HIGH- TECH SKILLS

INDUSTRY

Increasing EU's talent pool and promoting the highest quality standards in support of digital transformation

#EUIndustryDay   #InvestEU

High-Tech Skills Industry

Increasing EU's talent pool and promoting the highest quality standards in support of digital transformation

Contents

Foreword

Skills are at the heart of industrial policy. The EU Industry Days 2019 demonstrated that skills are one of the main concerns of business leaders and social partners. Finding enough people with right skills and access to talents are key for the future of European industry.
To prepare the longer-term vision of EU industry, the European Commission established a high-level industrial roundtable: Industry 2030 with the mission to reflect on key elements of industrial transformation towards low carbon, socially responsible and competitive European industry. In addition, the Strategic Forum of important projects of common European interest identified key strategic value chains that require well-coordinated action and investments, joining industry, regions, member States and the EU The Commission promotes industrial competitiveness with all its major initiatives including the Investment Plan for Europe, Single Market Strategy, Circular Economy Package etc. … and the Skills Agenda for Europe.

The digitisation of the economy is fundamentally changing the way enterprises operate. However, many of them do not fully use this potential as they are lacking a digital transformation strategy, expertise and necessary capability. They also face significant shortages of IT professionals; in particular small and medium-sized enterprises (SMEs) have difficulty in recruiting skilled staff. The Digital Skills and Jobs Coalition brings together Member States, social partners and education providers to tackle this issue.

It is in this context that this report is being published. The main aim is to presents how enterprises, especially SMEs, could increase their digital capability. This includes the competences of both managers and staff, as well as the use of relevant organisational (and business) processes. The report also shows how an appropriate combination of ability, competences, methods, tools and technologies can be achieved.

The key lesson is that success is enabled by competences and professionalism at individual and team level and by organisational capabilities at enterprise level. They are indispensable and mutually reinforcing.
Mapping digital organisational capability and IT competences is difficult, as their interplay is not always readily understood. This challenge is further compounded by the large number of IT organisational and management frameworks.

This brochure presents an overview of the state-of-the-art, testimonies, best practices and proposals for a digital organisational reference framework taking into account the existing e-Competence Framework, which is a standard providing a common language for competences, skills and proficiency levels for IT professionals.

For Europe to thrive it will be crucial to increase its talent pool and to promote the highest quality standards in support of digital transformation.

Slawomir Tokarski
Director Innovation and Advanced Manufacturing
European Commission
Directorate General for Internal Market, Industry, Entrepreneurship and SMEs

The shortage of digital talent has huge impact

Digital transformation is a part of every corporate strategy and critically important for enterprises of all sizes to remain competitive and grow. Successfully managing digital change depends on the one hand on leadership and digital competences to guide and engage that process, and on the other hand, on the digital maturity of the organisation. The latter requires the right technology and team of professionals to design, plan, build, run and manage digital systems. There are clear signs however that shortages of digital leaders and IT professionals are hampering adoption of technologies and innovation, and hence the competitiveness of European industry.

Investing in technology and innovation is imperative for keeping enterprises competitive

First, the European 2018 Industrial R&D Scoreboard reveals that **growth in investment by EU-based enterprises (5.5%) is outpaced by their US and Chinese counterparts: the former increased their research and development (R&D) investment last year by 9%, the latter by 20%**. In an accelerating global innovation race, in which digital technologies and the physical word are merging, investments play a fundamental role: they determine the innovation capacity of enterprises, their competitiveness, and contribute to creating a sustainable, inclusive and prosperous Europe. EU enterprises reinforced their specialisation in medium-high tech sectors, increasing their contribution to automobile industries but reducing their global share in IT industries. At the same time, US enterprises strengthened their position in high tech sectors of IT services and health, and Chinese enterprises increased their global R&D share in IT and low-tech sectors. In the words of Carlos Moedas, Commissioner for Research, Science and Innovation: *'EU enterprises are leading the global technology race in strategic industrial sectors such as automobiles, pharma or aeronautics. But*

we come up short in the deep-tech areas that are shaping the next wave of innovation, such as artificial intelligence or new materials.'

Second, the conclusions of a research from IDC states that American organisations are forecast to spend 1.75 times more than European organizations on IT from 2018 through 2022. According to the report, **Western Europe Risks Losing the Technology Race**, while European entities will invest more into IT than their Chinese counterparts through 2022, the latter will invest 47% more into innovation accelerators. 'It's important to recognise that European goods and services are still in high demand,' says Marc Dowd, Principal Advisor, IDC Europe. *'Many European enterprises have done an exceptional job of streamlining operations, innovating new business, and maintaining high standards without a lot of cutting-edge technology. But they will need to up their technology game considerably if they wish to stay competitive.'*

Oliver Grün, Founder and CEO of GRÜN Software AG, and President of European Digital SME Alliance emphasises that *'Europe's economy depends on the skills and expertise of digital SMEs. IT requires continuous efforts to increase the number of IT professionals and their competences; next to highly specialised solutions, they make knowledge and support available to non-IT small enterprises to develop innovative solutions and services for new markets within the entire value chain.'*

Third, **strategic software innovation accounts for over 65% of all economic growth and software innovations are the biggest single economic productivity booster**, according to Anders Flodstrom, Education Director at EIT Digital and a former President at the Royal Institute of Technology Stockholm. Innovation

means creation, not simply using. EU member countries have not been successful in creating new software engineering education structure and networks. He emphasises Europe needs a radical disruption of the education system to change and solve the systemic shortage and move towards a software creation industry. A consumer (industry) centred education system where blends of face2face and online, and full time and part time education allow for an education ecosystem with the dynamics to drive European software creation initiatives.

Digital skills shortages are costing European enterprises

Demand for digitally skilled workers and IT professionals is growing throughout industry. Past analyses at European level since 2010 have shown that demand always massively exceeded supply. Whichever scenario is assumed, IT professionals will continue to be in high demand in the future and even more than in the past. **The current supply of IT professionals is insufficient, and the estimated vacancy potential is forecasted to be around 749,000 in 2020** (empirica/IDC 2018). The likelihood is high that the skills shortage will increase dramatically over the coming years.

Though accurate statistics are not available for the supply of and demand for e-Leaders, expert opinions indicate growing needs in this area as well (as specified in one of the next sections in this brochure). *'The innovation role is extremely important for a Chief Information Officer. Digital experimentations allow to swiftly validate new ideas: prototypes instead of PowerPoint. One of the essential ingredients is to protect talent and allow time to develop great things'*, according to Emmanuel Gaudin, CIO at Lagardère.

Research by Capgemini Digital Institute revealed that over **half of the organisations surveyed agreed that the digital talent gap is hampering their digital transformation programs** and that their organisation has lost competitive advantage because of a shortage of digital talent.

IDC research further details the costs that skills shortages cause. **By 2020, 90% of all organisations will have adjusted project plans, delayed product/service releases, or incurred costs due to lack of IT skills, with losses worldwide totalling $390 billion annually**.

Solutions to solving shortages are complex but pivotal to ensure growth of enterprises

There is a job to do to increase Europe's talent pool and reduce skills gaps, mismatches and shortages. This requires the right mindset among politicians and stakeholders and the recognition that lifelong learning, retraining and up-skilling is crucial and that national education systems are to be enabled to respond and act properly.

One of the sources to decreasing shortage of IT skills is new talent in formal education. In Europe, **statistics show that the number of computer science students is modestly increasing, but by far not at a pace that can cover the existing gap**. The United States currently face a problem of another order: while students increasingly see the career opportunity, **universities have huge difficulties to attract and retain professors to match the staggering demand for computer science studies**. A recent American study reveals that the number of undergraduates majoring in computer science more than doubled from 2013 to 2017, to over 106,000, while the pool of professors (Ph.D. Candidates) remained flat, according to the Computing Research Association, a non-profit that gathers data from about 200 universities. **The hard part of computer science, according to the author, is to get into class. This challenge might also gain ground in Europe**. For instance, the Dutch National Institute for Artificial Intelligence (ICAI) claims that 90% of their Ph.D. candidates finds a job outside of the university. They fear that they will have too few educators for the next generation of scientists. Dutch universities are now considering student stops for AI courses, as they cannot place the influx of students. Studies in informatics, computer science and applied math-

ematics also see strong increase in students. An increase of STEM-students and shortage of skilled teachers was also reported on in the UK.

Another source is reskilling and upskilling of the workforce. This is specifically relevant in the context of future developments affecting the workforce, such as AI for instance. The common narrative is that AI will replace huge amounts of jobs, but also create new jobs. New jobs require either young people to grow a career in that field or existing workers to be re-skilled. **The World Economic Forum found that 95% of the 1.4 million US workers who are expected to be displaced in the next decade could be transitioned to new positions with similar skills and higher wages. However, the total costs add up to 34 billion dollars**. "The question of who pays for the stranded workers and for the upskilling needed across economies is becoming urgent," says Saadia Zahidi, Managing Director of the World Economic Forum and Head of the Centre for the New Economy and Society. ***"In our view, a combination of three investment options needs to be applied: enterprises working with each other to lower costs; governments and taxpayers taking on the cost as an important societal investment; and governments and business working together."*** The WEF's model to weigh up the costs reveals that for both government and private sector positive cost benefit balances can be made for part of the workforce.

