISION-MAKERS**



**ENHANCE COORDINATION
BETWEEN MINISTRIES**



**STREAMLINE INTERACTION
BETWEEN AUTHORITIES**



2. Efforts for schools, young people and occupational choices

To ensure the digital sector's long-term provision of skills, schools are needed that both in form and content are adapted to working life as it is today, strongly influenced by digitalisation and globalisation, and that give the young generation a comprehensive overview, free of stereotypes, of what different occupations involve.

To ensure this, the following measures are necessary (all of which require the general skills development of public decision-makers mentioned in the previous section):

- **Ensure that the government's national strategy for digitalisation of schools is carried out through resource commitments to, in active cooperation with the digitised world of work, raise the skills of teachers and principals.** The government has decided on a national strategy for the digitalisation of schools. The focus is largely good, but needs to be supplemented with real resource commitments to raise the digital skills of teachers and school principals far beyond those which the National Agency for Education currently administer.

The complexity of the different aspects of digitalisation, both in regard to knowledge content (computational thinking, programming, source criticism, etc.) and the use of digital aids and methods for teaching, makes it essential that skills development is not isolated in the world of education: a clear real-world contact through collaboration with representatives from the digitised world of work is necessary. There are many companies there that will be happy to help!

- **Fundamental reform of teacher education, with digitalisation as an essential component.** The current teacher education programme is criticised for being too lax and largely lacking education in methodology, and many people consider reform is needed. Course components where student teachers learn to use digitally based methods and aids, which are completely lacking today, are of course particularly important for skills provision to the digital sector. We therefore advocate a reform where those responsible ensure that the teacher education programme itself applies the digital aids and methods that are the objective of the digitalisation of schools. In parallel and partly in competition with the basic teacher education

programme, other routes into the teaching profession such as shorter, more intensive pedagogical education for people with occupational backgrounds in any of the school subjects, should be established.

- **Closer collaboration with the world of work, including by allowing career guidance to involve the whole school system, in order to ensure young people's comprehensive, non-biased and non-gender stereotypical appreciation of occupations.** Our proposals for action from 2015¹⁸ remain: reshape the schools' study and career guidance so that the career part involves contacts with the world of work for all teachers and not just for the individual career counsellors. It is clear that the need remains: upper secondary school choices are still gender-based and the lack of knowledge among young people of occupations in the modern world of work is great, particularly for young people from homes unfamiliar with study. To be effective, the career guidance element should be integrated into everyday teaching through case studies, lectures by people from the world of work and study visits, and not like today consist of airdrops of students on work experience weeks (prao) with no structure or quality follow-up.

Measures



**RESOURCE COMMITMENTS
FOR DIGITALISATION OF SCHOOLS**



**REFORM THE TEACHER
TRAINING PROGRAMME**



**CLOSER COLLABORATION
WITH THE WORLD OF WORK**



3. Efforts for higher education and models for training during career

Our changing world of work places completely different demands on higher education than what has been the case for the majority of the industrialised era.

In order to ensure both better development opportunities for individuals and better conditions to meet the skills needs of working life, these measures are proposed:

- **Take an integrated approach to life long learning by appointing an continuous education commission.** Our traditional view of education as a single and time-limited operation in parallel with a labour market policy focused on people out of, rather than in, work needs to fundamentally change. “Lifelong learning” has long been a buzz word and various proposals for education and funding reforms have been drawn up and, in some cases, tested. An integrated approach is now needed to systematise how public funds for, in particular, education can be re-directed in order to distribute risks and development opportunities between the public sector, employers and individuals. Our proposal is to appoint a one-

year continuous education commission, characterised by a flexible approach to the labour force, the workplace and employers, with the task of proposing a set of education forms, with associated funding, which will systematically encourage people in work to pursue further training.

- **Give students in higher education with clear paths into IT occupations better work life preparation by continuous skills training and compulsory working life contacts during their period of study.** The fact that educational programmes should have analytical depth and have a scientific basis should not be contradictory to the student’s need for concrete knowledge about IT occupations that provides the necessary understanding of the requirement of general skills, the information needed for informed specialisation choices, and the inspiration to complete the education. We therefore propose two compulsory credit meriting course elements in active cooperation with possible future employers during the education, one before the choice of specialisation and one at the end of the

third year. A model for implementation of the proposal by reciprocal action can be made in connection with the proposal for a continuous education commission above: employers contribute to students’ skills training while the educational institutions contribute to the training of those already employed.

- **Prioritise allocation of funds to higher vocational education training programmes of high quality.** Since 2015, vocational education providers have got both more resources and the opportunity for more course start-ups for training programmes with strong demand. However, the challenge of the varying quality in higher vocational education programmes in data/IT, and among the providers of these, remains. Applications per place and throughput for several of these education programmes are also, in comparison to other professional fields, weak. The problems, which have particularly been highlighted by the National Agency for Higher Vocational Education, can be resolved by giving funding priority to higher vocational education providers that show both quality and a strong brand.

Measures



**APPOINT IN-SERVICE
TRAINING COMMISSION**



**SKILLS TRAINING FOR
HIGHER EDUCATION STUDENTS**



**REWARD HIGH-QUALITY
VOCATIONAL COLLEGE EDUCATION**



4. Promotion of migration and integration

A **globalised economy** requires an efficient system for migration and integration. Sweden in general and the digital sector in particular are, and will continue to be, dependent on the immigration of skills to remain internationally competitive, and should without doubt aim to be a talent-attracting nation. Through the poor management of labour immigration in recent years, Sweden has lost much of its attractiveness and, thereby, many valuable talents, and this must be remedied.

