



Skills for Industry

High-Tech Skills: Scaling up best practices and re-focusing funding programmes and incentives

Final Report

EUROPEAN COMMISSION

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Executive Agency for Small and Medium-sized Enterprises (EASME)

Department A – COSME, H2020 SMEs and EMFF

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EASME/COSME/2018/016

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Executive Summary

The competitiveness of industry in Europe is dependent on the effective use of new technologies and the knowledge, skills, competences and creativity of its workforce. Shortages, gaps and mismatches in high-tech skills negatively affect innovation, productivity growth, job creation and social cohesion. Estimates of the number of jobs that will be lost to automation over the next decades have been alerting policy makers and the public. Although the numbers differ by author and scenario, there is a broad consensus that many of the tasks carried out by workers today are likely to be automated in the not too distant future. As jobs change in their task content at an accelerating pace, and as new jobs emerge, policy makers must help industry and workers to keep pace with fast-changing skills requirements. This calls also for large-scale multi-stakeholder partnerships and re- and upskilling initiatives, as well as a clear view of the way lifelong learning should be funded, managed and incentivised to become a reality for all.

In their report¹ on Education on the digital era: challenges, opportunities and lessons for EU policy design (2018), the European Parliament Committee on Culture and Education indicated that it “supports the increased funding available for digital skills across the next generation of Multiannual Financial Framework programmes”. However, it also “insists on the need to deliver synergies across programmes to maximise the effectiveness of funding for digital skills development and deliver lasting results”. The Committee also stresses the importance of setting up education and training programmes between industry and training providers that are more cooperative and give greater importance to re-skilling and up-skilling efforts. It calls for a “shift towards more on-the-job learning and insists on the need to have the right education and training frameworks in place, and to ensure that vocational education systems are properly resourced; believes that opportunities for re-skilling and up-skilling are essential, with relevant digital skills components mainstreamed in workplace training programmes”.

Key Findings

The objectives of our work were to benchmark public policies and funding programmes for high-tech skills development², to identify good practices and to make concrete recommendations for scaling up best practices and re-focusing funding programmes and incentives in Europe. Our definition of high-tech skills encompasses the skills needs related to digital technologies and a group of six key enabling technologies including advanced manufacturing technologies; advanced materials and nano-technologies; life science (as a broader definition of industrial-biotechnology); micro- and nano-electronics and photonics; artificial intelligence; security and connectivity.

The analysis of 70 of the most promising high-tech skills initiatives out of 270 identified in ten European countries revealed that there are very promising and successful examples showing how to make Universities (e.g. [Expertkompetens](#) in Sweden) and VET institutions (e.g. [Katapult](#) in the Netherlands) efficient re- and up-skilling players. At the same time, our analysis confirmed that the funding landscape is still very fragmented throughout Europe, leading to significant inefficiencies and duplication of effort. Long-term sustainability of funded projects is very often lacking.

Consultations with experts (workshops, interviews and survey) revealed that there is an important need for a clear vision and strategy (4.3 on a scale from 1 to 5), leadership and commitment (4.2). Experts demand more evidence-based initiatives with stronger industry engagement. Scaling is seen as a crucial factor since the vast majority of projects are reaching piloting or demonstration phases with no or little capability/ambition for large-

¹ See: http://www.europarl.europa.eu/doceo/document/A-8-2018-0400_EN.html

² Including public private partnerships.

scale rollout plans. Major barriers include the lack of business and funding models to enable them to become large-scale players in cooperation with industry. In addition, on the supply side, many Universities lack entrepreneurial spirit and remain reluctant to take an additional role in lifelong learning and professional further education and training.

Experts strongly believe that funding should be available for longer-term public-private-partnerships with strong scaling potential to create significant impact. A competitive and coherent model with sufficient funding and multiple levels of intervention (EU, national, regional and city level) of fewer promising initiatives and best practices is preferred to the *watering can* model of larger number of small projects with modest funding. Those who deliver successful scalable results should be further supported while those failing the test should be terminated as soon as possible. Increased funding for successful scalable initiatives is seen as a way to overcome the virtual *valley of death* and to create large impact. There is a growing need for demand driven and industry led initiatives including strong elements of co-creation and co-delivery with education and training organisations.

The motivation for continuous education and training and life-long-learning is not very prevalent among the European workforce. In 2018, adult participation in company provided training is at a mere 11% on average in the EU. The same holds true for businesses whose willingness to pay employees for re- and up-skilling remains at low level. Moreover, only 23% of companies provide training to their staff³. Different types of incentives – whether financial or tax-related – have shown successes. They are not available in all EU Member States and not easily accessible, which makes them invisible to a significant number of European employees. Several types of incentives – whether financial or tax-related – have already proven their success. However, they are not available in all EU Member States and not easily accessible, which makes them invisible to a significant number of European employees. For example, individual learning accounts offer the opportunity to empower working-age adults to equip themselves with the skills needed to support their employability. They provide a new vehicle for funding continuous learning. This kind of solution has been implemented in 2016 in Singapore, where the [SkillsFuture Credit](#) aims to encourage individuals to take ownership of their skills development and lifelong learning.

SMEs constitute an underserved market in need of a low threshold skills transfer to improve operation and remain competitive. Scaling up best practice funding programmes based on vouchers could help to address this demand. There is little knowledge about available funding to the widely underserved and untapped markets for high-tech talent creation including women, disadvantaged groups and youngsters struggling with today's education and training systems. There is little knowledge about available funding to the untapped groups for the creation of digital talent, including women and youngsters struggling with today's education and training systems. Innovative initiatives such as [Code](#) in Germany, [Generation](#) in Spain, [École 42](#) and [La Grande École du Numérique](#) in France show how these groups can be addressed. Examples like these need viable business models to become significant training pathways.

³ Eurostat: https://ec.europa.eu/eurostat/statistics-explained/index.php/Adult_learning_statistics and http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=isoc_ske_itn2&lang=en

Facts and Figures

The demand for high-tech skills is on a solid growth track compared to the supply, which is notoriously insufficient. Demand for high-tech skills is on a solid growth track compared to the supply, which is insufficient. Employers, especially from small and medium-sized enterprises (SMEs), have great difficulties to find employees with relevant high-tech skills. A survey conducted in 2018 revealed that 92% of experts agree that there are difficulties for employers in their country to find employees with new relevant high-tech skills. It is estimated that the shortage of IT professionals could reach 749,000 in 2020. Making projections until 2030 will be a challenge as a report from the Institute for the Future⁴ indicates that 85% of the jobs that will exist in 2030 have not been invented yet.

A McKinsey survey⁵ highlighted that business executives increasingly see investing in retraining and up-skilling of existing workers as an urgent business priority. Addressing skills gaps is seen as the top or one of the top priorities in large enterprises both in the United States and in Europe. For almost 30% of enterprises this is among the top five priorities, and for a further 50% it is among the top ten priorities. Over 80% of corporate executives believe retraining and re-skilling must be at least half of the answer to addressing their skills gap. Research by the McKinsey Global Institute found out that by 2030, the time spent using advanced technological skills at work will increase by 50 percent in the United States and by 41 percent in Europe, and time spent using even basic digital skills will rise by 69 percent in the United States and by 65 percent in Europe.⁶ By 2030, according to the further a recent McKinsey Global Institute report⁷ as many as 375 million workers—or roughly 14 percent of the global workforce—may need to switch occupational categories as digitization, automation, and advances in artificial intelligence disrupt the world of work. The kinds of skills companies require will shift, with profound implications for the career paths individuals will need to pursue.

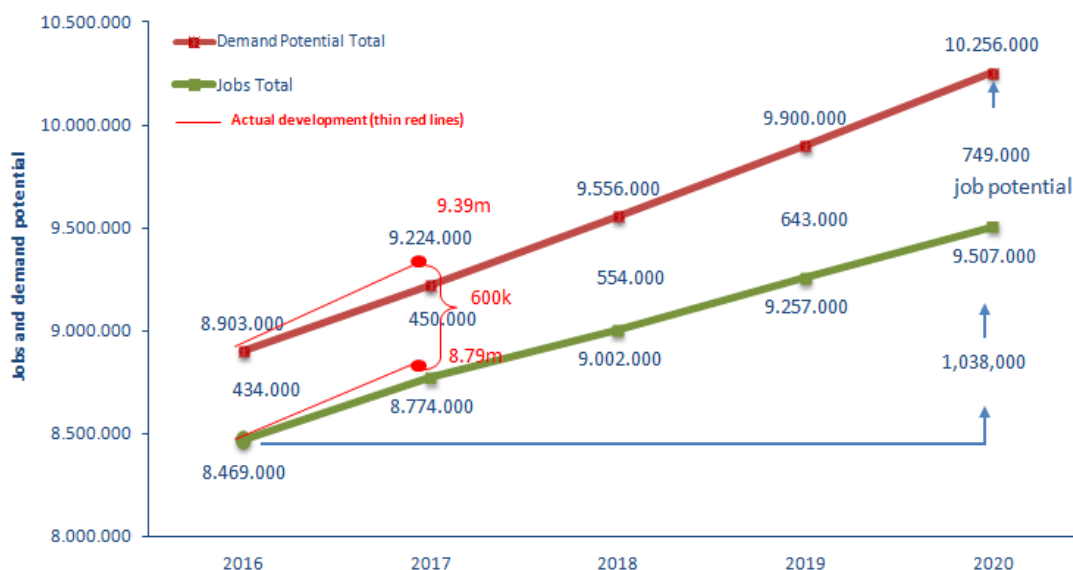
⁴ Institute for the Future (2017): “The next era of human machine partnerships - Emerging Technologies’ Impact on Society and Work in 2030”.

⁵ Pablo Illanes, Susan Lund, Mona Mourshed, Scott Rutherford, and Magnus Tyreman, McKinsey Global Institute: Retraining and reskilling workers in the age of automation, January 2018

⁶ Jacques Bughin, Eric Hazan, Susan Lund, Peter Dahlström, Anna Wiesinger, and Amresh Subramaniam: Skill shift: Automation and the future of the workforce. Discussion Paper - McKinsey Global Institute - May 2018

⁷ James Manyika, Susan Lund, Michael Chui, Jacques Bughin, Jonathan Woetzel, Parul Batra, Ryan Ko, and Saurabh Sanghvi: Jobs lost, jobs gained: What the future of work will mean for jobs, skills, and wages. Report - McKinsey Global Institute - November 2017

Supply and Demand of IT Professionals in Europe (2016-2020)⁸



A 2017 executive survey confirmed that respondents are increasingly seeing investing in retraining and up-skilling of existing workers as an urgent business priority. They also believe that this is an issue where businesses must take the lead. Addressing potential skills gaps is seen as the top or one of the top priorities in the large private-sector organisations interviewed in the US and Europe. For almost 30% of companies this is among the top five priorities and in a further almost 50% it is among to top ten priorities. The study report continues by stating that “... 82 percent of executives at companies with more than \$100 million in annual revenues believe retraining and re-skilling must be at least half of the answer to addressing their skills gap. Within that consensus, though, were clear regional differences. Fully 94 percent of those surveyed in Europe insisted the answer would either be an equal mix of hiring and retraining or mainly retraining versus a strong but less resounding 62 percent in this camp in the United States. By contrast, 35 percent of Americans thought the challenge would have to be met mainly or exclusively by hiring new talent, compared to just 7 percent in this camp in Europe”⁹.

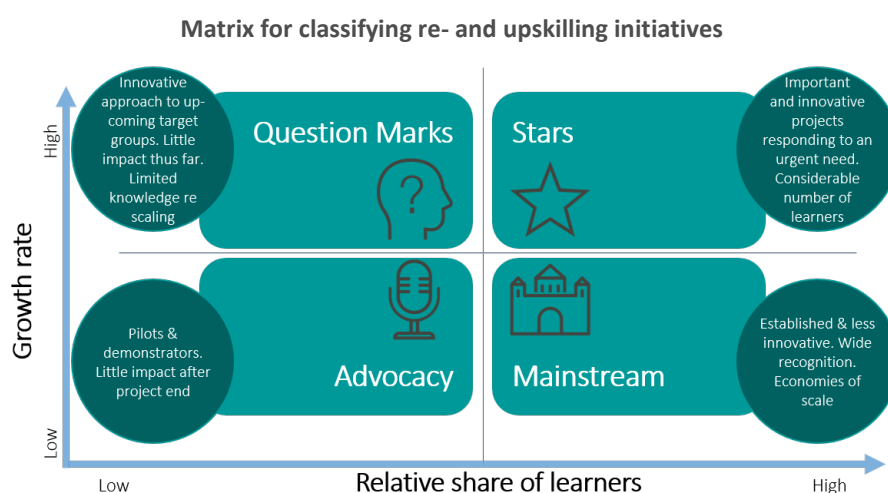
⁸ Source: Capgemini, empirica and IDC, 2018

⁹ Pablo Illanes, Susan Lund, Mona Mourshed, Scott Rutherford, and Magnus Tyreman: Retraining and reskilling workers in the age of automation. Article - McKinsey Global Institute - January 2018

Good Practices at a Glance

Positioning good practice initiatives in a matrix makes it possible to distinguish four basic types according to their impact in the labour market and along two axes related to their (x) “relative share of learners” and (y) “growth rate”. In analogy to a sound management of investment, one can derive recommendations for decision taking for scaling regarding the performance and growth potential of projects and initiatives in each of the four quadrants. Recommendations derived from this approach are the following:

- To fund an initial portfolio of a large number of (small-scale) advocacy initiatives (based on calls for proposals) to pilot and demonstrate new approaches and test if they might generate promising results when scaling them up. Conceptually being a risk sharing approach where results cannot be predicted but success of some is the result of testing many, one should expect a portion of these to become “question marks” and a smaller portion eventually success stories;
- To sustain question marks initiatives for some time for experimentation with the hope for at least some of them - supported through relevant investments - would evolve into the “star” quadrant. Spotting the future stars among question marks involves some risk and requires solid judgment and clear evidence;
- To nurture leading star initiatives to keep their edge. They are to be developed to transitioning to larger scale mainstream offerings to address the re- and upskilling needs of the workforce. This may require further selection and ongoing investment.
- To further support mainstream offerings to be integrated in the broader education and training systems to meet the goals of re- and upskilling a large proportion of the workforce before being complemented (and eventually replaced) by better and more efficient offerings coming from “stars” and “question marks” quadrants.
- In the analysis, it became apparent that a large number of funding programmes are supporting initiatives to be classified as advocacy. Several of these serve the purpose of advocating the topic of re- and upskilling for specific target groups. They are initiatives with small or moderate levels of funding. Training is carried out for a limited number of individuals, and scaling is not the main objective since their focus is on research, awareness raising and promotion.

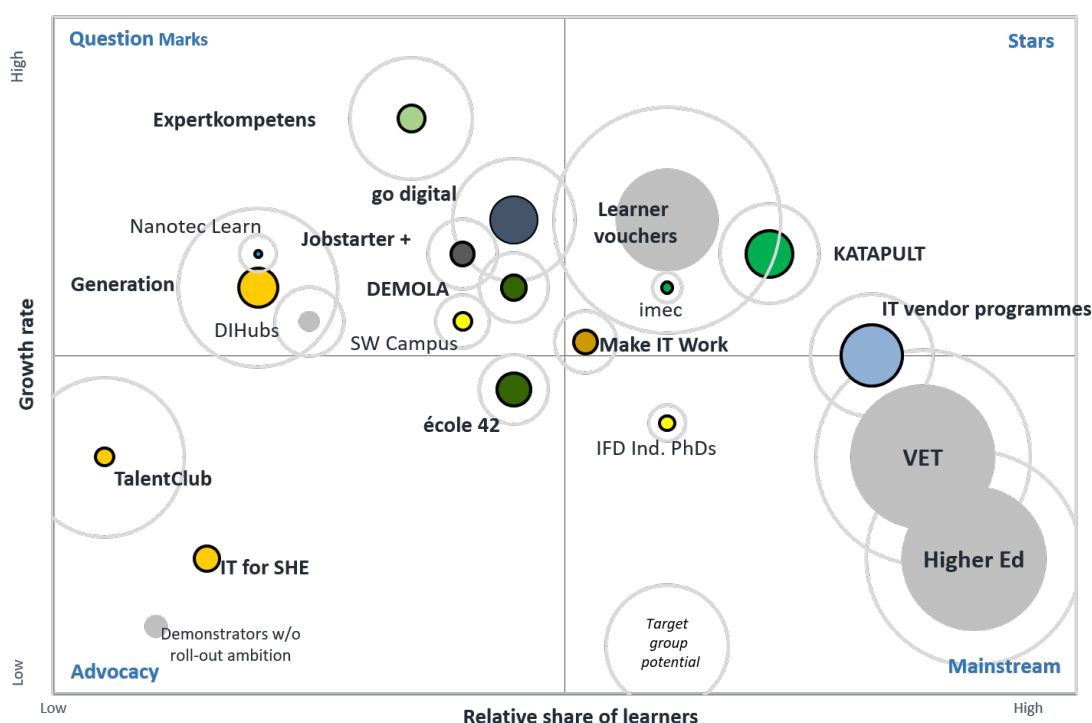


Disruptive initiatives such as École 42, which are following completely new education and training approaches, are for the time being to be found in this category. It is still too early to judge their success and potential impact since their current funding is based on investment by a donor. However, it could have the potential to be developed into a scheme to serve groups of people some distance away from education and training, e.g. socially under privileged, school dropouts, and in this way close a gap. The initiatives in the question marks quadrant have come up with good results but show no or very limited scaling ambition or impact. Again, funding and

investments per case are moderate. It is in this category where some change is needed. These could best be implemented through so-called “complementary or growth funding programmes”. This has been confirmed by numerous experts.

Only very few stars could be identified. These are of very different types. For example, Katapult in the Netherlands was set up as a cooperation initiative of formerly disconnected actors under a shared goal and innovation ambition pushed by a small team of experts. The additional costs for this team are small, but through this cooperation Katapult managed to leverage large sums coming from all the actors involved and scale up its operation nationwide, with around 150 training centres throughout the Netherlands in less than ten years. Learner voucher schemes - which exist in Germany, France and elsewhere - appear worthwhile and a functioning instrument addressed to individuals and paid for by governments. The investment level per individual is low but the impact can be large. In order to promote the use of this instrument among a larger number of beneficiaries, further awareness raising and promotion efforts are needed. It should help persuade employees that further training is necessary.

Indicative distribution of good practice examples in the matrix

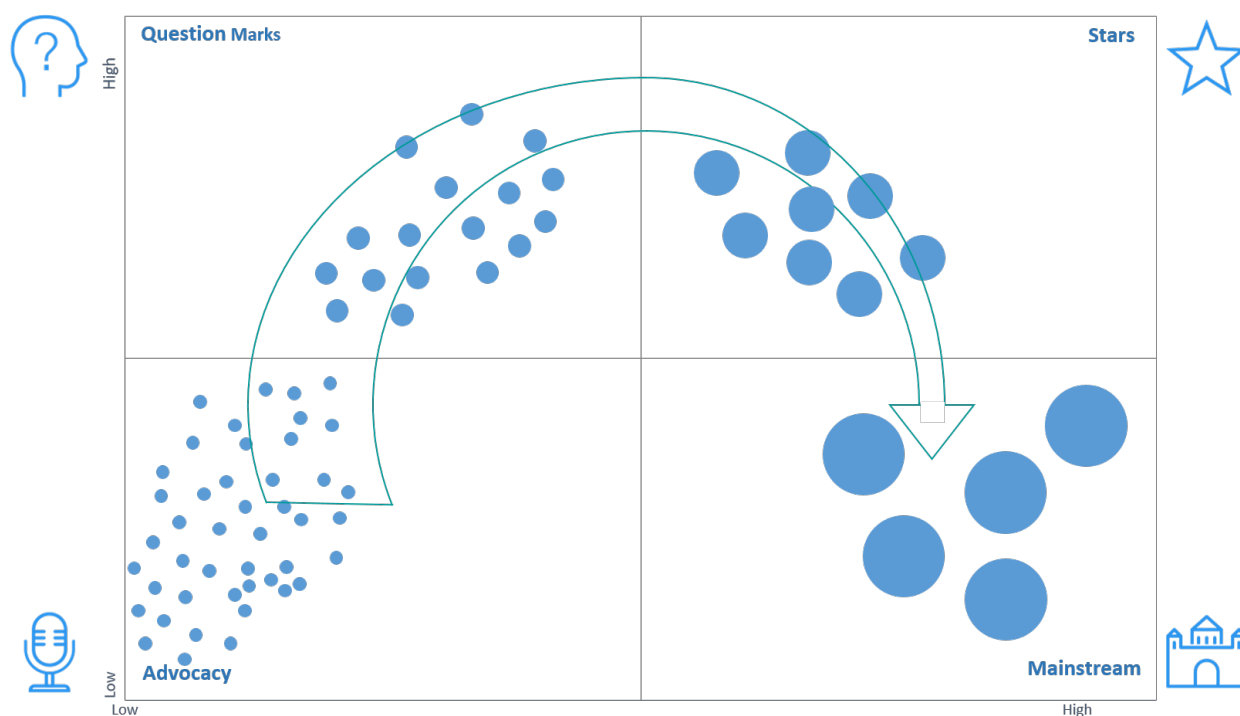


The formal education and training systems in the EU Member States and IT vendor programmes can be described as mainstream, operating in a well-established environment with moderate competitive pressure and benefiting from economies of scale. Several large IT vendor programmes (e.g. Cisco Networking Academies) are part of or adjacent to this quadrant. Interestingly, many of the programmes and initiatives from earlier life cycle stages can be seen and used as modules for injection into the formal education and training systems to bring innovation and make them fit for purpose in an increasingly rapidly evolving environment.

Funding and investment should be able to support initiatives through the different stages of growth, which are those of a life cycle model. The matrix analysis exercise is helping to:

- Reveal the most promising and successful initiatives;
- Highlight the funding needs at different stages to scaling up good practices;
- Recommend how to push them forward and support good practices throughout their life cycle depicted in the following figure (see figure ‘funding life cycle’).

The stages of growth: funding life cycle for scaling-up initiatives



There are numerous funding programmes at EU, national, regional and local levels. With current funding programmes, many (promising) initiatives do not reach beyond the two initial advocacy and question marks stages. Funding intervention at multiple stages with greater complementarity and coordination mechanisms at all levels would be necessary to make successful and promising initiatives move into stars and mainstream stages with a view to scaling them up and achieving big impacts. These mechanisms are not in place in the current funding programme landscape, resulting in many promising projects entering a valley of death similar to that of many start-ups missing scaling-up funds.

In order to stay upfront, European education and training systems depend on the capability for regular and continuous innovation. These typically need to be nurtured and integrated into the mainstream with a view to supporting large-scale re- and upskilling initiatives and progressively making lifelong learning a reality for all. Different types of funding programmes and incentives for high-tech skills re- and up-skilling were identified. They offer a wide range of funding approaches as well as public and private instruments. These include in particular:

- Centre-based VET (vocational education and training) co-design and delivery together with industry. It includes government, education and training institutions as well as private corporations investing in training of the workforce through centres of expertise in VET;
- Programmes offered by universities and co-created with industry in a new role of professional training providers (professional Master programmes);
- Programmes funding the development and delivery of new high-tech skills apprenticeship modules added to traditional apprenticeships to generate VET graduates with high demand in the market;
- Excellence schemes addressing new demand for digital leadership skills, career change and development programmes offering attractive re- and upskilling courses jointly financed by companies and learners after initial funding;
- Voucher-type funding programmes aimed at low threshold high-tech skills for SMEs;

- Disruptive peer-to-peer high-tech skills training following new and innovative pedagogical models and offering an alternative entry point to new jobs;
- Inclusive digital training schemes addressed to unemployed young people;
- Activities aimed at the innovation ecosystem creation combining the talent of students with company R&D and with student teams solving a real-world company problem.

It became clear that from the EU countries analysed, the Netherlands, Sweden, Germany, Denmark and France are most active, followed by Finland, Belgium and Spain.

A new dynamic, multi-stage funding intervention model could help to overcome the **valley of death**. The various funding programmes existing at EU, national and regional levels would need to be more complementary in their intervention (in line with the subsidiarity principle) and contribute to scale-up of successful initiatives and rollout of wider uptake and adoption of best practices. This idea was already presented in the Skills Agenda for Europe (June 2016) in the [Blueprint for Sectoral Cooperation on Skills](#), which is piloted in several sectors since 2018 through sectoral skills alliances at EU-level. Each partnership develops a skills strategy for the sector and matches the demand and supply of skills. Partners identify priorities and milestones for action and develop solutions, such as creating and updating curricula and qualifications based on updated and new occupational profiles. Building on the results achieved at EU level, the Blueprint will be progressively rolled out at national and regional level, in cooperation with national and regional authorities, and key stakeholders, and with relevant exploiting synergies with regional smart specialisation strategies. By further improving and refining this approach one could leverage the testing and validating of a large number of small-scale projects before enabling the allocation of more substantial and complementary funding, ensuring critical mass to initiatives with proven results to scale them up.

To mobilise efficiently funding programmes and incentives to scale-up best practices, a set of policy recommendations have been developed. Five modules will serve to guide policy makers and stakeholder groups at all level to design and implement their own strategies, programmes and initiatives in line at EU level with proposals of the Commission in the new multiannual financial framework¹⁰ (2021-2027).

¹⁰ Several proposals for EU funds and programmes over that period could support actions on skills: Asylum and Migration Fund; Digital Europe; European Agricultural Fund for Rural Development; European Globalisation Adjustment Fund; European Maritime and Fisheries Fund; European Regional Development Fund; European Social Fund +; Erasmus; Horizon Europe; InvestEU; Just Transition Fund; Reform Support Programme; and Single Market Programme.

Recommendations

To mobilise efficiently funding programmes and incentives to scale-up best practices a set of policy recommendations have been developed. Five modules will serve to guide policy makers and stakeholder groups at all level to design and implement their own strategies, programmes and initiatives in line at EU level to the new funding programmes and structural and regional development funds (2021-2027). The recommendations encourage the launch of forward-looking, scalable and sustainable multi-stakeholder partnerships and agile re- and up-skilling initiatives. They encompass:

1. **Vision and long-term strategy: Develop a compelling vision for scaling-up re- and up-skilling programmes, and a long-term strategy to stimulate greater investments at EU and national level to create a bigger impact.**

Europe is missing a compelling vision and longer-term strategy in the area of high-tech skills development and of the re- and up-skilling the workforce. The same holds true for national vision and strategy development at Member State level. 86% of experts surveyed agree to the need for a compelling vision for scaling-up re- and up-skilling funding programmes and initiatives aligned with a longer-term strategy and commitment of all stakeholders and policy levels concerned. And 72% of experts are in favour of funding based on an inclusive approach to reduce inequalities. It is recommended that the vision should be based on the demand of industry and labour markets, with a focus on scalability and sustainability, complementarity and close cooperation at EU, national and regional levels, and should aim at world-class performance and best practices. It should also be inclusive and address target groups, e.g. diverse groups of people, women (who are under-represented in high-tech education and jobs) and youngsters struggling with the traditional education system. It should include better counselling and mentoring for smoothing the entry of underrepresented groups in high-tech professions.

2. **Scalable multi-phase funding programmes and initiatives: Multi-stage funding intervention based on the lessons learned from best practice cases allowing for differentiated funding of initiatives' life cycle with upfront-defined KPIs, scaling ambition, rollout and business plans.**

Higher education and VET providers could become larger re- and up-skilling players by operating under new organisational and business models. Funding programmes intervention targeting the operation and growth phase of training programmes and courses should be planned. This re-quires reconsidering the traditional scope of funding intervention and extending it beyond piloting activities as well as learning from existing best practice examples to avoid duplication and aim for excellence.

Funding intervention will need to have a clear focus. A new project or initiative will need to have a credible work plan, business and rollout plan, commitments from key stakeholders, especially from industry to buy and use the training solutions developed. It also will require the relevant management capacity and expertise for fully-fledged operation and clear KPIs and success criteria to be reached within a given time. Policy makers at EU and national level should put on a map the positioning of their (future) funding programmes to foster better coordination and complementary intervention allowing efficient funding of scalable re- and upskilling initiatives. For example, support of ESF+ funding to support growth and operation of successful Blueprints and relevant training initiatives is recommended.

82% of experts are in favour of a multiple-stage funding model to unlock additional funding for growth and to accelerate scalability and impact. Funding should address both the development and growth stages of training solutions, with a differentiated funding intervention at the various stages of the life cycle of initiatives. Funding programmes should focus on initiatives with measureable KPIs, rollout and business plans. Universities and VET institutions need to be encouraged to play a greater role in re- and up-skilling efforts under new business models. 70% of experts argue for an annual assessment and ranking of initiatives according to an agreed set of KPIs with awards and go/no-go decisions. This would help to reallocate resources if and where necessary. 73% argue for the reallocation of funds from failing initiatives to those,

which are performing well. Finally, 79% indicate that current calls for proposals do not offer sufficient time for setting-up strong partnerships. Evaluation and contracting should be processed faster

- 3. Massive investments and better ways of funding: Business leaders and policy makers are to prepare for substantial investments in skills development as well as re- and up-skilling funding initiatives following a multiple stage funding intervention model with a focus on growth and scale. It should include the wider promotion of successful voucher and excellence schemes, development of a world-class curriculum and proposal of Individual Learning Accounts. New programmes and incentives also need to address underserved and untapped markets (women, diverse groups, SMEs) and enable disruptive schemes to become alternative pathways in addition to mainstream education and training systems.**

Europe should be prepared for greater investments at EU and national level to create an impact. It will require EU investment for initiatives of common European interest in strategic areas, leveraged at national and regional level, and a dynamic funding approach with a focus on growth and scale. There is unanimous agreement among experts of the need of large-scale investments in re- and up-skilling in Europe. 84% of experts argue that high-tech skills funding should be integrated in a coherent way in the future EU financial framework (2021-2027). 81% of experts see co-creation and delivery of re- and up-skilling initiatives between industry and training providers as a must for effective funding programmes to be operated through a one-stop-shop. It is the most favoured option to counter negative effects stemming from the fragmented and dispersed funding programmes landscape. Moreover, 86% of experts express a strong need for reviewing and simplifying funding rules to be more inviting for industry partners to take part.