The latest analysis on supply of IT professionals, as presented in this brochure, reveals that industry has obviously managed to compensate the lack of suitable graduates through training and employing what is commonly called 'lateral entries'. Given the fact that most lateral entries gain their knowledge and expertise from more or less intensive and mostly rather short-term training courses this development could become a problem in terms of IT professionalism. Very little is known about the qualification background of lateral entries. Career path tracking of IT workers is seen as an urgent need to obtain more information on this issue.

With Europe losing competitive ground compared to other regions, fuelled by shortages of

digital leaders and IT professionals hindering enterprises, it becomes clear there is a strong need to strengthen the IT profession and radically re-think education and skilling of students and professionals in order to increasingly match industry demand and achieve a highly competent workforce. Recognition of competence is essential in that sense, as there is no shortcut to properly trained professionals.

'The IT profession is growing faster than ever before, and we need to constantly focus on further maturing the profession', according to Jim Friars, CEO of the Irish Computer Society. He continues: *'Many professionals have careers with IT elements, but a profession has well-defined criteria such as a code of ethics, an established body of knowledge, continuous professional development, and a set of competences.*

I believe IT is establishing its own identity through a competence-based approach, using for instance the e-Competence Framework. In Ireland, CareerPlus, our Continuous Professional Development (CPD) system will help us to map the skills of the IT workforce. It benefits both the employer and the professional in facilitating the timely acquisition of skills with a view to creating business value. But it will also feed back into the education sector, where those skills gaps can be addressed directly through the design of curricula and syllabi to meet industry needs.'

The key priorities for successful digital transformation

The past decade has seen a new wave of information technology "coming of age" and being adopted widely in organisations in Europe (and worldwide). Technologies, such as cloud, big data and analytics, mobile devices and apps, and social media technologies are now fundamental to organisations' IT environments. More recently, there is a surge in interest in how to use emerging technologies such as cognitive computing, artificial intelligence (AI), robotics process automation (RPA), Internet of Things (IoT) and 3D printing to name a few. It could be argued that a spate of new IT coming to market is nothing new – but what is new is how organisations are looking at applying these technologies. They are no longer in the realm of the IT department only and neither are the skills needed for technology adoption. According to Marianne Kolding, Vice-president IDC Technology: *'IT skills must move much closer to the core business. They cannot stay isolated just in the IT space. Many of the IT decisions will be taken outside of the IT department.'*

According to IDC's Digital Transformation Leader Sentiment Survey in May 2018, 91% of more than 400 European organisations interviewed stated that digital transformation was part of the corporate strategy of the organisation. According to IDC research, 'improving the quality of IT support for the business' and enabling digital transformation of the business' are the key strategic priorities in the next two years.

A new global survey reveals that CEOs view attracting and retaining talent as their top internal concern. Their second biggest internal concern is creating new business models due to disruptive technology.

The lack of skills has strong direct and indirect impact on financial performance of organisations. It could lead to employee stress, new products or services being delayed, decreased quality, declining customer satisfaction, increased operating costs and more.

Cybersecurity skills is one of the most in-demand areas – for both small-and-medium sized as well as large enterprises. The recent ENISA Threat Landscape concludes that exposure to cyber-attacks in the EU remains high and that *'skills and training are the main focus of defenders. Public organisations struggle with staff retention due to strong competition with industry in attracting cybersecurity talents.'* Other skills areas in demand concern could and big data analytics, as well as virtualisation, software, IoT and enterprise architecture.

Figure 1. Most Sought After Skills in Europe (IDC's European Skills Survey, 2018; employers representing a European IT workforce of 400,000)
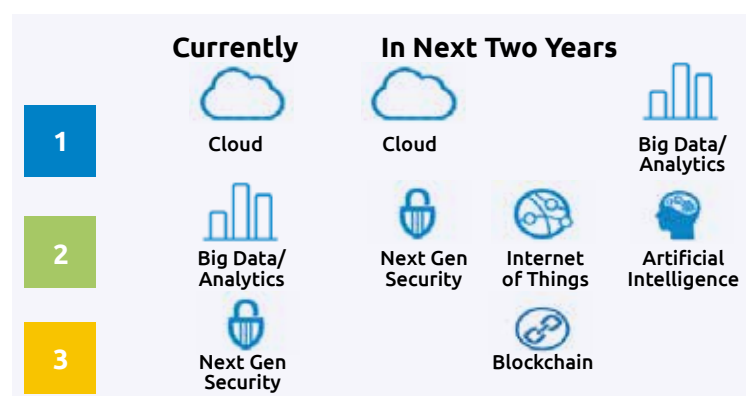
The demand for IT professionals is on a solid track

The IT workforce in Europe comprises 8.5 million workers, or 3.8% of the European workforce.[1] It is anticipated that the number of IT professionals will grow to significantly more than 9 million in 2020 in the EU.

The analysis of trends related to IT job statistics over the past few years hint at a growing polarization of skills:

■ the highest skills category (management, architecture and analysis jobs) and the lowest (mechanics and servicers) have increased their shares of employment over the last five years (8.3% and 7.4% annually, respectively);

■ Mid-level skills, especially at the associate and technician level, have seen rather little (yet still some) gains and might get under pressure as productivity gains from automation and commoditization of IT services continue.

Continuous, life-long education and training therefore gain more relevance than ever as the industry strives for maturing the IT profession and keeping pace with disruptive change.

'Closing this skills gap requires cooperation of demand and supply stakeholders to create new training offers. These need to very importantly focus more on re-skilling and up-skilling of IT workers and include offers of shorter duration and micro-degree to reveal positive results already in the short-term and scale up successful programmes quickly', says Werner B. Korte, Director at empirica GmbH.

---

1.   *This definition includes all the occupation categories, which are included in table shown. The definition of e-skills through occupation statistics largely follows the Eurostat definition. Minor deviations are due to different practice with regards to imputation of missing data apply. Eurostat imputes data using a methodology explained in Sabadash, 2012 and here: http://ec.europa.eu/eurostat/cache/metadata/en/isoc_skslf_esms.htm. We do not follow Eurostat in this approach and impute data based on the respective country's known data for the superset (in most cases the 3-digit ISCO data) and apply the average percentage distribution of the subsets (i.e. % of 4-digit ISCO data in the 3-digit group) in those countries that provide data to the countries that do not have this data. We justify this decision by the fact that also in the countries with a known 4-digit distribution there will be many IT practitioners without a formal IT education background who in Eurostat's practice are counted in the total but those in the other countries where imputation is necessary are excluded. This inconsistency would in our view be more biased than the assumption that a certain share of a subset can be estimated by applying percentages taken from the known distributions in other countries.*

Figure 2. IT specialist workforce in Europe 2016 by ISCO-08 skills clusters [2]

Management, architecture and analysis
Core ICT practitioners - professional level
Other ICT practitioners - professional level
Core ICT practitioners - associate/technician level
Other ICT practitioners - associate/technician level
Mechanics and servicers

EU Total 2016 ('000s)

820   1,268
645
1,350   3,050
1,335

Source: *empirica, 2018 (based on Eurostat LFS data 2016). Diagramme areas to scale (except EU total)*

Demand for IT professionals continues to be high and likely to grow even further in the future

Demand for IT skilled workers and IT professionals is growing throughout industry. Past analyses at European level since 2010 have shown that demand always massively exceeded supply. Whichever scenario is assumed, IT professionals will continue to be in high demand in the future and even more than in the past.

Even if evidence is only available for a short time frame, according to the IT sector vacancy analysis activities of Eurostat there is a growing number of vacancies in the IT sector, growing from 2.5 in 2016 (Q3) to 3.3% in 2018 (Q3)[3].

2. *Source: empirica calculations based on LFS retrieval by Eurostat. Some further estimates apply as explained in previous footnote*
3. *Eurostat database jvs_q_nace2, accessed on 22 Feb 2019.*

Supply of IT professionals is insufficient and resulting in a large number of vacancies today and much more so in the future

The supply of IT professionals is insufficient, and the estimated vacancy potential is forecasted to be around 749,000 in 2020. The likelihood is high that the skills shortage will increase dramatically over the coming years. We are confident that the scenario chosen and presenting the results below is the most likely one as demonstrated by a comparison of the past development with the forecasted development for the same period.