Our proposals for measures (all of which require the general skills development of public decision-makers mentioned in previous sections) are:

- **Develop a national strategy for talent attraction, including a "one-stop-shop" for all case management connected to labour immigration, coordinated by regional "expat centres".** Effective collaboration

between the authorities responsible for recruitment and establishment of third-country nationals in the Swedish labour market is crucial for Sweden to be able to compete internationally for skills. Our proposal is to set up regional so-called expat centres for the coordination of all contacts with authorities (one-stop-shop¹⁹). A prerequisite is that the Migration Agency is given the task of promoting labour immigration for occupations where there is a lack of supply, clearly differentiated from its by nature restrictive asylum management. We also advocate a review of the regulatory framework for employee stock options and expert tax, in order to make it more profitable and attractive to work in Sweden, as a part of the national strategy.

- **Aim for an increase of at least 10,000 more international top students applying to Swedish universities and, by extension, to the Swedish labour market by more**

generous public-private funded scholarship programmes and extended deadlines for seeking work in Sweden after graduation. The number of inbound students has decreased by 10,000 since 2011, and fewer than one in ten students from countries outside the EU get into our labour market. Our scholarship programmes, which are today linked to the aid budget and therefore not freely available to students from all over the world, should be both broadened and increased, including by a greater degree of co-financing with private actors. The aim should be that 10,000 more top students are recruited every year, of which at least half should be willing and able to work in Sweden after graduation. Together with better collaboration between colleges and the working life (as proposed in earlier sections) and an extended deadline to at least a year for seeking work after graduation, it can be ensured that these talents will be available for the Swedish labour market.

Measures



**NATIONAL STRATEGY FOR
TALENT ATTRACTION**



**AT LEAST 10,000 MORE
INTERNATIONAL TOP STUDENTS**





**” AIM FOR AN INCREASE OF
AT LEAST 10,000 MORE INTERNATIONAL
TOP STUDENTS APPLYING TO SWEDISH
UNIVERSITIES AND, BY EXTENSION, TO
THE SWEDISH LABOUR MARKET.”**

Survey methodology

Information for the survey has been collected and processed in three stages:

1. An interview and consultation phase in the spring of 2017, where drivers and competencies were identified. Ten in-depth interviews were conducted, in parallel with the document describing drivers and competencies being distributed and widely discussed.

2. Conducting of a questionnaire in May 2017. The questionnaire is built on the drivers and competencies identified in stage 1, and was sent to 434 people active in recruitment and business management, both in and outside of the IT and telecom industry and in different parts of the country. The questionnaire results, including discussions of their statistical sustainability are presented in the text below, as well as in more detail in Appendix 1.

3. The development and determination of the proposed measures to combat the skills shortage, carried out during September and October 2017 in consultation with the IT Skills Council and with the other parties involved in the first stages.

Sources

Interviews carried out during April 2017 with representatives of Axians, Findwise, Volvo Trucks Technology, Volvo Cars, Science Park Mjärdevi, Hansoft, Academic Work/Digitalent, IBM Client Innovation Center and Sigma IT Consulting.

Questionnaire sent in May 2017 to 434 recipients from the following organisations/networks: Swedish IT & Telecom Industries, Swedsoft, IAMCP, Swedish Games Industry, Swedish Ed-tech Industry, Business Region Gothenburg, Region Skåne, Mobile Heights, IEC (Växjö), Science Park Mjärdevi, Eskilstuna Fabriksförening, Automation Region Västerås, Företagsutbildarna Hudiksvall and Make IT Umeå. See Appendix 1.

Statistics Sweden statistics, see Appendix 3.

References (in chronological order of their being named in the report)

¹ IT Skills Council is one of the Swedish IT & Telecom Industries member councils which, in the form of a discussion and decision-making forum, focuses on promoting actions that can meet business and public sector needs for IT skills.

² The Swedish Public Employment Service, Where Are The Jobs? Assessment up to and including the first half of 2018, June 2017; National Institute of Economic Research, Economic Tendency Survey July 2017, (chart appendix p.45); Statistics Sweden, Trends and Forecasts, December 2014, s. p.54 and 57

³ Tillväxtanalys (Growth Analysis) report 2014:12 ”How Digitalisation drives productivity and competitiveness in Sweden”

⁴ See Almega’s economic report “Ökat tjänsteinnehåll i Sveriges export” [Increased service content in Swedish Export], May 2017.

⁵ In the 2015 report referred to as the IT and Telecom Sector

⁶ <https://www.itotelekomforetagen.se/fakta-och-debatt/statistik>

⁷ The categorisation is a development of that presented in previous reports: Akut och strukturell kompetensbrist i IT- och Telekomsektorn [Acute and structural competency shortage in the IT and telecom sector] 2015 and IT-och telekomsektorns kompetensbrist [The IT and telecom sector’s competency shortage] 2012

⁸ Six more than in the report “Akut och strukturell kompetensbrist i IT- och Telekomsektorn” 2015.