Vouchers and excellence schemes should be further promoted when proven successful. In addition, Individual Learning Accounts (ILA) could offer opportunities to empower adults to equip themselves with the skills needed to support their employability. While not constituting a panacea, they could contribute usefully for funding continuous learning if relevant training solutions, counselling, and coaching are available. The European Commission through its Structural and Investment Funds (e.g. ESF+) could help the setting up of ILA schemes at national level specifically for training for priority skills or strategic sectors (e.g. high-tech and green skills). Only 55% of experts see (student) loan systems as fit for purpose. However, there is an argument for exploring the topic of income sharing agreement loans. It could be seen as an additional incentive for the creation of a stronger solvent demand for innovative training solutions. 72% of experts argue that funding should follow an inclusive approach. Underserved and untapped groups struggling in the formal education system should be addressed and an evaluation carried out to identify ways for disruptive schemes following new pedagogical models to become an alternative pathway complementary to existing mainstream education and training systems.

Experts recommend investing a smaller level of funding budget for projects and initiatives in the advocacy stage, more substantial funding for the question mark stage (explore and demonstrate) and a greater level of funding for the small number of star initiatives reaching the star stage (grow and prosper). Funding for those described in the mainstream stage should mainly come from indirect funding schemes to be made widely available in Europe and targeting learners such as individual learning accounts, insurance schemes and further incentives such as income sharing loan agreements. Future funding programmes and financial instruments at EU, national and regional levels should allow the intervention of funding at multiple stages and at different levels in a complementary and well-coordinated way. It should move away from the 'watering can' funding of multiple projects which at best can reach a piloting or mini demonstration phase with limited sustainability of efforts and quasi-absent scalability opportunity – and, as a result, little impact on the European workforce.

Today no satisfactory solutions exist to finance individual adult high-tech training. Some country-specific offers exist that provide individual financing (such as learning vouchers in Germany and "compte personnel de formation" in France). Further public or private financing options are specific local offers with no or little potential for portability in case of professional and geographic mobility. And the conditions for bank loans

are not very attractive for individuals. There is a need for action since many adults are in need of re- or upskilling. Potential learners often do not have the financial capacity to upfront fund a training course at costs typically between 5,000 - 15,000€, nor can they borrow from a bank easily. At the same time, SMEs that need to recruit are not ready to finance training since they run the risk of the recently trained employee leaving the company and pursuing a career elsewhere. Clearly, the topic of individual incentives (individual learning accounts and income sharing loans agreements) should be further explored.

4. **Means to guide future policy development: Develop policy briefs and guidance for policy makers aimed at a better integration in the future of new learning principles into education and training, career path tracking to better understand labour market, demand for skills, workforce credentialing alternatives to formal qualifications for quality assurance purposes and recognition of skills of job applicants. Guidance is also needed for practitioners for the integration of re- and up-skilling initiatives co-created and co-delivered with industry and third parties.**

Means to guide future policy development include the recommendation for a feasibility study on the integration of new learning principles and pedagogies, a study to develop methods for career path tracking, and further activities towards additional low-threshold workforce credentialing. 81% of experts would like to see activities started to identify ways of integrating newly developed re- and up-skilling programmes into an existing formal education and training eco system.

Career path tracking is seen as an important approach for obtaining more information on the skills background of professionals needed in the market and for best understanding developments for necessary actions to be taken by relevant stakeholders. Despite the stagnating figures of ICT graduates over recent years, industry has managed to compensate for 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 short-term training courses, this development could become a problem in terms of IT professionalism. Nevertheless, they seem to fill a gap but very little is known about the qualification background of lateral entries. Career path tracking of high-tech workers is seen as an urgent need to obtain more information on this issue, better understand developments and take best possible action at all levels and by all actors concerned ranging from policy to education and training. Finally, certification fulfils the role of quality assurance and skills recognition where Europe may want to take a leading role. The European level is seen as the most appropriate level for interventions in this area by more than 60% of experts. More than 30% argue for national level actors to become active.

5. **Networking and skills hubs: Relevant key stakeholders at EU, Member State and regional levels should join forces and further develop VET competence centres based on clusters and digital innovation hubs. The aim is to reach a large number of enterprises of all sizes and offer a catalogue of training solutions, curricula, certifications and best practices with a platform for exchange of resources and experience on how to train the workforce and make lifelong-learning a reality.**

High-tech clusters and digital innovation hubs are valuable sources of leading edge industrial high-tech expertise. Their experience and proximity to enterprises of all sizes, and their large networks should be strengthened and closely integrated in the funding and skills policy landscape.

80% of experts recommend this as a means to enhance the scalability and ultimately the impact of the funding of high-tech skills initiatives. It should be noted that 25% of experts see regions as the key actors for funding interventions of high-tech skills centres, clusters and hubs. 40% allocate this task predominately to the national level. 35% see the EU as the most appropriate in this area. This suggests that strong cooperation and co-ordination will be necessary.

1 Introduction

The digitisation of the economy and key enabling technologies are drastically and fundamentally disrupting the way enterprises operate. This is posing new demands in terms of knowledge, skills and competences towards the economy and workforce. Demand for high-tech skills is increasing fast which is resulting in significant shortages at all levels in organisations: technical, professional, management and strategic leadership level.

Member States and EU policies and initiatives need to take these disruptions into consideration and further develop and adapt their programmes and incentives if they want to provide the economy with a larger talent pool and the high-tech skills and competences needed. This will enable them to better anticipate and cope with change and help individuals and organisations acquire and/or update these specialised skills. Education and training systems in Europe need also to react on these new demands and develop appropriate training offers.

empirica and PwC have been analysing the situation at national level and selectively also with respect to relevant programmes at EU level¹¹ and the synergies between the different instruments with a view to identify successful ones, i.e. best practices. These were identified in order to highlight their potential to be scaled up to become even more successful and sustainable and they may also serve as a guide for re-focusing and improving existing funding programmes and incentives.

The identified policies, policy programmes, financial and fiscal incentives and funding programmes are recorded in a repository which provides for each policy and incentive the sources of information used, a classification by forms of incentives and a structured and brief description according to specific criteria to be developed and agreed on. In a second step, an evaluation of the identified schemes (policies, programmes, initiatives, incentives of different type) was carried out using criteria such as impact, sustainability and scalability.

A best practice selection was carried out following a deeper evaluation of the shortlisted practices using further selection criteria.

This activity is part of the COSME 2016 Work Programme. Since 2016, important developments affecting skills policies and funding in particular took place in the meantime, including the Blueprint on sectoral cooperation on skills and the Digital Skills and Jobs Coalition.

Cooperation was sought with these two initiatives as well as participation at key events to promote progress and results from the service contact.

The European Commission has announced on 18 September 2017 their new industrial policy strategy¹² that aims at empowering European industries to continue delivering sustainable growth and jobs. The industrial policy strategy aims to bring together existing and new initiatives, to clarify tasks ahead for the actors involved, to establish an annual Industry Day, the first edition of which took place in February 2017, and a High Level Industrial Roundtable aiming to allow industry and civil society to steer industrial policy actions in the future.

The Industrial Policy Strategy confirmed the extension of the Blueprint for sectoral cooperation on skills to new key industry sectors, such as construction, steel, paper, green technologies and renewable energies, additive manufacturing and maritime shipping. In particular, the strategy confirms the pivotal role of skills and

¹¹ At EU level funding opportunities for skills development include: the European Structural and Investment Funds: European Social Fund; European Regional Development Fund; Youth Employment Initiative; European Agricultural Fund for Rural Development; European Maritime and Fisheries Fund; Erasmus+; Horizon2020; European Fund for Strategic Investment; EU Programme for Employment and Social innovation; European Investment Bank's "Skills and Jobs" loan programme"; COSME – Europe's Programme for SMEs; European Globalisation Fund ; and the LIFE Programme. Source: European Commission: Staff Working Document: Analytical underpinning for a New Skills Agenda for Europe Accompanying the Communication from the European Commission "A New Skills Agenda for Europe: Working together to strengthen human capital, employability and competitiveness" {COM(2016) 381 final}, Brussels 10.6.2016, p. 76

https://ec.europa.eu/info/funding-tenders/european-structural-and-investment-funds_en

¹² https://ec.europa.eu/commission/news/new-industrial-policy-strategy-2017-sep-18_en

qualification in the deep transformation that European industry is undergoing and in closing the innovation gap that is growing with some of the key competitors.

Policy at all levels needs to identify viable funding models for high-tech skills development. These need to take into account the scale dimension as well resources and timing issues. Furthermore, issue of quality are crucial followed by governance, monitoring and supervision, business buy-in, business model, scalability, sustainability as further important aspects for consideration.

The present activity therefore sets out to learn from existing initiatives, identify the key success factors, key challenges, and based on that, develop guidelines for future policy making purposes. The extracted results will be of high practical relevance for policy makers, and should enable them to make strategic decisions regarding high-tech skills-related policies and support measures.

The focus will be on high-tech skills which encompass the skills needs related to digital technologies (e-skills) and a group of six advanced technologies (ATs) including: micro and nanoelectronics, nanotechnology, industrial biotechnology, advanced materials, photonics, and advanced manufacturing technologies, artificial intelligence and security & connectivity.

Definitions and scope:

High-tech skills encompass the skills needs related to:

- digital technologies (e-skills) and
- a group of six key enabling technologies (KETs) including:
 - micro and nanoelectronics,
 - nanotechnology,
 - industrial biotechnology,
 - advanced materials,
 - photonics, and
 - advanced manufacturing technologies
 - artificial intelligence
 - security & connectivity.

The work is covering hard to fill high-level skills needs of enterprises related to new technologies.

The target groups of this work are:

- students,
- professionals,
- managers and
- entrepreneurs in enterprises in all sectors

who would need to acquire and/or update these specialised skills. A particular attention will be put on small and medium sized enterprises (SMEs) and start-ups.

2 Objectives

The overall objectives were to:

- Benchmark public policies and public-private partnerships,
- Make recommendations for scaling up best practices and re-focusing funding programmes and incentives in Europe
- Mobilise a large number of stakeholders and Member States contributing to the success of the EU high-tech skills strategy and
- Invest efforts to facilitate the uptake of digital and key enabling technologies by European enterprises, especially SMEs and start-ups
- Inform policy-makers and business and social leaders regarding more effective policies, partnerships, funding programmes and incentives to
- Increase the high-tech talent pool, employment and the competitiveness of the European economy and
- Contribute to the further evolution and improvement of European and national initiatives on high-tech skills.

For the 2020+ funding period changes are currently under discussion. Without interfering in the political process, the work will bring a contribution by analysing and documenting best practices and identifying scalable and sustainable mechanisms to support policy makers and stakeholders in improving the effectiveness and efficiency of their funding programmes and incentives.

3 Approach, activities and achievements so far

The present chapter describes the approach taken and work undertaken for each activity.

3.1 Establishment of an informal expert group

An informal expert group of more than 100 experts from all over Europe has been established. These experts were supposed and have committed themselves to support the partners and the European Commission in this work by actively attending workshops, taking part in online surveys, reviewing documents and giving recommendations. The complete list of experts is shown in the annex.

3.2 Identification and analysis of relevant funding programmes

Since the start of this activity in summer 2017 we have carried out an identification and first analysis of around 270 policies, funding programmes, incentives and instruments. Around 70 are currently further analysed. More than 50 expert interviews have already been carried out already (see annex for more details).

The country coverage agreed with the Commission is as follows: Germany, France, United Kingdom, Spain, Italy, Poland, Netherlands, Sweden, Finland and Estonia. However, further interesting cases from other countries (e.g. Denmark, Belgium) are also considered. The following table provides an overview of the number of schemes identified in the different countries and those selected as promising practises and currently under further investigation.

Country		Identified programmes	Selected candidate programmes: Digital	Selected candidate programmes: ATs
Germany	DE	55	6	5
France	FR	21	8	3
United Kingdom	UK	29	3	2
Spain	ES	14	4	
Italy	IT	19		
Poland	PL	39	5	
Netherlands	NL	17	5	2
Sweden	SE	46	4	5
Finland	FI	20	2	1
Estonia	EE	11	2	
Denmark	DK	2	2	
Belgium	BE	1		1
Europe	EU	4	4	
USA	US	5	3	
Global		1	1	
Total		284	49	19

The list of all national programmes from EU member states identified in the selected countries is shown in the following table. This is followed by the overview table of 10 philanthropic and CSR-based programmes of global vendors in the USA and in Europe. From these the table of programmes is presented which were selected as

best practice candidate programmes following a further analysis of their fit as high-tech skills development funding programmes.

However, several of the 'failures' will serve as 'learning practices' when deriving and developing recommendations at a later stage. This resulted in the selection of 69 best practice candidates including 49 funding programmes with a primary focus on 'digital' and 19 programmes focussing on KET skills.

Further analysis activities for the best practice candidate cases are currently underway as will be further described in subsequent chapters.

Overview of identified funding programmes
(Best practice candidates are marked in green)

Country	Title of policy initiative / funding programme
BE	imec.academy
DE	Allianz für Aus- und Weiterbildung 2014 - 2018 (Alliance for Education and Training 2014 - 2018)
DE	"Smart Energy Showcases - Digital Agenda for the Energy Transition" (SINTEG)
DE	Autonomik für Industrie 4.0 (Autonomics for Industry 4.0)
DE	BEN - der Berufsentwicklungsnavigator (The professional development navigator)
DE	Bildungsgutschein (education voucher)
DE	Bildungsprämie (education bonus premium voucher)
DE	Bildungsscheck NRW (Educational check NRW)
DE	Bündnis "Zukunft der Industrie" (Alliance "Future Industry")
DE	Centre of Excellence on securing skilled labour (Kompetenzzentrum Fachkräftesicherung (KOFA))
DE	Cluster-Netzwerke-International (Competiton, 3rd round) with accompanying measures: InterSpiN, MeNeC, The Virtual Cluster Academy, PubliSta
DE	Deutschland Digital 2015
DE	Deutschlands Spitzencluster (Germany's Top Clusters)
DE	Digital manufacturing processes - Additional qualification for the future career in INDUSTRY 4.0!(Digitale Fertigungsprozesse - Zusatzqualifikation für die berufliche Zukunft in INDUSTRIE 4.0!)
DE	Digital Media in Vocational Training (technical program) (Digitale Medien in der beruflichen Bildung (Fachprogramm))
DE	Digitale Agenda 2014-2017
DE	Digitale Strategie 2025 (DE.DIGITAL)
DE	DIV - Deutschland intelligent vernetzt (Focus Group "Intelligent Networking" of the Digital Summit)
DE	Education and further education in business 4.0 - funding line of the JOBSTARTER plus programme (Aus- und Weiterbildung in der Wirtschaft 4.0)
DE	erlebe IT
DE	Fachkräfte für Deutschland (Partnership for skilled professionals)
DE	Fachkräfte Offensive (Qualified Professionals Initiative)
DE	Förderprogramm "go-digital" ("go-digital" funding programme) - 2nd phase
DE	Förderprogramm "go-digital" ("go-digital" funding programme) - Pilot project - 1st phase
DE	General financial incentives for further education in Germany
DE	go-Inno
DE	Hands on Industrie 4.0
DE	Hightech-Strategie 2020
DE	IKT 2020 – Forschung für Innovationen (ICT 2020 programme)
DE	IKT für Elektromobilität III (ICT for electro mobility)
DE	Industrie 4.0
DE	Initiative Berufsbildung 4.0
DE	KURSNET - das Portal für berufliche Aus- und Weiterbildung
DE	Lernende Systeme- Plattform für künstliche Intelligenz (Learning Systems - platform for AI)
DE	MINT Regionen (STEM regions)
DE	MINT Zukunft schaffen (Create MINT Future)
DE	Mittelstand 4.0 - Digitalisierung im Mittelstand (Digitalisation of SMEs)

Country	Title of policy initiative / funding programme
DE	NanoTecLearn - E-learning for education and training in micro-nano-integration (project within the technical programme 'Digital Media in Vocational Training')
DE	Nationales MINT Forum (National STEM Forum)
DE	Platform Smart Living
DE	Rahmenprogramm der Bundesregierung für Forschung und Innovation 2016-2020 „Mikroelektronik aus Deutschland – Innovationstreiber der Digitalisierung“ (framework program of the Federal Government for Research and Innovation 2016-2020 "Microelectronics from Germany - the Innovator of Digitization")
DE	RKW Kompetenzzentrum (RKW Competence Center)
DE	Smart Data
DE	Smart Home
DE	Smart School
DE	Smart Service Welt I & II (SmartServiceWorld)
DE	Software Campus
DE	Supporting the digitalisation in inter-corporate occupational vocational training centres (Förderung von Digitalisierung in überbetrieblichen Berufsbildungsstätten und Kompetenzzentren)
DE	Tax deduction related to further education in Germany
DE	Trusted Cloud
DE	Weiterbildungsprämie (further training grant)
DE	Weiterbildungsstipendium (training scholarship)
DE	Education Network High Technology Berlin (ANH Berlin)
DE	NANOFUTURES (WING Initiative)
DE	Festo Didactic
DK	IFD – Innovation Fund Denmark: Industrial PhD
EE	NutiLabor (SmartLabs)
EE	“Year of Skills” 2017
EE	Centre for Integrated Electronic Systems and Biomedical Engineering
EE	Centre of Excellence in Genomics
EE	Competence Centre ELIKO
EE	e-Governance Academy
EE	Estonian Biocentre
EE	Estonian eXcellence in Computer Science
EE	Estonian Lifelong Learning Strategy 2020
EE	Proge Tiger
EE	Samsung DigiPass
EE	Software Technology and Applications Competence Centre (STACC)
EE	Study IT in Estonia
ES	AceleraTIC
ES	Agenda Digital para España
ES	Agenda para el fortalecimiento del sector industrial en España (Agenda for the strengthening of the industrial sector in Spain)
ES	Asesores Digitales
ES	Formación postgrado
ES	Generation Spain
ES	Industria Conectada 4.0
ES	NanoSpain
ES	Plan de Acción de Empresa Digital 2016-2020
ES	Plan de impulso de la economía digital y los contenidos digitales
ES	Plan de TIC en PYME y comercio electrónico
ES	Profesionales Digitales
ES	Programa de Gestión de la Innovación (free Innovation Management program)
ES	Talent Club
ES	TodoFP
FI	Avainta tekoälykaaan (key to artificial intelligence)

Country	Title of policy initiative / funding programme
FI	BioDigi
FI	Competence required by digitalisation
FI	Digiosaamisen kehittäminen (Development of Digital Learning)
FI	Digiosaamisen kehittäminen (Digital Skills development)
FI	Digiosaava satavuotias Suomi
FI	Digital Excellence Academy
FI	Digitalisaatiolla kilpailukykyä -koulutuksen (Digitalisation for Competitiveness Training)
FI	Digitekijä fast track -erikoistumiskoulutus (Fast Track Specialization Training)
FI	eAMK Oppimisen uusi ekosysteemi (the new ecosystem for learning)
FI	Ecosystem Forum
FI	Hundred
FI	Innovation voucher
FI	Korkeakoulutettujen muuntokoulutuksen määräraha lisätalousarvio 2017
FI	Mehackit
FI	Post Docs in Companies (PoDoCo)
FI	Talent Boost programme
FI	The Future Makers
FI	Demola
FI	Photonics Finland – Finnish Society of Photonics
FR	Plan pour l'inclusion numérique
FR	Arts et Métiers Acceleration
FR	Arts et Métiers ParisTech
FR	Cap Digital
FR	École 42
FR	Education pour numérique
FR	French Tech
FR	Institut Mines-Télécom
xFR	L'industrie du futur
FR	La Grande Ecole du Numérique
FR	Le Blender
FR	Le plan numérique pour l'éducation
FR	Manche Open School
FR	Orange Digital Academy (Only for Orange employees)
FR	Paquet discal et réglementaire pour les start-ups, por favoriser l'attractivité et la croissance économique
FR	SheMeansBusiness
FR	Station F
FR	Thales Digital Factory
FR	Thales Station F Cybersecurity Programme
FR	"Industrie 4.0 et Formation pour le futur" by Opcalia
FR	NANOEL
FR	MINATEC
IT	Bestr
IT	Confindustria Digitale
IT	Crescere in digitale (Growing in Digital)
IT	Digital and Environmental Skills for Facilities Management (DEFMA)
IT	Digital Italy Agency
IT	Digital Transformation Team
IT	Eccellenze in digitale (Excellence in Digital)
IT	Gaetano Marzotto Award
IT	Industry 4.0 Plan
IT	Istituti Superiori (ITS) - Higher Technical Institutes

Country	Title of policy initiative / funding programme
IT	ITS Tech Talent Factory Milan
IT	Motorvehicle University of Emilia-Romagna (MUNER)
IT	Programma il Futuro (The Future Programme)
IT	Samsung Innovation Camp
IT	VEGA Park (VEnice GAteway for Science and Technology)
IT	Venice Innovation Hub for Re-Startup Manufacturing
IT	Local partnership by ManpowerGroup
IT	Crescere in Digitale
IT	Industria 4.0 – Impresa 4.0 agevolazioni per l'innovazione e lo sviluppo di tecnologie abilitanti
IT	Advanced Training in Key Enabling Technologies and Entrepreneurship
NL	Automotive Centre of Expertise (ACE)
NL	BioHack Academy: BioFactory
NL	CA-ICT Foundation, ICT Labor Market Training Fund
NL	Centres of Expertise
NL	CHILL - Chemolot Innovation and Learning Labs
NL	dutch digital delta Talent Grants
NL	Industrial Doctorates
NL	Katapult
NL	Make it Work
NL	Mechatronics Academy
NL	NWO Physics Industrial Partnership Programmes (IPP)
NL	Regional VO-HO networks
NL	Skills & Technology of the 21st Century
NL	Top technology in secondary vocational education (Toptechniek in Bedrijf in het MBO) (TiB)
NL	Topsectoren - Sectoral Human Capital Agendas
NL	Techniekpact
NL	Oefenfabriek
PL	(Dobry Pomysł) Good Idea Program
PL	Akademia PARP
PL	Akademia Zarządzania IT Administracji Publicznej (Academy of Commanding Public IT Administration)
PL	COSME
PL	CyberSecIdent
PL	Education and New Technologies
PL	e-learning training
PL	e-obawytel (e-citizen)
PL	Foundation Nowe Technologie (New Technologies)
PL	Fundacja Rozwoju Kardiologii im. Prof. Zbigniewa Religi (Foundation for the Advancement of Cardiology under the name of Prof. Zbigniew Religi)
PL	HORIZON 2020
PL	Industry Cluster Bydgoszcz
PL	INFOSTRATEG
PL	INNOLOT
PL	INNOMED
PL	IT FOR SHE
PL	IT/ICT Promotion Program
PL	Jeden IT - Polish Programmers
PL	klaster IT
PL	Krajowy Fundusz Szkoleniowy (National Training Fund)
PL	Microsoft and CISCO West Pomeranian for SMEs
PL	Network of Regional Specialist Observatories in the Process of Exploring Entrepreneurship
PL	OP Knowledge Education Development
PL	OP Polska Cyfrowa (Digital Poland)
PL	OP Smart Growth

Country	Title of policy initiative / funding programme
PL	Plan for Responsible Development (pl.: Plan na rzecz odpowiedzialnego rozwoju)
PL	Polish-Norwegian Research Cooperation
PL	Polska 3.0
PL	Przemysł 4.0 (Industry 4.0)
PL	Sektor 3.0
PL	Start in Poland
PL	Startup Poland
PL	STRATEGMED
PL	Swiss Contribution: Swish-Polish Cooperation Programme
PL	Szkola Gospodarki Cyfrowej (School of Digital Economy)
PL	Szkolenia by ASSECO (Training by ASSECO)
PL	TECHMATSTRATEG
PL	Technologie wspomagające rozwój bezpiecznej energetyki jądrowej (Technologies Supporting the Development of Secure Nuclear Energy)
PL	Lifelong Learning Centre of New Technologies (CKUNT abbreviation in Polish)
SE	ISACA Sweden Chapters stipendium
SE	Produktionslyftet
SE	Automationsutmaningen
SE	Avans
SE	Checkar för digitalisering
SE	Civilingenjör 4.0 Nationell utbildning inom Smart- och uppkopplad industri
SE	Den smarta digitala fabriken 2016-2018
SE	DesignIT
SE	Diagnos på distans
SE	Digitalakademin
SE	Digitalisering och ledarskap i offentlig förvaltning
SE	E-DIG – Digital lärplattform för den smarta digitala fabriken
SE	Expertkompetens (Expertise for Innovation)
SE	Expertkompetens sociala medier och webbteteknologi för innovation och tillväxt
SE	För ett hållbart digitaliserat Sverige - en digitaliseringsstrategi
SE	Forsknings- och innovationsprojekt - Smartare elektroniksystem 2018
SE	Gjutmagistern
SE	Graduate School Produktion2030 (Nationella Forskarskolan Produktion2030)
SE	IEC
SE	Industrial PhD 2017
SE	Industriklivet
SE	Informator
SE	Internetfonden
SE	Kickstart Digitalisering
SE	Nationell strategi för nanoteknik
SE	Photonics Agenda
SE	ProdEx – Expert i produktionsteknik
SE	Produktion2030
SE	PROMPT
SE	Regionala företagsstöd
SE	Regionalt investeringsstöd
SE	Robotlyftet
SE	Samverkan för kommersiella grafentillämpningar
SE	Smart industri - en nyindustrialiseringsstrategi för Sverige
SE	Smarta Fabriker
SE	Smartare Elektroniksystem
SE	Startup-Sweden - Boot camp för digitala startups
SE	Stora IT-kompetensdagen

Country	Title of policy initiative / funding programme
SE	Stora IT-kompetenspriset
SE	Strategiska innovationsprogram - samarbete för hållbar innovation
SE	Strategiska innovationsprogrammet för processindustriell IT och automation - PiiA
SE	Sverige Digitaliserar!
SE	SwedNanoTech
SE	Uppkopplad industri och nya material
SE	Wallenberg Autonomous Systems and Software Program (WASP)
SE	XPRES - Initiative for excellence in production and research
UK	ADDopt
UK	Aston University Degree Apprenticeship
UK	Black Country Apprenticeships for High Value Manufacturing
UK	British Institute of Technology, England (BITE)
UK	City RegionDeals
UK	Digital Strategy 2017
UK	E.ON Academy
UK	Industrial Strategy Challenge Fund
UK	Industry Partnership (Trailblazer): Specialization: Medicine Manufacturing (MMIP)
UK	Industry Partnership (Trailblazer): Specialization: Science (SIP)
UK	Industry Partnerships (Trailblazers): Overall
UK	ITA (Individual Training Account) (formerly ILA - Individual Learning Account)
UK	Learndirect
UK	Leeds City Region Deal: 14+ Apprenticeship Academy Apprenticeship Hubs
UK	Manchester City Apprenticeship & Skills Hub
UK	My World of Work
UK	National Innovation Centre for Data (NICD)
UK	National Software Academy
UK	National Training Academy for Rail
UK	Oxford Innovation Centres
UK	Professional and Career Development Loans
UK	Skills 4 Growth Programme in Advanced Manufacturing and Engineering (Coventry & Warwickshire)
UK	Skills for Londoners Capital Fund
UK	The apprenticeship levy supporting SIP programmes
UK	The Creative Quarter
UK	The Tech Partnership
UK	University of Cambridge Bioinformatics Training
UK	University of Sheffield Industrial Training Programme
UK	PAiCE (Platforms Additive Manufacturing Imaging Communication Engineering)
UK	AMRC
UK	KTPs (Knowledge Transfer Partnerships)
UK	Alacrity Graduate Entrepreneurship Programme

Overview of selected philanthropic and CSR-based programmes of global vendors identified in Europe

Country	Title of policy initiative / funding programme
EU	Freeformers and Facebook partnership
EU	#SheMeansBusiness programme (Facebook)
EU	Google 'Growth Engine' Programme
EU	Cisco 'Country Digitization Acceleration' programme

Overview of relevant NSF programmes and philanthropic and CSR-based programmes of global vendors identified in the USA

Country	Title of policy initiative / funding programme
USA	Advanced Technological Education (ATE) (NSF – National Science Foundation)
USA	Training-based Workforce Development for Advanced Cyberinfrastructure (CyberTraining) (NSF – National Science Foundation)
USA	NSF Scholarships in Science, Technology, Engineering, and Mathematics Program (S-STEM)
USA	SkillSET (founding partners are Accenture, CA Technologies, Cisco, Cognizant, Hewlett Packard Enterprise (HPE), Infosys, Pegasystems, PwC, Salesforce, SAP and Tata Consultancy Services)
USA	Grow with Google
USA	Goodwill Digital Career Accelerator
USA	Facebook Community Boost programme
USA	Facebook Community Boost EU programme

Overview of DIGITAL best practice candidate programmes in Europe

Country	Title of policy initiative / funding programme
DE	Education and further education in business 4.0 - funding line of the JOBSTARTER plus programme (Aus- und Weiterbildung in der Wirtschaft 4.0)
DE	Förderprogramm "go-digital" ("go-digital" funding programme) - 2nd phase
DE	Förderprogramm "go-digital" ("go-digital" funding programme) - Pilot project - 1st phase
DE	NanoTecLearn - E-learning for education and training in micro-nano-integration (project within the technical programme 'Digital Media in Vocational Training')
DE	Software Campus
DE	Supporting the digitalisation in inter-corporate occupational vocational training centres (Förderung von Digitalisierung in überbetrieblichen Berufsbildungsstätten und Kompetenzzentren)
DK	IFD – Innovation Fund Denmark
DK	Industrial PhD
EE	Proge Tiger
EE	Study IT in Estonia
ES	Asesores Digitales
ES	Generation Spain
ES	Profesionales Digitales
ES	Formación postgrado
FI	Digiosaamisen kehittäminen (Digital Skills development)
FI	Demola
FR	École 42
FR	Institut Mines-Télécom
FR	La Grande Ecole du Numérique
FR	Manche Open School
FR	Station F
FR	Thales Station F Cybersecurity Programme
FR	"Industrie 4.0 et Formation pour le futur" by Opicalia
IT	Crescere in Digitale
NL	CA-ICT Foundation, ICT Labor Market Training Fund
NL	Industrial Doctorates
NL	Katapult
NL	Make it Work
NL	Techniekpact
PL	Akademia Zarządzania IT Administracji Publicznej (Academy of Commanding Public IT Administration)
PL	IT FOR SHE
PL	Microsoft and CISCO West Pomeranian for SMEs
PL	Sektor 3.0
PL	Lifelong Learning Centre of New Technologies (CKUNT abbreviation in Polish)

Country	Title of policy initiative / funding programme
SE	Digitalakademin
SE	E-DIG – Digital lärplattform för den smarta digitala fabriken
SE	Expertkompetens (Expertise for Innovation)
SE	PROMPT
UK	National Software Academy
UK	KTPs (Knowledge Transfer Partnerships)
UK	Alacrity Graduate Entrepreneurship Programme

Note:

	Programmes presented and discussed at expert workshops in Brussels
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Overview of Advanced Technologies best practice candidate programmes in Europe

Country	Title of policy initiative / funding programme
BE	imec.academy
DE	Festo Didactic
DE	Digital manufacturing processes - Additional qualification for the future career in INDUSTRY 4.0!(Digitale Fertigungsprozesse - Zusatzqualifikation für die berufliche Zukunft in INDUSTRIE 4.0!)
DE	go-Inno
DE	Education Network High Technology Berlin (ANH Berlin)
DE	NANOFUTURES (WING Initiative)
FI	The Future Makers
FR	L'industrie du futur
FR	MINATEC
FR	Arts et Métiers Acceleration
FR	Arts et Métiers ParisTech
NL	Automotive Centre of Expertise (ACE)
NL	Top technology in secondary vocational education (Toptechniek in Bedrijf in het MBO) (TiB)
SE	Civilingenjör 4.0 Nationell utbildning inom Smart- och uppkopplad industri
SE	Graduate School Produktion2030 (Nationella Forskarskolan Produktion2030)
SE	Industrial PhD 2017
SE	Produktion2030
SE	Wallenberg Autonomous Systems and Software Program (WASP)
UK	Industry Partnership (Trailblazer): Specialization: Science (SIP)
UK	AMRC

Note:

	Programmes presented and discussed at expert workshops in Brussels
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3.3 Workshops

3.3.1 Background and objectives

The objective had been to organise four workshops (covering all tasks of WP1 – WP3) with at least 15 experts attending each workshop and coming from government, industry, associations, academia and other relevant stakeholders to gather their views, contributions and feedback on the findings and achievements, foster consensus on progress and work, plus soliciting ideas regarding the next steps and the key elements and messages to be included in the interim and final reports.