Figure 3. Forecast Supply and Demand of e-Skills in Europe (2016-2020): High Growth Scenario (empirica, 2018)
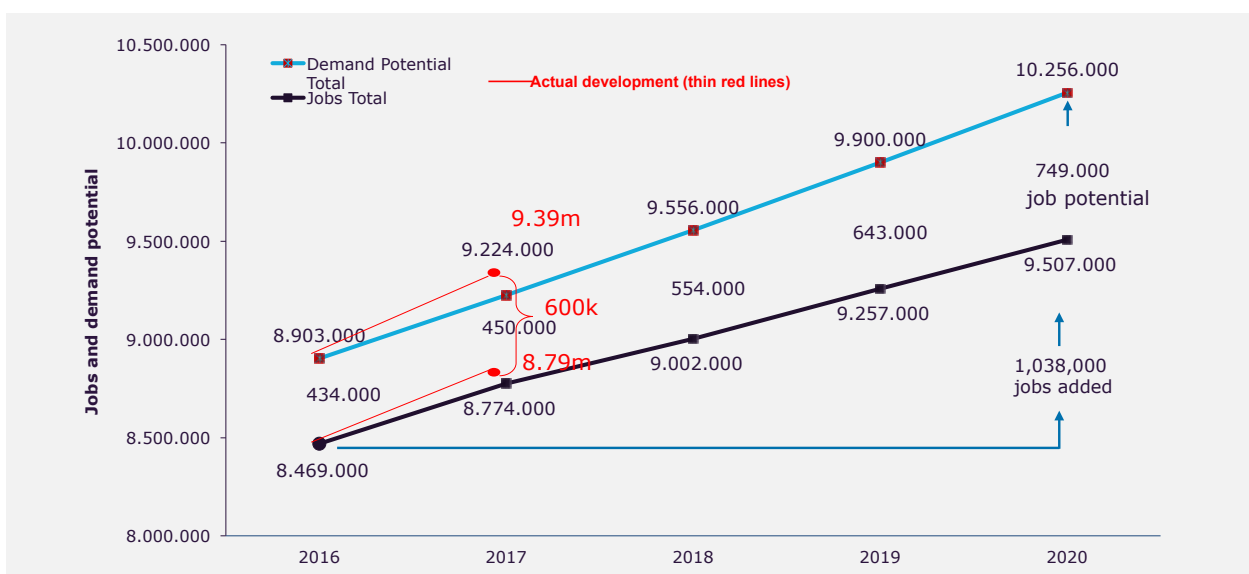
Comparing the actual development of the IT workforce to the estimated forecasts until 2017 (indicated by the thinner red lines) reveals that so far this scenario seems to be the most applicable one. In addition, the figures on potential job vacancies are likely to be at around three quarters of a million in 2020 and likely to even further increase beyond.

IT professionals are in high demand not only in Europe but globally and the demand is not likely to be met by the current supply from formal education and training institutions. However, the work force should be provided with relevant education and training opportunities. If Europe does not manage to foster the supply of these high-tech workers, it runs the danger of severely missing out on innovation opportunities and leaving them to be taken up by its competitors. The high skills gap of 749,000 potential job vacancies is forecasted for 2020 already. That is in two years' time and with the latest insights on the impact of artificial intelligence and automation on the workforce, there is a clear call to action for policymakers, industry and educational institutions to intensify efforts to prepare the workforce for these challenges.

There is a job to do to increase Europe's talent pool and reduce skills gaps, mismatches and shortages.

This requires the right mindset among politicians and stakeholders and the recognition that lifelong learning, retraining and up-skilling is crucial and that national education systems are to be enabled to respond and act properly.

'CEDEFOP's Skills Forecast highlights future skills supply and demand for EU and each Member State. It provides a concise outlook on employment trends for sectors, major occupational groups and qualifications. The Skills Forecast is a valuable tool to support policy measures in the area of skills development and matching', explains Jiří Braňka, Expert in Labour Market Intelligence at CEDEFOP.

Digital Leadership – A key ingredient to foster Europe's competitiveness and innovation potential

Digital leaders have been defined as leaders with high-tech leadership and innovation skills (short digital leadership skills) and as people capable of driving successful innovation and capitalizing on new digital and key enabling technologies. These skills are not usually captured in any statistical system and hence assumption about their prevalence needs to be made when trying to quantify the "order of magnitude" or range of likely size of these skills in the labour market.

Sufficient supply of high-tech leadership skills to the economy can arguably be attributed to fostering innovation, economic growth and creating jobs. These competences are key inputs to initiating, guiding and establishing digital innovation at all levels of enterprise, from the start-up to the largest of corporations, from private to public.

On an individual level, high tech and innovation leaders are defined as both business and digitally savvy, and having the capability to lead strategically. They might be digital leaders who are also business-savvy or business leaders who are digitally savvy. Digital leadership involves leading and managing e-skilled professionals as well as other professionals.

Cross-disciplinary leadership skills that exploit new digital and key enabling technologies for enterprises to excel in their business are crucial factors for an increasing high-tech economy. The three domains of skills – digital skills, business skills and strategic leadership skills – have been further spelled out into specific skills within the taxonomy of the e-CF, and most of these skills are well defined, enabling and following through the innovation process. In defining digital leadership through the e-CF, these have been organised as strategic, management, innovation/transformation and creative/implementation skills.

Measuring demand for digital leaders through economic business structure analysis

A first attempt at estimating the demand for digital leadership in Europe was carried out based on assumptions that an enterprise of a certain size and in a certain, more or less IT intensive sector, needs on average a minimum number of employees with digital leadership skills. This work has resulted in a demand of 594,000 digital leaders in 2016 and 630,000 in 2018. The demand is growing as a result of the increasing number of enterprises in the respective business sectors from 2016 to 2018 (with 36,000), which corresponds with a CAGR of 3.0%.

E-Skills pyramid - an order of magnitude sketch

- EU-Population 512 million; emplyment 217 million
  57% (of pop 16-74 years) (220M) have at least basic user skills;
  31% have above basic skills
  Main concerns: Participation, inclusion and basic digital literacy
- Of 217 million emplyment,
  Users: 67% (145M) have at least basic level skills
  Main concerns: employability, work quality
- Advanced users: 7% (80M) of individuals
  in emplyment have above basic level digital skills
  (Non-manual workers 47%, manual workers 15%)
  Concerns: new ways of working; Future of work;
  "Race against the machine"
- ICT Specialists (8,2M)
- Core profession (5,7M)
  - Management 450k
  - Software 3,4M
  - Network&database (505k)
  - Core technicians (1,4M)
  Concerns (both): professionalism,
  systemic risk, competitiveness,
  innovation, business & job, generation
- Digital Leaders (~630,000)
  Concerns: competitiveness,
  innovation, business & job
  generation

Digital Leaders (630k)
Core Profession (5.7M)
IT Specialists (Professionals) (8.5M)
Advanced users (80M)
Users (145M)
Workers (217M)

The bottom line is that according to expert scenarios Europe will require to generate around 50,000 additional high-tech leaders per year in the years up to 2025, or around 450,000 until 2025. These figures do not yet take into account of the needs of medium to low skilled workers. We can be sure that the overall numbers for the entire work force will be many times higher since already today enterprises face significant shortages of highly skilled workers. There is quite probably a continuing trend towards more digital leadership skilled employment. As digital leadership skills are acquired by a mix of work experience, education and training – these are key levers for supply side measures to improve European digital leadership. Will Europe's education and training providers manage to get this done?

However, measurement remains challenging. A fully satisfactory statistic that might present a reliable figure of the status quo of digital leadership skills present in the current workforce is not available. To arrive at order-of-magnitude estimations, bold assumptions need to be made to arrive at figures of labour market incidence. The methods used in this estimation do not strictly lend themselves to producing time series data.

The industrial structure changes over time for many reasons, so that taking this structure as an indication of digital leadership demand can give rough estimates about the order of magnitude, but not concerning changes over short periods.

Open vacancy measurement is possible, under several assumptions, which may strongly influence the result. This statistic is providing a very volatile metric and for the time being no conclusions can be made other than that a significant growth in digital leadership must have taken place. More big data based research into job advertisements, e.g. what are the emergent job titles of digital leaders and what are maturing job roles discernible from task descriptions, might one day result in "digital leader" being a discernible set of classification categories with the potential of translation into official standards such as ISCO. There is a job to do!

The Impact of skills shortage on the workplace

Nearly all organisations would agree that digital talent is important and that they are aware of the digital talent gap. A pioneering research of Capgemini Invent in collaboration with LinkedIn gained insight into the perspectives of both employees and leadership teams and researched both human resource and talent executives within organisations as well as digital and technology recruiters.

It found that although the majority of enterprises frequently discuss this gap, concrete action to bridge it is rarely taken. **Close to 50% of the organisations that were studied conceded, they have not taken digital talent seriously.**

The digital talent gap is widening. Every second organisation surveyed acknowledged that the digital gap is widening. Moreover, over half (55%) of the organisations agreed that the digital talent gap is hampering their digital transformation programs and that their organisation has lost competitive advantage because of a shortage of digital talent.

Figure 4 Overview of the Digital Talent Gap globally (Capgemini & LinkedIn 2018)

The talent gap in soft digital skills is more pronounced than in hard digital skills. More employers (59%) say that their organisation lacks employees who possess soft digital skills than hard digital skills (51%). **The two soft digital skills in most demand are customer-centricity and passion for learning and the two hard digital skills in most demand are cybersecurity and cloud computing.**

Many of today's employees are anxious. Employees are worried that their skills are either already redundant or soon to become so. Overall, 29% of employees believe their skill set is

redundant now or will be in the next 1–2 years. Employees feel organisations' training programs are not hugely effective and those who want to excel are looking beyond their organisations' learning and development (L&D). More than half of today's digital talent say that training programs are not helpful or that they are not given time to attend. Close to half actually describe the training as "useless and boring." Nearly 60% of digital talent are even investing their own time and money, most commonly to be on a par with their colleagues on the required digital skills.