⁹ Akut och strukturell kompetensbrist i IT- och Telekomsektorn 2015

¹⁰ The Confederation of Swedish Enterprise, Rekryteringsenkäten [Recruitment survey] 2016, Rekrytering – när teknikutveckling och digitalisering förändrar jobben [Recruitment – when technological developments and digitalisation change jobs] (p. 12), March 2016 and Economic Tendency Survey, July 2017 (chart appendix p. 45)

¹¹ https://www.itotelekomforetagen.se/fakta-och-debatt/rapporter_1/enkat-kompetensbehov-2017

¹² A detailed presentation of most questionnaire responses was published on the Swedish IT & Telecom Industries website on 25 August 2017, see itot.se

¹³ https://www.itotelekomforetagen.se/fakta-och-debatt/rapporter_1/enkat-kompetensbehov-2017

¹⁴ Eltel Networks, Relacom, Ericsson Local Services and Bäck Installation

¹⁵ See, for example, Etta eller nolla? En rapport om digitaliseringen av Sverige, [One or zero? A report on the digitalisation of Sweden] Swedish IT & Telecom Industries, 2017

¹⁶ Akut och strukturell kompetensbrist i IT- och Telekomsektorn, 2015

¹⁷ För ett hållbart digitaliserat Sverige - en digitaliseringsstrategi [For a sustainable digitised Sweden - a digitalisation strategy], Reference number: N2017/03643/D

¹⁸ Akut och strukturell kompetensbrist i IT- och Telekomsektorn, 2015

¹⁹ One Stop Shop för arbetskraftsinvandring [One stop shop for labour immigration], Almega 2016

Appendix 1: Presentation of questionnaire survey

GENERAL METHODOLOGY

Making surveys that achieve high response rates is undeniably difficult, especially when the questions are complex. Answering what skills needs will look like in a few years time, and what actions are needed to deal with any gaps, demands a lot from the respondents:

- **They should have a good** understanding of the impact technological and commercial changes in the outside world have on their own business.
- **They should have a good** overview of their current staff situation.
- **They should be well** oriented in various educational forms, and how these can be adapted to meet changing needs.

Very few people master of all these perspectives. Choosing respondents by random selection, instead of first identifying recipients that master the above perspectives, would give a far too low response rate to be useful.

The method for producing the basis for this report has therefore been to identify the correct respondents by sending a preliminary questionnaire to a wider audience. This preliminary questionnaire, as in April 2017, was sent to over 3,000 people, and contained three short questions:

- 1. Is the question** of increased access to IT skills, or other professional digital skills, an issue for you in your business?
- 2. (If yes to question 1)** In May we will be carrying out a survey concerning skills needs which is expected to take 20 minutes to complete. Are you willing to respond to the questionnaire?
- 3. (If yes to question 2)** We have produced study material with questions

on technology trends and related skills and training needs. Would you like to receive this in preparation for the forthcoming survey?

The responses to the preliminary questionnaire gave a mailing list for the standard questionnaire (called the "May questionnaire") consisting of 434 respondents.

The study material mentioned in question 3 was produced in the spring in consultation with the IT Skills Council and with the participation of a wider network of stakeholders. In this process, which included ten in-depth interviews, the 13 drivers and 21 competencies described in the report were identified.

ON THE MAY QUESTIONNAIRE

The questionnaire was open during the period of 22 May to 5 June 2017. It was sent by e-mail to the 434 identified respondents and was also available through an open link that was spread via the web, newsletters and social channels.

A total of 202 responses were received, which gives a response rate of about 40 percent.

Given that the questionnaire was targeted to recipients who had in advance expressed a need for IT/digitalisation skills and that the response rate was below 50 percent, the survey results cannot be considered statistically significant. The results do give clear indications, however, which we and other sources (e.g. Public Employment Service forecasts, National Institute of Economic Research economic tendency surveys and Confederation of Swedish Enterprise recruitment surveys) consider provide a reliable overall picture. This is further confirmed by the uniformity of the replies to the questionnaire, regardless of region or line of business.

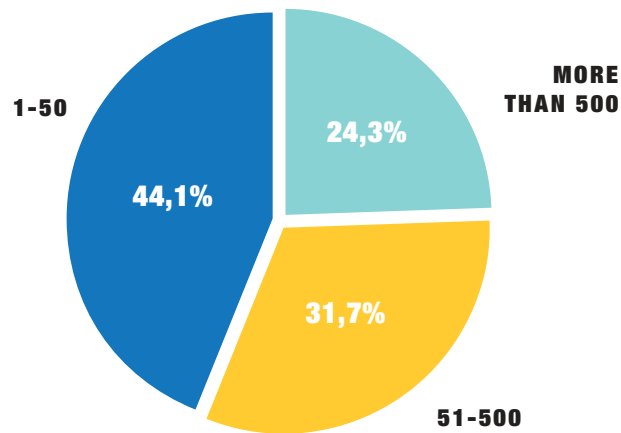
Some comments on the interpretation of certain specific questions:

- Two possible sources of error related to the questions concerning future needs for competencies are, firstly, uncertainty about whether the respondents have understood that the question of need for the next 3 to 5 years was per year and not for the entire 3-5 year period and, secondly, that respondents may have stated the proportion of new recruitments rather than the increase in the total number of employees (i.e., not included those who for various reasons end their employment). An argument against these interpretations having been widespread is that the respondents answered remarkably uniformly regardless of region, line of business and size of company.

- **Regarding the need** for telecom technicians, the skills "Infrastructure development and operation of public telecom networks" was included in the questionnaire, but the respondents mainly consisted of operators active in IT and telecom services, rather than telecom infrastructure. Those who responded to the questions related to the infrastructure development skills were only 20 in number, unlike other competencies that had at least 50 respondents. Therefore, the infrastructure development competence has been taken out of the chart presentations for occupational experience and personal skills.