Participants for all workshops were carefully selected from the lists of experts and stakeholders from the informal expert group held by the study team and documented in the annex of this Interim Report.

In total four workshops are to be organised as follows:

Workshop & Conference	Month	Proposed date	Venue
Workshop no. 1	Month 06	30 th January 2018	European Liaison Office of the Deutsches Zentrum für Luft- und Raumfahrt (DLR), Rue du Trône 98, B-1050 Brussels
Workshop no. 2	Month 10	16 th May 2018	European Liaison Office of the German Research Organisations, Rue du Trône 98, B-1050 Brussels
Workshop no. 3	Month 17	17 th December 2018	European Liaison Office of the German Research Organisations, Rue du Trône 98, B-1050 Brussels
Workshop no. 4	Month 21	11 th April 2019	

The workshops were very well attended by members from the informal expert group. The planned number of attendants set in the contract (15) was heavily exceeded, only limited by the available seating capacity and on average 30-40 experts attended.

3.3.2 Results

The experts agreed that as a starting point a **policy vision** is needed for the revision of present and the development of **new, more appropriate funding programmes, instruments and mechanisms**. To some extent, this already exists at European level through the different recent European Commission policy documents and Communications in this area. These should be integrated and further developed, streamlined and put forward as a common policy document proposal. The policy vision should be developed in a coordinated fashion involving the different DGs at the Commission dealing with these issues and involving relevant national EU Member State stakeholders and government departments and policy decision makers to achieve an overall European-wide agreement.

Based on that decision and agreement, necessary partnerships, programme types and funding instruments and mechanisms and details need to be developed at national and European level, as to necessary monetary dimensions and budgets to be allocated to specific (new) ways of funding.

One-size-fits-all policies and programmes will not provide the necessary basis and means to address future challenges. Based on an analysis of identified promising practices, it became apparent that the future policy and funding landscape is likely to be multi-faceted with a co-existence and combinations of a multitude of different types of funding programmes and mechanisms.

The results of the workshops are documented and made available in separate reports at: <http://leadership2019.eu/publications.html>

3.3.3 Workshops

While workshops 1 and 2 followed an approach of inviting, presenting and discussing best practice candidate funding schemes in expert rounds, workshop 3 moved towards the development of a typology of funding schemes, focussing on those which have proven successful along certain criteria (effectiveness, efficiency, scalability, sustainability ...), extracting the success factors to best implement and operate such schemes and presenting and discussing these at the workshop. First draft recommendations were presented and discussed. Experts gave their own views and recommendations as to these and presented their own proposals for future action needed by different stakeholders. Workshop 4 focussed on learning from the successful cases, defining

elements of relevance for the development of new and innovative funding schemes, developing and moving towards finalising the recommendations with experts.

3.4 Expert interviews

The objective of the desk research together with expert interviews in conjunction with online surveys was to conduct a comprehensive collection of the latest relevant information, data, etc. from reliable sources.

The target set was at least 50 interviews of relevant stakeholders split across experts in the different fields of high-tech skills (digital and KET skills) to investigate their needs regarding the transformation of their activities and businesses. In a later phase, the expert interviews were expanded geographically by contacting relevant experts from other parts of the world, namely the USA.

More than 50 interviews - including experts from different backgrounds and affiliation - were organised and carried out already. The insights and results of these are fully integrated in the present report and the descriptions of the high-tech training programmes identified and analysed.

3.5 Online surveys

Two online surveys were carried out under this service contract. The objective was to engage experts throughout Europe on the topic of high-tech skills policies and initiatives. It was addressed mainly to the members of the informal expert group of more than 100 experts from all over Europe and active in relevant fields for the present study. These experts had committed themselves to support this European Commission initiative. The expert group was established at the start of this activity in autumn 2017.

Both surveys were organised as a feedback survey to ask questions around and get feedback on the initial draft types of initiatives, funding schemes and incentives to obtain an expert validation, expert advice and recommendations for improvement.

The first online survey was carried out in summer 2018 which allowed consideration and incorporation of the results from the second workshop and the first analysis work into to survey questionnaire. The second survey was conducted in early 2019 to ensure consideration of results from the third workshop and the advanced analysis work.

The structure and outline of the first questionnaire agreed on with the Commission. The full questionnaires are shown in the annex to this report.

4 The European funding programme landscape for high-tech skills development

In the present chapter, firstly an overview of high-tech skills funding programmes in Europe is given, followed secondly, by philanthropic and CSR-based programmes of global vendors in Europe and the USA. Thirdly, and in addition to the above types of funding programmes, a whole range of different general types of funding and incentives supporting skills development addressed to individuals or companies in general were identified. These are briefly outlined as well and – where appropriate – related to the specific high-tech skills funding programmes. Fourthly, a typology of relevant high-tech skills funding programmes is developed and described. This typology is built on the integrated framework recently developed by Ziderman¹³ which the author developed after a thorough analysis of the training finance system. This framework with its further developments and extensions by empirica has proven suitable and fully applicable in the context of the present service contract. Fifthly, results from the application of the integrated framework are described which include a first typology of funding programmes in 10 types and an assessment of the different funding programmes captured under each type. Sixthly, this is complemented by an analysis of ‘learning practices’, i.e. past funding programmes which ceased to exist but from which one can learn for the development of future funding programmes, mechanisms and incentives. The assessment was carried out along relevant criteria to assess for each funding programme type their SWOTs, effectiveness, efficiency, impact, scalability and sustainability and then draw some first conclusions and develop recommendations with respect to the future applicability for funding high-tech skills development, thereby increasing the respective talent pool for Europe to remain competitive at a global level.

4.1 Overview

4.1.1 High-tech skills funding programmes in Europe

Based on an analysis of the identified promising practices in the selected number of European countries, it becomes apparent that the funding programme landscape is multi-faceted with a co-existence and combinations of a multitude of different types of funding programmes and mechanisms. The range of funding programmes is very broad as can be illustrated by describing each of the most relevant promising practices in a few words each with the aim to allow grasping the key elements in order to get an informative and expressive overview.

The result is presented herewith:

1. New and innovative (free) peer-to-peer learning programmes without curricula entirely funded by an investment from a donor like École 42 in France.
2. Tri-partite ecosystem development partnerships for joint problem solving or case handling and thereby professional skill development like Demola which started in Finland and is now operating in around 15 countries. Demola is a model in which academic students along with business staff carry out fast co-creation projects following open innovation rules. Demola is integrated in university curricula and business co-operation in 58 academic institutions in 15 countries (status: May 2019). The co-creation services of Demola are used by over 1000 companies yearly.
3. Co-development programmes for professional skills development like Expertkompetens in Sweden with projects like PROMPT and several others funded through this programme.

¹³ Ziderman, Adrian: Funding Mechanisms for Financing Vocational Training: An Analytical Framework. IZA Policy Paper No. 110. Bonn, 2016, p. 29

4. Katapult, a Dutch network of more than 150 partnerships (so-called centres of expertise) between education and business with 50,000 students, 4,500 companies and 4,000 teachers participating and constantly growing since it was established in 2016 through fund of the Ministry of Education, Culture and Science and the Ministry of Economic Affairs with the objective to improve cooperation between education and business by professionals from the business community providing training lessons or students doing research for an SME during their training. Government and private sector have joined forces to accelerate change and invest in conversion of the workforce through Centres of Expertise (Higher Education) and Centres for Innovative Craftsmanship (Vocational Education) for more than 15 years now in collaboration between entrepreneurs, vocational schools, higher education institutions and government in various sectors offering – amongst others - nine to 12 months of intensive skills training to apprentices.
5. Industrie 4.0 et Formation pour le future is claimed to be a programme developed and tailored to the needs of industry and run by Opcalia in France which aims at developing professional competences of employees to adapt to the high-tech trends and boost their career with a primary training focus on automation, robotics, co-robotics, 3D printing, artificial intelligence and big data. Opcalia funds up to 70% of the training programmes and deliver certifications to participants.
6. The 'Advanced Training in Key Enabling Technologies and Entrepreneurship' programme of Sapienza University in Italy is an excellence programme closely involving key industry partners with the objective to develop knowledge, and high qualified competences on some of the Key Enabling Technologies such as nanotechnology, microelectronics with a focus on combining these technologies for generating new business models.
7. Excellence programmes for PhD skills development within a cooperation of university and industry followed by a career in industry instead of university like the Industrial Doctorates and IPP programmes in the Netherlands, the Industrial PhD 2017 programme in Sweden or the programme Software Campus in Germany, or IFD, Denmark
8. The national graduate school funded by the WASP - Wallenberg Autonomous Systems and Software Program closely interacting with Swedish industry. The intention of this joint effort is to raise the knowledge level in Sweden in areas such as vehicles, robots and complex software-intensive systems with the intelligence to achieve autonomy in interactions with humans, and include industrial PhD students as an important component generating at least 100 new PhDs, with at least 50 of those being industrial PhD students.
9. The Knowledge Transfer Partnership (KTP) is a tri-partite ecosystem development partnership connecting industry, higher education institutions and research organisations which focuses on multi-KETs. It was initiated by the United Kingdom's Technology Strategy Board, now Innovate UK and has been set up to ease the transition of graduates into the labour market, to increase the extent of knowledge transfer between academia and small businesses, and to increase the chances of graduates to get a job.
10. Career exploration programmes of High-Tech U (HTU), a global programme run by SEMI the global industry association representing the electronics manufacturing supply chain.
11. Academies like the Imec.academy in Belgium - imec's learning institute - which offers specialized courses on nanoelectronics and digital technology and at the same engages in research on educational technology allowing its technical training programs to combine world-class expertise with hands-on applications for industry, academia and the (imec) employees.
12. The AMRC Training Centre at the University of Sheffield's AMRC Group is a centre of excellence for industry-focused machining and materials research providing training in the practical and academic skills that manufacturing companies need to compete globally, from apprenticeship through to doctorate and MBA level with options available from level 3 engineering apprenticeships to level 6 degree-level apprenticeships with are about 250 apprentices each year and more than 240

- associated employers. The AMRC Training Centre secured government backing for the Training Centre in 2013 and operates with an additional strong industry financing.
13. The IT Academy in Estonia which is, among other things, an industry and government funded academy developing and offering education and OERs (IT)
 14. The MINATEC innovation campus in France is a joint effort of research institutes and local government offering graduate, undergraduate programmes as well as further educational tracks to train students and technicians from the KETs area in management skills, and programmes that place PhD's in companies. The MINATEC Innovation Campus shows how KETs skills issues can be addressed by academia and local government jointly establishing KETs research and education centres, especially the KETs challenges related to educational programmes not being fully aligned with industry needs, to too little awareness of KETs when students make critical choices, to KETs careers not being perceived as attractive and prestigious, and to limited opportunities to study KETs in Europe.
 15. The network ANH Education Network High Technology Berlin (Aus- und Weiterbildungsnetzwerk Hochttechnologie) offers free training, targeted advice and support in photonics to small and medium-sized enterprises, advice in all matters regarding vocational training in the high-tech area (whereby vocational trainings have a particular focus on photonics and micro-systems technology), consultancy and support for companies and institutes in vocational education and training, tailor-made courses for further training. It additionally provides opportunities for young people to explore STEM (science, technology, engineering, and mathematics) professions and get first-hand information about jobs and career prospects by visiting associated school laboratories and companies. They can also apply for an apprenticeship within the partner companies via the network's main office at FBH – Ferdinand Braun Institut.
 16. Accelerators and incubators addressed to start-up support and skills training and development including schemes like Station F in France hosting incubator and accelerator programmes from major institutions and organisations enhanced by plus own programmes for vulnerable groups of people commonly neglected, and also offering financial assistance and loans. Examples of accelerators hosted come from well-known global players like Microsoft and Facebook but also the Thales Cybersecurity Programme selecting candidates following a rigorous selection process or the Arts et Métiers Acceleration hardware accelerator programme which offers grants and financial assistance to start-ups.
 17. The Alacrity Graduate Entrepreneurship Programme offered by the Alacrity Foundation of the Welsh government provides tax free stipends and delivers mentoring and support to graduates in emerging technologies and running a successful business through a 12-month programme that provides graduates with practical business training, software skills and mentoring so that they can develop as entrepreneurs and launch their own UK based technology companies.
 18. Support programmes like the German government programme Supporting the digitalisation in inter-corporate occupational vocational training centres (Förderung von Digitalisierung in überbetrieblichen Berufsbildungsstätten und Kompetenzzentren) for the development and testing of innovative vocational training concepts based on digital equipment in inter-corporate occupational vocational training centres to become competence centres on digitalisation and associated innovative training with the aim to thereby motivate for replication and wide dissemination throughout vocational training institutions.
 19. Funding for regional projects in Germany to support small and medium enterprises on issues related to dual vocational training on topics related to 'digitalisation' and providing advice on how to develop related company-internal training methodically and didactically as in the JOBSTARTER Plus funding line on Education and further education in business 4.0 (Aus- und Weiterbildung in der Wirtschaft 4.0) which can be illustrated by the project.

20. Digital manufacturing processes - Additional qualification for the future career in INDUSTRY 4.0! (Digitale Fertigungsprozesse - Zusatzqualifikation für die berufliche Zukunft in INDUSTRIE 4.0!) is a JOBSTARTER Plus project. The additional qualification module for the future career in INDUSTRY 4.0! targeted at ambitious trainees in the technical-industrial occupations in the 2nd year of apprenticeship training in Germany especially from SMEs helps secure the availability of advanced manufacturing process specialists with specialist knowledge of the future. The programme provides adaptation support for dual vocational training. Apprentices get to know the production network in the "Smart Factory" along the value-added process.
21. Industrial Partnerships (Trailblazers) in the UK bringing together employers across an industry sector to lead the development of skills, with a focus on growth and competitiveness. These were established for different sectors in the United Kingdom offering apprenticeships from Level 2 to 6 (Level 5 – 8 under development) following the 'earn and learn' principle set-up by the UK government funding with matching funds from industry. A typical example is the SIP – Science Industry Partnership and its Industry Degree Scheme and SMART Apprenticeships programmes having received an initial government funding of GBP 52 million for setting up and piloting the scheme and being one of eight such partnerships throughout the country.
22. City Region Deals in the UK (<https://beta.gov.scot/policies/cities-regions/city-region-deals/>), constitute agreements between the Scottish Government, the UK Government and local government designed to bring about long-term strategic approaches to improving regional economies. Each deal is tailored to its city region, reflecting its individual economic strengths and weaknesses, and comprises a programme of interventions to support positive, transformative change. Many of these include skills development in general or high-tech skills training related activities. Examples include the Leeds City Region Deal with 14+ Apprenticeship Academy Apprenticeship Hubs, the Manchester City Apprenticeship & Skills Hub and the Black Country Apprenticeships for High Value Manufacturing.
23. Top technology in secondary vocational education (Toptechniek in Bedrijf in het MBO) (TiB) programme set up in 2012 by the Dutch the Ministry of Education, Culture and Science and the Ministry of Economic Affairs through which seventeen self-appointed regions received a three-year incentive contribution to develop a regional vision including a plan for strong cooperation between VMBO, MBO and the business community to train sufficient professionals for the regional labour market. Meanwhile 21 regional VMBO-MBO networks are working on their ambitions to train more professionals for the future. Some regions focus strongly on the development of continuous VMBO-MBO curricula, while other regions focus more on lifelong learning from primary education to the workplace. There are networks that have set up their approach to the manufacturing industry, while others focus their arrows on installation, construction or transport. Each region has its own identity and therefore its own strategy.
24. The Technology Pact (Techniekpact) is a joint initiative and public-private partnership of central government, the business community, the trade unions, and the education community and five regions each developing their own Technology Pact to increase the number of technically educated people in the Netherlands, improve the alignment between secondary education, vocational education and higher education, help primary education teachers improve their skills in the area of Science & Technology education, strengthen public-private partnerships in support of primary and secondary education, make optimal use of technically-skilled staff and their talents and retain them for individual companies.
25. The ProgeTiger programme in Estonia founded by the Information Technology Foundation for Education (HITSA) and the Estonian Ministry of Education and Research as a supportive initiative for educational institutions in 2012 with the goal to enhance learners' technological literacy and digital skills, help students understand the basics of technological creativity and the relationships among technologies, support the development of problem-solving skills and to achieve better

- learning outcomes in general – in preschool, general and vocational education domains with a special focus on activities related to integration of three thematic fields - engineering sciences, design and technology (D&T), and information and communications technology (ICT) into the teaching and learning of different subjects and extracurricular activities.
26. Study IT in Estonia, is a cooperation programme run by the Republic of Estonia, universities and IT industry for securing necessary skilled labour force for the ICT sector and for creating preconditions for Estonia's growth through ICT, contributing to educating tomorrow's university graduates so they are highly qualified and valued specialists on the Estonian and international labour markets supported by a scholarship fund which provides financial support to the brightest students. Universities also offer university-specific tuition waivers and other support.
 27. Programmes like the Arts et Métiers ParisTech offer training in engineering subjects by a higher engineering school in partnership with an industrial engineering institute and industrial companies which are addressed to apprentices to obtain a higher degree
 28. Programmes addressed to the manufacturing industry like Produktion2030 in Sweden funding collaboration activities between industry, academia and research institutes with levels of co-financing from industry above 50% with the two education and training-related projects Civilingenjör 4.0 developing and introducing new course module for Master level education in engineering, with a strong focus on Industry 4.0-related topics and the Graduate School Produktion2030 (Nationella Forskarskolan Produktion2030) which has developed and introduced a number of courses to become part of the so-called "Special Produktion2030 offer" which are offered free or at fee-reduced rates to members enrolled at university.
 29. Programmes supporting the development of knowledge and learning platforms for technicians, masters, students as well as experts and engineers with or without a didactic background as teachers like German NanoTecLearn (E-learning for education and training in micro-nano-integration) in Germany, which enables a targeted and efficient knowledge update in the field of micro-nano-integration, now offered by different universities and training centres and put to practical use in industrial companies to manage their in-house knowledge and use it for their in-house training.
 30. E-DIG Digital lärplattform för den smarta digitala fabriken is a web-based learning platform for digitalisation in development, operation and change of production with combined education opportunities addressed to industry to strengthen digitalisation skills in Swedish industry. The project is part of Vinnovas programme Den smarta digitala fabriken, which aims to promote the digitalisation of Swedish industry.
 31. Similar activities include the virtual repository of several hundred (online) training programmes for high-tech skills development including those addressed to vulnerable groups of people and receiving financial support from the government like La Grande École du Numérique in France.
 32. Schemes like the Manche Open School in France offer innovative and intensive non-academic training lasting 6 months with an additional 2 months internship which are aimed mainly at people who have left the school system and people in professional reconversion.
 33. We can also observe support activities of large global consulting organisations. McKinsey & Company is offering 'Generation' - a youth employment programme offered in several countries worldwide including Spain in Europe. In Spain funding for this programme is through public programs, e.g. obtained by cooperating with European Social Fund intermediaries, such as EOI (Escuela de Organización Industrial) and Fundación INCYDE (Chamber of Commerce Foundation), which cover up to 92% of total program costs. McKinsey supports the Foundation by covering the 8% gap of public funds as well as the Foundation costs and is continuously looking for donors and other new sources of funding to support scale-up.

34. A further example addressed to disadvantaged youngsters is the JOBLINGE programme funded by the JPMorgan Chase Foundation and the Boston Consulting Group encouraging youths to explore the STEM subjects.
35. Funding programmes supporting the high-tech skills training and development of women like IT for SHE run by a foundation (Perspektywy Education Foundation) in Poland or the Talent Club in Spain offering IT-related qualification and training from a portfolio of over 40 certifications which has been piloted by APMG together with several associations.
36. Scholarship support programmes – co-financed through the European Regional Development Fund of ESF - providing grants to students making use of specific training programme offers in the field of the digital economy like the Formación Postgrado programme in Spain.
37. Industry initiatives like the Festo Didactic 'Transfer Factory' offering higher education institutes and companies with access to the technology and applications of Industry 4.0 through a research and teaching platform (the MSP Transfer Factory) demonstrating the advanced manufacturing and production of tomorrow in a locally controlled intelligent network especially developed for flexible training in a wide range of technologies and subjects.
38. Voucher-based systems for bringing innovation competences into SMEs like go-inno and go-digital, both from Germany including a government 50% subsidy for consultant and skills development work of around 20 days for an SME to train and support them on 'digitalisation', and matched by an additional 50% of the overall budget from an SME. A similar programme exists in Spain called Asesores Digitales operated by red.es (the Ministry of Energy, Tourism and Digital Agenda). The Italian region Basilicata supported by the Italian government has recently published a public notice called 'Industria 4.0 – Impresa 4.0 agevolazioni per l'innovazione e lo sviluppo di tecnologie abilitanti' through which SMEs and micro enterprises can obtain financial support through a voucher entitling them to receive support, advice and training in the development of KETs to optimise production and automation processes etc.
39. Tax-based systems like the apprenticeship levy supporting SIP programmes in the UK or the Alliance Industrie du Futur in France offering companies (SMEs) investing in the modernization of their production capacities tax benefits and an option to get additional development loans.
40. The Digital Academy (Digitalakademin) founded by Almi Företagspartner and Google offering free courses in IT skills development, both online and physical education constituting the Swedish activity of Google's 'Growth Engine' programme which has been implemented in many further European countries under different names.
41. As part of Facebook's flagship #SheMeansBusiness programme, Facebook plans to provide digital skills training to more than 15,000 women in France. The programme intends to encourage entrepreneurship through developing networks, mentoring, partner-led training programmes and inspiring relatable role models. It is already active in the UK and Italy and will be rolled out in Ireland, Spain and Sweden in 2018.
42. Through its Facebook Community Boost EU program launched in January 2018, Facebook will work with small businesses and start-ups to help them grow and hire. It is based on the US program launched last year. Facebook will open three new community skills hubs in Spain, Poland and Italy, to train 1 million people and business owners across the EU by 2020. The hubs will run in partnership with local organisations, offering training in digital skills, media literacy and online safety to underrepresented groups. They follow the successful model of Facebook's Digitales Lernzentrum in Berlin, which opened last year in partnership with the ReDI School of Digital Integration and other organisations. The school works with refugees, the elderly and other community groups in Germany to offer courses from basic coding classes to professional development classes.
43. Facebook together with Freeformers will offer training to 300,000 people across the EU in UK, France, Germany, Poland, Italy and Spain from 2018 onwards

- (<https://freeformers.com/media/blog/freeformers-partners-with-facebook/>) using the Freeformers Future Workforce Model (<https://freeformers.com/products/future-workforce-model/>) to help individuals acquire the attributes to be employable, successful and productive in a digital world. For 75,000 people, this training will be in person, and the rest will be online. All training will be tailored to each person, so someone with very strong skills could be taught how to code, while others might learn how to open a bank account online.
44. Samsung Digi Pass is a free of charge 5-month digital and life-skills training programme developed by Samsung Electronics Baltics in cooperation with the Tallinn University and Youth Union for vocational school students aged 14 to 19 in Estonia aimed to reduce youth unemployment and to increase the number of high-level professionals in various sectors by enabling youngsters acquire the digital and social competencies that will make them valuable employees in the future including real hands-on work experience through developing digital projects, such as apps and online platforms in teams, training of social skills, self-regulation, interpersonal communication, leadership and teamwork, planning and decision-making.
 45. Sektor 3 in Poland, which is a programme oriented towards the knowledge and skills of Polish NGO representatives in the area of practical use of information and communication technologies (ICT).
 46. The Automotive Centre of Expertise (ACE) is a knowledge centre focused on automotive innovation set up as cooperation between Fontys University of Applied Sciences, University of Applied Sciences Arnhem and Nijmegen and University of Applied Sciences Rotterdam and funded by the government. It is one of multiple centres of expertise focusing on different subjects. The centres operate in both, higher vocational education and higher professional education. The vocational education centres have a strong connection to the employment market.
 47. Make IT Work has been set up for retraining people with an ICT background in another area of ICT to address and solve the unemployment issues in the ICT sector. Amsterdam University of Applied Sciences set up an IT professional re-training programme for higher IT positions, which - after the termination of a 2-year funding period - needs to run on its own as a university offer without any further funding.
 48. The National Software Academy, Wales, which is a Higher Education institution, offering innovative degrees in software development.

4.1.2 IT vendor activities in Europe

A range of IT-vendor activities on high-tech skills development as well as re- and up-skilling can be identified in Europe. Some of these are more or less identical to those which the companies already started in the US.

Freeformers and Facebook partnership is an initiative in which Facebook together with Freeformers plan to offer training to 300,000 people across the EU in UK, France, Germany, Poland, Italy and Spain from 2018 onwards (<https://freeformers.com/media/blog/freeformers-partners-with-facebook/>) using the Freeformers Future Workforce Model (<https://freeformers.com/products/future-workforce-model/>) to help individuals acquire the attributes to be employable, successful and productive in a digital world. For 75,000 people, this training is supposed to be in person, and the rest will be online. All training is said to be tailored to each person, so someone with very strong skills could be taught how to code, while others might learn how to open a bank account online.

As part of Facebook's flagship **#SheMeansBusiness programme**, the company plans to provide digital skills training to more than 15,000 women in France. The programme is planned to encourage entrepreneurship through developing networks, mentoring, partner-led training programs and inspiring relatable role models. It is already active in the UK and Italy and will be rolled out in Ireland, Spain and Sweden in 2018.

The **Google 'Growth Engine' programme** has been implemented in many European countries under different names. It is designed to help individuals and businesses succeed online. The digital skills training programme is

delivered through both online and offline training in all EU28 Member States. Digital Workshop, an online learning platform, provides each visitor with a plan that is specifically tailored to the gaps in their knowledge and desired learning pace. Google states that the Growth Engine skills offline programmes address local economical and societal challenges through the development of partnerships within local ecosystems and with multiple levels of government (<https://growthengine.withgoogle.com/intl/en-eu>).

Cisco is using its '**Country Digitization Acceleration**' programme and strategy coupled with some major investment to establish long-term partnerships with national leadership, industry and academia to accelerate the national digitization agenda in these countries. Part of the related activities include investments in universities and the extended use of Cisco's Networking Academy. The 'Country Digitization Acceleration' programme has already been established in Europe in countries like France, the UK, Germany, Portugal and Luxembourg.

Samsung Digi Pass is a free of charge 5-month digital and life-skills training programme developed by Samsung Electronics Baltics in cooperation with the Tallinn University and Youth Union for vocational school students aged 14 to 19 in Estonia aimed to reduce youth unemployment and to increase the number of high-level professionals in various sectors by enabling youngsters acquire the digital and social competencies that will make them valuable employees in the future including real hands-on work experience through developing digital projects, such as apps and online platforms in teams, training of social skills, self-regulation, interpersonal communication, leadership and teamwork, planning and decision-making.