Skill redundancy fears and lack of faith in their organisation's upskilling efforts could trigger attrition. Over half of digital talent (55%) say they are willing to move to another organisation if they feel their digital skills are stagnating at their current employer. In addition, over half of digital talent (58%) are likely to gravitate towards organisations that offer better digital skill development. Furthermore, digital talents have an easy exit option as they are faced with an abundance of job opportunities. To counter these worrisome employees' perceptions, enterprises should invest in re- and upskilling programmes. Despite a widening digital talent gap, the training budgets have remained flat in half of the organizations. Very few organizations take a pro- active approach to upskilling talent: only 17% indicated to upskill every year based on current needs and future requirements for the upcoming year.

'A defined digital talent strategy that meets both business objectives and the needs and preferences of digital talent is critical for a sustainable and successful digital transformation' according to Claudia Crummenerl, Vice-president People & Organisation, Capgemini Invent.

The capability-competence tandem underpins digital transformation

This initiative developed a 'digital capability reference framework' with the purpose of establishing a connection between capabilities of the organisation and competences of the employees. It could support organisations in their digital transformation journey and be instrumental to defining digital talent strategies. **Improving organisational capability requires improving individual IT competences, skills and knowledge (and vice versa)**. This is essential for building digital management and governance capabilities, with relevant organisational structures and processes at enterprise level.

It is necessary to start with a clear definition of both concepts:
- Competence: the demonstrated ability to apply IT knowledge, skills and attitudes for achieving observable results;
- Capability: the ability of an organisation to systematically and repeatedly mobilise processes, people and technology towards achieving specific outcomes.

Organisations should be proactively seeking out opportunities for competitive advantage through IT and adopt a mechanism that achieves repeated and sustained value. Understanding the capability-competence tandem is pivotal to successfully deliver on strategic investments.

Solid potential exists for the concept of a 'digital capability reference framework' as a survey performed during this initiative concluded: almost 3 in 5 organisations would likely use such reference framework.

Caroline van Rompuy, CIO of Agfa-Gevaert confirms that *'Connecting capabilities with competences is key for successful transformation and this framework can be of great added value.' Organisations will also need to embed a change skillset into all employees' profiles for a successful implementation.'*

Figure 5. Potential use of the Digital Capability Reference Framework

POTENTIAL

24%
Of organisations uses some kind of reference framework linking capabilities with competences

58%
Of organisations would (likely) use such reference framework
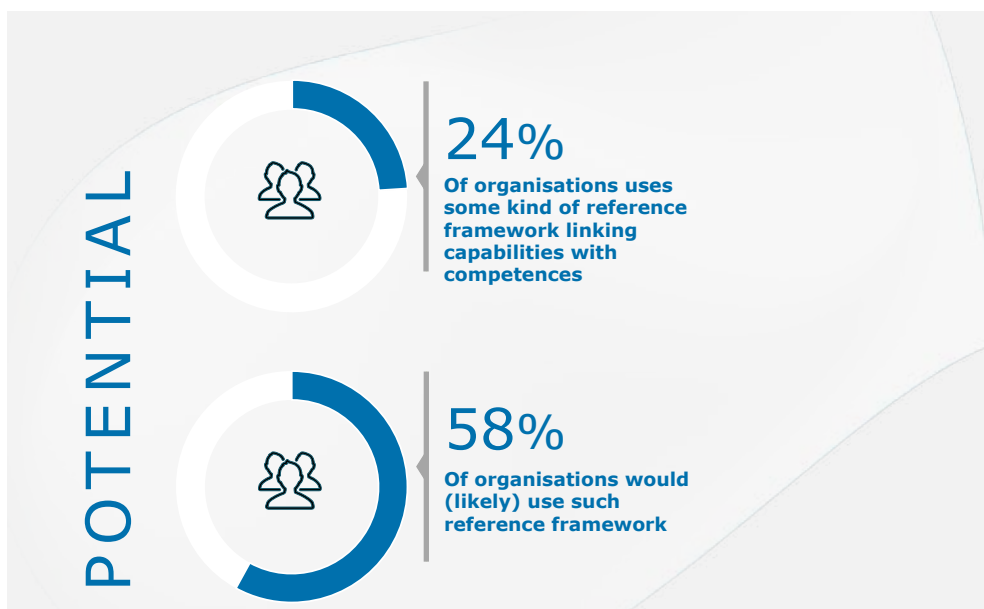
In developing a 'digital capability reference framework' the objective was to provide organisations with answers to the following questions:

■ In which capability should we invest to improve our business performance?

■ Which competences are relevant for developing that capability?

■ Who in our organisation carries out a role associated with those competences? Moreover, is the employee matching the requirements for that role?

■ Which IT framework or IT standard could support our employees with methods and tools to organise and standardise work processes?

Figure 6. How organisations develop capabilities and competences in tandem

Capability	Competence	Role	Method
■ Which capability do we need to invest in to improve business performance?	■ Which competences are relevant for developing a capability?	■ Who in the organisation is carrying out a role associated with those competences? ■ Is the employee involved matching the requirements for that role? ■ Decisions can be taken as regards upskilling, recruiting or outsourcing.	■ Which IT organisational and management frameworks provide the competences, knowledge and skills related to the required area of expertise? ■ Which methods/ tools can support our employees?

Following the identification of these four pillars, the Digital Capability Reference Framework was further designed by the following sources to further describe those pillars:

■ **Capabilities**: The 24 IT-capabilities were determined based on business expertise, good practice and stakeholder inputs. Inspiration for structuring the capabilities is the 9-square model, derived from earlier Strategic Alignment Models (SAM) and Amsterdam Information Model (AIM).

■ **Competences and Roles**: the European Framework for IT Professionalism defines four building blocks and each of them includes standards or instruments to support further development of the IT professional as well as the IT profession itself:

■ Competence. European e-Competence framework (e-CF), version 3.0

■ Knowledge. European Foundational IT Body of Knowledge (fBOK), version 1.0

■ Ethics. European Ethical Guidelines, developed as part of the European Framework for IT professionalism (in 2017)

■ Education, training and certification. Some instruments exist (e.g. quality labels for industry-based certifications). The framework has not included (yet) the huge variety of (vendor) certifications.

■ **Methods are defined by IT organisational and management frameworks, and IT standards**: as can be distinguished in the areas of IT Development, IT Management, Architecture, Project management, Business management. The list was constructed following desk research on existing publications, consultation of IT professionals in various areas of expertise, and finalised after the interviews with experts. These frameworks are categorised following the 12 knowledge areas of the European Foundational IT Body of Knowledge (fBOK).

Figure 7. The meta-model of the Digital Capability Reference Framework

IT PROFESIONALISM BUILDING BLOCKS:			IT CAPABILITY AREAS (9)		
			IT CAPABILITIES (24)		
			E-CF ROLE PROFILES (30)		
E-CF COMPETENCES (40)	PLAN	A1 – A9	5 1 4 3 3	1 2 1 3 4 3 5	5 2 4 3 5 5 5 1 1 5
	BUILD	B1 – B6	1 4 5 4 1	5 3 4 1 5 3 5 5	1 1 2 1 4 4 3 2 2 3
	RUN	C1 – C4	3 5 2 5 4	4 5 2 2 5 4 3 3	4 5 5 1 2 5 2 5 5 5 2
	ENABLE	D1 – D12			
	MANAGE	E1 – E9	2 1 1 5 1	3 2 5 5 1 1 1 5	5 5 5 3 5 2 2 4 4 2
fBOK KNOWLEDGE AREAS (12)	From ICT Strategy & governance to Operations & Service Management (12)	Various IT Frameworks and standards (40+)			
Ethics	Generic	EU Ethical Guidelines			
	Specific (applied)	a.o. for Architects (NL)			
Education & Certifications	*Various*	*Various*			

The organisational capability and maturity

Digital capabilities reflect the ability of an organisation to systematically and repeatedly mobilise processes, people and technology towards achieving specific outcomes.

Within this building block, twenty-four IT capabilities are plotted in nine areas. The nine-square matrix, as defined in AIM, is constructed by two axes: domains of governance (from business to IT, horizontally), and levels of governance (from strategy to operations, vertically). This model was chosen for its objective of governing IT and aligning with business. It is an abstract model aiming to support strategic discussions around outsourcing, responsible organisational units, selection of IT frameworks, growth areas. It is widely applied in IT industry (for mapping IT frameworks), vendor-neutral and addresses the relevant target group for this framework. The digital capability reference framework is also meant to initiate proper discussion around digital strategy and implementation. The framework further identifies which roles correspond with these capabilities.

Figure 8. The 24 IT capabilities structured in nine areas

1

Business Strategy & Transformation

- Strategy & planning
- Financial Management

2

Information Strategy & Transformation

- Innovation Management
- Business/IT Partnership
- IT Risk Management
- Enterprise
- Architecture
- IT Management & Governance
- Security Management
- Finanacial Mngrt

3

Delivery Strategy & Transformation

- Solution Delivery
- IT Governance
- IT Management
- Financial Management
- Talent Management

4

Business Change Management

- Project Management
- Data Management

5

Governance of Demand & Supply

- Innovation Management
- Portfolio Management
- Security Management
- Sourcing & Procurement

6

Application Enhancement & Modernisation

- Relationship Management
- Contract Management
- Application Management
- Test Mngt
- IT Service Mngt
- Solution Delivery
- Infrastructure Mngt
- Talent Mngt

7

Business Operations

- Data Management

8

Operational Service Delivery

- Incident Management

9

Application Support

- Test Management
- Application Management
- Incident Management
- Solution Delivery
- Infrastructure Management

The IT Capability Maturity Framework (IT-CMF) provides information on how organisations can actually improve and offers a great enrichment to the European Digital Capability Reference Framework. IT-CMF is developed by the Innovation Value Institute (IVI) and aims to align IT with business strategy. It is an IT Framework, which allows organisations to baseline their current capabilities while enabling targeted improvement of capabilities in a systemic way. IT-CMF enables decision-makers to identify and develop the IT capabilities they need in the organisation to deliver agility, innovation and value for the organisation. IT-CMF is a high-level management framework covering IT Management, but not a process framework comparable to the long-list included in previous sections. Rather it does cover breadth of IT from technical infrastructure to strategic management.