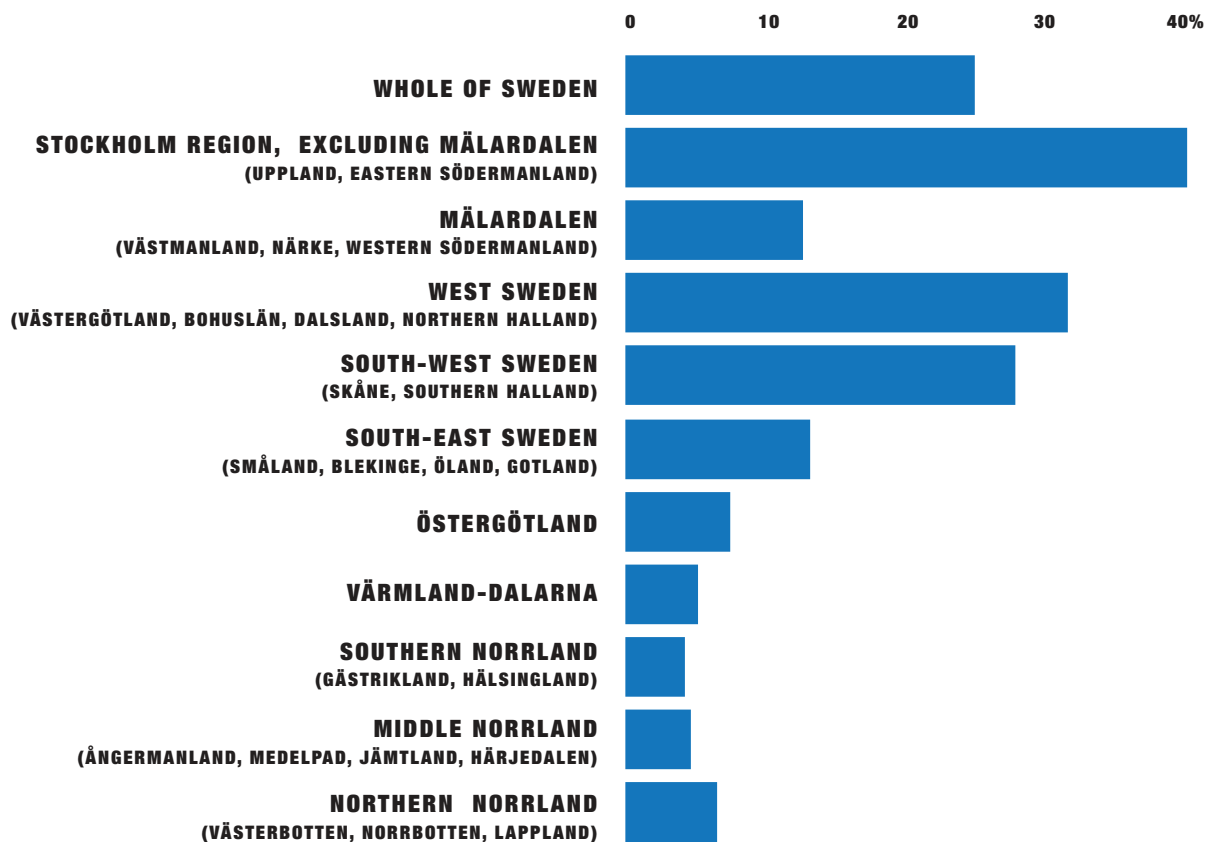
A detailed presentation of most of the responses to the questionnaire was published on the Swedish IT & Telecom Industries website on 25 August 2017, see itot.se. Presented below are a selection of charts which, together with the charts in the body of the report, should give a sufficiently detailed overview of the questionnaire responses to assess the report's analysis and proposals.