4.2 Relevant activities in the USA

4.2.1 Programmes and initiatives in the USA

Relevant programmes and initiatives from the USA identified in the course of the present activity include some National Science Foundation (NSF) programmes and a range of IT-vendor based initiatives. IT-vendor based programmes are often to be seen as philanthropic programmes (or at least these start as such). Those selected programmes initiated and run by the NSF and further described are a mature and a recent programme launched as high-tech skills development programme at technician level and another one as graduate education programme. These are programmes to which stakeholders can submit proposals at specific deadlines. The programmes involve partnerships between academic institutions and industry to promote improvement in the education of professionals from science and engineering in specific disciplines and domains further described in the subsequent sections.

National Science Foundation programmes

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defence..." NSF supports basic research and people to create knowledge that transforms the future. With an annual budget of \$7.5 billion (FY 2017), the NSF is the funding source for approximately 24% of all federally supported basic research conducted by America's colleges and universities. In many fields such as mathematics, computer science and the social sciences, NSF is the major source of federal backing.

In the context of our present activity we identified mainly two programmes as relevant for further analysis:

- Advanced Technological Education (ATE)
- Training-based Workforce Development for Advanced Cyberinfrastructure (CyberTraining).

These are further described below.

The NSF has launched a technician level programme called '**Advanced Technological Education (ATE)**' which is addressing specific area of disciplines including

- Biotechnology/Biology/Chemistry,
- Engineering,
- Evaluation/Research,
- Geographic Information Systems/Geosciences,
- Information Technology/Computer Science and
- Information technology/Cybersecurity.

The Advanced Technological Education (ATE) program has been active for 25 years funding institutions educating the skilled technical workforce (workforce that needs more than a high school degree but less than A 4-year degree. The ATE programme provides educational opportunities for Undergraduate Students, K-12 Educators. The programme requires committed partnerships between educational institutions and industry. Industry supports curriculum development, equipment, student internships, plus a host of other activities. ATE funds projects, centres, and applied research on technician education. Much more than pilot studies are supported.

With an emphasis on two-year Institutions of Higher Education (IHEs), the Advanced Technological Education (ATE) programme focuses on the education of technicians for the high-technology fields that drive the US economy. The programme involves partnerships between academic institutions (grades 7-12, IHEs) and industry to promote improvement in the education of science and engineering technicians at the undergraduate and secondary institution school levels. The ATE program supports curriculum development; professional development of college faculty and secondary school teachers; career pathways; and other activities. The programme invites research proposals that advance the knowledge base related to technician education. It is expected that projects will be faculty driven and that courses and programmes credit bearing, although materials developed may also be used for incumbent worker education.

The ATE program encourages partnerships with other entities that may impact technician education. For example, with:

- the National Institute of Standards and Technology (NIST) Manufacturing Extension Partnerships (MEPs) (<http://www.nist.gov/mep/index.cfm>) as applicable to support technician education programs and the industries they serve;
- Manufacturing USA Institutes (<https://manufacturing.gov/>) and Investing in Manufacturing Communities of Practice (IMCPs) (<https://www.eda.gov/imcp/>) addressing workforce development issues (also see DCL NSF 16-007); and
- NSF Industry University Cooperative Research Centers Program (I/UCRC) awardees (<http://www.nsf.gov/eng/iip/iucrc/>).

The ATE programme encourages proposals from Minority Serving Institutions and other institutions that support the recruitment, retention, and completion (certificate, degree, programme) of students underrepresented in STEM in technician education programmes that award associate degrees. NSF is particularly interested in proposals from all types of Minority Serving Institutions (including Hispanic Serving Institutions, Historically Black Colleges and Universities, Tribal Colleges and Universities, and Alaska Native and Native Hawaiian Serving Institutions) where the proportion of underrepresented students interested in advanced technology careers is growing.

At present 349 projects are being funded¹⁴, with around slightly more than a third with a budget of up to \$500,000, another 45% with a budget between \$500,000 and \$1 million and almost 20% with a budget of more than \$1 million. The vast majority are standard grants. Only around 7% are continuing grants. The deadline for the current round of submissions is 3rd October 2019.¹⁵

The following case examples provide some information on rather typical projects funded through the ATE programme.

Lasers and Fiber Optics Regional Center (USA)

NSF Standard ATE (Advanced Technological Education) Programme Grant Award - Award Number: 1700352

Lasers and fibre optics (LFO) undergird most twenty-first century advanced technologies. They are fuelling innovations in medical instrumentation, photonics integrated circuits, telecommunications technologies, laser additive manufacturing, remote sensing, analytical instrumentation, and other industries. The economic impact of light-based technologies on the U.S. gross domestic product was \$7.5 trillion in 2010. The Department of Labor projects that 1,710 LFO technicians will be needed annually between 2014 and 2024. U.S. colleges with LFO and photonics programs produce only 300 technicians annually. The demand is almost six times the supply. This project will support the education of the workforce needed to keep the U.S. as the world leader in laser and fibre optics enabled technologies.

The ATE Regional Center, LASER-TEC, proposes to continue developing the LFO workforce for the southeastern U.S., and will expand the current network of 21 partner colleges. The industrial corporate network will increase to include companies from different sectors of the economy. The goals are to: 1) Increase and strengthen LFO academic programs to meet industry demand; 2) Create and offer LFO professional development programs for secondary school teachers, college faculty, and incumbent workers; 3) Develop LFO curriculum materials for secondary schools, colleges, and industry; 4) Develop, promote, and deliver outreach and awareness programs to secondary STEM teachers, advisors, counsellors, and administrators; 5) Develop strategies and materials to recruit and retain underrepresented groups to promote diversity in LFO programs; and 6) Identify and disseminate LFO technicians' skillsets and employment needs in the southeastern U.S. LASER-TEC is working with AIM Photonics, Power America, Advanced Functional Fabrics of America, and other Manufacturing USA Institutes to provide the workforce education and training as new technologies are developed.

Duration: September 2017 – August 2020

Awarded amount to date: \$2,618,100.00

Sponsor: Indian River State College

https://www.nsf.gov/awardsearch/showAward?AWD_ID=1700352&HistoricalAwards=false

Pathways for Learners to Engineering Technology Employment (USA)

NSF Standard ATE (Advanced Technological Education) Programme Grant Award - Award Number: 1801177

Louisiana Delta Community College in collaboration with Louisiana Technology University propose an engineering technology career pathway for high school and post-secondary students. This project aims to prepare students for instrumentation technician careers in manufacturing and other highly automated industries. Through recruitment and retention programs set in a diverse geographic region, this project has the potential to promote increased participation in the STEM workforce by veterans, women, and students from groups that have been traditionally underrepresented in STEM fields. This project aims to positively affect local industry and residents by strengthening the pipeline into high-technology, high-wage jobs. As a

¹⁴ Overview of ATE funded projects:

<https://www.nsf.gov/awardsearch/advancedSearchResult?ProgEleCode=7412&BooleanElement=Any&BooleanRef=Any&ActiveAwards=true&#results>

¹⁵ ATE Programme website: https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5464

result, this project has the potential to improve the quality of life for these residents and to serve as a model for high-tech workforce development in other rural areas across the nation.

The primary goal of this project will be to increase engineering technology career pathways for high school students, engage and retain these students through college, and ensure they will be employable upon graduation. The two pathways to become an automation technician will be either through a two-year technology degree or a four-year engineering technology degree. High school students will be offered dual credit courses to seamlessly transfer into the two-year or four-year career paths in automation technology. High school teachers and counsellors from across North Louisiana will participate in workshops where they will be introduced to advanced manufacturing curriculum and career pathways. A strong collaboration between higher education and industry will help to align the curriculum to workforce needs. This project expects that it will reach about 500 high school students, about 100 undergraduate students, and more than 25 high school teachers and counsellors over a three-year period.

Duration: August 2018 – July 2021

Awarded amount to date: \$599,973.00

Sponsor: Louisiana Delta Community College

https://www.nsf.gov/awardsearch/showAward?AWD_ID=1801177&HistoricalAwards=false

The Necessary Skills Now Network: Integrating Employability Skills Development into Technician Education Across STEM Disciplines

NSF Standard ATE (Advanced Technological Education) Programme Grant Award - Award Number: 1801096

For several decades, employers in high-tech fields have complained that entry-level employees often lack "employability skills," which are also called "soft skills." These skills are the non-technical skills necessary for success in the workplace, including working in teams, problem solving, verbal communication, written communication, dependability/work ethic, and planning/organizing. Reports have called on colleges to redesign courses and curricula to address the deficiency in employability skills, and many projects have been launched to do so, often with a focus on a particular discipline. As a new Advanced Technological Education (ATE) Coordination Network, the Necessary Skills Now Network will foster the collaboration of community and technical college faculty with business/industry partners to integrate employability skills into technician education programs across the STEM disciplines.

The Necessary Skills Now Network will assist community and technical colleges in sharing resources, exploring new teaching methods, and collaborating with employers to help students improve their mastery of employability skills. The Network will (1) create an active "community of practice" to exchange ideas, promising practices, research, and employment trends; (2) provide faculty development workshops and courses to support the adoption of effective teaching methods, instructional materials, and learning environments; and (3) create an online portal of open educational resources to improve the development of employability skills among students in technical associate degree programs. The project is led by the Center for Occupational Research and Development and three ATE centres: the South Carolina Advanced Technological Education centre (engineering technology), the Center for Systems Security and Information Assurance (cybersecurity), and the Florida Advanced Technological Education centre (advanced manufacturing). Through the existing, extensive networks of these partners, the investigators expect to reach over 450 faculty members with workshops, online courses, and on-demand resources and to engage over 300 colleges and 75 companies in community-of-practice activities. Conference presentations, webinars, publications, and social media will further extend awareness of the Network's resources to stakeholders across the STEM disciplines. The overall goal is to develop an environment in which many employers and educators collaborate across roles, technology sectors, and geography to build solutions that will give students the full range of skills needed for working productively after they are hired.

Duration: October 2018 –September 2021

Awarded amount to date: \$599,973.00

Sponsor: CORD - Center for Occupational Research and Development

https://www.nsf.gov/awardsearch/showAward?AWD_ID=1801096&HistoricalAwards=false

A very recent graduate education programmes launched by the NSF is the one on ‘**Training-based Workforce Development for Advanced Cyberinfrastructure (CyberTraining)**’. This programme seeks to prepare, nurture, and grow the national scientific research workforce for creating, utilising, and supporting advanced cyberinfrastructure (CI) to enable and potentially transform fundamental science and engineering research and contribute to the Nation's overall economic competitiveness and security. The goals of this solicitation are to (i) ensure broad adoption of CI tools, methods, and resources by the research community in order to catalyze major research advances and to enhance researchers’ abilities to lead the development of new CI; and (ii) integrate core literacy and discipline-appropriate advanced skills in advanced CI as well as computational and data-driven science and engineering into the Nation’s educational curriculum/instructional material fabric spanning undergraduate and graduate courses for advancing fundamental research. Pilot and Implementation projects may target one or both of the solicitation goals, while Large-scale Project Conceptualization projects must address both goals. For the purpose of this solicitation, advanced CI is broadly defined as the set of resources, tools, methods, and services for advanced computation, large-scale data handling and analytics, and networking and security for large-scale systems that collectively enable potentially transformative fundamental research.

This solicitation calls for innovative, scalable training, education, and curriculum/instructional materials—targeting one or both of the solicitation goals—to address the emerging needs and unresolved bottlenecks in scientific and engineering research workforce development, from the postsecondary level to active researchers. The funded activities, spanning targeted, multidisciplinary communities, will lead to transformative changes in the state of research workforce preparedness for advanced CI-enabled research in the short- and long-terms. As part of this investment, this solicitation also seeks to broaden CI access and adoption by (i) increasing or deepening accessibility of methods and resources of advanced CI and of computational and data-driven science and engineering by a wide range of scientific disciplines and institutions with lower levels of CI adoption to date; and (ii) harnessing the capabilities of larger segments of diverse underrepresented groups. Proposals from, and in partnership with, the aforementioned communities are especially encouraged.

Three project classes have been defined: Pilot, Implementation (Small or Medium), and Large-scale Project Conceptualisation:

- Pilot Projects: up to \$300,000 total budget with durations up to two years;
- Implementation Projects: Small (with total budgets of up to \$500,000) or Medium (with total budgets of up to \$1,000,000) for durations of up to four years; and
- Large-scale Project Conceptualization Projects: up to \$500,000 total budgets with durations up to 2 years.

This funding programme has only just been launched (status: November 2018). Proposal submissions deadlines have been set for 6th February 2019 and 15th January 2020. The NSF intends to give between 12 – 18 awards. Up to 4 Pilot, 8 Small and 3 Medium Implementation, and 3 Large-scale Project Conceptualization awards are anticipated. The anticipated funding amount will be \$6,000,000.¹⁶

The NSF Division of Undergraduate Education has announced the S-STEM programme on ‘**NSF Scholarships in Science, Technology, Engineering, and Mathematics Program (S-STEM)**’ to open a further solicitation in spring/summer 2019. The programme is about augmented reality learning and training and supporting low income STEM student through scholarships.

¹⁶ NSF graduate education programme (USA): <https://www.nsf.gov/pubs/2019/nsf19524/nsf19524.htm>

NSF Scholarships in Science, Technology, Engineering, and Mathematics Program (S-STEM)

The programme addresses the need for a high quality STEM workforce in STEM disciplines. The aim is to support low-income academically talented students with demonstrated financial need who are pursuing associate, baccalaureate, or graduate degrees in science, technology, engineering, and mathematics (STEM).

Recognizing that financial aid alone cannot increase retention and graduation in STEM, the programme provides awards to Institutions of Higher Education (IHEs) to fund scholarships and to advance the adaptation, implementation, and study of effective evidence-based curricular and co-curricular activities that support recruitment, retention, transfer (if appropriate), student success, academic/career pathways, and graduation in STEM. The S-STEM programme encourages collaborations among different types of partners: Partnerships among different types of institutions; collaborations of STEM faculty and institutional, educational, and social science researchers; and partnerships among institutions of higher education and local business and industry, if appropriate.

The programme seeks: 1) to increase the number of low-income academically talented students with demonstrated financial need obtaining degrees in STEM and entering the workforce or graduate programs in STEM; 2) to improve the education of future scientists, engineers, and technicians, with a focus on academically talented low-income students; and 3) to generate knowledge to advance understanding of how factors or evidence-based curricular and co-curricular activities affect the success, retention, transfer, academic/career pathways, and graduation in STEM of low-income students.

The STEM disciplines supported by the S-STEM programme include:

- Biological sciences (except medicine and other clinical fields);
- Physical sciences (including physics, chemistry, astronomy, and materials science);
- Mathematical sciences;
- Computer and information sciences;
- Geosciences; and
- Technology areas associated with the preceding disciplines (for example, biotechnology, chemical technology, engineering technology, information technology, etc.)

This programme provides educational opportunities for Undergraduate Students and provides indirect funding for students at this level or focuses on educational developments for this group such as curricula development, training or retention.

https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5257&org=NSF&from_org=NSF

4.2.2 IT-vendor initiatives in the US

IT-vendor based programmes are often to be seen as philanthropic programmes (or at least these start as such). A selection of prominent programmes is briefly described herewith.

Grow with Google is a Google philanthropic programme aimed at the United States, with free training and tools designed to get a job in light of rapid technological change. The Grow with Google website (<https://grow.google/>) has sections with several programmes for students, teachers, local businesses, job seekers, developers, and start-ups. One particular training programme is offering 50,000 Udacity scholarships for Android and web development, split between developers with no qualifications and those who already have experience.

Goodwill Digital Career Accelerator is the result of Google giving a grant to Goodwill, the United States' largest workforce development non-profit, to launch the Goodwill Digital Career Accelerator in the USA. It is the largest grant Google.org has ever given to a single organisation. Through this grant and with the assistance of 1,000 Google volunteers, Goodwill plans to offer 1.2 million people digital skills and career opportunities in all 156 Goodwills across every state over the next three years that will enable them to become more marketable and advance in today's labour market. Goodwill was the winner of an open invitation to non-profits to submit their ideas to address economic opportunity in Pittsburgh to the Pittsburgh Impact Challenge.

Facebook Community Boost is a programme to help US small businesses grow and to equip more people with the digital skills they need to compete in the new economy which was launched in 2017. Facebook Community Boost plans to visit 30 US cities in 2018, including Houston, St. Louis, Albuquerque, Des Moines and Greenville, South Carolina. Facebook plans to work with local organizations to provide digital skills and training for people in need of work, to advise entrepreneurs how to get started and to help existing local businesses and nonprofits get the most out of the internet. Since 2011, Facebook has invested more than \$1 billion to support small businesses. Boost Your Business has trained more than 60,000 small businesses in the US and hundreds of thousands more around the world. More than 1 million small businesses have used Facebook's free online learning hub, Blueprint, and more than 70 million small businesses use the free Pages tool to create an online presence. Facebook recently created a digital marketing curriculum that is supposed to help train 3,000 Michigan residents in digital skills development over the next two years.

At the Davos World Economic Forum Summit in 2018 Accenture, CA Technologies, Cisco, Cognizant, Hewlett Packard Enterprise (HPE), Infosys, Pegasystems, PwC, Salesforce, SAP and Tata Consultancy Services launched the IT Industry Skills Initiative SkillSET to meet the global skills gap challenge and address job displacement arising from automation and the Fourth Industrial Revolution. SkillSET calls itself the first ever IT industry initiative to bring competitive training content together on one platform. To empower people to address fast-changing skill requirements, initiative partner companies are opening up key elements of their individual training libraries into one centralized portal. Users will have access, free of charge. SkillSET is hosted on the EdCast AI-powered Knowledge Cloud platform. **The initiative will initially target the US market, with plans to scale to other geographies and build industry and public-sector partnerships in 2018 and beyond.** However, at the time of writing this report (May-June 2019) no SkillSET activities could be identified. It appears as if this initiative never got started.

4.2.3 General assessment of US activities and funding programmes

ATE programme evaluation activities have resulted in several evaluation reports. A recent report on the skilled technical workforce has been released and made available on the National Academies of Science website (www.nap.edu). The title of the report is "Building America's Skilled Technical Workforce".

Information on the ATE programme can be accessed at ATE Central, www.atecentral.net, and www.atecenters.org. A recent publication "ATE Impact: 25 years of technician education" can be downloaded from the centres site. Evaluation and impact data are made available on the ATE Evalu-ate Center site (www.evaluate-ate.org) including the summaries of the annual surveys.

Data from the most recent 2017 evaluation report¹⁷ revealed that in 2016, ATE projects offered 1,700 professional development activities, serving almost 32,000 participants. These activities range from short presentations intended primarily to raise awareness to long-term periodic instructional activities (e.g., internships or peer coaching). A little more than half of the participants attended short presentations and a little less than half attended longer sessions, with more than 7,000 educators participating in activities that lasted one full day or more.

In 2016, NSF-funded ATE projects collectively reported the following accomplishments¹⁸:

- Educated more than 70,000 students—60 percent of whom were at two-year colleges and 31 percent at secondary schools,
- Developed 1,430 curriculum materials, including 870 activities, 430 modules, and 130 courses.
- Offered 1,710 professional development opportunities, which served 32,000 educators; roughly 44 percent of participants were two-year-college faculty and 29 percent secondary school teachers,

¹⁷ Evalu-ate: ATE Annual Survey. 2017 Report.

¹⁸ Taken from Evalu-ate: ATE Annual Survey. 2017 Report.

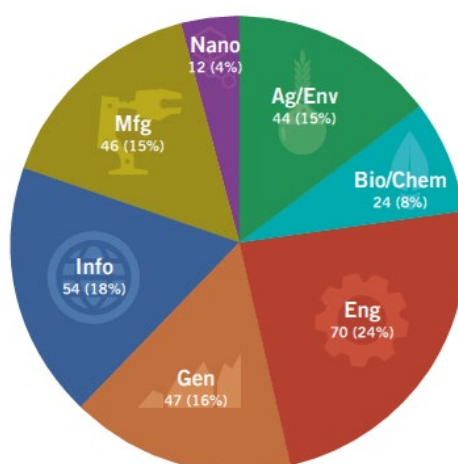
- Supported 1,183 existing articulation agreements and developed 162 new agreements in 2016; these agreements helped 3,590 students matriculate between high schools and two-year colleges, and 6,230 students between two-year and four-year institutions,
- Served a student population that was 31 percent racial minority, 34 percent Hispanic or Latino/Latina, and 28 percent female.
- Collaborated with more than 9,600 groups.

47% of ATE projects supported a degree or certification program in 2016. The majority of these were projects in the areas of advanced manufacturing technologies, agricultural and environmental technologies, or information and security technologies. Together, these three areas accounted for 64 percent of degree or certification programs funded by the ATE program in 2016.

The most recent distribution of funds by area can be seen in the following figure. The highest concentration of projects is in the areas Engineering Technologies and Bio and Chemical Technologies (24% each), followed by Information and Security Technologies (18%).

From its initial round of funding a few dozen awards in 1994 to the wide array of centres and projects funded in 2018 in areas like robotics, sustainable construction, additive manufacturing, and geospatial technologies, the program continues to grow and expand.

Figure 1: ATE projects and centres by area (May 2018)



Mfg: Advanced Manufacturing Technologies
 Nano: Micro and Nanotechnologies
 Info: Information and Security Technologies
 Gen: General Advanced Technological Education
 Eng: Engineering Technologies
 Bio/Chem: Bio and Chemical Technologies
 Ag/Env: Agricultural and Environmental Technologies

Source: National Science Foundation: *Advanced Technological Education Impacts – Twenty-five Years of Advancing Technician Education (2018-2019)*: <https://ateimpacts.net/book>

The current ATE program tracks include centres with budgets up to \$5 million over five years; resource centres with budgets up to \$600,000 over three years; targeted research on technician education with budgets ranging from \$150,000 for pilot studies to \$800,000 for full-scale research and development over three years; and projects with budgets ranging from \$225,000 to \$600,000.

It is too early for an evaluation of the **‘Training-based Workforce Development for Advanced Cyber-infrastructure (CyberTraining)’ programme** which has only just started. However, it is worthwhile mentioning that the programme’s ambition is to reach beyond funding of pilot but also implementation and larger scale operation of activities.

The NSF '**Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM)**' programme is entering a new round in 2019. In previous rounds more than 700 projects were funded. The vast majority (516) received Grants between \$500,000 - \$1,000,000, and a further 125 Grants above \$1,000,000. Evaluation reports could not be identified.

All the **philanthropic and CSR-based programmes of global vendors** in the US but also in Europe can be described as support or funding programmes of 'donors funding the implementation and operation of a specific new training concept'. Given their size and volume as well as the very large number of trainings for individuals aimed at, we have decided to allocate these to a separate type of programme called 'IT vendor funding high-tech skills training at a large scale'.

Most of them have started in the US where they already have a history. Those started in Europe are mostly rather recent developments with little or no reliable information about their achievements and impact. Having started as CSR-based programmes, they need to be critically reviewed as to their real 'substance' and ambition and whether these will remain announcements and the prospective large numbers of people to be trained will become reality.

Apart from that, these initiatives mostly address and carry out rather general digital skills training. Where they move towards specific (high-tech) skills training, they are strongly related to vendor products and services (e.g. Cisco Networking Academy Program).

All these programmes with substantial budgets can add and contribute but not replace major funding policies and related programmes of national governments and those from industry – government partnerships mostly embedded in existing institutional education and training structures. The latter are to be adapted constantly to changing requirements and developments which the IT vendor programmes seem to be faster at. This seems to remain a big challenge for the more traditional programmes in many countries.

Moreover, the large-scale IT vendor programmes announced or already in operation seem to attract large numbers of individuals for training reaching figures which are way beyond these of the other types of schemes identified and analysed. It may be worthwhile having a closer look at the vendor-based schemes, identify the success factors and learn from them with respect to rapid scaling up. These schemes and programmes practice what has recently and in the context of start-up company growth been described as 'blitzscaling'¹⁹. 'Blitzscaling' implies prioritising speed over efficiency, even in the face of uncertainty. It is important when the success of an undertaking depends on lots of participants or members and getting feedback from them for successful scaling up. In businesses and areas – such as training programmes to reach, attract and train vast numbers of individuals – scale matters and getting in early and doing it fast can make the difference. The more traditional schemes and programmes more closely related to or integral part of the formal education and training systems in the different countries can probably learn some lessons from these programmes for consideration and use in their future operation.

4.3 Further types of funding and incentives

In addition to the above types of funding programmes, we could identify a whole range of different general types of funding and incentives supporting skills development addressed to individuals or companies in general.

Some of these can be applied for or apply also when participating in one of the above funding programmes (e.g. tax incentives through the tax levy in the UK which had a positive impact on the SIP – Strategic Industry Partnership Programme or the tax incentives in the Alliance Industrie du Futur in France) subject to the fulfilment of specified entitlement criteria.

¹⁹ Hoffman, R., Veh, C.: Blitzscaling. The lightning-fast path to building massively valuable businesses. Ney York, 2018

The more general schemes include training grants which cover payment of tuition fees, or other charges for educational services, including scholarships, course subsidies (fully or partially subsidised courses), loans awarded to individual participants or enterprises for training purposes, cost reimbursements with repayments to beneficiaries in whole or in part, reduced social contributions with full or partial exemptions to obligatory social contributions, paid or unpaid educational leave schemes, training vouchers (with/without relationship to Individual Learning Accounts (ILA)) which can take the form of financial support in form of ILAs or vouchers for individuals or SMEs, tax incentives which include different types of economic incentives to invest in training such as tax allowances, tax exemptions, tax credits, tax relief, tax deferrals and finally combinations of the above.

These general schemes will be presented here for reasons of completeness and only by using the example of Germany. By using Germany as an example the vast majority of existing general types of financial and fiscal incentives in Europe including voucher-based schemes are covered since identical or very similar schemes exist throughout Europe.

4.3.1 Financial incentives

Financial incentives for further education in Germany are offered by the employment agency, the Federal government and most Federal states (Laender) and especially to individuals working at SMEs (max. 250 employees) or the companies. Typically, the reimbursement of cost ranges between 50-70% of the actual costs and up to a maximum of between 2,000 and 4,500 Euro. Generally, the taxable gross annual income has to be in a certain range and not exceed EUR 30,000 (EUR 60,000 with joint assessment). Many of these schemes are financed through the ESF.

4.3.2 General tax deductions

The **general tax deduction opportunities** related to further education in Germany range up to a maximum of 4000 Euro/year deductible from the annual income.

4.3.3 Education vouchers

Bildungsgutschein (education voucher): The Education voucher (Bildungsgutschein) is issued by the employment agency or the job centre and is geared towards a specific educational goal. The educational voucher can be redeemed by certified providers and is used for billing with the employment agency or job centre.

4.3.4 Individual Learning Accounts

Individual learning accounts offer the opportunity to empower working age adults to equip themselves with the skills needed to support their employability. They provide a new vehicle for funding continuous learning. This kind of solution has been implemented in 2016 in Singapore, where the SkillsFuture Credit aims to encourage individuals to take ownership of their skills development and lifelong learning.

4.3.5 Further training grants

Weiterbildungsprämie (further training grant): Further training grant is an incentive for a retraining, where job-seekers receive up to 2,500 Euro extra. The prerequisite is that retraining leads to a recognized professional qualification - such as the chambers of commerce retraining at different training institutions. The money is paid by the employment agency or the job centre - the sum is not assigned and is at free disposal of the individual.

4.3.6 Training scholarship

Weiterbildungsstipendium (training scholarship): The training scholarship (Weiterbildungsstipendium) is a continuing education fellowship aimed at young people under 25 who have successfully completed their training. The aim is the career advancement through qualification or the step into self-employment. As a scholarship holder, up to EUR 6,000 are eligible for funding, which can be spread over various training courses over a period of three years. In some cases, this can also be used to finance a career-accompanying study program.

4.3.7 Educational check

Bildungsscheck NRW (Educational check NRW): The Educational check North Rhine-Westphalia (NRW) (Bildungsscheck NRW) is taken as an example. It promotes continuing education with a maximum of 500 Euro. With the application permit, certain groups are deliberately preferred: immigrants, employees without professional qualifications, professional returners, older workers and atypically employed persons (e.g. temporary workers). In addition, the taxable gross annual income may not exceed EUR 30,000 (EUR 60,000 with joint assessment). Another criterion is that one must be employed in a company with less than 250 employees. The Ministry of Labour, Integration and Social Affairs of the State of North Rhine-Westphalia is responsible for the NRW education checklist. Similar schemes also exist in the other German Länder (regions).

4.3.8 Education bonus premium voucher

Bildungsprämie (education bonus premium voucher): The education bonus premium voucher (Bildungsprämie) supports people in the financing of a vocational training course. Premium vouchers are issued annually (instead of only once every two years as it was practiced until June 2017). There is no longer an age limit. This allows people below 25 years of age and working pensioners to receive a bonus voucher. Prerequisites are that they are working at least 15 hours a week and earn a taxable income of a maximum of EUR 20,000 (couples being jointly assessed: EUR 40,000). The funding amounts to 50% of the training event fees, but a maximum of 500 Euro. Premium vouchers can be used in most of the federal states regardless of the amount of the event fees (the so-called 1,000-Euro limit). This is an ESF co-funded scheme.