Dr. Clare Thornley, Senior Research Fellow at the Innovation Value Institute explains: *'Tools to help must provide a good method of identifying strategic capability priorities and then accurately mapping them to specific skills, process and organisational improvements that can drive them. A clear picture of 'what good looks like' is essential to guide organisations.'*

The value of the IT-CMF is that it enables organisations (it is targeted at CIO's and IT leadership)

to benchmark their critical capabilities against a proven maturity model, and that outcomes of that assessment indicate what value can be realised when improving, with concrete practices, outcomes and metrics. It hence offers a roadmap to increase value. The maturity model underpinning the benchmark consists of five levels, from low to high maturity: initial, basic, intermediate, advanced, optimising – and is labelled for each of the four macro-capabilities. The assessment done within IT-CMF enables CIO's to gain insight across the breadth of their IT organisation, to understand what is going well and also where gaps exist (possibly unknown issues too), and how the results compare to peers and similar organisations (included in a significant database) – with the ambition to develop a capability improvement plan.

The capabilities in the European Digital Capability Reference Framework and in IT-CMF are connected and the IT-CMF provides further a further description of 'what good looks like'.

DIGIFRAME Capability	IT-CMF capability
Strategy & Planning	IT leadership (LDP
'What good looks like'	
When yhe IT leadership (LPD) capability is well developed or mature, it has the following characteristics.	

Strategy, vision, and culture
- IT leadership steers the IT function in a direction that supports the organization's strategic goals and objectives.
- The IT vision is jointly perpared by IT leadership and the business as part of the organization's planing cycle.
- IT leadership ensures that the IT function is united around a sherd IT value proposition, vision, and direction.
- The desired cultural model is in place and IT leadership ensures it in throughout the IT organization.

Workforce management
- IT leadershi ensures that IT recruits, manages, and retains its workforce - through an effective approach that results in increased team productivity an morale.
- IT leadership ensures that IT takes account of performance metrics results in seeking to achieve its deliverables/ outputs and that it identifies productivity issues early.
- IT leadership ensures that the IT workforce is motivated ans inspired to overcome obstacles to change.

Tools
- IT leadership ensures that the appropriate tools and technologies are in place to support activities within the IT organization.
- IT leadership raises awareness of changes in the IT and business environments and ensures these are respondedto through utilizing a comprehensive library of tools, technolgies, methods, and processes.

Case Study: IT-CMF in practice at Expleo

Expleo is a trusted partner for end-to-end, integrated engineering, quality services and management consulting for digital transformation. Expleo helps businesses harness unrelenting technological change to successfully deliver innovations that will help them gain a competitive advantage and improve the everyday lives of people around the globe. Expleo is active in the technology-intensive sectors that make business and society more connected, sustainable and secure, offering access to industry-specific expertise and best practice across the following services: consultancy and business agility, product design, production and in-service support, as well as continuous quality.

For over 30 years in Ireland, Expleo has been helping organisations manage business and technology risks to achieve fit-for-purpose business outcomes. This French-based company has divisions in Ireland in both Belfast and Dublin. In fact, in the IVI 2015-2020 business plan, IVI announced that Expleo was to create 20 new jobs in Dublin after signing a collaborative agreement with IVI. The collaboration was to see the two organisations work closely together to develop a set of tools and measuring techniques to more effectively manage and measure the business value of IT investments. This collaboration has been strongly evidenced over the past four years.

Expleo's engagement with IVI has primarily centred around 1) the use of IT-CMF to improve internal capabilities, 2) the use of IT-CMF and associated management toolsets for client engagements, and 3) the use of IT-CMF as an independent BoK and assessment tool to gain acceptance and credibility with clients. To date, Expleo has undertaken eight IT effectiveness assessments and four PDP assessments, and its employees have completed several IVI training courses (ten 'passport' and four 'core' training courses). Expleo has also used PDP (extensively), SD, and project management-related CC assessments with client organisations. Over the past four years Expleo was intensively involved in developing and reviewing a large number of the IT-CMF CCs recently released, and also contributed to both skills and CPI-related projects. Specific examples of its engagement and collaboration with IVI include involvement in the development of the IVI DevOps assessment for use with Expleo clients; involvement in the piloting of the IVI Digital Readiness assessment, and involvement in development of the Personal Data Protection (PDP) CC and use of this CC with clients as part of the EI Lean Start Personal Data Protection Programme.

For Expleo, use of IT-CMF has delivered considerable benefits:

■ Supported market protection and enabled new market entry: it helped retain clients in the USA (e.g. a very successful engagement with a US Health insurance provider) and within Ireland to generate new business. Particularly in the area of data protection, use of IVI assets has enhanced credibility with clients

■ New service development: It has supported Expleo service development around management consultancy for data protection

■ Time to market reduction: Having the IT-CMF PDP solution readily available greatly reduced lead-times with clients

■ Productivity improvements: IT-CMF helped Expleo to 'hit the ground running' with many clients

■ Efficiency savings: Client turn-around time was reduced in a large number of engagements

■ Improved turnover: Turnover was modestly improved due to data protection engagements; while this figure is difficult to quantify, it is in the region of many €100,000's

Going forward, Expleo expects to better leverage use of IT-CMF on an international basis through its local operations. The framework will become more and more useful once clients are familiar with its contents and how it can be deployed.

The individual competence and job roles

This building block of the Digital Capability Reference Framework is based on the **European e-Competence Framework (e-CF)**. The e-CF is an early significant response to the need for standardisation and guidance to IT practitioners (students or experienced) in their performance, training and development Europe wide. The e-CF supports the definition of jobs, training courses, qualifications, career paths, formal and non-formal learning paths, certifications etc. in the IT sector. In this way, local, national, European and global IT vendor and user enterprises as well as qualification and certification providers have access to a shared reference. It offers a uniform language. This is a key achievement of the CEN Skills Workshop.
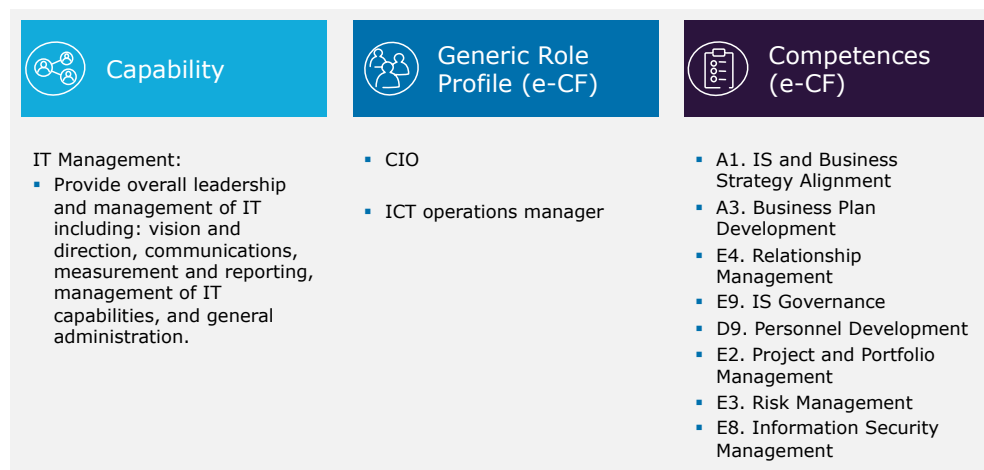
> *'The e-CF is not just a framework; it's an enabler for transformation. It helps to define future evolution and skills needs. An addition challenge is to change the mindset of people'.*

The European e-Competence Framework aims to provide general and comprehensive e-Competences specified at five proficiency levels that can then be adapted and customised into different contexts from IT business and stakeholder application perspectives. The forty competences of the framework are clas-sified according to five main IT business areas, and relate to the European Qualifications Framework (EQF).

Complementary to the e-CF, the **European IT Professional Role Profiles** contribute to a shared European reference language for developing, planning and managing IT Professional needs in a long-term perspective and to maturing the IT Profession as a whole. The profiles are considered a flexible tool for IT professional development and profile construction. Implementing the e-CF competences from a profile construction perspective, the European IT Professional Role Profiles provide a tool and entry point for e-CF application to individuals and organisations working with the e-CF EN 16234-1 standard. The profiles have been recently updated and now consist of thirty profiles clustered in seven groups ('families'). The example shows how the Digital Capability Reference Framework reveals the connection between a capability (the 'what') and the related competences and roles (the 'who').