Number of employed staff in sweden



Regions where we have employed staff

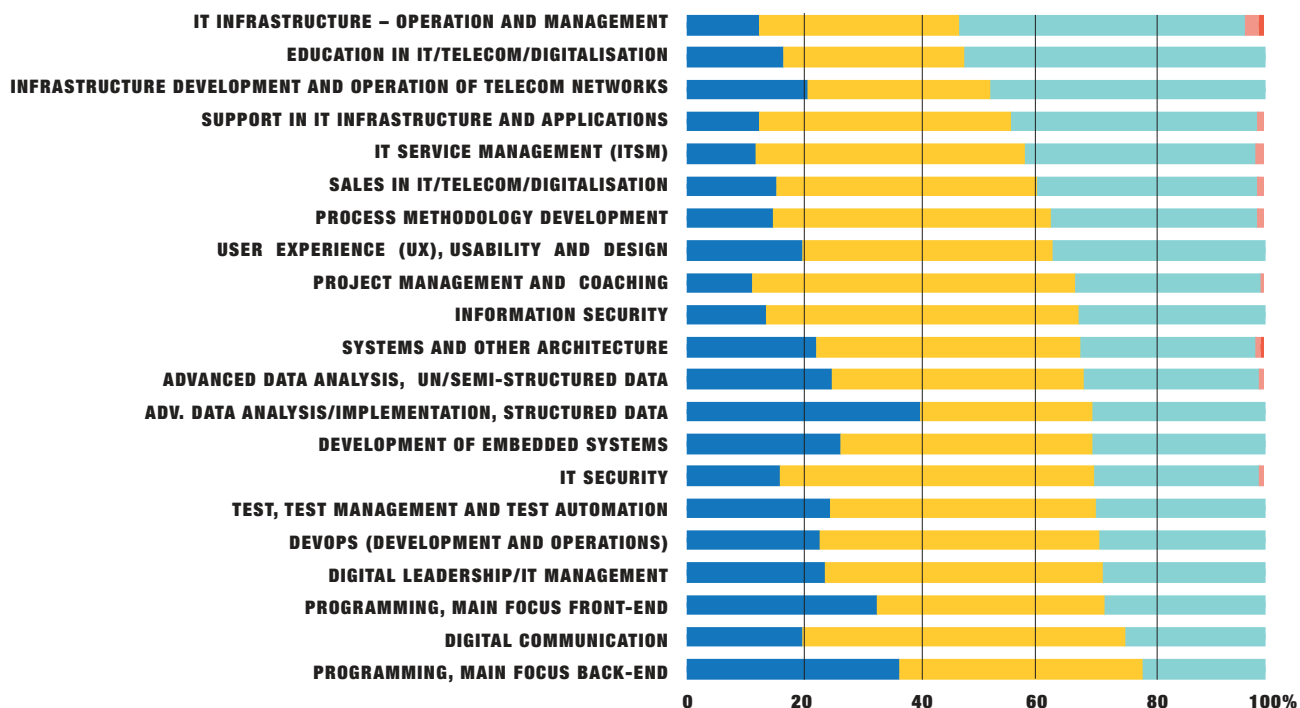
Multiple answers allowed



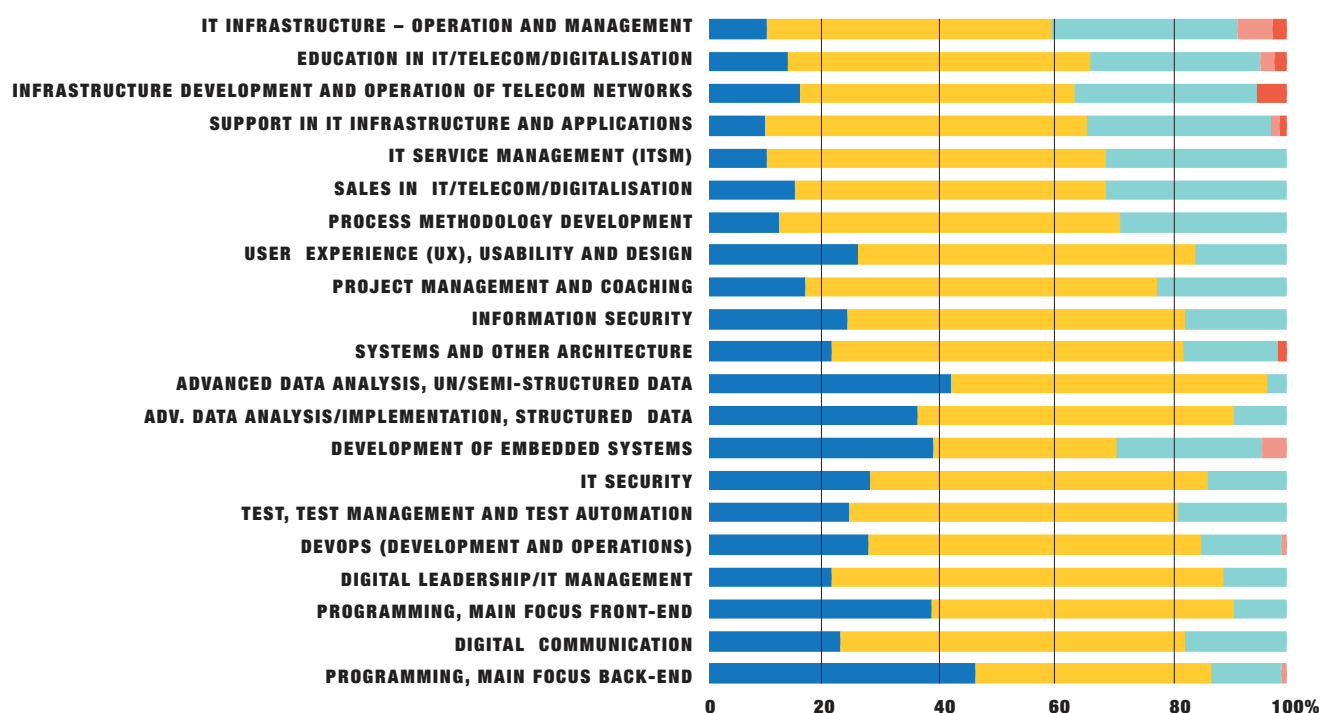
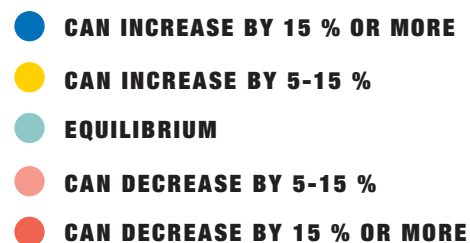
**To what extent do you judge that your competence needs
in the next 3-5 years will be affected by:**



What is your current need for people with their main competence in this field?