4.3.9 Loans

Traditional student bank **loans** are offered by many banks in the different countries. These are not offered online and in the vast majority of cases constitute local bank offers difficult to scale to become applicable as national or Europe-wide offers. Different types of loans exist:

Specific online bank loans for students with deferred payment: these are mostly offered in the US only. Interest rates are high (>5%). Examples and their related interest rates and durations include:

- <https://climbcredit.com> US only, 5% min, 3 years
- <https://skills.fund> US only, 7-8% min, 3-5 years
- <http://upstart.com/> US only, 7.46% – 35.99%
- <https://quotanda.com/> Spain, 9-11%, 1-3 years

Training financed through a share of future income (8-25%) of students over several years: Examples from different countries include:

- A dedicated financial instrument **“Income Sharing Agreement”** which exists in the US. Its providers pay the school upfront and then get paid back by the student 8-25% of their salary over typically 3 – 4

years. In some cases schools offer the service themselves, but several dedicated financial service providers appear to take the risk (ex. [Vemo](#), [Leif](#) or [Goal Structured Solutions](#)). Schools that offer such a program include [General Assembly](#), [Holberton school](#), [MakeSchool](#) and many others.

- In UK, a similar type of agreement [“Human Capital Contract”](#) has been [examined recently](#) and is assessed by the FCA (UK financial regulator).
- In Germany, [CHANCEN EG](#) developed an Income Share Agreement instrument that is used within Germany since 2016.

4.3.10 General assessment

In the vast majority of cases, the general financial and fiscal incentives restrict (financial) support to specific types of target groups, e.g. SMEs or individuals with an income not exceeding a certain (low) threshold, making it very unlikely that such schemes can be applied in a wide area of high-tech skills development. These schemes are mostly aimed at more basic types of skills development addressed to unemployed and people without or low levels of skills and qualifications. Some (e.g. tax incentives) are partially relevant in cases where these constitute an integral part of one of the above funding programmes as described above. The Apprenticeship Levy in the UK is a tax on employers which can be used to fund apprenticeship training. In the current (2018/19) tax year it is payable by all employers with an annual pay bill of more than £3 million at a rate of 0.5% of their total pay bill. This could become a powerful means of funding high-tech skills training. Since it was only launched recently in late 2017 no robust data as to its application, use and successes are yet available.

In order to motivate employees and citizens to become more active in continuous education and training and lifelong learning, innovative financing solutions for students should be developed. In order to be attractive these should be loan-based using instruments like an Income Sharing Agreement, diverse, online and all-European. The European Commission through its Structural and Investment Funds could support the creation of such schemes at national level. This should be contracted easily online by all students admitted in pre-certified training programmes. Since most further training in the future will be likely to have durations of between 6 – 12 months and higher education programmes between 3 – 5 years the conditions include an interest rate of around 1% and durations of 1-5 years.

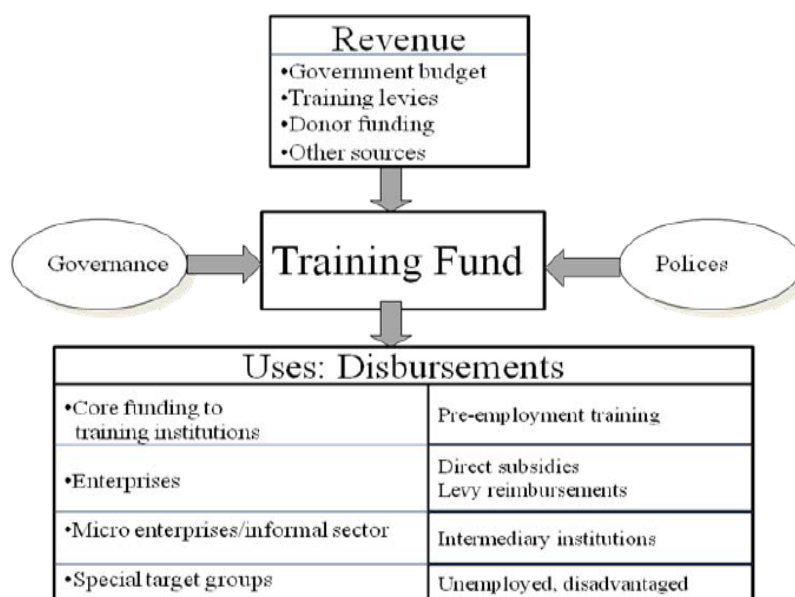
Individual Learning Accounts (ILA) offer opportunities to empower adults to equip themselves with the skills needed to support their long-term employability. First generation ILAs were started in countries like Sweden, the UK and Austria and date back to the early years of this century. They provide a vehicle for funding continuous learning. The European Commission through its Structural and Investment Funds (e.g. ESF) could support the setting up of ILA schemes at national level specifically for training for priority skills or strategic sectors (e.g. digital and green skills).

4.4 Typology of relevant high-tech skills funding programmes

In a further step we aimed at studying and categorising the selected programmes to develop a typology of funding programmes to then in a further step identify the typical key elements of different types of programmes but also their success factors, the ability to scale-up, the transferability potential and very importantly their sustainability in terms of secured financial capability but also governance structures. The objective was to help gaining a better understanding of the different mechanisms, specifics and overall functioning of these programmes and to find out which of these or which combinations bear the potential for successfully supporting high-tech skills development in the future.

Authors like Johanson and Zidermann²⁰ in their work on national training funds and funding mechanisms for financing training have used the term ‘training fund’ and describe this as “a dedicated stock or flow of financing outside normal government budgetary channels for the purpose of developing productive skills for work” which “provide an institutional framework for collecting and allocating funding to training providers” whereby “the functions may differ, but training funds often have the same objectives, coverage and modus operandi”²¹. Ziderman in describing the diversity of sources of funding – including public, private and donor sources –, financing flows and the diversity of beneficiaries of fund expenditure started to develop a corresponding framework of activities depicted in the following figure.²²

Figure 2: Generic financial flow framework



This framework may help in developing an appropriate framework for and a typology of high-tech skills development funding programmes.

A starting point could also be building on the different purposes and objectives of such funding programmes which Johanson describes as follows²³:

1. Unify and coordinate various sources of revenue, i.e. pooling of income from different sources;
2. Mobilize resources and increase revenue available for training;
3. Build pre-employment training systems and capacities;
4. Expand the volume of employer-based training by encouraging enterprises to invest more in worker training;
5. Provide equality of opportunity for access to training services by disadvantaged populations;

²⁰ Johanson, Robert: A Review of National Training Funds. The World Bank Social Protection & Labour Discussion Paper No. 0922, Washington D.C., 2009; Ziderman, Adrian: Ziderman, Adrian: Financing Vocational Training in Sub-Saharan Africa. African Region Human Development Series. The World Bank, Washington, D.C. 2003; Ziderman, Adrian: Funding Mechanisms for Financing Vocational Training: An Analytical Framework. IZA Policy Paper No. 110. Bonn, 2016

²¹ Johanson, Robert: A Review of National Training Funds. The World Bank Social Protection & Labour Discussion Paper No. 0922, Washington D.C., 2009, p. 3

²² Ziderman, Adrian 2003; taken from Johanson 2009

²³ Taken from: Johanson, Robert: A Review of National Training Funds. The World Bank Social Protection & Labour Discussion Paper No. 0922, Washington D.C., 2009, p. 5

6. Improve the relevance of training, e.g. allocate funds according to employer priorities and market needs;
7. Raise the quality of training, e.g. through accreditation of training providers and specification of performance conditions;
8. Use training resources efficiently, e.g. lower the unit costs of training;
9. Develop competitive training markets; and
10. Foster involvement by employers and collaboration among stakeholders.

He continues to build categories of funding programmes as described below. Each category aims at different clients and represents a response to different training needs and policy objectives²⁴:

1. “Core funding for pre-employment training in training institutions constitutes the primary and most traditional use. This pertains mainly to formal sector occupations and employment.
2. The second use can be for training of workers in enterprises, through apprenticeships, on-the-job training or training off the premises. This constitutes the bulk of training provided through training levies.
3. Third, training funds may offer services to build the skills and productivity of people working in microenterprises and the informal sector. Given the small scale of such operators, the way to reach them is often through intermediaries, such as informal sector associations. Training for the needs of micro-enterprises and the informal sector has generally been neglected in traditional training programs.
4. Fourth, training funds may open a funding window to train the unemployed or disadvantaged groups. Such training traditionally has been regarded as a government responsibility, but competitive contracting for such training is becoming a preferred mechanism to finance it.”

Although these approaches lead some way for the present study they do not fully cover the entirety of funding programme types identified in our work.

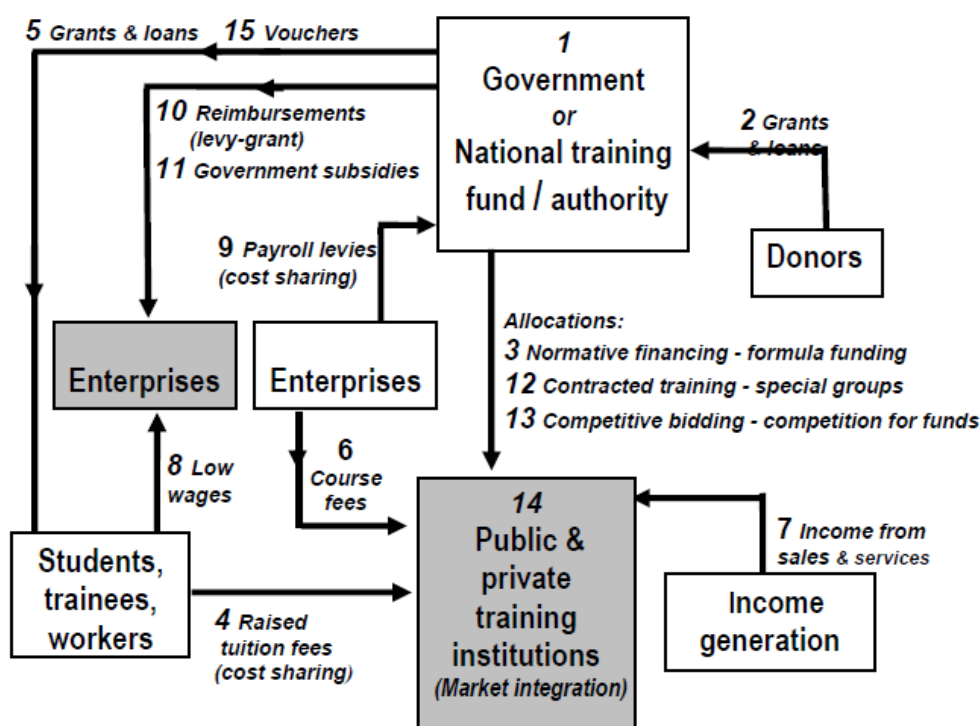
It is against this background that we decided to use and apply the integrated framework recently developed by Ziderman²⁵ which the author developed after a thorough analysis of the training finance system which he describes as ‘excessively fragmented’. His approach covers the traditional funding mechanisms as well as new, innovative ones (e.g. private training provision, levy-grant schemes, subsidising apprenticeship training). The framework is supposed to combine all the old and new financing mechanisms. It will hopefully also cover all the training funding programmes for high-tech skills development identified in our work and studied in the present report. This would make it applicable for further structuring and analysing the European high-tech skills training and development landscape.

The financing flows, in such an integrated framework, are set out in the schematic form in the figure below.

²⁴ Taken from: Johanson, Robert: A Review of National Training Funds. The World Bank Social Protection & Labour Discussion Paper No. 0922, Washington D.C., 2009, p. 7

²⁵ Ziderman, Adrian: Funding Mechanisms for Financing Vocational Training: An Analytical Framework. IZA Policy Paper No. 110. Bonn, 2016, p. 29

Figure 3: Financial flow framework by Ziderman (2016)



Note: Black arrows represent funding flows
Training providers are indicated by the shaded boxes

The illustration shows that²⁶

1. Government funding of training (institutions) is made either directly or via a national training authority (Ziderman calls these 'national training fund' (or NTA)) (1).
2. Where available, donor funding is supplied centrally to the government or training authority and not to individual institutions (2).
3. Core financing of public training institutions is based on normative financing (3).
4. Greater cost sharing is introduced in public training institutions, through augmented course fees closer towards competitive levels (4); this is
5. Facilitated by the availability of selective scholarships for the poor or student/trainee loans (5).
6. Additional income for public training institutions derives from fee payments for tailor-made courses for firms (6) and from
7. Income generation activities (7).
8. On-the-job training within firms is partially financed by workers through low wages (8).
9. Payroll levies on firms may be used, to either augment national funding for training (9) or may
10. Constitute part of a levy-grant scheme to encourage enterprises to train more (10).
11. Alternatively, government subsidies may be used to augment enterprise training (11).
12. Contract financing of designated government programs (such as for the unemployed) are made available to both public and private and training institutions (12);
13. Competitive bidding for funds (13) would ...

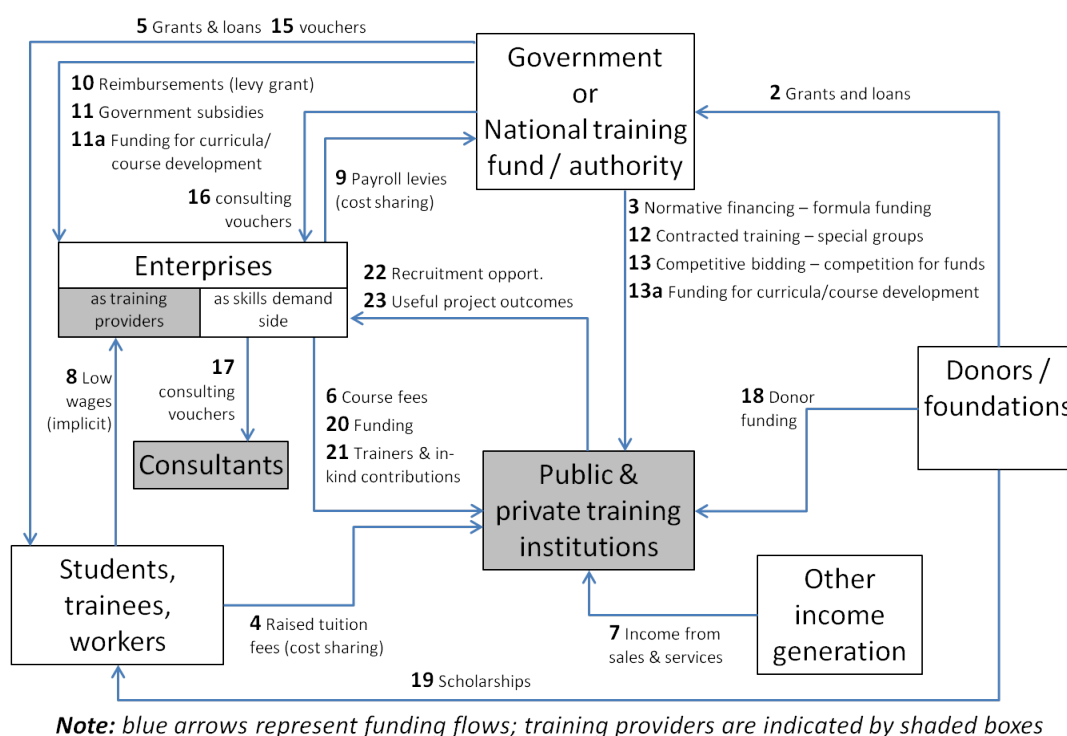
²⁶ Taken and expanded from: Ziderman, Adrian: Funding Mechanisms for Financing Vocational Training: An Analytical Framework. IZA Policy Paper No. 110. Bonn, 2016, p. 28

14. ... further enhance market integration of public and private training providers on a competitive basis (14);
15. Finally, training vouchers addressed and given to individuals or specific types of organisations (e.g. SMEs) constitute another popular funding instrument throughout Europe.

4.5 Results from the application of the typology

Applying this integrated framework to the funding programmes selected and analysed, it became apparent that it quite nicely covers almost all financing and funding mechanisms in these programmes. With some few additions integrated - which were carried out to make it fully fit the purposes of our activities - the framework has proven to be highly applicable and useful for the purposes of the present study. The value of this framework resides in its integrated system view, rather than piecemeal, and it can rightly be described as an 'integrated, demand-responsive training markets framework'. It is very helpful in introducing the different funding mechanisms and programmes as a comprehensive, integrated system leading the way to transforming the fragmented, inefficient training systems into an integrated competitive, demand-driven training system²⁷.

Figure 4: Adapted financial flow framework based on Zideman (2016)



The following typology of financing and funding programmes emerged once applying this extended framework. Altogether, 11 different types have been distinguished:

- Funding for industry in building and running dedicated vocational education centres
- Funding for the co-creation by industry and academia of new courses and curricula

²⁷ See: Zideman, Adrian: Funding Mechanisms for Financing Vocational Training: An Analytical Framework. IZA Policy Paper No. 110. Bonn, 2016, p. 27-30

- Funding for of new innovative and alternative teaching/learning systems²⁸
- Funding excellence schemes with top universities to draw top academic talent and students
- Funding SME vouchers for consulting contracts and knowledge transfer.
- Funding high tech apprenticeships/traineeships in industry
- Funding the development of open education resources (OER, including MOOCs)
- Funding (lifelong) learners through vouchers, fiscal incentives and/or cost sharing
- Funding up-skilling/re-skilling programmes for the workforce²⁹ in particular sectors or regions
- IT vendor funding high-tech skills training at a large scale
- Other

Type of financing and funding programmes	Examples of relevant funding programmes
EXCELLENCE - Funding excellence schemes with top universities to draw top academic talent and students	Software Campus (DE) IFD Industrial PhD (DK) Industrial Doctorates and IPP programmes (NL) Industrial PhD 2017 (SE) WASP - Wallenberg Autonomous Systems and Software Program - graduate school and affiliate PhD program (SE)
VOUCHER - Funding SME vouchers for consulting contracts and knowledge transfer	go-inno (DE) go-digital (DE) Asesores Digitales (ES) Alliance Industrie du Futur (FR) Industria 4.0 – Impresa 4.0 agevolazioni per l’innovazione e lo sviluppo di tecnologie abilitanti’ (IT) Knowledge Transfer Partnership (KTP) (UK)
DONOR - Funding for of new innovative and alternative teaching/learning systems	Study IT in Estonia (EE) Generation (ES) école 42 (FR) Manche Open School (FR) Thales Cybersecurity Programme (FR) Talent Club (ES)
CO-CREATION - Funding for the co-creation by industry and academia of new courses and curricula	Imec.academy (BE) ANH Education Network High Technology Berlin (DE) NanoTecLearn (DE) Supporting the digitalisation in inter-corporate occupational vocational training centres (Förderung von Digitalisierung in überbetrieblichen Berufsbildungsstätten und Kompetenzzentren) (DE) La Grande École du Numérique (FR) Arts et Métiers ParisTech (FR) MINATEC innovation campus (FR) Produktion2030 / Graduate School Produktion2030 (Nationella Forskarskolan Produktion2030) (SE)

²⁸ Such as project or challenge based learning approaches, for students who might have difficulties in the traditional system, e.g. Ecole 42’s approach, se: [https://en.wikipedia.org/wiki/42_\(school\)](https://en.wikipedia.org/wiki/42_(school))

²⁹ With co-funding from industry

Type of financing and funding programmes	Examples of relevant funding programmes
	<p>E-DIG Digital lärplattform för den smarta digitala fabriken (SE)</p> <p>Expertkompetens / PROMPT (SE)</p> <p>WASP - Wallenberg Autonomous Systems and Software Program - graduate school and affiliate PhD program (SE)</p>
APPRENTICESHIP - Funding high tech apprenticeships/traineeships in industry	<p>Knowledge Transfer Partnership (KTP) (UK)</p> <p>ANH Education Network High Technology Berlin (DE)</p> <p>Supporting the digitalisation in inter-corporate occupational vocational training centres (Förderung von Digitalisierung in überbetrieblichen Berufsbildungsstätten und Kompetenzzentren) (DE)</p> <p>Education and further education in business 4.0 (Aus- und Weiterbildung in der Wirtschaft 4.0) (DE)</p> <p>Digital manufacturing processes - Additional qualification for the future career in INDUSTRY 4.0! (Digitale Fertigungsprozesse - Zusatzqualifikation für die berufliche Zukunft in INDUSTRIE 4.0!) (DE)</p> <p>Katapult (NL)</p> <p>Advanced Training in Key Enabling Technologies and Entrepreneurship (IT)</p> <p>The apprenticeship levy supporting SIP programmes (UK)</p>
CENTRES - Funding for industry in building and running dedicated vocational education centres	<p>ANH Education Network High Technology Berlin (DE)</p> <p>Supporting the digitalisation in inter-corporate occupational vocational training centres (Förderung von Digitalisierung in überbetrieblichen Berufsbildungsstätten und Kompetenzzentren) (DE)</p> <p>Imec.academy (BE)</p> <p>Advanced Training in Key Enabling Technologies and Entrepreneurship (IT)</p> <p>Automotive Centre of Expertise (ACE) (NL)</p> <p>Katapult (NL)</p> <p>AMRC Training Centre (UK)</p> <p>Industrial Partnerships (Trailblazers) (UK)</p> <p>City Region Deals (UK)</p> <p>Top technology in secondary vocational education (Toptechniek in Bedrijf in het MBO) (NL)</p> <p>ProgeTiger programme (EE)</p> <p>The Technology Pact (Techniekpact) (NL)</p> <p>National Software Academy, Wales (UK)</p>
OER - Funding the development of open education resources (OER, including MOOCs)	<p>Imec.academy (BE)</p> <p>NanoTecLearn (DE)</p> <p>La Grande École du Numérique (FR)</p> <p>E-DIG Digital lärplattform för den smarta digitala fabriken (SE)</p>
FISCAL & COST-SHARING - Funding (lifelong) learners through vouchers, fiscal incentives and/or cost sharing	<p>Study IT in Estonia (EE)</p> <p>Formación Postgrado (ES)</p> <p>Make IT Work (NL)</p> <p>The apprenticeship levy supporting SIP programmes (UK)</p>
RESKILL - Funding upskilling/reskilling programmes for the	<p>Formación Postgrado (ES)</p> <p>Katapult (NL)</p>

Type of financing and funding programmes	Examples of relevant funding programmes
workforce in particular sectors or regions	Make IT Work Sektor 3 (PL) IT for SHE (PL) Alacrity Graduate Entrepreneurship Programme (UK)
IT VENDOR - IT vendor funding high-tech skills training at a large scale	Grow with Google Goodwill Digital Career Accelerator Facebook Community Boost SkillSET Greeformers and Facebook partnership #SheMeansBusiness Google 'Growth Engine' programme Cisco 'Country Digitisation Acceleration' programme Samsung Digi Pass
OTHER	Festo Didactic 'Transfer Factory' (DE) NanoFutures DEMOLA (FI and others) Station F (FR) Arts et Métiers Acceleration (FR) Digital Academy (Digitalakademin) (SE) Facebook Community Boost EU program (EU) Samsung Digi Pass (EE) Freeformers Future Workforce Model (EU) #SheMeansBusiness programme (FR)
Note:	Funding programmes highlighted in bold were presented and discussed at expert workshops in Brussels

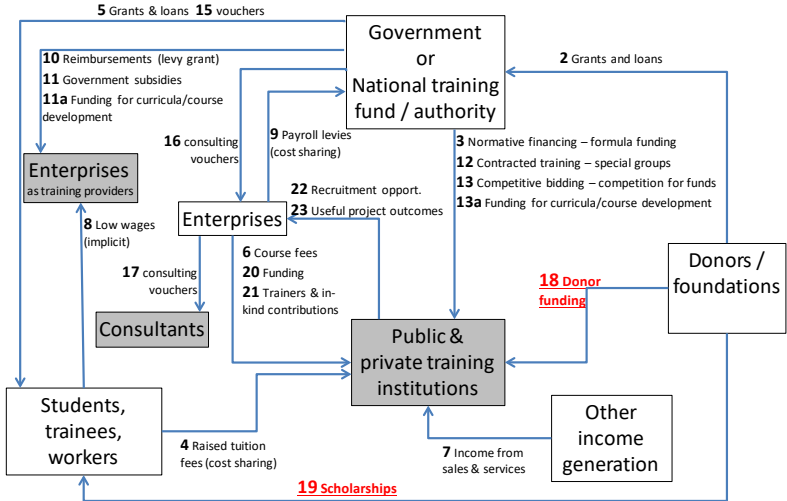
EXCELLENCE					
Title:	Excellence schemes with top universities and high tech industry funded by governments to draw more academic top talent towards industry careers				
Programme type	Ref. no.	Description of funding / support mechanisms (financing flows)	Identified programmes	Effectiveness	Efficiency
Funding excellence schemes with top universities to draw top academic talent and students (PPP for high-tech skills development, developing and offering tailor-made programmes to create future industry leaders)	5	Government or National training fund / authority funding students, trainees, workers through grants & loans	<ul style="list-style-type: none">• Software Campus (DE)• Industrial PhD 2017 (SE)• Industrial Doctorates (NL)• Industrial PhD (DK)	High: The programmes reach the target groups, have successfully mobilised the relevant stakeholders (industry and universities) and the PhD candidates develop industry-relevant high-tech skills. Provision of funding works very well in most cases.	High: Evaluation reports (where these exist) show a high level of satisfaction among all stakeholders. The average cost per PhD candidate varies between 125,000 and 190,000 EUR is likely to be a reasonable investment and good value for money if the majority of candidates further pursue a career in industry or in their own start-ups and are likely to become top level industry leaders in the future.
	12	Government or National training fund / authority to fund public & private training institutions for contracted training of special groups			
	20	Enterprises supporting public & private training institutions through funding			
	21	Enterprises supporting public & private training through own trainers and in-kind contributions			
	22	Public & private training institutions offering partnership programme to enterprises with recruitment opportunities			
	23	Public & private training institutions provide enterprises with useful project outcomes			
Impact	+	The impact on high-tech skills development for future decision makers in industry is considered high, as the scope and focus are on bringing together national leading industrial and academic organisations in this field and fully targeting the high-tech skills topic. The programmes are expected to lead to growth and employment on macroeconomic level. On individual level they equip research talents with commercial insight and experience by working at a company while studying and doing research work at university. The programmes are designed to create a larger pool of high-tech talents. Cooperation between research institutions and private companies is prone to leading to innovation and exchange of perspectives.			
Scalability	+	Scalability is considered to be high. The programmes can be considered highly scalable regarding the involvement of further industrial companies including larger SMEs, the public sector and additional higher and executive education and training institutions (reaching beyond the top technical universities). The programmes possibly need not only be addressed to PhD but may also include Master students. Replication on a larger scale requires rather high investments should this model be replicated 1:1. Transferability is considered to be rather high. The model offered by the initiative is highly transferable to different contexts, which is demonstrated by the fact that the Dutch programmes was built on the basis of the experiences in Denmark. Replication in other European regions may also be feasible probably with less investment and funding.			
Sustainability	+	The programmes can be described as excellence initiatives funded through a combination of private and public sources, integrating industry and higher education and training, with a strong link to practice and mentoring, gaining work experience in a company and practical problem solving through carrying out and leading a project dealing with an issue of relevance for the company. With the present shared funding model the programmes can be considered to be highly sustainable.			

EXCELLENCE						
Title:		Excellence schemes with top universities and high tech industry funded by governments to draw more academic top talent towards industry careers				
Programme type	Ref. no.	Description of funding / support mechanisms (financing flows)	Identified programmes	Effectiveness	Efficiency	
SWOT		STENGTHS:	WEAKNESSES:	<p>Software Campus (DE) Programme type: PPP for high-tech skills development, developing and offering tailor-made programmes to create future industry leaders (elite programmes)</p> <p>Note: blue arrows represent funding flows; training providers are indicated by shaded boxes; red texts highlight the relevant funding flows in the case.</p>		
		Proximity of university education and industry including corporate top executive training for PhD candidates.	Transferability requires quite substantial investments. Danger of lack of sufficient number of candidates when focussing on PhDs only.			
		Real top management and industry leader candidates as outcome.	Comparably high levels of churn of corporate participation have been observed in Germany which may hint to weaknesses, but reasons for this are yet to be identified.			
		OPPORTUNITIES:	THREATS:			
		Increasing the pool of industrial leadership talent, strengthening the integration of innovation systems.	Potential misuse of budget when transferring it to universities as just another source of research funding (can be avoided by proceeding according to the Nordic model: employer status of PhD candidate and direct payment).			
Bottom line and recommendations		The programmes reach the target groups, have successfully mobilised the relevant stakeholders (industry and universities) and had and have an impact since the PhD candidates develop industry-relevant high-tech skills, cooperation between research institutions and private companies is seen as leading to innovation and exchange of perspectives and the programmes are creating a larger pool of high-tech talents with most of them becoming candidates for top-level leadership positions in industry or starting their own business. Provision of funding works very well. Evaluation reports (where these exist) show a high level of satisfaction among all stakeholders. The programmes require a reasonable investment and can be seen as good value for money if the majority of candidates further pursue a career in industry or in their own start-ups and are likely to become top level industry leaders in the future. With the present shared funding model the programmes can considered to be highly sustainable.				