Figure 9. An example of the connection between capability, competence and role profile

Capability	Generic Role Profile (e-CF)	Competences (e-CF)
IT Management: • Provide overall leadership and management of IT including: vision and direction, communications, measurement and reporting, management of IT capabilities, and general administration.	• CIO • ICT operations manager	• A1. IS and Business Strategy Alignment • A3. Business Plan Development • E4. Relationship Management • E9. IS Governance • D9. Personnel Development • E2. Project and Portfolio Management • E3. Risk Management • E8. Information Security Management

The benefits of IT Frameworks and standards

What is exactly meant by 'IT organisational and management frameworks'? In essence, these frameworks represent an established norm and are a repository of specifications, procedures, guidelines in a certain domain. They are designed to ensure processes, methods, services and systems are safe, reliable and consistent. Frameworks provide a uniform language. They are based on industrial, scientific and consumer experience and are regularly reviewed to ensure they keep pace with new technologies. With 'IT organisational and management frameworks' we also include IT standards.

The trigger for implementing a framework is often related to the need to develop digital capabilities. A prerequisite for increasing digital capabilities is a well-organised base. The foundational building blocks, concerning infrastructure and applications, should be managed with minimum effort. Implementing a framework is a proven way to reduce this effort.

We found that organisations would benefit from a transparent overview of these frameworks, where they contribute to and how they work together. Over 40 Frameworks were identified via research, interviews, and a survey, and included both recognised and emerging frameworks. From this list, a selection was identified for in-depth analysis and these were mapped against the competences of the e-CF and the roles they mostly support. The key learning from the research is that organisations that are in change and/or growth gain interest in these frameworks as they offer ways to structure that change and/or growth in the organisation. This also offers a huge opportunity for the e-CF, especially now the link between IT frameworks and the e-CF is clearly established. Good practice also showed that these frameworks could be used in relation to e-CF – either in traditional and agile situations.

Martine de Groot- Grosman, Sourcing manager at VIVAT, confirms this view: *'Our transformation is made possible by high performance teams. We created new IT-professional profiles using e-CF in combination with soft skills and business knowledge for both traditional specialists and agile T-shaped functions.'*

Figure 10. Application of e-CF in traditional and agile context

E-CF in waterfall   **E-CF in DevOps**
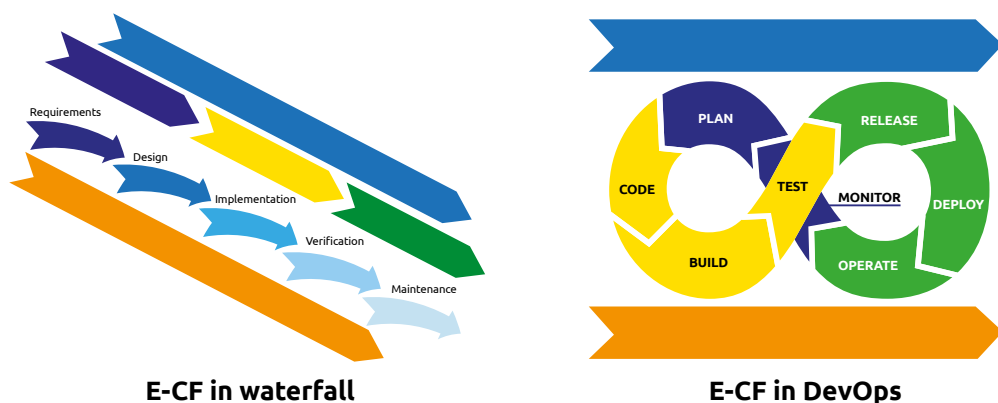
Case Study VIVAT: implementing e-CF together with IT organisational and management frameworks

VIVAT is an insurance company in the Netherlands. The process of digital transformation at VIVAT illustrates the benefit of using a uniform language when it comes to competences. A very urgent shift in business model forced VIVAT to re-think their approach towards high-performing teams. Building from their view on the IT specialists for the future, they started to design the organisation and describe jobs for the next level of Agile maturity. This implied a shift from segregated teams to high performing teams.

Building digital capabilities around customer experience and insight was one of the priorities. The motives of consumers taking insurances is more and more one of convenience and benefit. Convenience means the ease of doing research and making purchases, avoiding problems, and services like claims handling. Benefit refers to a balance between price, product and service. Digital journeys were made to understand the customer life events and to retain customers. The ultimate goal of VIVAT is offering customer centric solutions by high performing teams using advanced automation at flexible and secure platforms.

This meant that the employees of the VIVAT IT & Change organisation had to work in teams, using new technologies and frameworks like Agile and DevOps. A new organisation was designed, and new job roles were introduced which had to match with some traditional job roles. In these teams, employees need to be 'T-shaped professionals'. The new job descriptions and classifications are based on the e-CF, and all job descriptions together cover all competences in the e-CF. This works perfectly fine, also in an Agile/DevOps context. Some new job roles, like DevOps Engineer, are also based on the e-CF competences. These profiles then made it possible to select employees, to identify the skills and competences needed for digital transformation and to focus on the most suitable qualifications/certifications to further grow their professionals. In the words of Ms. de Groot-Grosman: *'e-CF helps you to understand what you do, why and how you need to do it'*. VIVAT also indicated that on top of the e-CF

profiles it is necessary to add certain competences around agility for instance, and to combine with business knowledge and soft skills to complete the profiles.

Another interesting point is that VIVAT works together with start-ups, and through this collaboration, also the ecosystem of VIVAT is introduced with the e-CF standard.

Key challenge in the transformation process is to monitor progress – outcomes rather than outputs. This is also important as they consider 'change' as a constant; it is continuous, ongoing and organisations need to be prepared for that. In this context, VIVAT also underlined the absolute need to increase supply of T-shaped IT professionals.

To support the digital transformation VIVAT chose for specific frameworks like IT4IT as the foundation of managing the digital enterprise. Agile and DevOps for self-managing and controlling teams. Prince2 Agile for project management. Agile and Scrum for developing new apps. Some traditional frameworks are also still used, such as TOGAF and ITIL.

The Digital Capability Reference Framework in practice

A practical example of how the Digital Capability Reference Framework would work in practice.
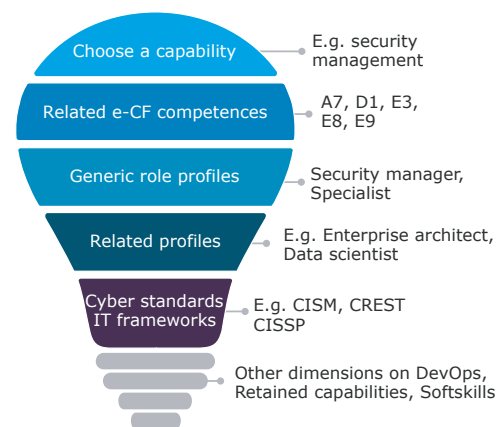
Not only big enterprises, but also SMEs [fall victim](#) to cyber threats more and more often. Although many owners of SMEs underestimate their risk of becoming the target of a cyber-attack, they are likely targets for [cyber criminals](#) or state-sponsored [attacks](#).

Let us assume that an owner of an IT-using SME realises urgent action is required. He wants to increase the level of cybersecurity in his company, but runs into a series of questions. For instance:

■ Which capability covers cyber security and how do I know where my company stands on the maturity ladder?

■ Which competences are related to the capability of security management and how are they described?

■ Who should I make responsible for developing a cybersecurity strategy in our company, and what knowledge, skills and attitude should this person master?

■ Who should execute that strategy and which standards or frameworks should the employee be trained in?

■ Which other roles in my organisation are affected by cyber security and what should these employees understand?

■ How can I assess employees and identify gaps?

The Digital Capability Reference Framework provides answers to these questions by connecting the various building blocks.

Tata Steel applied e-CF in a similar way, and to their satisfaction. Floor Scheffer, Senior Business Consultant at Tata Steel Europe, says: *'I recommend using e-CF in large and/or complex organisations with a lot of digital roles, when there is a need to improve digital skills and capabilities across the organisation, to establish common definitions and terminology within the organisation and for aligning digital initiatives across the organisation.'*

Choose a capability	E.g. security management
Related e-CF competences	A7, D1, E3, E8, E9
Generic role profiles	Security manager, Specialist
Related profiles	E.g. Enterprise architect, Data scientist
Cyber standards IT frameworks	E.g. CISM, CREST CISSP
	Other dimensions on DevOps, Retained capabilities, Softskills

Case Study: Digital Competence Framework at Tata Steel Europe

Tata Steel is one of the world's most geographically diversified steel producers, with operations in 26 countries and commercial offices in over 35 countries. It is one of the largest steel producers in Europe. Tata Steel Europe (TSE) started the Tata Steel Academy in 2011, which introduced a common approach across the company using Job Families, Functional Faculties and common terminology related to skills, competencies and proficiency levels. Digital capabilities began to feature high on the corporate strategy in 2017 and TSE embarked on the task to develop a Digital Competence Framework, to underpin several isolated digital initiatives across the company. It was decided to use e-CF as the standard for IT skills going forward. TSE has since also joined the Erasmus+ European Steel Skills Agenda (ESSA) programme.