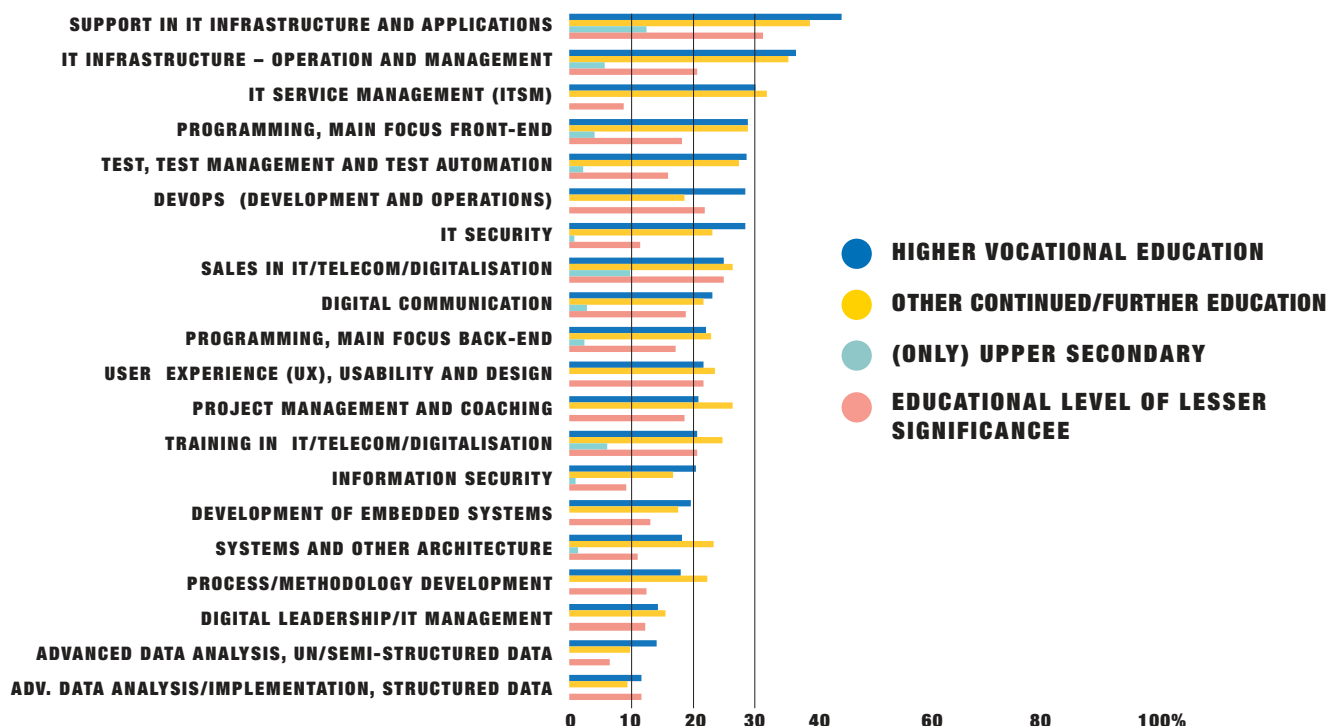


What will your need be for people with their main competence in this field in the next 3-5 years?



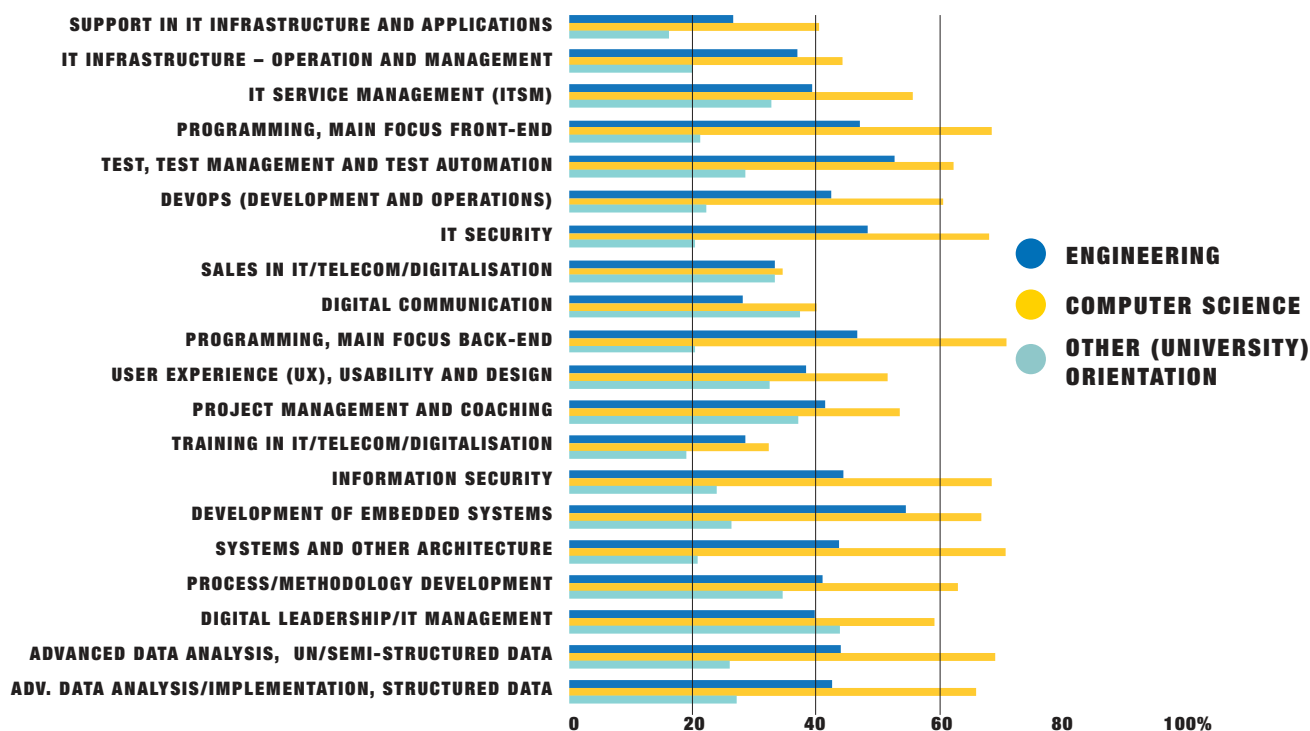
What educational background is relevant for the people you are looking for in this area of competence?