VOUCHER					
Title:	SME vouchers for a large number of smaller consulting contracts and knowledge transfer in high tech to SMEs				
Programme type	Ref. no.	Description of funding / support mechanisms (financing flows)	Identified programmes	Effectiveness	Efficiency
Funding SME vouchers for consulting contracts and knowledge transfer (SME vouchers for a large number of smaller consulting contracts and knowledge transfer in high tech to SMEs)	16	Government or National training fund / authority (part) financing training and support through consultants through consulting vouchers	<ul style="list-style-type: none">Go-inno (DE)Go-digital (DE)Asesores Digitales (ES)Industria 4.0 – Impresa 4.0 agevolazioni per l’innovazione e lo sviluppo di tecnologie abilitanti (IT)	High: The programmes reach the target groups and have successfully transferred the necessary knowledge to SMEs. In many cases the current operation has been optimised through lessons learned. Provision of funding (payment of consultants) works very well and in some cases (go-digital, go-inno) this is carried out fully online and basically without any bureaucracy.	High: Evaluation reports (where these exist) show a high level of satisfaction among all stakeholders. Depending on the programme the average funding per SME is between 5,000 to 8,000 Euro which is between 50% - 80% of the total cost. Complementary funding from the SMEs therefore varies between 20% - 50%. This can be seen as a very reasonable investment of public money and good value for money.
	17	Enterprises (part) financing training and support through consultants through consulting vouchers			
Impact	+	The impact on high-tech skills development for SMEs in industry is considered high. The programmes are successful in technological knowledge and know-how transfer. For the go-inno programme 66% of SMEs state that only the public funding was the trigger for starting the initiative. SME executives and decision makers get successful training and advise on digitisation and digital transformation (see: go-digital) as well as the introduction and development of the enabling technologies (KETs) for industry 4.0 (see: Industria 4.0, go-inno).			
Scalability	+	Scalability is considered to be high. Depending on further demand in the market and in industry the programmes can be considered highly scalable regarding the involvement of further industrial companies, especially SMEs and further consulting organisations. These are straightforward programmes with a very low level of administrative and bureaucratic effort to be spent since (in the cases from Germany) a number of lessons learnt led to successful incremental changes of the programme to lower the threshold for SMEs to apply for funding. It is a comparatively small funding provided per case which allows for creating an impact already with smaller investments by public authorities. Replication on a larger scale requires rather small or at maximum very reasonable investments. Transferability is considered to be high. The model offered by the initiatives is highly transferable to different contexts, which is also demonstrated by the fact that all the different national programmes have huge similarities.			
Sustainability	+	With the present shared funding model the programmes can be considered to be highly sustainable. Sustainability is also demonstrated by the fact that for instance the German go-digital programme has already entered its second phase with more than twice as many expected applicants compared to the first phase. The go-inno programme is already running successfully since 2010 and it looks as if it could be continued even after the lifetime of the present phase which is set to 2020.			
SWOT		STENGTHS:	WEAKNESSES:		

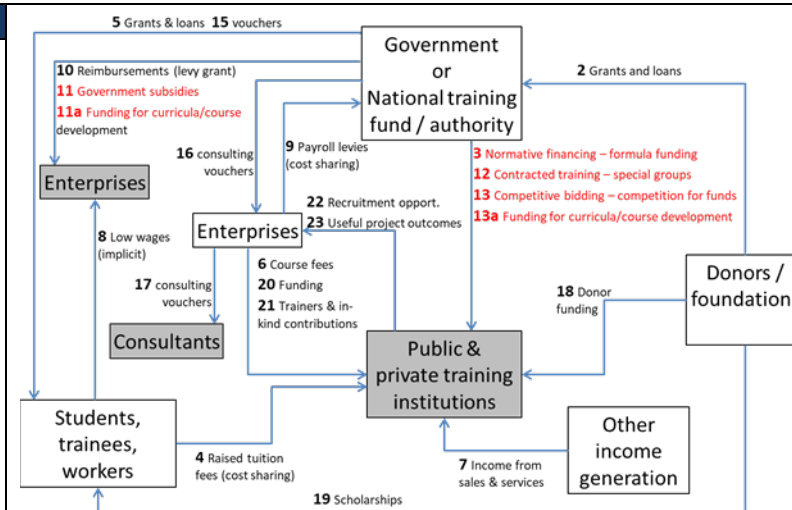
VOUCHER			
Bottom line and recommendations		<p>Flexibility: highly customised solutions through individual consulting contracts.</p> <p>Small public investment per case (approx. 8,000 Euro/contract).</p> <p>Many 'lessons learned', i.e. high transferability potential.</p> <p>Straightforward implementation and operation.</p> <p>Own partial SME investment minimises free-riding risks,</p> <p>Low level of bureaucracy.</p>	<p>Licensing / QA of consultants necessary, which could otherwise be left to market forces.</p> <p>Free-riding effects still possible crowding out regular demand.</p>
		<p>OPPORTUNITIES:</p> <p>Encourage and enable access to knowledge (which otherwise might be exclusive to corporate clients) through consultants for the underserved market segment of SMEs.</p> <p>Rather low-cost digitisation and digital transformation support for SMEs.</p>	<p>THREATS:</p> <p>Artificially creating a lower tier market for consultancy.</p> <p>Risk of collusion between SMEs and consultant.</p>
		<p>Go-digital (DE) Programme type: SME vouchers for a large number of smaller consulting contracts and knowledge transfer in high tech to SMEs</p> <p>Note: blue arrows represent funding flows; training providers are indicated by shaded boxes; red texts highlight the relevant funding flows in the case.</p>	

DONOR					
Title:	Donor funding alternative and new teaching / learning system				
Programme type	Ref. no.	Description of funding / support mechanisms (financing flows)	Identified programmes	Effectiveness	Efficiency
Funding of new innovative and alternative teaching / learning systems	18	Donors/ foundations funding public & private training institutions through donor funding	<ul style="list-style-type: none">École 42 (FR)Station F (FR)High-Tech UThales Cybersecurity Programme (FR)Arts et Métiers Acceleration (FR)Manche Open School (FR)Talent Club (ES)WASP (SE)	Varying: Very little information is available on the criteria for measuring effectiveness. The French donor schemes seem to reach their target group and the individuals passing the programmes succeed in entering the labour market or starting a new venture.	Varying: Very little information is available on the criteria for measuring efficiency. Where these are available (École 42), efficiency seems to be good since the operation of the programmes is achieved with small teams of staff and rather large numbers of successful programme participants.
	19	Donors/ foundations funding students, trainees, workers through scholarships			
Impact	+/o	Impact measurement is difficult to measure since most of the activities only started recently and very little information is available. École 42 seems to create a significant impact whereas Talent Club ceased to operate after one successful round and is still looking for alternative funding models making it independent of donors.			
Scalability	+	Schemes such as École 42 are currently being spread to other regions (e.g. Lyon: https://www.le-101.fr/) or even ‘exported’ to other countries through a franchise model (e.g. Belgium: https://www.s19.be/ , the Netherlands: https://www.codam.nl/) and even countries such as Morocco, South Africa, Ukraine and Russia). Station F also has the potential for scaling. However, all the other schemes seem to operate at a rather small scale and are likely to continue as such at a maximum or cease operation.			
Sustainability	o/-	Sustainability is ensured for the donation period (in the case of École 42 financing is secured up until 2023) but the dependency on donors is likely to create financial problems after that period as can be seen by the Talent Club example.			

SWOT	STRENGTHS:	WEAKNESSES:	
	<p>Donor funded special concept education schemes like École 42 seem to close a gap in attracting individuals who would normally not attend traditional training courses.</p> <p>The vast majority seem to succeed in entering the labour market either after or already while running the programme.</p> <p>Programmes like WASP seem to support exchanges between research and industry partners.</p>	<p>Limited duration of funding through donors.</p>	 <p>Note: blue arrows represent funding flows; training providers are indicated by shaded boxes</p> <p>Note: blue arrows represent funding flows; training providers are indicated by shaded boxes; red texts highlight the relevant funding flows in the case.</p>
	<p>OPPORTUNITIES:</p> <p>Offering opportunities for otherwise excluded individuals, specifically NEETs (individuals neither in employment, education or training) and applicants from diverse backgrounds.</p>	<p>THREATS:</p> <p>Unknown sustainability due to the type of temporary funding through donor. Continuation through donor or other sources and funding institutions is open.</p>	
Bottom line and recommendations	<p>Donor schemes do their job for the donation period but are not unlikely to cease to exist after that period. Radically new, innovative and alternative teaching / learning systems such as École 42 seem to be successful in bringing formerly excluded individuals into the labour market. It needs to be seen whether in the future and after the end of the donation period other stakeholder will step in and ways of funding can be found. These types of schemes can be seen as ‘eye openers’ demonstrating completely new and radical approaches for IT and high-tech training, which seem to have a potential for success in terms of offering new and additional pathways into the labour market. However, final judgements need to await the potential for continuation of these schemes, specifically after the end of the funding period through a donor. Open question whether this alternative pathway to IT jobs can or should be embedded in the traditional education and training system.</p>		

CO-CREATION					
Title:	Funding for the co-creation by industry and academia of new courses and curricula				
Programme type	Ref. no.	Description of funding / support mechanisms (financing flows)	Identified programmes	Effectiveness	Efficiency
Funding for the co-creation by industry and academia of new courses and curricula	3	Normative financing – formula funding addressed to public & private training institutions through government or national training fund / authority	<ul style="list-style-type: none"> • Imec.academy (BE) • ANH Education Network High Technology Berlin (DE) • NanoTecLearn (DE) • Förderung von Digitalisierung in überbetrieblichen Berufsbildungsstätten und Kompetenzzentren (DE) • La Grande École du Numérique (FR) • Arts et Métiers ParisTech (FR) • MINATEC innovation campus (FR) • Produktion2030 / Graduate School Produktion2030 (SE) • E-DIG Digital lärplattform för den smarta digitala fabriken (SE) • Expertkompetens / PROMPT (SE) • WASP - Wallenberg Autonomous Systems and Software Program - graduate school and affiliate PhD program (SE) 	Medium/High: The programmes seem to reach the target groups and have successfully mobilised the relevant stakeholders (industry and universities). Provision of funding works very well in most cases. In the most promising cases co-creation in course and programme development involves universities, research institutes and centres, trade organisations, and companies from industry.	Medium: Initial investment is likely to be rather high to kick-start this development in the different countries. Example of public investment from Expertkompetens programme in Sweden: approx. 10 - 15,000 Euro/graduate (rough calculation based on current graduate figures which are likely to increase and then (significantly) reduce costs.
	11	Government or national training fund / authority subsidies to enterprises			
	11a	Government or national training fund / authority funding for curricula / course development			
	12	Contracted training – special groups addressed to public & private training institutions through government or national training fund / authority			
	13	Competitive bidding – competition for funds addressed to public & private training institutions through government or national training fund / authority			
	13a	Funding for curricula / course development to public & private training institutions through government or national training fund / authority			

CO-CREATION			
Title:	Funding for the co-creation by industry and academia of new courses and curricula		
Impact	+/o	All identified programmes are still in a pilot phase. Governments and the stakeholders involved are experimenting and it is too early to give a reliable value judgement on the impact already now. Initial results in terms of users as well as graduates from courses seem to be promising.	
Scalability	+/o	See above. All programmes are at a rather early stage of development, implementation and operation. Scalability very much depends on the stakeholder ability and willingness to continue to follow these (new) paths in the future and find ways of integrating these into their portfolios. Limitations for scaling could be the lack of suitable trainers since many (and the most suitable in terms of knowledge) of these come from the research area and are occupied by research tasks (see case: imec.academy).	
Sustainability	+/o	See above	
SWOT		STENGTHS:	WEAKNESSES:
		Co-creation in course and programme development involves universities, research institutes and centres, trade organisations and companies from industry and ensures alignment to industry demands and creation of workers with required job profiles and skills which is likely to make these types of courses attractive to all stakeholders (industry, workers, education and training institutions). Public (government) – private (industry) co-funding model (50:50) in some of the identified programmes ensuring high levels of motivation and commitment of all stakeholders.	Conservatism among universities including traditional university perception of only being responsible for traditional higher education following the Humboldtian model of higher education (Humdoldtian educational ideal). Unwillingness to change role / enhance range of activities and more strongly move towards professional and further education and training which may require a more commercial thinking and behaviour of universities.
		OPPORTUNITIES:	THREATS:
		Opportunity for universities and other traditional education and training institutions to become active and new players in the further and professional training market.	Need for stamina not resulting in a situation where failure of initial pilot offering is going to de-motivating stakeholders to continue.



Note: blue arrows represent funding flows; training providers are indicated by shaded boxes; red texts highlight the relevant funding flows in the case.

CO-CREATION				
Title:		Funding for the co-creation by industry and academia of new courses and curricula		
Bottom line and recommendations		Stronger use of blended learning and additional focus on and production of OEMs and MOOCs are likely to increase outreach in an efficient way.	Lack of flexibility and business model for further education under present financing models of universities. Problems in maintenance and continuous further development to keep offers updated due to lack of and/or unwillingness for investment. Failure to make new offers integral part of training course/programme portfolio under present financing models and conditions of universities. Lack of willingness among industry (those not participating in the co-creation process) to pay for these new offers.	
		<p>Co-creation programmes could be seen as an opportunity for universities and other traditional education and training institutions to become active and new players in the further and professional training market. This requires the willingness to take up this new (professional) training pathway and leave aside the quite widespread conservatism among universities and their traditional perception of only being responsible for traditional higher education following the Humboldtian model of higher education (Humboldtian educational ideal).</p> <p>Implementation, operation and scalability very much depends on the training providers' ability and willingness to continue to follow these (new) paths in the future and find ways of integrating co-created courses into their portfolios.</p> <p>Both, traditional degree-oriented education and training activities and professional training based on courses co-created with industry should be included in the higher education institution programme portfolio and run in parallel.</p> <p>Achievement of sustainability requires developing and finding a suitable business model which can more easily be achieved if industry is (more) prepared to invest in making use of and pay for these courses they themselves or other companies from their sector have co-designed and co-created. This is specifically needed in cases where the traditional financing models of universities based on number of graduates and research projects turn out to be unsuitable, which probably will be the case in the vast majority of cases.</p> <p>Existing funding programmes at EU and national level fall short of the mark to adequately support and co-finance the development and continuous and successful <u>growth and operation</u> of such co-creation programmes. In the vast majority of cases funding is provided for initial R&D activities, demand and needs analysis and specification and pilot implementation of a training course or programme with the funding expiring at this stage which can best be described as proof-of-concept or a pilot demonstration stage. Typically these types of funding - resulting only in pilot demonstrations - do not find their way into continuous operation. Activities remain at a pilot stage and cease to exist after a short while already. Financial support and funding of a growth phase moving away from the pilot stage to full operation is not</p>		

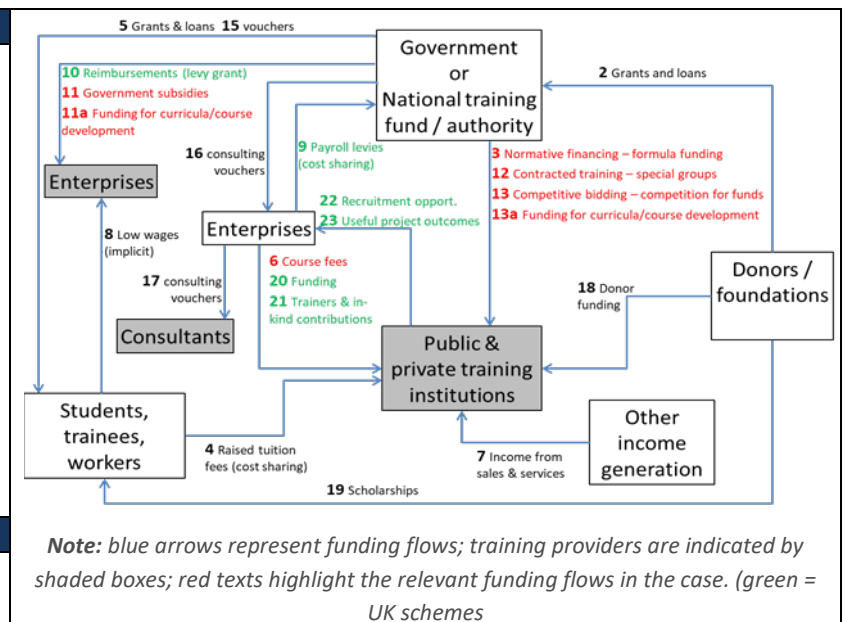
CO-CREATION	
Title:	Funding for the co-creation by industry and academia of new courses and curricula
	<p>supported through public (co-)funding or any other source of finance although these are regularly formulated as political goal in related national and European policy programmes and action plans. With the present type of funding mechanisms these cannot be achieved.</p> <p>It is against this background that it may be worthwhile to analyse existing European Commission funding programmes as to their suitability for funding the operation and growth phase of co-created high-tech training programmes.</p> <p>Careful investigations are also needed to assess the suitability of ESF funding and should this turn out not to be suitable or require major changes to support development and operation of training programmes of the above type, efforts may be undertaken to adapt funding conditions to this new paradigm.</p> <p>This would require an application round where relevant stakeholder consortia submit their applications of co-designed (professional) training courses which at minimum should already be in their pilot phase, have a clear business and roll-out plan, financial commitments from other stakeholders, industry commitments to use the programme, the relevant capacity and expertise for fully-fledged operation and a clear specification and quantification of KPIs and success criteria to be reached within a given time schedule. Not meeting the KPIs would automatically lead to a termination of funding.</p> <p>This would need to be followed by short-listing process using and based on an agreed set of criteria and followed by an expert selection. This would result in a shortlist of candidates for funding.</p> <p>Successful operation of such funding schemes and successful operation of the funded programmes require patience and stamina of all stakeholders concerned and may need quite large-scale investment by the European Commission and in all EU Member States to kick-start this development and ensure operation at a larger scale involving not only a few selected universities and sectors of the industry but reaching significantly beyond that to create an impact.</p>

APPRENTICESHIP					
Title:	Funding high-tech apprenticeships / traineeships in industry				
Programme type	Ref. no.	Description of funding / support mechanisms (financing flows)	Identified programmes	Effectiveness	Efficiency
Funding high-tech apprenticeships / traineeships in industry	3	Normative financing – formula funding addressed to public & private training institutions through government or national training fund / authority	<ul style="list-style-type: none"> Knowledge Transfer Partnership (KTP) (UK) ANH Education Network High Technology Berlin (DE) Supporting digitalisation in inter-corporate occupational vocational training centres (Förderung von 	Varying to (potentially) High: The programmes seem to reach the target groups and have successfully mobilised the relevant stakeholders (industry, VET training institutions etc.). The apprenticeship levy seems to still have problems of	Varying to (potentially) High: Initial investment in the German cases 8offereing additional qualification modules as add-on to already existing apprenticeships) was rather low to kick-start this development in a specific region and now stepwise transfer it to other regions and industry sectors
	6	Course fee from enterprises to public & private training institutions			
	11	Government or national training fund / authority subsidies to enterprises			
	11a	Government or national training fund / authority funding for curricula / course development			

APPRENTICESHIP					
Title:		Funding high-tech apprenticeships / traineeships in industry			
	12	Contracted training – special groups addressed to public & private training institutions through government or national training fund / authority	<p>Digitalisierung in überbetrieblichen Berufsbildungsstätten und Kompetenzzentren) (DE)</p> <ul style="list-style-type: none"> • Education and further education in business 4.0 (Aus- und Weiterbildung in der Wirtschaft 4.0) (DE) • Digital manufacturing processes - Additional qualification for the future career in INDUSTRY 4.0! (Digitale Fertigungsprozesse - Zusatzqualifikation für die berufliche Zukunft in INDUSTRIE 4.0!) (DE) • Katapult (NL) • Advanced Training in Key Enabling Technologies and Entrepreneurship (IT) • The apprenticeship levy supporting SIP programmes (UK) 	acceptance in the UK industry. These can hopefully be ruled out with the promotion of good practice cases which can be found for instance in the SIP Science Industry Partnership.	(German cases). Substantially higher investments are needed to speed up the process and transfer good results to other regions more rapidly. Rather substantial investments for Industrial Partnerships initiative. Substantial budget coming from Apprenticeship Levy in the UK. Wise spending of the unspent budget will (hopefully) result in a positive impact on high-tech talent creation in the future and good results in terms of efficiency.
	13	Competitive bidding – competition for funds addressed to public & private training institutions through government or national training fund / authority			
	13a	Funding for curricula / course development to public & private training institutions through government or national training fund / authority			
	9	Payroll levies (cost sharing) from enterprises to government or national training fund / authority			
	10	Reimbursements (levy grant) from government or national training fund / authority to enterprises			
	20	Funding from enterprises to public & private training institutions			
	21	Trainer & in-kind contributions from enterprises to public & private training institutions			
	22	Recruitment opportunities for enterprises from public & private training institutions			
	23	Useful project outcomes for enterprises from public & private training institutions			
Impact		o/+	<p>The SIP Science Industry Partnership (in the UK) is an example of a successful Industry Partnership (IP) but still with a rather small number of placements. The SIP potential is rather high. Other Industry Partnerships (IP) seem to have not come up with the intended achievements and results. In Germany and the German cases one can observe successful two consecutive rounds of operation of apprenticeships with the additional 'digitisation' qualification modules. This is a first indication of a potentially large impact potential. However, a business plan and roll-out plan is missing. The KTP case in the UK seems to have a rather high impact with 350 job opportunities created each year.</p>		

APPRENTICESHIP		
Title:	Funding high-tech apprenticeships / traineeships in industry	
Scalability	o/+	Scalability potential could be high but certain further prerequisites need to come into place (see above: e.g. roll-out plans, substantial further investments) before this can happen. Scalability of the KTP initiative is judged as high. The number of partnerships has increased steadily over the past years with currently 692 knowledge partnerships that are operational.
Sustainability	o/+	Motivation and financing and funding resources of the actors in German cases and the UK SIP case seem to be existing and available.

SWOT		STENGTHS:	WEAKNESSES:
		Further training and apprenticeships activities are fully embedded in the existing strong VET system. Strong direct involvement of companies and partnerships between industry and training providers (German cases).	Apprenticeship Levy is often regarded by companies as an extra tax and simply paid as such without seeing it as an incentive to claim it back through training activities (UK case). No clear plan for roll-out of the successful first two consecutive operational phases (German cases). Without concrete roll-out plan and (substantial) investments addressed to the training providers to also implement and run these programmes, roll-out and scalability will remain slow / poor (German cases).
		OPPORTUNITIES: Additional qualification modules which are likely to find their way into revisions of the skilled occupations / apprenticed profession to make these future-proof (German cases). Good roll-out potential but still lacking roll-out plan and investments (German cases). Some (larger) companies make proper use of the Apprenticeship Levy and see	THREATS: Overburdening apprentices with additional qualification and training modules in addition to already tight training plans and curricula. Need to clean out existing curricula with respect to outdated content (German cases).



Bottom line and recommendations	it as and incentive for the development and operation of related training and apprenticeship offers (UK case).		
	<p>It still is too early to give a final judgement as to the success of programmes funding high-tech apprenticeships / traineeships in industry. Those identified as good practices seem to have a high future potential. Their approaches vary significantly.</p> <p>The German cases have the advantage of being embedded in an existing well functioning and strong VET system. However, for the approaches of offering additional qualification modules to be successful existing curricula need to be cleaned out in the long run to make them applicable and useful for larger groups of apprentices. This is a process which has not (yet) been initiated. Furthermore, and although seemingly successful, they all still operate at rather small scale and local level. Roll-out plans are needed to more widely spread and implement the programmes and bring them into full operation nationwide. This will also include more substantial investments in supporting VET training providers in implementing and running these programmes nationwide. The theoretical impact potential is high.</p> <p>It becomes apparent that funding schemes are needed which do not stop at the demonstration and pilot stage but reach beyond. This would help the most successful programmes to move on towards large-scale operation, become sustainable also in financial terms for all actors involved which would be the case once fully embedded into working training systems and governance structures.</p> <p>With Katapult in the NL there is another powerful network of more than 150 partnerships (so-called centres of expertise) between education and business with 50,000 students, 4,500 companies and 4,000 teachers participating in place which is constantly growing since it was established in 2016.</p> <p>In the UK the experiences with the Apprenticeship Levy are mixed with respect to its use as a key instrument to attract industry to further education and training activities at all levels. It is only starting to be recognised as such an instrument and not just as an additional tax industry is obliged to pay without any direct return on investment.</p> <p>Promotion campaigns of instruments such as the Apprenticeship Levy are needed. These would have to present the levy as a means and incentive for companies helping them to more easily become active in necessary education and training activities – especially those addressed to professionals and employees - and at the same time getting substantial financial support and funding for these.</p>		

CENTRES					
Title:	Funding for industry and education and training institutions in building and running dedicated vocational education centres and public private partnerships				
Programme type	Ref. no.	Description of funding / support mechanisms (financing flows)	Identified programmes	Effectiveness	Efficiency
Funding for industry and education and training institutions in	3	Normative financing – formula funding addressed to public & private training institutions through government or national training fund / authority	<ul style="list-style-type: none"> ANH Education Network High Technology Berlin (DE) Supporting the digitalisation in inter- 	Varying: This typology includes a large variety of different types of training centres and partnerships which make it	Varying: Again, very little information is (made) available which makes it very difficult to elaborate on the efficiency of the cases under this
	4	Tuition fee payment (cost sharing) of students, trainees, workers to public & private training institutions			

CENTRES					
Title:	Funding for industry and education and training institutions in building and running dedicated vocational education centres and public private partnerships				
building and running dedicated vocational education centres	5	Grants and loans from government or national training fund / authority to students, trainees, workers	<p>corporate occupational vocational training centres (Förderung von Digitalisierung in überbetrieblichen Berufsbildungsstätten und Kompetenzzentren) (DE)</p> <ul style="list-style-type: none"> • Imec.academy (BE) • Advanced Training in Key Enabling Technologies and Entrepreneurship (IT) • Automotive Centre of Expertise (ACE) (NL) • AMRC Training Centre (UK) • Industrial Partnerships (Trailblazers) (UK) • City Region Deals (UK) • Top technology in secondary vocational education (Toptechniek in Bedrijf in het MBO) (NL) • Katapult (NL) • ProgeTiger programme (EE) • The Technology Pact (Techniekpact) (NL) • National Software Academy, Wales (UK) 	<p>next to impossible to draw general conclusions. With the little data available we come to the conclusion that the programmes' effectiveness varies significantly from country to country. Imec.academy (BE) seems to reach the target groups and have successfully mobilised the relevant stakeholders. The German ANH is still at an embryonic stage. The Industry Partnerships in the UK seem to vary significantly with respect to effectiveness (with most of them showing rather poor results). The UK City Region Deals seem to be more at a planning stage than real implementations or operations. Only the Dutch cases TiB and Techniekpact show some successes. They are in operation for some time already, managed to spread throughout the country. For the majority of cases in this category only very little data is (made) available to judge on effectiveness, but also</p>	<p>category. Those cases with the longest tradition (the Dutch schemes and the Belgian imec.academy) seem to have managed to operate rather efficiently and to secure funding for the coming years. Several other schemes are using a variety of different sources and funding programmes to finance themselves but at the same time the lack of financial and trainee data provided does not allow for a thorough evaluation.</p>
	6	Course fee from enterprises to public & private training institutions			
	9	Payroll levies (cost sharing) from enterprises to government or national training fund / authority			
	10	Reimbursements (levy grant) from government or national training fund / authority to enterprises			
	12	Contracted training – special groups addressed to public & private training institutions through government or national training fund / authority			
	13	Competitive bidding – competition for funds addressed to public & private training institutions through government or national training fund / authority			
	13a	Funding for curricula / course development to public & private training institutions through government or national training fund / authority			
	20	Funding from enterprises to public & private training institutions			
	21	Trainer & in-kind contributions from enterprises to public & private training institutions			
	22	Recruitment opportunities for enterprises from public & private training institutions			
	23	Useful project outcomes for enterprises from public & private training institutions			

CENTRES					
Title:	Funding for industry and education and training institutions in building and running dedicated vocational education centres and public private partnerships				
				efficiency and impact in general.	
Impact	o/+	Little information could be obtained on actual figures and achievements which could help in judging on the impact. Several schemes – specifically those which secured long-term government funding – seem to continue to operate with good impact in terms of numbers of people successfully trained.			
Scalability	o/+	Scalability seems to work as long as government funding is available or where long-term government funding could be secured, or in cases (e.g. imec.academy) where training is closely related to and coupled with research and development activities (again government funded to a significant extent).			
Sustainability	o	Danger of termination of activities after end of initial funding and incentive contributions from governments in a large number of cases.			

The flowchart illustrates the financing system for TVET in South Africa, showing the flow of funds and resources between various stakeholders. The central entities are the Government or National training fund / authority, Enterprises, Consultants, Students, trainees, workers, Public & private training institutions, Donors / foundations, and Other income generation.

Key Funding Sources and Flows:

- Government or National training fund / authority:**
 - Provides **5 Grants & loans** and **15 vouchers** to **Enterprises**.
 - Provides **2 Grants and loans** to **Donors / foundations**.
 - Provides **3 Normative financing – formula funding** to **Public & private training institutions**.
 - Provides **12 Contracted training – special groups** to **Public & private training institutions**.
 - Provides **13 Competitive bidding – competition for funds** to **Public & private training institutions**.
 - Provides **13a Funding for curricula/course development** to **Public & private training institutions**.
 - Provides **9 Payroll levies (cost sharing)** to **Enterprises**.
 - Provides **22 Recruitment opport.** to **Enterprises**.
 - Provides **23 Useful project outcomes** to **Enterprises**.
 - Provides **6 Course fees** to **Public & private training institutions**.
 - Provides **20 Funding** to **Public & private training institutions**.
 - Provides **21 Trainers & in-kind contributions** to **Public & private training institutions**.
- Enterprises:**
 - Provides **10 Reimbursements (levy grant)** to the **Government or National training fund / authority**.
 - Provides **11 Government subsidies** to the **Government or National training fund / authority**.
 - Provides **11a Funding for curricula/course development** to the **Government or National training fund / authority**.
 - Provides **16 consulting vouchers** to the **Government or National training fund / authority**.
 - Provides **8 Low wages (implicit)** to **Students, trainees, workers**.
 - Provides **17 consulting vouchers** to **Consultants**.
 - Provides **4 Raised tuition fees (cost sharing)** to **Students, trainees, workers**.
 - Provides **19 Scholarships** to **Students, trainees, workers**.
- Consultants:**
 - Provides **17 consulting vouchers** to **Enterprises**.
- Students, trainees, workers:**
 - Provides **7 Income from sales & services** to **Public & private training institutions**.
- Public & private training institutions:**
 - Provides **18 Donor funding** to **Donors / foundations**.
- Donors / foundations:**
 - Provides **18 Donor funding** to **Public & private training institutions**.
- Other income generation:**
 - Provides **7 Income from sales & services** to **Public & private training institutions**.