Tata Steel's IJmuiden plant has recently been recognised by the World Economic Forum as a key player in the technologies of the Fourth Industrial Revolution. The 'Lighthouse' status has been awarded to the Tata Steel plant, among just 16 factories worldwide. This acknowledges the cutting-edge production techniques employed by the facility, largely as a result of the pioneering Advanced Analytics techniques, which have optimized and improved every step of the steel-making process.

The Digital Competence Framework connects digital capabilities, both in IT and in other domains, to responsible roles contributing to those capabilities. It consequently defines for each of those roles which competences are relevant (based on e-CF and DigComp), relevant knowledge and behavioural competences. TSE finds the following benefits of using their Digital Competence Framework:
- Career Planning and Personal Development
  - Provide transparency of role requirements;
  - Enable self-assessment (cf. Skills Profiler);
  - Support Personal Development Planning.
- Gap Analysis and Capability Development
  - Help identify capability gaps (ref BA case study);
  - Help design L&D interventions.

- Organisation Development and Digital Strategy
  - Identify similar roles across departments;
  - Promote common definitions and terminology;
  - Facilitate alignment of individual skills and organisational capabilities with digital vision, strategy and roadmaps.
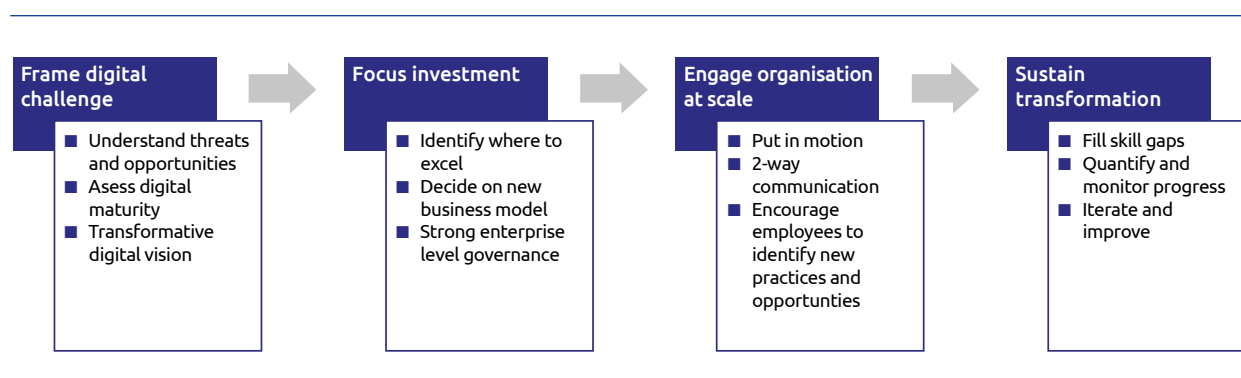
TSE's experience with the e-CF are positive as the framework is manageable and suits business use. It helps to identify and address gaps in digital skills and capabilities. TSE recommends using e-CF in situations such as:
- For large and/or complex organisations with a lot of digital roles;
- If an organisation needs to improve digital skills and capabilities across the organisation;
- If an organisation lacks common definitions and terminology across the organisation;
- If an organisation needs to align digital initiatives internally.

The beneficiaries of the Digital Capability Reference Framework

In general, a digital transformation process can be described in four steps (as captured in the figure below): frame the digital challenge, focus investment, engage the organisation at scale, and sustain the transformation.

Figure 11. Four steps of driving digital transformation

Frame digital challenge	Focus investment	Engage organisation at scale	Sustain transformation
■ Understand threats and opportunities ■ Asess digital maturity ■ Transformative digital vision	■ Identify where to excel ■ Decide on new business model ■ Strong enterprise level governance	■ Put in motion ■ 2-way communication ■ Encourage employees to identify new practices and opportunties	■ Fill skill gaps ■ Quantify and monitor progress ■ Iterate and improve

A Digital Capability Reference Framework could support various steps of this process and serve various purposes, and hence targets various users.

The following potential users of a digital capability reference framework were identified:

■ **At enterprise level**: the level of the organisation that makes choices concerning the strategy and ambitions of the organisation, and the investments in capabilities to get there, i.e. leadership of the organisation (CxO);

■ **At organisational level**: where the strategic choices related to process, people and technology are implemented, e.g. IT or HR management. Activities here consist of understanding what competences need to be developed, by whom and if the current workforce matches those requirements. Understanding skills gaps and acting on it (learning pathways, job profiles, skills assessment);

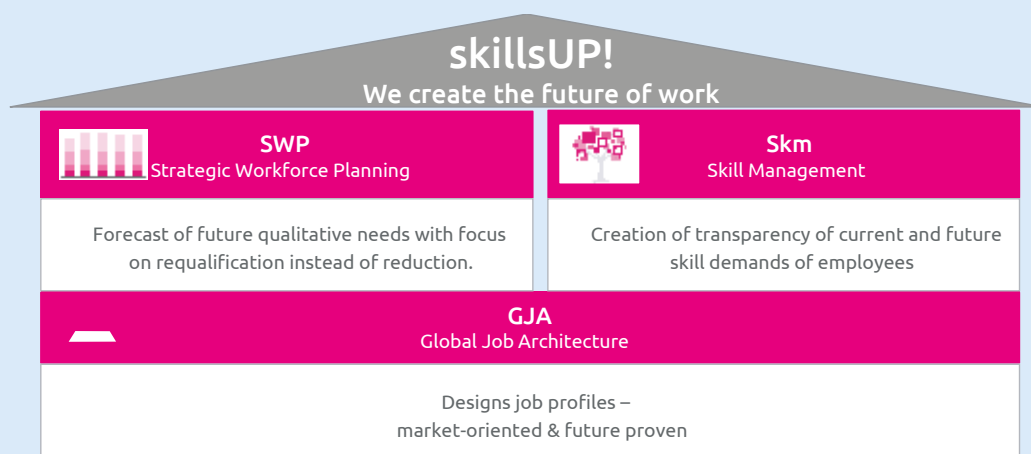■ **At individual level**: the employees within the organisation, and how they contribute to the overall strategy and success of the company, as well as for them to understand how they could develop their careers within the company in the best possible way.

Markus Lecke, Senior Manager for education policy and strategic education programs at Deutsche Telekom states: *'The SkillsUP! Is a comparable concept to Digital Capability Reference Framework. In our view such framework will be successful through an open dialog between managers and employees.'*

SkillsUP! – A corporate framework example from Deutsche Telekom

Deutsche Telekom realised that the consequence of shorter and steadily accelerating innovation cycles, also impacts their employees. A successful business strategy implementation requires a common global job architecture, a quantitative and qualitative planning and an IT-supported skill management process, which allows an easy way of potential analysis and deriva-tion of HR measures. The goal of the SkillsUP! Initiative was to establish a structured picture regarding future required skills of employees as well as the consequent derivation of re-qualification and recruiting needs. The framework accelerates future business, a passion for lifelong learning and employability.

skillsUP!
We create the future of work

SWP Strategic Workforce Planning	**Skm** Skill Management
Forecast of future qualitative needs with focus on requalification instead of reduction.	Creation of transparency of current and future skill demands of employees

GJA Global Job Architecture
Designs job profiles – market-oriented & future proven

Small and Medium Sized Enterprises (SMEs) account for roughly 99% of all en-terprises in Europe. More tools need to be made available for SMEs to stimulate digi-tal transformation and skills development. Undoubtedly, defining strategies for skills development must account for the hetero-geneity of the SME landscape. However, this is not the only aspect to consider. Within an enterprise, the profiles of employees are also heterogeneous: leadership, IT professionals, advanced users have different requirements. Their job activities, responsibility and future opportunities require different skill develop-ment strategies.

A digital capability reference frame-work helps SMEs to better understand – when deciding to invest in certain capabilities - what they need in terms of competences development and provides an overview of the relevant frameworks (and related certi-fication) for selection. SME's will apply a dif-ferent attitude compared to large enterprises when selecting frameworks. Small enter-prises will likely skip heavier frameworks and select what they really need (for instance from ITIL or Agile DevOps). A medium-sized company might already need more rigour around for instance programme and project management, architecture governance and security (and for instance add components of TOGAF, project management frameworks such as Prince2, PMBOK or IPMA, and secu-rity frameworks such as CISM or CISSP). The framework offers transparency and links to concrete tools.

'SMEs will highly benefit from a trans-parent view on capability and skills de-velopment. They need practical tools and instruments to move forward', ac-cording to Sebastiano Toffaletti, Secretary-General Digital SME Alliance.

The strong value propositions for certifications

Business leaders are working to transform their business, often employing digital technologies coupled with organisational, operational, and business model innovation to create new ways of operating and growing businesses. To be responsive to the need of the enterprise, IT organisations must accelerate the time to value of innovation all while optimising spending on IT. Sometimes being responsive to the needs of the enterprise means upgrading hardware or implementing new software, but upgrading skills and certifying staff will deliver the most persistent performance improvement in IT operations. Certifications contribute to increase genuine knowledge and professionalism. The value propositions for leveraging IT certifications seems clear to each stakeholder:

- **Individual**: IT certifications improve on the job performance, career success and advancement, and salary potential. Individuals in IT or who intend to make IT a career choice should identify and actively consider if certifications would support their career aspirations.
- **Enterprise**: IT certifications improve organisational IT performance, IT-hiring costs and increase in quality hires. If high quality certifications are available for the significant components of the infrastructure, enterprises of all sizes and in any industry, should consider the potential impact of more thoroughly integrating IT certifications into the career development program and new hire selection criteria.
- **Technology vendors and consultants**: Successful client projects, increased quality engagements and increased revenue. While the evidence is less clear, technology vendors that support greater knowledge on the part of their partner consultants are likely to be rewarded with more satisfied clients, and more successful implementations of their technologies.