Answer options in multiple-choice form



What educational background is relevant for the people you are looking for in this area of competence?

Answer options in multiple-choice form



Appendix 2: Description of occupational roles, the competencies they cover and expected growth in need.

CATEGORIES IT OCCUPATIONAL ROLES	COMPETENCIES THAT THE ROLES COVER	EQUIVALENT ROLE IN STATISTICS SWEDEN'S SSYK 2012 *)	ESTIMATED TOTAL WORKING TODAY **)	INCREASED NEED IN THE NEXT FOUR YEARS, TOTAL ***)	
SOFTWARE/ SYSTEM DEVELOPERS	<ul style="list-style-type: none"> • PROGRAMMING FRONT-END • PROGRAMMING BACK-END • DEVELOPMENT EMBEDDED SYSTEMS • DEVOPS, WITH ASSOCIATED TOOLS SUCH AS CONTINUOUS DELIVERY AND DEVELOPMENT PIPE 	SOFTWARE AND SYSTEM DEVELOPERS, ETC. + DEVELOPERS IN GAMES AND DIGITAL MEDIA	54,200	24,300	*) The roles in italics are generic, non-IT/telecom specific roles. When estimated total working has been calculated, only those in roles employed in the Information and Communication sectors (see Statistics Sweden) have been counted. This leads to an underestimation as, e.g., digital communicators active in other sectors are not included.
PROJECT MANAGERS	<ul style="list-style-type: none"> • PROJECT MANAGEMENT 		14,300	14,300	
IT ARCHITECTS	<ul style="list-style-type: none"> • SYSTEMS AND OTHER ARCHITECTURE 		9,900	3,400	
ADVANCED DATA ANALYSTS AND DATABASE DEVELOPERS	<ul style="list-style-type: none"> • REQUIREMENT ANALYSIS, UN/SEMI-STRUCTURED DATA • REQUIREMENT ANALYSIS AND IMPLEMENTATION, STRUCTURED DATA • IT SERVICE MANAGEMENT INCL. ITIL 	SYSTEMS ANALYSTS AND IT ARCHITECTS, ETC. + OTHER IT SPECIALISTS	13,00	5,200	
BUSINESS DEVELOPERS/ BUSINESS CONSULTANTS	<ul style="list-style-type: none"> • PROCESS/METHODOLOGY DEVELOPMENT 	MANAGEMENT AND ORGANISATION DEVELOPERS	4,400	1,200	**) The starting point for the assessment is the number active in 2014 and 2015 in the equivalent SSYK category (the column to the left) officially recorded by Statistics Sweden. The differences between 2014 and 2015 figures have been carefully extrapolated by a year. For the role categories that do not have a direct equivalent in SSYK (e.g. project managers) the number working in the equivalent competency according to the survey (see chart p.15)) has been used as a distribution key.
TESTERS	<ul style="list-style-type: none"> • TEST, TEST MANAGEMENT AND TEST AUTOMATION 	SYSTEM TESTERS AND TEST MANAGERS	4,800	1,700	
SYSTEM MANAGERS	<ul style="list-style-type: none"> • IT INFRASTRUCTURE OPERATION AND MANAGEMENT 	SYSTEM MANAGERS, ETC. + SYSTEM ADMINISTRATORS	11,100	2,300	
INFRASTRUCTURE EXPERTS, BOTH IT AND TELECOM	<ul style="list-style-type: none"> • INFRASTRUCTURE DEVELOPMENT/ OPERATION PUBLIC TELECOM NETWORKS 	GRADUATE ENGINEER PROFESSIONS IN ELECTRICAL ENGINEERING + ENGINEERS AND TECHNICIANS IN ELECTRICAL ENGINEERING	3,400	1,100	
SUPPORT TECHNICIANS, IT	<ul style="list-style-type: none"> • SUPPORT IN IT-INFRASTRUCTURE AND APPLICATIONS 	OPERATIONS TECHNICIANS, IT + SUPPORT TECHNICIANS, IT	27,500	6,700	
INFRASTRUCTURE ENGINEERS, TELECOM	<ul style="list-style-type: none"> • INFRASTRUCTURE DEVELOPMENT AND OPERATION OF PUBLIC TELECOM NETWORKS 	NETWORK AND SYSTEMS TECHNICIANS, ETC.	12,300	3,100	
SALES PERSONS WITH BUSINESS RESPONSIBILITY	<ul style="list-style-type: none"> • SALES IN IT/TELECOM/DIGITALISATION 	COMMERCIAL SALES REPRESENTATIVES	8,600	2,500	
INFORMATION/IT SECURITY EXPERTS	<ul style="list-style-type: none"> • IT SECURITY • INFORMATION SECURITY 	IT SECURITY SPECIALISTS	1,400	500	***) Assessment based on the survey, using answers to the questions on needs for the next 3 to 5 years. A downward adjustment of 30% has been incorporated into the calculation, see description in the body of the report "Who are the 70,000 that are needed?"
USABILITY EXPERTS IN IT	<ul style="list-style-type: none"> • USER EXPERIENCE (UX), USABILITY AND DESIGN 	DESIGNERS IN GAMES AND DIGITAL MEDIA	2,000	800	
DIGITAL LEADERS /IT MANAGERS	<ul style="list-style-type: none"> • DIGITAL LEADERSHIP/IT MANAGEMENT, INCL. BUSINESS ANALYSIS AND CHANGE MANAGEMENT 	IT MANAGERS LEVEL 1 + 2	12,700	4,800	
TRAINERS IN IT/TELECOM	<ul style="list-style-type: none"> • TRAINING IN IT/TELECOM 	OTHER EDUCATORS AND INSTRUCTORS	140	40	
DIGITAL COMMUNICATORS	<ul style="list-style-type: none"> • DIGITAL COMMUNICATION 	INFORMATION OFFICERS, COMMUNICATORS AND PR SPECIALISTS	1,700	800	
TOTAL			181,400	63,200	