		<p>They are in operation for some time already and managed to spread throughout the country. For the majority of cases in this category only very little data is (made) available to judge on effectiveness, efficiency and impact in general.</p> <p>Hardly any transparency and little information are available on the outcomes of the vast number of programmes and activities. Often, these come up with interesting approaches and plans but continuous implementation and operation do not seem to work in many cases, specifically after the end of government funding.</p> <p>In several cases there seems to be the need for complicate, complex and difficult funding from many different national and European sources to secure funding. This seems to distract from the original objectives and ambition since many different demands of different funding programmes need to be served and fulfilled at the same time.</p>
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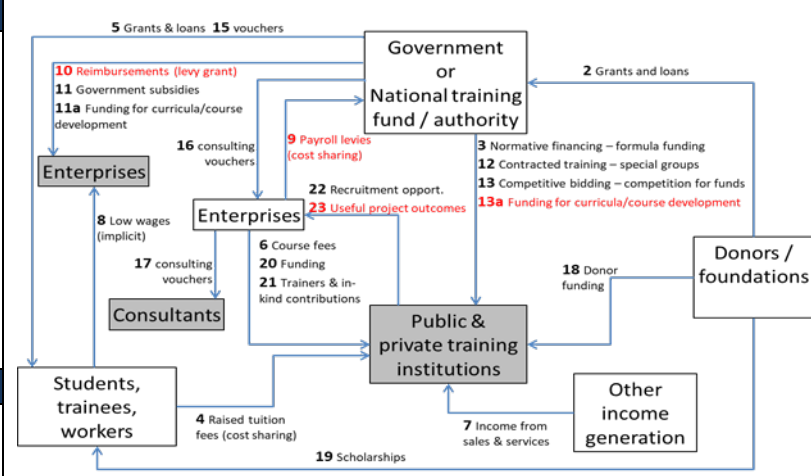
OER					
Title:	Funding the development of open education resources (OER, including MOOCs)				
Programme type	Ref. no.	Description of funding / support mechanisms (financing flows)	Identified programmes	Effectiveness	Efficiency
Funding the development of open education resources (OER, including MOOCs)	11a	Government or national training fund / authority funding for curricula / course development	<ul style="list-style-type: none">• Imec.academy (BE)• NanoTecLearn (DE)• La Grande École du Numérique (FR)• E-DIG Digital lärplattform för den smarta digitala fabriken (SE)	Theoretically High: Very little information on effectiveness indicators is provided but the offers seem to reach their target groups offering relevant content. Only for NanoTecLearn (DE) a figure of 300+ users in the first implementation round is provided together with expansion plans at further universities.	Theoretically High: Again, little information is provided.
	13a	Funding for curricula / course development to public & private training institutions through government or national training fund / authority			
	23	Useful project outcomes for enterprises from public & private training institutions			
Impact	o	Again, little information is provided. Only for NanoTecLearn (DE) a figure of 300+ users in the first implementation round is provided together with expansion plans at further universities. At imec.academy the strong dependency on teaching resources turned out to be a challenge. This resulted in the development and continuous increase of online offers. No concrete figures are given. E-DIG as a web-based learning platform addressed to the digitisation of factories still is at an embryonic stage and cannot report about any impact.			
Scalability	o	Theoretically, scalability should not be a major issue given the fact that we are talking about OERs. However, at present no clear plans for instance for the active promotion of online offers and learning content could be identified. NanoTecLearn clearly states that commercialisation has not been part of their mission and objectives.			
Sustainability	o	See ‘scalability’			

OER					
Title:	Funding the development of open education resources (OER, including MOOCs)				
Programme type	Ref. no.	Description of funding / support mechanisms (financing flows)	Identified programmes	Effectiveness	Efficiency
SWOT		STENGTHS:	WEAKNESSES:	<p>NanoTecLearn (DE) Programme type: OER</p> <p><i>Note: blue arrows represent funding flows; training providers are indicated by shaded boxes; red texts highlight the relevant funding flows in the case.</i></p>	
		OERs offer the possibility of very high outreach to the different target groups. The NanoTecLearn offers seem to meet target groups demands. Imec.academy indicates a continuous growth of their online offers without given more details.	No clear plans for further development and roll-out.		
		OPPORTUNITIES:	THREATS:		
	See ‘strengths’	No further development and maintenance of the online offers coupled with a lack of promotion and marketing activities bear the danger of not being recognised and therefore also not used by target users.			
Bottom line and recommendations		No further development and maintenance of the online offers coupled with a lack of promotion and marketing activities bear the danger of the OER offers developed and piloted not being recognised and therefore also not used by target users.			

FISCAL + COST SHARING					
Title:	Funding (lifelong) learners through vouchers, fiscal incentives and/or cost sharing				
Programme type	Ref. no.	Description of funding / support mechanisms (financing flows)	Identified programmes	Effectiveness	Efficiency
Funding (lifelong) learners through vouchers, fiscal incentives and/or cost sharing	9	Payroll levies (cost sharing) from enterprises to government or national training fund / authority	<ul style="list-style-type: none">Formación Postgrado (ES)Make IT Work (NL)Apprenticeship Levy (UK)	Medium/High: The programmes seem to reach their target groups. In Spain all scholarships were used and Make IT Work in the Netherlands has a very low drop-out rate of only 9%. No robust data has become available from the application and use of the UK Apprenticeship Levy which only started in 2017.	High: Make IT Work can look at a high efficiency rate with around 97% of the trained workers still in employment based on training costs for employers of € 6.000 /person. The student pays an own contribution of € 1.000,- No data has become available from the other programmes identified.
	10	Reimbursements (levy grant) from government or national training fund / authority to enterprises			
	13a	Funding for curricula / course development to public & private training institutions through government or national training fund / authority			
	23	Useful project outcomes for enterprises from public & private training institutions			
Impact	o/+	The Apprenticeship Levy is a UK tax on employers which can be used to fund apprenticeship training. In the current (2018/19) tax year it is payable by all employers with an annual pay bill of more than £3 million at a rate of 0.5% of their total pay bill. The impact is likely to be high. While apprenticeships starts are down, digital apprenticeships have bucked the trend as their numbers have kept on increasing sharply. They constitute 14% of all apprenticeships across England in 2017/18, compared to just 3% in 2016/17. ³⁰ The number of apprenticeships in “Digital and technology solutions professionals” (level 6 and 7) has increased by 240%, from 411 to 1399 enrolments from the academic year 2015/16 to 2017/18. ³¹ Given the rather small size of Formación Postgrado and Make IT Work, the total figures of successful graduates from professional and further training programmes are rather small.			
Scalability	o/+	Scalability of Make IT Work appears to be good due to positive industry feedback willing to pay the full and non subsidised price for re-training of workers. Formación Postgrado looks like a one-off ESF funded activity with no visible plans for scalability. The Apprenticeship Levy in the UK was set up as a very large activity which is reaching out to the entire industry in the UK.			
Sustainability	o/+	Sustainability appears to be high with respect to the Apprenticeship Levy in the UK. However, its future very much depends on the results of its use in the coming years for which now robust data is available yet. MakeITWork has found a sustainable working model.			

³⁰ BCS (2018): Whilst apprenticeship starts continue to decline BCS Digital IT Apprenticeships continue to grow. Press release, 29 March. Retrieved from: <https://www.bcs.org/content/conWebDoc/59316>

³¹ Universities UK and Higher Education Funding Council for England: Degree Apprenticeships: Realising Opportunities. March 2017

FISCAL + COST SHARING					
Title:	Funding (lifelong) learners through vouchers, fiscal incentives and/or cost sharing				
Programme type	Ref. no.	Description of funding / support mechanisms (financing flows)	Identified programmes	Effectiveness	Efficiency
SWOT		STENGTHS:	WEAKNESSES:	 <p>UK Apprenticeship Levy Programme type: FISCAL</p>	
		Make IT Work (NL): High success rate (91%). Successful even after termination of public funding Apprenticeship Levy (UK): strong tax instrument with huge impact potential.	Make IT Work (NL): rather small scale Apprenticeship Levy (UK): Apprenticeship Levy is often regarded by companies as an extra tax and simply paid as such without seeing it as an incentive to claim it back through training activities. Formación Postgrado (ES): Danger of termination after the end of ESF funding		
		OPPORTUNITIES:	THREATS:		
		Make IT Work (NL): Expansion and scaling up of a successful model with further universities Apprenticeship Levy (UK):	Make IT Work (NL): Apprenticeship Levy (UK): lack of change of mindset among employers in seeing the value of this instrument for necessary workforce training Formación Postgrado (ES): Not unlikely termination after the end of ESF funding.		
Bottom line and recommendations		The programmes under this category are very varied and therefore need to be treated individually in the evaluation and assessment. <i>Make IT Work (NL):</i> it seems that the initial government funding period has help to develop a critical mass and attractive high-tech skills re-skilling programmes which industry is willing to fully pay for without a need for subsidies. At present it is a rather small-scale programme with plans for expansion. <i>Apprenticeship Levy (UK):</i> The successful future of the Apprenticeship Levy very much depends on the results of its use in the coming years for which no robust data is available yet since it was only launched recently. However, theoretically the potential is huge and the instrument – properly used (i.e. by using unspent budget for SME training) - could become a very powerful one also helping SMEs to become stronger actors in high-tech skills training for their workers than at present. <i>Formación Postgrado (ES):</i> is an ESF funded training programme which will have to demonstrate whether or not it will continue to exist after the end of ESF funding.			

RESKILL					
Title:	Funding up-skilling/re-skilling programmes for the workforce in particular sectors or regions				
Programme type	Ref. no.	Description of funding / support mechanisms (financing flows)	Identified programmes	Effectiveness	Efficiency
Funding up-skilling/re-skilling programmes for the workforce in particular sectors or regions	4	Tuition fee payment (cost sharing) of students, trainees, workers to public & private training institutions	<ul style="list-style-type: none">• Katapult (NL)• Make IT Work (NL)• Sektor 3 (PL)• IT for SHE (PL)• Alacrity Graduate Entrepreneurship Programme (UK)• Formación Postgrado (ES)	Unknown (High): The programmes seem to reach their target groups but differ significantly in terms of size which makes it difficult to give a general statement. Katapult (NL) seems to be very effective with government investment 2010-2017 of over 200 million, and at least 200 million funding from businesses and regional governments and more than 50,000 students.	Unknown (Medium): With hardly any financial data provided, this is difficult to evaluate but estimated to be at least medium.
	13a	Funding for curricula / course development to public & private training institutions through government or national training fund / authority			
	20	Funding from enterprises to public & private training institutions			
	23	Useful project outcomes for enterprises from public & private training institutions			
Impact	o/+	Most of the programmes under this category seem to have managed to create an impact in terms of successful training. This predominantly applies to the schemes which are already in operation for a longer period of time (e. Katapult since 2010, Sektor 3 since 2012) and which have secured funding for a longer period of time and for the (near) future.			
Scalability	o/+	Programmes such as Katapult, Make IT Work and Sektor 3 have either already managed to scale up or are in the process. For the other programmes sufficient information is missing.			
Sustainability	o/+	See ‘Impact’			

SWOT	STENGTHS:		WEAKNESSES:
	OPPORTUNITIES:		THREATS:
Bottom line and recommendations	Specifically Katapult (NL) but also Sektor 3 (PL), both seem to have managed to run training programmes and courses for their target groups over a longer period of time and have also secured funding for the coming years		Commitment of businesses for long-term funding and existing large education bureaucracies making it difficult to change from current practices and improve these.
	Specifically Katapult (NL) but also Sektor 3 (PL), both seem to have managed to run training programmes and courses for their target groups over a longer period of time and have also secured funding for the coming years. Make IT Work is on a good path to making itself independent of any public funding. The future will show whether the other programmes will manage to survive and create an impact.		<p>Katapult (NL) Programme type: RESKILL</p> <p><i>Note: blue arrows represent funding flows; training providers are indicated by shaded boxes; red texts highlight the relevant funding flows in the case.</i></p>

IT-VENDOR					
Title:	IT vendor funding high-tech skills training at a large scale				
Programme type	Ref. no.		Identified programmes	Effectiveness	Efficiency
IT vendor funding high-tech skills training at a large scale	18	Donors/ foundations funding public & private training institutions through donor funding	<ul style="list-style-type: none"> Grow with Google (USA) Goodwill Digital Career Accelerator (USA) Facebook Community Boost (USA) SkillSET (USA + EU) 	High: Very little information is available to measure the success. However, the past	High: See 'Effectiveness'
	19	Donors/ foundations funding students, trainees, workers through scholarships			

IT-VENDOR					
Title:	IT vendor funding high-tech skills training at a large scale				
Programme type	Ref. no.		Identified programmes	Effectiveness	Efficiency
			<ul style="list-style-type: none"> • Greeformers and Facebook partnership (USA) • #SheMeansBusiness (USA) • Google 'Growth Engine' programme (USA + EU) • Cisco 'Country Digitisation Acceleration' programme (EU + global) • Samsung Digi Pass (EU) 	experiences and given the high investment the potential for effectiveness is likely to be high.	
Impact	+	Impact measurement is difficult to since most of the activities only started recently, are announcements or provide very little information. Most of the programmes are likely to have a substantial quantitative impact in terms of 'numbers of trained individuals', at least their ambitions are high, e.g. SkillSET: "Last January 2018 during the World Economic Forum (WEF), a platform called SkillSET was launched to promote the re-skilling of 1 million workers by providing them with access to technology training." (http://digitalinclusionnewslog.itu.int/2018/02/09/world-economic-forum-launches-skillset-platform-to-train-1-million-workers-by-2021/)			
Scalability	+	The IT vendor programmes demonstrate high scalability (potential). Typically large budgets are spent over a rather short period of time.			
Sustainability	o	(Most of) the schemes are of a limited duration and it is unknown whether and how they are able to continue afterwards.			

SWOT		STENGTHS:	WEAKNESSES:
		<p>Large investments are likely to create a huge impact in terms of number of individuals trained.</p> <p>OPPORTUNITIES:</p> <p>Potential for up-skilling and re-skilling of vast numbers of individuals.</p>	<p>Limited duration of funding through IT vendors.</p> <p>THREATS:</p> <p>Programmes are add-ons to those in the formal education and training systems.</p> <p>Unknown sustainability due to the type of temporary funding through IT vendors. Continuation through other sources and funding institutions is open.</p>
Bottom line and recommendations	<p>Note: blue arrows represent funding flows; training providers are indicated by shaded boxes</p> <p>Note: blue arrows represent funding flows; training providers are indicated by shaded boxes; red texts highlight the relevant funding flows in the case.</p>		
	<p>The very high investments of IT vendor programmes are likely to create large scale programme activities and have a huge impact in terms of number of individuals trained. The programmes are responding to a very specific demand in industry and do not offer broader IT education and training but very specific trainings. The value of graduating from these programmes (some of which with a certificate) is rather positive recognised in industry (but only) for the specific skills trained and could offer a good opportunity for entering the IT labour market.</p> <p>These programmes are add-ons to those in and the formal education and training system in general. They have an unknown sustainability due to the type of temporary funding through IT vendors. Continuation through other sources and funding institutions is open and it is not unlikely that IT vendor programmes are likely to cease to exist after that planned operation period.</p> <p>It remains an open question whether and how other players in the market could or are willing to learn from the IT vendor programmes in terms of ‘speed to the market’ and ‘scalability through large investment’ and whether this alternative pathway to IT jobs can or should be embedded in the traditional education and training system and if so, how.</p>		

Those funding programmes and initiatives which could not easily be included in any of the above types have seen allocated to the ‘other’ category. We have selected the Demola case which started in Finland and is now also being operated in 13 other countries globally as a promising practice from this type of programmes. It appears to be unique in Europe and the world at least as an organisation and network in this area operating at such a large scale.

OTHER --- DEMOLA					
Title:	DEMOLA: Innovation Ecosystem combining the talent of students with company R&D activities and university research				
Programme type	Ref. no.	Description of funding / support mechanisms (financing flows)	Identified programmes	Effectiveness	Efficiency
Other	20	Funding from enterprises to public & private training institutions	• DEMOLA	High: Engagement of more than 1000 business partners, 10,000+ students, creation of new jobs and companies.	High: Service fees from the partner organisations, university education and research operations cover all costs. Demola offers new opportunities via its international ecosystem. As such and since it can be operated on a reasonable and rather low budget which universities and businesses are willing to pay, it is highly efficient.
	21	Trainer & in-kind contributions from enterprises to public & private training institutions			
	22	Recruitment opportunities for enterprises from public & private training institutions			
	23	Useful project outcomes for enterprises from public & private training institutions			
Impact	+	Engagement of more than 1000 business partners, 10,000+ students, creation of new jobs and companies.			
Scalability	+	The initiative is considered to be highly scalable towards an involvement of further industrial companies including SMEs larger corporations, the public sector and further higher and executive education and training institutions.			
Sustainability	+	Demola operates on a region-wide basis globally and opens new opportunities via its international ecosystem. As such it is highly sustainable since it can be operated on a reasonable and limited budget.			

SWOT	STENGTHS:	WEAKNESSES:
	OPPORTUNITIES:	THREATS:
Bottom line and recommendations	<p>Blueprint for high-tech skills development at the interface of university and industry in concrete collaboration and problem-solving projects which has been implemented successfully in many different countries and regions.</p> <p>See 'Strengths': Demola as a blueprint for scaling up and growth.</p>	<p>DEMOLA Programme type: Other</p> <p><i>Note: blue arrows represent funding flows; training providers are indicated by shaded boxes; red texts highlight the relevant funding flows in the case.</i></p>
	<p>Demola is an international organisation that facilitates co-creation projects between university students and companies, either locally or internationally. Demola is an alliance of various partners including universities, their faculties, researchers and students, as well as companies, local agencies and a growing number of Demola Centers around the globe which is truly international and interdisciplinary. It operates a co-creation concept that is geared to solve real challenges. Demola offers new ways and practices for collaboration between businesses, students and universities. For companies and other organisations, Demola offers an opportunity to test and co-create innovative solutions with multidisciplinary university student teams and researchers. Projects and challenges are developed jointly by companies, public sector and universities. Multidisciplinary teams are formed from students from multiple universities and participating staff from partner companies and organisations. Demola is internationally part of universities' education and research processes providing a unique opportunity to create inspiring combinations of knowledge. Part of initial development was enabled by ERDF funding. Today it is fully financed by service fees from the partner organisations, university education and research operations. Demola offers new opportunities via its international ecosystem. As such and since it can be operated on a reasonable and rather low budget which universities and businesses are willing to pay, it is highly efficient. It can serve as a blueprint for expansion and growth in other parts of the world.</p>	

4.6 Best practice programmes and initiatives

Based on the results from previous analysis of the best practices, the online surveys and expert consultation and presentations, discussions and debate at the workshops a matrix for organising the best practices and initial recommendations (see 'recommendations' chapter below) have been developed and intensively discussed with experts and key stakeholders.

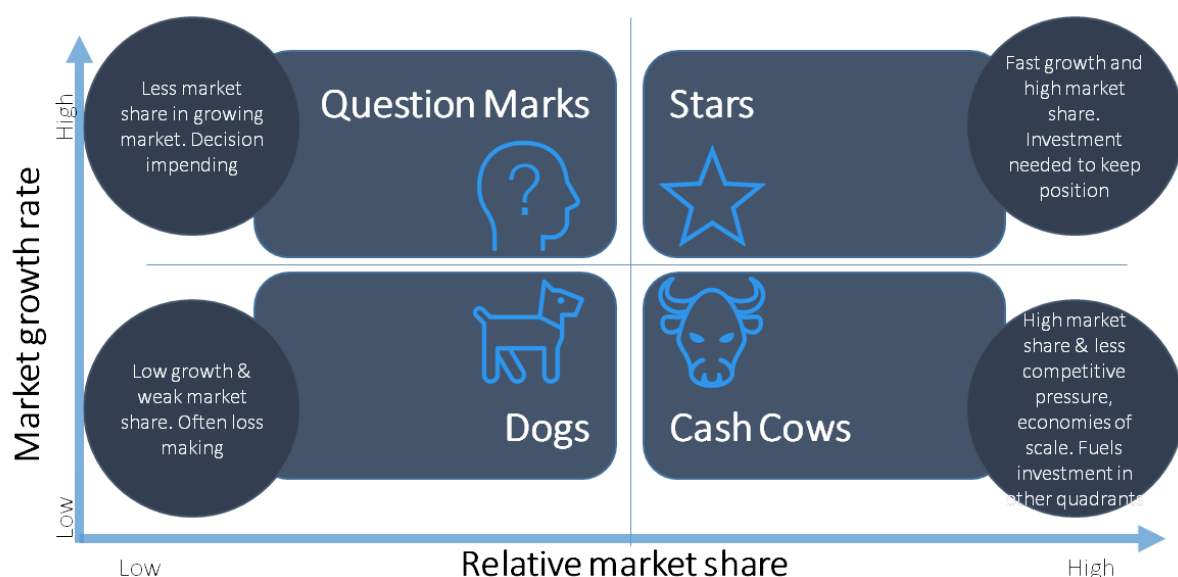
4.6.1 Funding programmes and initiatives in a growth/share matrix

Organising the best practice funding programmes and tentatively allocating them in a market growth-share matrix (which is based on a product portfolio matrix used by the Boston Consulting Group) helps to distinguish different types of funding programmes according to their position in the market and along the dimensions 'market share' and 'market growth'.

In analogy to the product portfolio approach one can derive recommendations for further operation and investment for scaling regarding the funding programmes and initiatives in each quadrant. The recommendations derived from such a portfolio analysis are

- To remove from the portfolio or do not excessively invest in **dogs**, unless they generate steady income at low maintenance cost or serve a very specific and relevant niche market;
- To hold a portfolio of **question marks** for some time for experimentation with the hope for at least some of them – supported through relevant investments - to evolve into the star quadrant. Spotting the future star among question marks is not easy and therefore involves some risk;
- To nurture market leader **star products** to keep their edge. They are to be developed into cash-cow products of the future. This may require ongoing investment.
- To maintain the **cash-cow products until they approach their product life cycle end** to generate the income and cash flow necessary to keep up investment in the other quadrants, especially stars and question marks.

Figure 5: The market growth-share matrix by Boston Consulting Group ³²



It has to be noted of course that **political decisions** to intervene in markets are most often **not made under the imperative of market success in the sense of profit generation** as the decisions of corporations for which this tool has been intended. For example, programmes for a not fast growing and small group of top level experts can be justified by the impact that is expected from these programmes on innovation and growth. It was therefore decided to adapt the matrix to our purpose and exchange the axis titles into “relative share of learners” and “market and relevance growth”.

Accordingly, the names of the quadrants had to be changed to represent the topic of learning better.

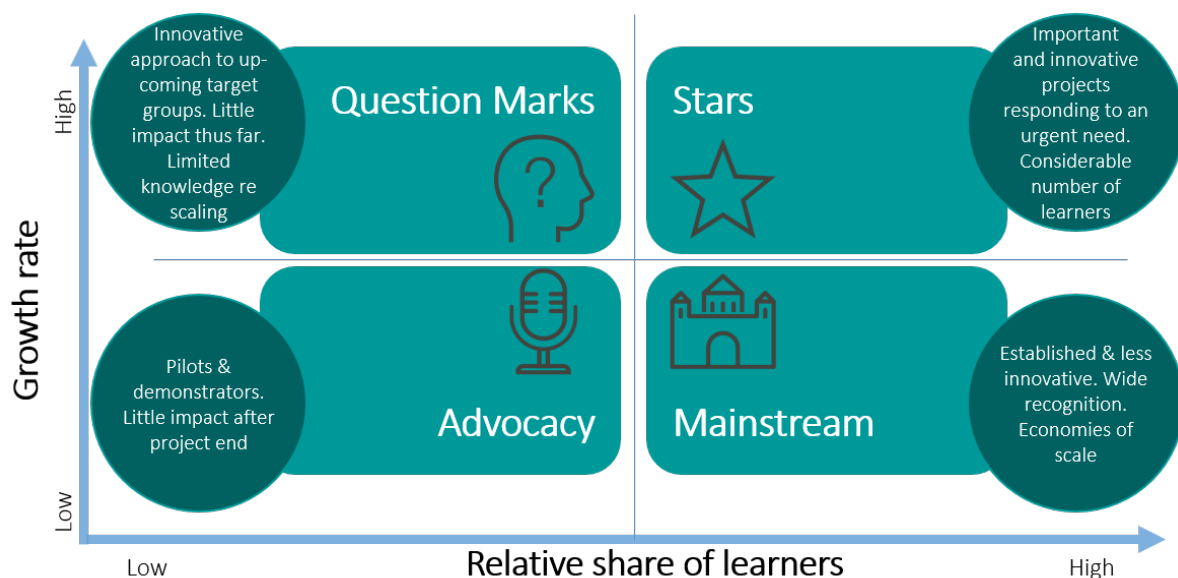


Figure 6: Adapted growth-share matrix for classifying re-skilling and up-skilling programmes

³² Source: Our visualisation adapted from https://www.bcaperspectives.com/content/classics/strategy_the_product_portfolio/; https://en.wikipedia.org/wiki/Growth%E2%80%93share_matrix

Positioning good practice initiatives in a matrix allows distinguishing four basic types according to their impact in the labour market and along two axis related to their (x) “relative share of learners” and (y) “growth rate”.

In analogy to the management of investment, one can derive recommendations for decision taking for scaling regarding the growth potential in each of the four quadrants. Recommendations derived from this approach are:

- To build a portfolio of small scale **advocacy** initiatives to pilot and demonstrate new approaches and test if they might generate promising results when scaling them up. Conceptually being a risk sharing approach where results cannot be predicted but success of some is the result of testing many, one should expect only a small portion of these to eventually become a success story;
- To sustain **question marks** initiatives for some time for experimentation with the hope for at least some of them - supported through relevant investments - would evolve into the “star” quadrant. Spotting the future stars among question marks involves some risk and request clear evidence;
- To nurture leading **star** initiatives to keep their edge. They are to be developed to transitioning to larger scale mainstream offerings to address the re- and upskilling needs of the workforce. This may require further selection and ongoing investment.
- To further support **mainstream** offerings to be integrated in the broader education and training systems to meet the goals of re- and upskilling a large proportion of the workforce before being complemented (and eventually replaced) by better and more efficient offerings coming from “stars” and “question marks” quadrants.

In the analysis, it became apparent that a large number of funding programmes are supporting initiatives to be classified as **advocacy**. Several of these serve the purpose of advocating the topic of re- and upskilling for specific target groups. They are initiatives with rather moderate investments. Training is carried out for a rather limited number of individuals and scaling is not the main objective since their focus is on research, awareness raising and promotion³³.

‘Disruptive’ initiatives such as École 42, which are following completely new education and training approaches, are for the time being to be found in this category. It is still too early to finally judge on their success and potential impact since their current funding is based on an investment of a donor. However, it could have the potential to be developed into a scheme to serve groups of people some distance away from education and training, e.g. socially under privileged, school drop outs and thereby close a gap. Initiatives such as Generation can only be successful with the strong involvement of volunteers in campaigns and volunteer mentors from IT industry. In this type of initiative with small investment training is carried out for a rather moderate number of individuals and scaling is not the aim and objective since the main focus and purpose of these initiatives is on awareness raising, advocating and promotion.

Advocacy good examples: École 42 and IT for She

École 42 (France)		IT for She (Poland)	
Peer-to-peer IT training: innovate pedagogy and alternative entry point to IT		Increasing the participation of women in the technology industry	
Innovation	Innovative pedagogical model and peer-to-peer learning approach; students solve given tasks / challenges themselves without teachers and instructors	Innovation	Approach with a strong ‘volunteering’ part with three different action lines: (1) ‘Women in Tech Camp’ where the 130 best IT female students in Poland take part in a hackathon, workshops and mentoring. (2) ‘Kids in IT’, 50 volunteer female students from IT departments teach 1,000 kids in rural areas basic coding, how to use 3D printers, Arduino programming and robot building. (3) ‘Mentoring Programme’ with real work experiences

³³ These should not be confused with Potemkin village’s type of initiatives developed merely for lobbying or public relation purposes.

			for female IT students, run by representatives from technology companies in Poland.
Funding	Donor funding: 70 million € for 10 years (2013-2023) – Paris campus	Funding	Initial funding: 100,000 € through donor: Perspektywy Education Foundation; activities are strongly based on volunteers
Target groups	Young people regardless of school or social background including many who failed in the formal education system	Target groups	Women and children
Costs / learner	2000 € / year	Costs / learner	Very low
Impact	Approx. 3000 graduates who all got a job in the IT labour market; currently 2300 enrolments	Impact	Successful organisation first steps towards ICT jobs in industry for women. Familiarisation of children towards IT.
Lessons learned	Disruptive, innovative peer-to-peer learning approach seems to be attractive for the target groups and for initial training and re-skilling unemployed people.	Lessons learned	Initiatives of this type can only be successful with the strong involvement of volunteers in campaigns and volunteer mentors from IT industry. The annual 'Women in Tech' summit and career fair have become the most popular activities with a positive impact on the further activities.
Scale-up level and ambition	Continuation and expansion of operation in France. École 42 franchise model for scaling-up currently applied in several European and African countries. Ambition is to train 12.000 new individuals over the next five years across all campuses.	Scale-up level and ambition	Limited. Slow increase of the number of mentors, women learners and children addressed from 2016 to 2019. Strong focus on 'Women in Tech' summit. Increase the number of the currently almost 10 partners from industry.
Sustainability	Donor investment guaranteed for 10 years. Indication of successful use of franchise model in further countries.	Sustainability	Dependency on donor funding and support from partnering companies from industry.

The initiatives in the **question marks** quadrant have come up with good results but show no or very limited scaling ambition or impact. Again, investments per case are moderate. It is in this category where some change is needed. These could best be implemented through so-called “complementary or growth funding programmes”. This has been confirmed by numerous experts.