Certifications are often based on IT organisational and management frameworks. These represent an established de facto norm and are a repository of specifications, procedures, guidelines in a certain domain. They are designed to ensure processes, methods, services and systems are safe, reliable and consistent. Frameworks provide a uniform language. They also increase performance of the workforce and hence contribute to achieving the organisation's strategic goals.

'There are no short-cuts to properly trained IT professionals', says Zane Schweer, Senior Marketing Manager at Global Knowledge: *'Skills development should not be considered a 'Laissez-faire Affair'; however, it seems to be the current practice in many organisations. Enterprises need to proactively build cultures of learning, and an easy first step is certification. Certifications are key in validating skills and maximizing technology investments.'*

The importance of strengthening IT professionalism

In light of anticipated skills shortages and increasing risks for society, leading stakeholders regrouped under the IT Professionalism Europe (ITPE) network and announced a declaration to further maturing the IT profession by 2025. ITPE invites all relevant stakeholders to join their efforts to support this initiative.

Damien O'Sullivan, Chief Executive at the ECDL Foundation & ITPE, emphasises its importance: *'There is a clear need to develop and mature the IT profession and improve its status in Europe, in the context of and with the support of major EU policies. This ITPE Declaration is a call to action in order to advance IT professionalism in Europe.'*

Recognising that the world is being changed profoundly by the digitalisation of the economy and society, and that today's working conditions and job dynamics are set to change significantly, ITPE members are convinced that it is imperative that IT professionalism receives greater focus and priority in Europe as well as globally. ITPE members, including experts from industry, education and training institutions, social partners, professional associations, public authorities etc., want to build a large community for the promotion and the adoption of the highest standards that apply to the IT profession.

To this end, it will:

- Support the development, adoption and maintenance of the highest standards for the IT profession by 2025;
- Foster an open dialogue about IT professionalism and disseminate good practices;
- Contribute to raising awareness of the attractiveness of a career in IT and the available opportunities;
- Invite key stakeholders (especially from the demand side) to promote the IT profession and its benefits for society; and encourage policy makers to give IT professionalism a greater priority;
- Support communities that promote a shared vision of the IT profession at all levels.

The way forward: recommendations for action

This initiative on developing a Digital Capability Reference Framework concluded with a high-level conference on Digital Transformation and IT Professionalism. The conference was a contribution to the success of the EU Skills Agenda, provided new insights into current and future IT professionals' skills gaps as well as concrete solutions to increase the EU talent pool and the digital capabilities of enterprises in all sectors. The event discussed major themes addressing the digital maturity levels of enterprises and SMEs, and the shortage of IT professionals and digital leaders. Over 150 experts from industry, education, government and associations from across Europe participated. Speakers included Chief Information Officers (CIOs) of leading European enterprises and associations, European Commission officials and experts in the field of digital skills and capabilities development and IT professionalism.

There is work to do however in moving forward, and the following recommendations are made:

- It is pivotal to further mature the IT profession to avoid that the risks to society from IT will grow to unacceptable levels (IVI/CEPIS). This starts with ensuring everyone working in IT followed, and continues to follow, proper education to acquire relevant competences, knowledge and skills and keep up-to-date with developments, while behaving according to recognised ethical norms. The work done by the CEN TC428 in creating and updating the relevant standards has been valuable, and further work to contribute to areas such as e-Competence performance indicators and metrics, professional code of ethics, and e-Curriculum guidelines is timely and needed. Practical applications of the standards should be promoted and support broader adoption of these standards.
- While the IT workforce is growing, most of the new specialists are coming from lateral entries (without a background in computer science). There is hence a need to further develop a fully-fledged IT education to meet the growing IT skills demand, and to ensure it is clear to employers what the level of experience and education of potential employees is. Cross-sectoral cooperation should be promoted to establish synergies.
- There is a need to make the certification market more transparent and allow SMEs to understand which certification can be trusted and what the certification brings for the enterprise. Quality labels, or similar, based on recognised standards (e-CF and domain-specific bodies of knowledge, as well as existing public private partnerships in areas such as cybersecurity, big data and IoT) could be a means to achieve this goal.
- New education system is the biggest source of talents, innovations and jobs. To match the increasing demand for IT professionals on the market, and for domains such as cyber security and software development in particular, a radical education system disruption is needed to change the course and policy. Increased collaboration with industry to align offerings with market needs, to embed industry expertise in courses, and to better facilitate other users than students to facilitate the up- and reskilling of the workforce.
- Software development and engineering is one of the most important capabilities for organisations. There is a need to move towards a focus on creation rather than usage; software 'creation' to become really innovative, globally competitive and successful in the market today and in the future.
- While the numbers of SMEs that send their employees on training are astonishing low (approx. 10%), and there are vari-

ous studies clarifying why SMEs don't, it is not researched extensively how SMEs select training relevant to their business and what their motivation is. This could help to increase targeted communication about relevant courses as well as to re-consider current course structures.

Further maturing the IT profession also requires an increased focus on the ethical aspects. *'Maturing the IT profession is pivotal and especially now, Europe should apply a greater focus on the quality and the ethical values of the professional workforce that develop, install and maintain IT technology solutions to balance the current diverse, fragmented and immature regulation of IT services and activities*. A common 'ethics' language will add value, in the same way that the e-CF offers a common language about competences', says **Juan Pablo Peñarrubia**, president of the Spanish Association of Informatics Engineers.

The proposal for a Digital Capability Reference Framework for enterprises offers a coherent approach to help enterprises to take advantage of the opportunities offered by digital technologies. It illustrates the connection between capabilities and competences to support organisations in creating competitive advantage and describes how strategies for improving digital organisational capabilities of enterprises could be developed, together with IT competences development – and the relevant connection with IT-CMF that allows for a more effective development of digital organisational capabilities.

The work obviously does not start here, and various actions are required to promote adoption of the framework and to ensure its development over time:

■ Sustain the framework by transferring ownership to the community of ITPE and in particular build on the expertise in CEN and the TC428.

■ Promote the framework via the relevant communities, and events. A single point of access to information about this initiative and its deliverables as well as to various other studies and sources is highly advisable. The prototype tool to provide users with access to all the mappings in an intuitive and usable way could be further developed, combining content from e-CF and other relevant models.

■ Measure. Design an integral assessment to enable comparison and monitoring of the transformation.

■ Continuously improve the framework and its content from an open dialogue with users to capture lessons learned, and by collaborating with relevant stakeholders such as IT-CMF, knowledge foundations and communities of practice maintaining the IT frameworks and standards, and with certification providers.

A final reflection on this initiative forward: recommendations for action

This initiative presents a digital capability reference framework focused on how digital transformation of enterprises can be enabled by IT competences and professionalism at individual level and digital organisational capabilities at enterprise level. It offers a coherent approach to help enterprises to take advantage of the opportunities offered by digital technologies.

Enterprises, especially SMEs, still find it difficult to build strong digital capabilities to take full advantage of new technologies. Enterprises are more and more realising that they need to change and realise that agility is required to be able to keep up with a fast-changing environment. It is important to understand how organisations can continuously derive and leverage value through IT, and what mechanisms achieve repeated and sustained value for the organisation. Digital skills and digital leadership drive innovation and growth of European enterprises, but shortages of all kind hinder that development. This requires continuously prioritising actions to close existing gaps.

'The challenge of the digital talent gap is no longer just an HR issue; it is an organisation-wide phenomenon that affects all areas of the business', states Niels van der Linden, Principal Consultant at Capgemini Invent, and project lead of this initiative. 'We were very pleased to be awarded with this a service contract by the EASME to support this work in cooperation with stakeholders and in synergy with other relevant activities including those of the Digital Skills and Jobs Coalition and the European Committee for Standardisation (CEN) on IT professionalism in Europe.'

Our work reached out to a very broad community of stakeholders and experts to gather their views, and support for this initiative.

Numerous activities were conducted during the course of our work: in-depth interviews, online surveys, desk research and a series of four workshops - as depicted in the figure. This initiative on developing a Digital Capability Reference Framework concluded with a **successful high-level conference on Digital Transformation and IT Professionalism, held on 15 November 2018 and gathering over 200 participants.**

The results of the deployed activities can be found in the comprehensive final report.

We are very proud on the results accomplished, and greatly appreciate all the support and collaboration with so many committed, engaged people across the world. It could not have been done without them. We hope you enjoy the reading!

Contact Information

For further information, please contact:

European Commission

European Commission

Executive Agency for Small and Medium-sized Enterprises (EASME)
Department A – COSME, H2020 SMEs and EMFF
Unit A1 – COSME –Sector A1.4 - Entrepreneurship

DG for Internal Market, Industry, Entrepreneurship and SMEs
Unit F2 for Advanced Technologies, Clusters and Social Economy