Examples of occupations included in the role categories

Category: Software/System Developer

- Programmer
- Front-end Developer
- System Developer
- Web Developer
- Application Developer
- Interface/GUI Developer
- Specialist in Embedded Systems
- Database Developer
- Computer Game Developer
- Full-stack Developer

Category: Project Manager

- Technical Project Manager
- Programme Manager
- Change Manager
- Scrum Master

Category: IT Architect

- Enterprise Architect
- Business Architect
- Solutions Architect
- Systems Architect
- Information Architect

Category: Advanced data analysts and data system developers

- Business Intelligence Analysts
- Experts in decision support systems
- Requirement Analysts

Category: Business developers/business consultants

- Business Developer/Consultant
- Business Consultant
- Process Specialist

Category: Tester

- Software Tester
- System Tester
- Test Manager

Category: System Manager

- System Administrator
- System Manager
- DevOps Integrator

Category: Infrastructure experts, both IT and telecom

- Infra Specialists
- IT Cloud Specialist

Category: Support Technician, IT

- Network Administrator
- Operations Technician
- IT Support Specialist

Category: Infrastructure Technician, Telecom

- fibre optic technician
- fibre installer
- broadband technician
- metropolitan area network engineer
- supervisor fibre/telecom
- cable technicians
- planning managers in telecom.

Category: Seller with business responsibility

- Key Account Manager
- Account Manager
- Technical Pre-Sale
- Bid Manager
- Specialist Salesperson
- Business Project Manager
- Investment Advisor

Category: Information/IT security experts

- IT Security Specialist
- IT Security Technician

Category: Usability experts in IT

- Interactions Designer
- UX Designer
- UX Strategist
- GUI Expert
- Graphic Engineer

Appendix 3: Statistics Sweden's statistics for number of employees in it occupations

NUMBER OF EMPLOYEES AGED 16-64 IN PURELY IT OR TELECOM OCCUPATIONS IN 2015, ALL SECTORS

		STOCKHOLM EXCL. MÄLARDALEN	WEST SWEDEN	SOUTH WEST SWEDEN
1311 IT MANAGERS, LEVEL 1	4,179	1,874	691	368
1312 IT MANAGERS, LEVEL 2	7,857	3,681	1,387	726
2173 DESIGNERS IN GAMES AND DIGITAL MEDIA	1,906	933	391	260
2511 SYSTEMS ANALYSTS AND IT ARCHITECTS, ETC	11,033	5,671	1,937	1,090
2512 SOFTWARE AND SYSTEM DEVELOPERS, ETC.	66,335	30,829	10,758	7,519
2513 DEVELOPERS IN GAMES AND DIGITAL MEDIA	2,368	1,346	251	587
2514 SYSTEM TESTERS AND TEST MANAGERS	4,832	2,188	750	845
2515 SYSTEM MANAGERS, ETC.	6,791	3,150	970	667
2516 IT SECURITY SPECIALISTS	1,425	690	156	147
2519 OTHER IT SPECIALISTS	11,454	6,758	1,430	1,035
3511 OPERATIONS TECHNICIANS, IT	11,606	4,136	2,158	1,282
3512 SUPPORT TECHNICIANS, IT	15,872	6,638	3,093	1,860
3513 SYSTEM ADMINISTRATORS	3,723	1,421	769	419
3514 NETWORK AND SYSTEMS TECHNICIANS, ETC.	12,336	5,166	2,075	1,189
TOTAL:	161,717	74,481	26,816	17,994

NUMBER OF EMPLOYEES AGED 16-64 IN GENERAL OCCUPATIONS WHICH ARE ALSO IT OCCUPATIONS IN 2015, IN-

2143 GRADUATE ENGINEER PROFESSIONS IN ELECTRICAL ENGINEERING	2,206	
2421 MANAGEMENT AND ORGANISATION DEVELOPERS	4,362	
2432 INFORMATION OFFICERS, COMMUNICATORS AND PR SPECIALISTS	1,787	
3113 ENGINEERS AND TECHNICIANS IN ELECTRICAL ENGINEERING	1,075	(REGIONAL DATA NOT PRODUCED IN THIS SURVEY)
3322 COMMERCIAL SALES REPRESENTATIVES	8,850	
3449 OTHER TRAINERS AND INSTRUCTORS	148	
TOTAL:	18,428	
AGGREGATE TOTAL:	180,145	

Swedish IT & Telecom Industries

– an engine for the digitalisation of Sweden

Swedish IT & Telecom Industries is an industry and employer organisation for companies in the IT and telecom sector. We have approximately 1,200 member companies that together have almost 100,000 employees. Swedish IT & Telecom Industries' mission is to create the best possible conditions for a Swedish IT and telecom industry. The ways in which we do this include offering a competitive membership service, conducting business policy advocacy activities and pushing forward, facilitating and highlighting the advantages of digitalisation for Sweden. Swedish IT & Telecom Industries is one of seven collaborative federations in Almega, the employers' organisation for the Swedish service sector. Swedish IT & Telecom Industries' members are also members of the Confederation of Swedish Enterprise.

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