'Question Marks' good examples: Expertkompetens, Go digital, DEMOLA, Generation

Expertkompetens (Sweden) Professional Master training programme: industry demand, professional learners		Go digital (Germany) Low threshold skills transfer into SMEs	
Innovation	Co-design and delivery together with industry	Innovation	Skills transfer on digital transformation etc. into SMEs
Funding	Foundation and industry: investment for course development and implementation: 1.8 – 2.4 million €/course Costs for course delivery are shared between government and industry (costs: see below)	Funding	Phase 1 (2015-2016): 2.275.324 Euro Phase 2 (2017 - ongoing): 5.000.000 Euro 50% funding by Federal government 'go digital' programme; 50% own SME investment; funding is received by consultants, who advise SMEs and help with the implementation; consultants do all the administrative work for SMEs
Target groups	Professionals in IT and other areas of significant importance for the business sector	Target groups	Small SME (< 100 employees); funding is received by consultants who advise SMEs and are thus able to offer their services at reduced rates
Costs / learner	20.000 € / 2 year professional Master programme	Costs / learner	Average: 10.000 €
Impact	Successful career advancement for >2.000 professionals from around 330 companies; programme has become part of the company's learning systems; Industrial PhD projects	Impact	Since 04/2018 (actual opening of programme) 847 applications granted which is beyond expectations and likely to require additional funding to be made available by the ministry.
Lessons learned	Still some industry reluctance to pay for training/up-skilling. Programme operation without funding does not fit standard university funding model. Need for specific business model for university up-skilling training and government / EC incentives for professional lifelong learning	Lessons learned	Attractive for SMEs. Online programme with low level of bureaucracy and application effort.
Scale-up level and ambition	Annual application rounds stepwise increasing the number of graduates. Increasing number of universities offering up-skilling courses. Ambition is to train about 10.000 individuals over the next five years. Online training and MOOCs are under development to further increase the number of professional students.	Scale-up level and ambition	Go digital started in 07/2017 only and is at present limited to end in 2021; increasing number of applications per month; further decisions after evaluation (2019/2020)
Sustainability	Knowledge Foundation continuing funding for development and implementation. Government and industry cost sharing for course delivery. Universities including the up-skilling into regular programme / course portfolio	Sustainability	Federal Ministry of Economics continuing funding to meet current and future demand

DEMOLA (Finland et al.) University and industry innovation ecosystem: real world challenges for students, example of scaling well		Generation (Spain) Inclusive ICT training programme addressed to unemployed young people	
Innovation	Innovation ecosystem combining the talent of students with company R&D with student teams solving a real world company problem	Innovation	Curricula based on skills mapping process with industry. Technical skills, behavioural skills, and mind-sets. Tracking ROI.
Funding	Initially started as an ERDF project but is today sustainably funded through universities and industry financing.	Funding	ESF and national government funding supplemented by funding from McKinsey and Company (remaining 8%). UK, FR, IT: Private launch funding with employer contributions from first cohorts
Target groups	Universities (and their IT students), companies and their research departments	Target groups	Unemployed young people and employers
Costs / learner	20.000 – 30.000 € per university / ecosystem set up	Costs / learner	From 2.400 € for 6 week boot camp to 3.200 € for 12 week
Impact	Alliance and engagement of 50 universities, more than 1.000 business partners, 750.000+ students, creation of new jobs and companies.	Impact	1,800 graduates; 80% placed in employment; 83% placed remain employed 1 year out; 830 partner employers. 84% of Generation employers say graduates “outperform their peers” in similar roles.
Lessons learned	Demola is creating a new culture of cooperation between universities and industry/business cooperation. Several corporate partners have developed internal innovation processes based on their learning experiences in the Demola cooperation.	Lessons learned	1. Training is only the start 2. Proving business ROI is necessary, but not sufficient, to convince employers to change 3. Measure value, not just cost
Scale-up level and ambition	Successfully 'exported' and in operation in many countries (2019: 16 countries); growing scale of ambition to train, involve universities and business partners globally over the next five years.	Scale-up level and ambition	In 2019, Generation aims to graduate ~3,000 young people. By 2021, target is to increase annual number by 2-3X. Generation is live in 9 cities across Europe, 5 of which are in Spain. Experimenting with expansion into re-skilling programs for workers at risk of displacement.
Sustainability	Fully sustainable in its present model	Sustainability	Moving towards self-sustaining model entirely funded by employers and government.

Only very few **stars** could be identified. These are of very different type. Katapult in the Netherlands for instance was set up as a cooperation initiative of formerly rather disconnected actors under a shared goal and innovation ambition pushed by a small team of experts.

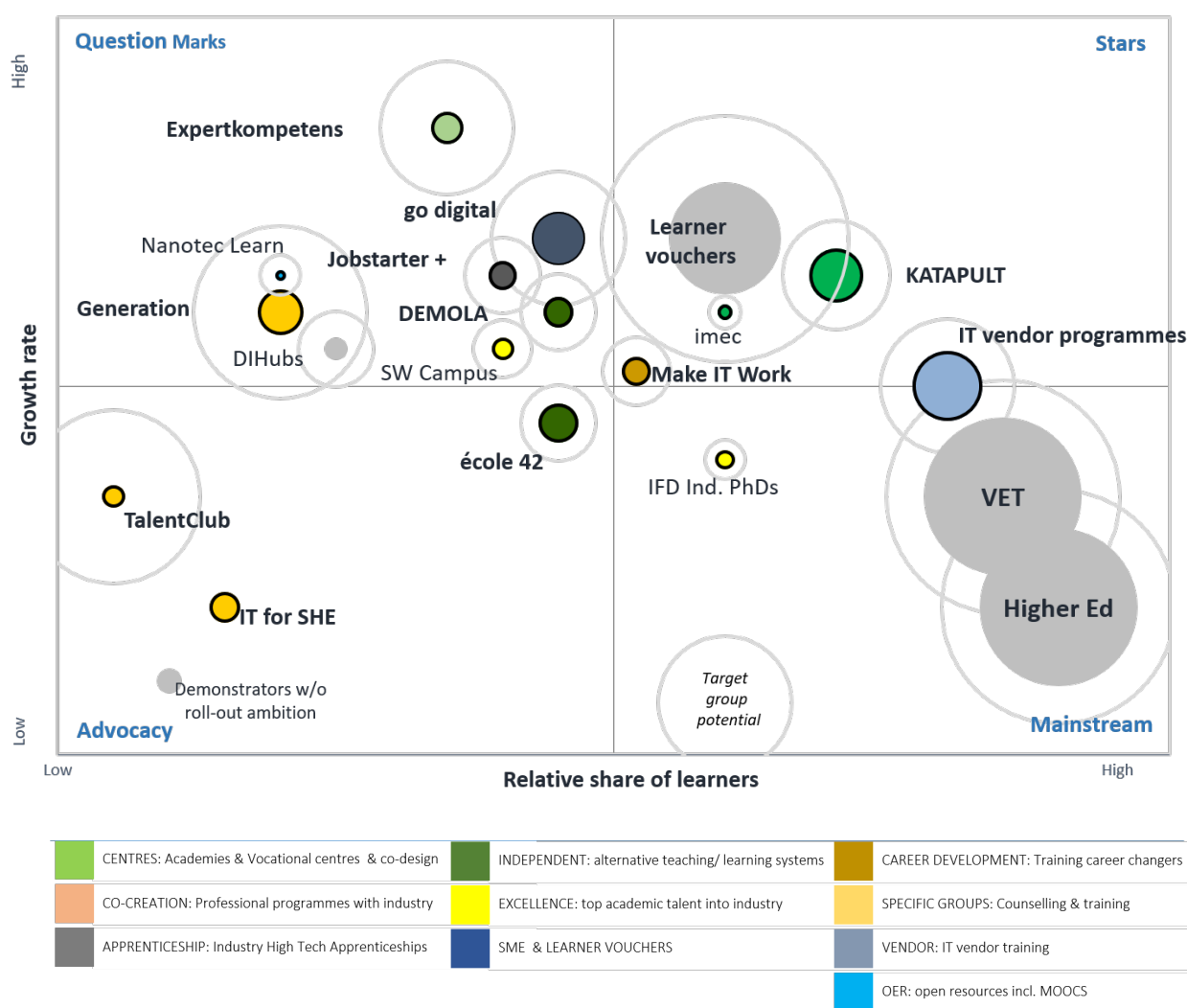
The additional costs for this team are rather small but through this cooperation Katapult managed to leverage large sums coming from all the actors involved and scale up its operation nationwide with around 150 training centres throughout the Netherlands in less than 10 years.

'Stars' good examples: Katapult, Make IT Work

Katapult (Netherlands) Driving the knowledge of tomorrow: Drive VET across industries		Make IT Work (Netherlands) Career changer programme: change careers to IT	
Innovation	Government, education and training institutions and private corporations investing in conversion of the workforce through Centres of Expertise	Innovation	Co-design and cost sharing with industry
Funding	Government investment: > 200 Euro million € plus > 200 Euro million € from businesses and regional governments	Funding	Initial government funding for 2 years; Today: funding through industry and trainees
Target groups	Apprentices and students in VET and Higher Education	Target groups	Employees of different background and occupations facing redundancy or wanting a career in IT
Costs / learner	8.000 € / 9 – 12 months training	Costs / learner	€ 7.000 (€ 6.000 by employer, € 1.000 by student) for 5 months course, 6 months' work experience. After the retraining, monthly networking and knowledge sharing meet-up with all graduates.
Impact	150 partnerships (so-called Centres of Expertise) between education and business with 50,000 students, 4,500 companies and 4,000 teachers participating; constantly growing.	Impact	91% completion rate; 97% continue to work in IT; 105 companies participate, 400 graduates (1/3 women); the 20th course will start on 2nd of September 2019.
Lessons learned	A policy environment that allows for innovation, experimentation and collaboration, not merely on paper, but also in real world scenarios. Smart use of regional approaches to jointly develop innovation in education and support the labour market Measures to embed innovations in education.	Lessons learned	Initial funding helped in quick starting the initiative, which is now self-financed
Scale-up level and ambition	The network is constantly growing since it was established several years ago. Ambition is to establish an even tighter network of Centres of Expertise and Centres of vocational individuals throughout the Netherlands and train 250.000 individuals over the next five years. Katapult – the community of Centres - is a dynamic network that intends to explore & launch new methods to include relevant stakeholders in the Centres, in order increase the outreach of the program, and to ensure sustainable impact. By 2025 Katapult aims to: <ul style="list-style-type: none"> - Include 90% of all Dutch Vocational Educational Institutes and Universities of Applied Sciences in the network (already achieved) - Achieve a 25% student involvement - Expand business involvement to 20.000 companies - Enhance teacher involvement to adapt and create new curricula 	Scale-up level and ambition	Straightforward and successful scaling up with offerings in several Dutch universities. At this moment (May 2019) 4 Dutch Universities of Applied Sciences offer the program in 8 locations throughout the Netherlands Ambition is to train 5.000 individuals over the next five years in the Netherlands. The model is easy to replicate at any university with some entrepreneurial ambitions.
Sustainability	- Secured funding for the future through existing funding partners, depending on whether the PPP proved to be a success (PPPs achieve a success rate between 66-75%).	Sustainability	Sustainable business model with funding from industry and trainees

Learner voucher schemes - which exist in several countries such as Germany and France - appear to be worthwhile and a functioning instrument addressed to individuals and paid for by governments. The investment level per individual is low but the impact can be large. In order to further spread the use of this instrument among employees further awareness raising and promotion campaigns are needed. These should help change the mind-set of employees that further training is a must and that in the very end they are responsible for that themselves.

Figure 7: Indicative distribution of good practice examples in the matrix



Source: empirica / PwC 2019

Mainly the well established education and training systems in the EU28 Member States and IT vendor programmes can be described as 'Cash Cows', or 'Mainstream', operating in a well established market with rather little competitive pressure and benefiting from economies of scale. Interestingly many of the programmes and initiatives from earlier life cycle stages can be seen and used as modules for injection into cash cows to innovate these and keep them upfront and fit for purpose in a continuously further developing environment and market. This is depicted in the above figure through the lines between initiatives in the different categories.

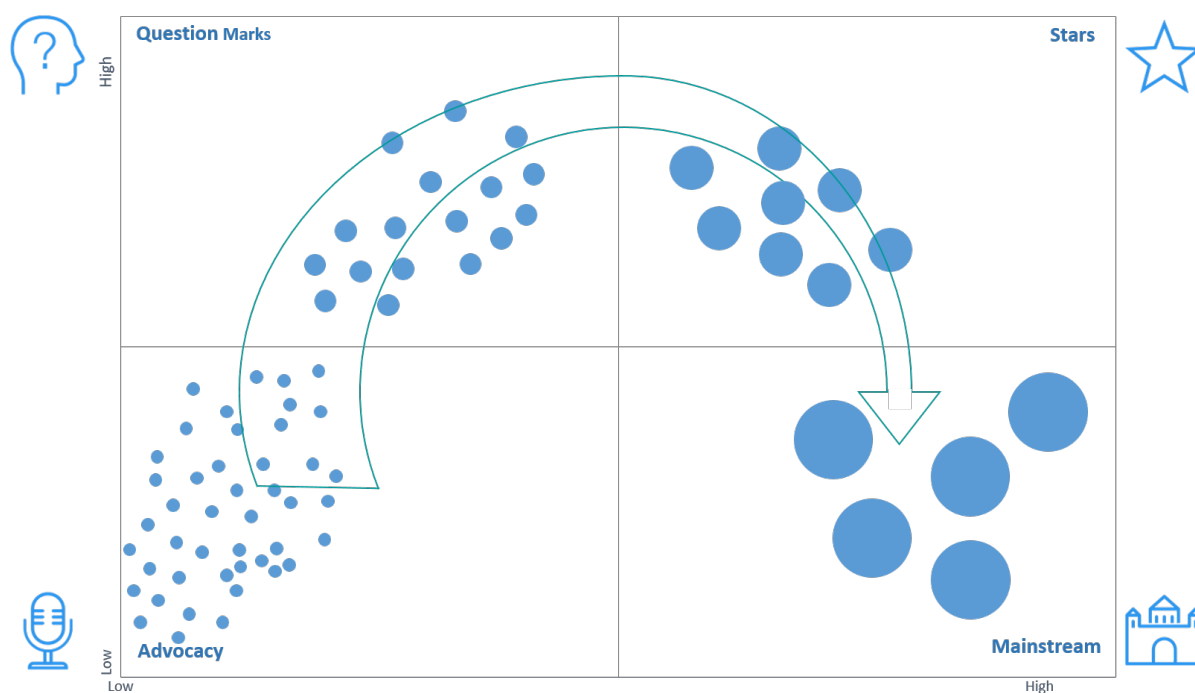
4.6.2 Funding life cycle and stages

This matrix analysis exercise is helping to:

- Reveal the most promising and successful initiatives;
- Highlight the funding needs at different stages to scaling up good practices;
- Recommend how to push them forward and support good practices throughout their life cycle depicted in the following figure (see figure 'funding life cycle').

Funding should be able to support initiatives through the different stages of growth, which are those of a life cycle model.

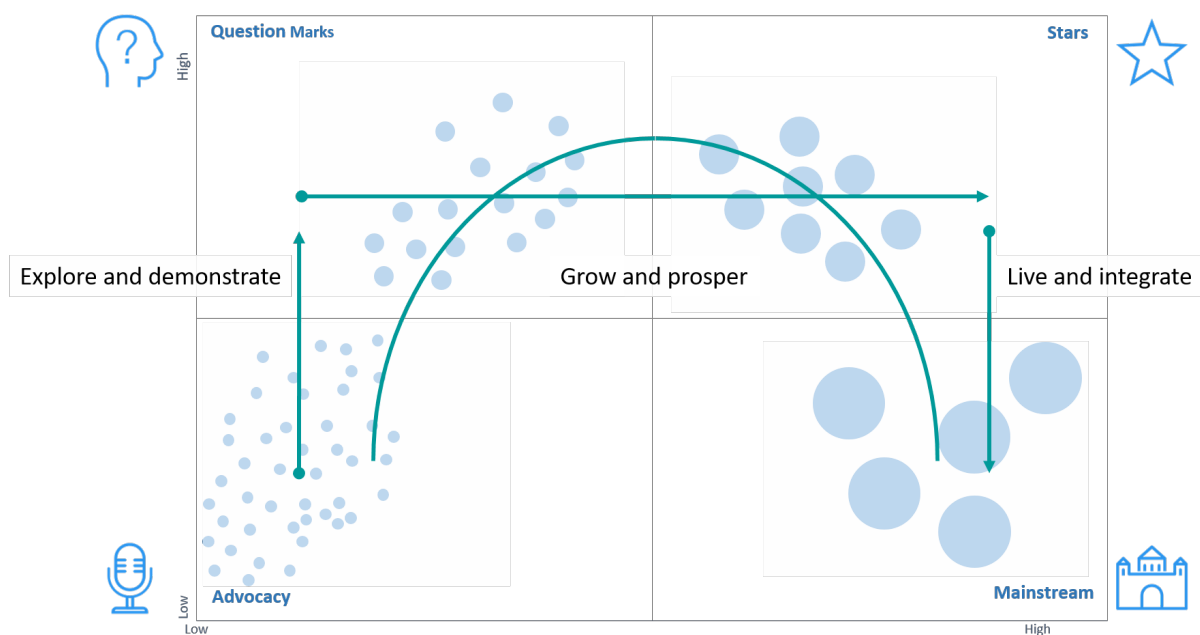
Figure 8: The stages of growth: funding life cycle for scaling-up initiatives



Source: empirica / PwC 2019

As mentioned before, there are numerous funding programmes at EU, national, regional and local levels. With current funding programmes, many (promising) initiatives do not reach beyond the two initial **advocacy** and **question marks** stages. New funding intervention at multiple stages, greater complementarity and coordination mechanisms at all levels are needed to make successful initiatives move into **stars** and **mainstream** stages with a view to scaling them up to achieving strong and greater impacts. However, these are not in place yet in the current funding programme landscape resulting in a large number of promising and successful funded projects to enter a **valley of death** similar to the one of many start-ups missing scaling-up funds.

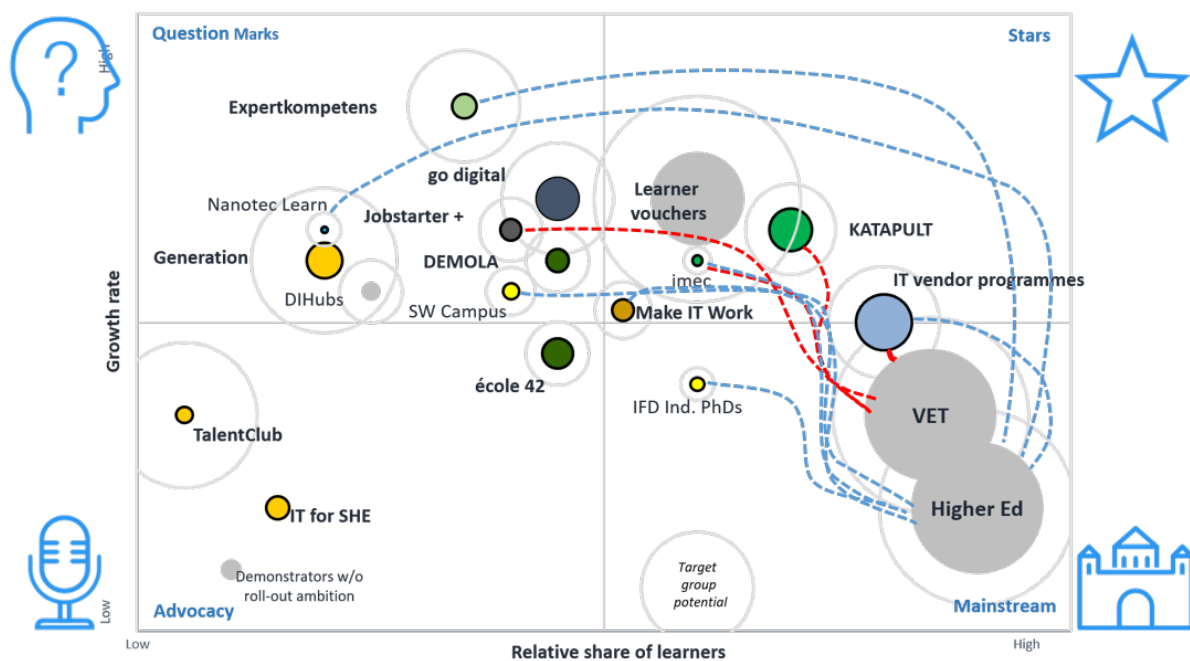
Figure 9: Funding programme initiatives life cycle stages



Source: empirica / PwC 2019

In order to stay upfront European education and training systems depend on the capability for regular and continuous innovation. These typically need to be nurtured and integrated into the **mainstream** with a view to support large-scale re- and upskilling initiatives and progressively make lifelong learning a reality for all.

Figure 10: Best practice initiatives in a market growth-share matrix 'injecting' innovation into mainstream programmes



Source: empirica / PwC 2019

4.6.3 Good practices by funding programme life cycle

Different types of funding programmes and incentives for high-tech skills re- and up-skilling could be identified. They offer a wide range of funding approaches as well as public and private instruments.

These include in particular:

- Centre-based vocational education and training co-design and delivery together with industry. It includes government, education and training institutions as well as private corporations investing in training of the workforce through centres of expertise in VET;
- Programmes offered by universities and co-created with industry in a new role of professional training providers (professional Master programmes);
- Programmes funding the development and delivery of apprenticeship high-tech skills modules added to traditional apprenticeships to generate VET graduates with high demand in the market;
- Excellence schemes preparing for future digital leaders, career change and development programmes offering attractive re- and upskilling courses jointly financed by companies and trainees after initial funding;
- Voucher-type funding programmes aimed at low threshold high-tech skills transfer into SMEs;
- Disruptive peer-to-peer digital training following new and innovative pedagogical models and offering an alternative entry point to digital jobs;
- Inclusive digital training programme addressed to unemployed young people;
- Activities aimed at the innovation ecosystem creation combining the talent of students with company R&D with student teams solving a real world company problem.

It became apparent that from the EU countries studied; the Netherlands, Sweden, Germany, Denmark and France are most active followed by countries such as Finland, Belgium and Spain.

4.6.4 Dynamic multi-stage funding intervention

To best support promising initiatives, a new dynamic, multi-stages funding model could help to overcome the valley of death. For this purpose the various funding programmes existing at EU, national and regional levels should be more complementary and contribute to scale-up successful initiatives and rollout a wider uptake and adoption.

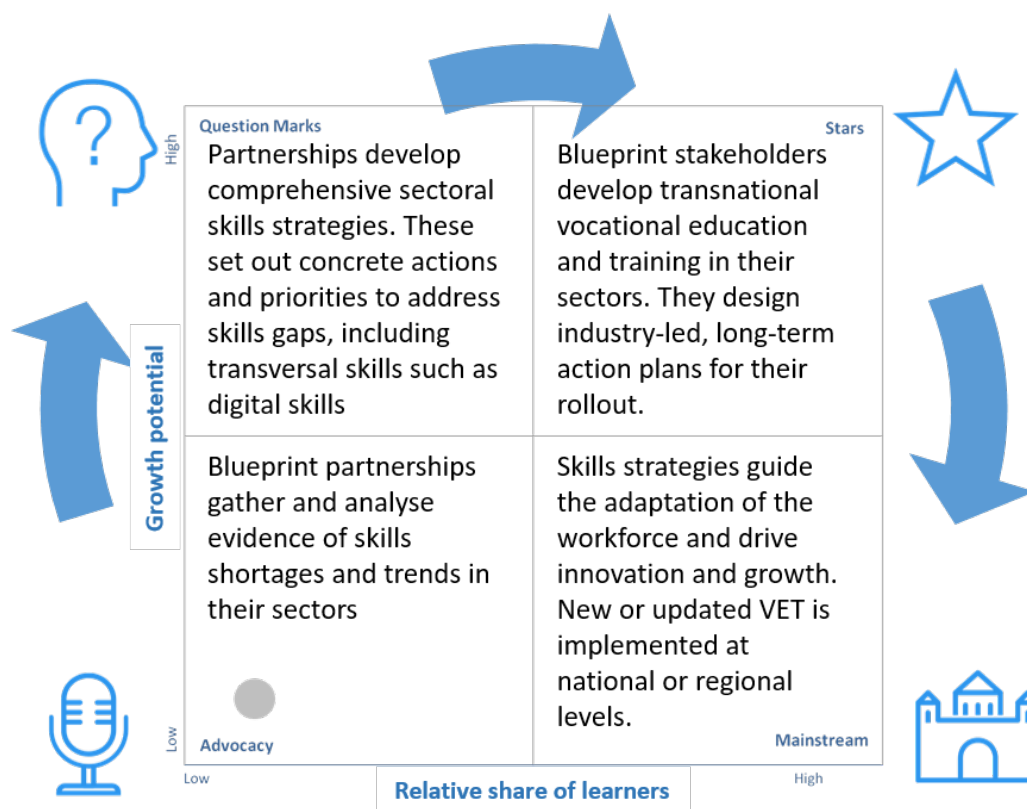
This idea was presented in the Skills Agenda for Europe (June 2016) in the Blueprint for Sectoral Cooperation on Skills, which is piloted in several sectors since 2018 through sectoral skills alliances at EU-level. Each partnership develops a skills strategy for the sector and match the demand and supply of skills.

Partners identify priorities and milestones for action and develop solutions, such as creating and updating curricula and qualifications based on updated and new occupational profiles.

Building on the results achieved at EU level, the Blueprint will be progressively rolled out at national and regional level, in cooperation with national and regional authorities, and key stakeholders, and as relevant exploiting synergies with regional smart specialisation strategies.

By further improving and refining this approach one could leverage the testing and validating of a large number of small-scale projects before enabling the allocation of more substantial and complementary funding ensuring critical mass to initiatives with proven results to scale them up.

Figure 11: Positioning the concept of the Blueprint for Sectoral Cooperation on Skills in the matrix



Source: empirica / PwC 2019

New ideas for initiatives are usually found in interactions between suppliers, users and supporting structure. Acknowledging this, one must ensure sufficient funds for the continuation of networks, associations and discussion forums in the high-tech industry. Overall funding will be modest.

During the **explore and demonstrate** phase funding should be addressed to many small experiments to find out what already works, what requires more work and what should be discontinued. The aim should be to generate as many good ideas with as little effort as possible leveraging a ‘start small, fail fast’ mentality. Funding should be provided for a given timeframe to prove potential for scale, by obtaining results based on concrete and measurable KPIs.

Experts believe strongly that funding should be available for scalable longer-term public-private-partnerships with scaling potential to create substantial impact. A highly competitive model with large-scale funding for fewer promising initiatives is preferred to the watering can model. Those who deliver successful scalable results should be further supported while those failing the test should be terminated as soon as possible. Increased funding for successful scalable initiatives is seen as a way to overcome valley of death and to create large impact. There is a need for demand driven and industry led initiatives including elements of co-creation and delivery.

During the **grow and prosper** phase, the main goal should be to ensure growth among a set of a selected number of good practices with proven records of potential for scale. Funding for each initiative needs to be substantial to ensure growth and achievement of a critical mass. In this phase, direct funding should be result-based (payment on delivery only) and gradually decreasing over time. In parallel indirect funding through publicly funded user incentives (student vouchers/ loans, tax levy, etc.) need to be in place and developed (see section below for more details on ‘Income Sharing Agreement’ as individual loan for adult learners). Hence, the initiative must remain attractive in the market. The skills development re- and upskilling initiatives would gradually need to find alternative funding from the market, i.e. student/user payment, employer payment, other forms of

private cooperation, etc. While in the exploration phase funding is allocated in smaller portions between many initiatives, only a selected few initiatives with proven results and scaling ambitions receive a more substantial funding in the scaling phase.

Initiatives in the final phase already have a critical mass and their being experienced and established institutions with well running operation machines should be properly made use of. Unlike in a corporate context, the function of this quadrant hardly can be to generate income as return on previous investment and as fuel for new investments. Rather, these machines should be governed to respond to reform and innovation demand and be injected with successful or proven innovation from the outside and so kept alive and well (unless institutional sclerosis becomes prohibitive of their mission).

Incentives for reform may be set such as for education providers to compete for indirect funding through publicly funded user incentives (i.e. a demand-side subsidy), such as student vouchers / loans, tax levy, etc. In this instance, institutions must remain attractive in the market through continuous improvement and demand side responsiveness.

In contrast to incremental reform of the established sector, disruption of the mainstream segment may be originating from third parties.

The existing mainstream education and training providers are likely to stay the most important actors in the education system in the future, if they manage to adapt properly and timely to the changing requirements facing them. They will remain also important for knowledge and experience sharing. Policy needs to ensure that their major share in building Europe's skills and competences is maintained while not hindering the life cycle flow of new initiatives and the capability for innovation in education and training.

5 Overall results and conclusions

The conclusions developed in the present chapter are based on the results from the analysis of the large number of funding programmes, a series of expert workshops carried out in Brussels and two online expert surveys and a final international conference.

Experts and stakeholders expressed the need for a common vision and agreed to the benefits of a developing a segmentation and classification of the best practice candidate programmes into a typology for the development of recommendations as described in this report.

5.1 Vision

There is broad agreement among the consulted experts that as a starting point, a policy vision is needed for the revision of present and the development of new, more appropriate funding programmes, instruments and mechanisms. To some extent, this already exists through the different recent European Commission policy documents and Communications in this area. These should be integrated and further developed, streamlined and put forward as a common policy document proposal. It should be developed in a coordinated fashion, involving the different DGs at the Commission dealing with these issues and involving relevant national EU Member State stakeholders and government departments and policy decision makers to achieve an overall European-wide agreement.

Based on that decision and agreement, necessary partnerships, programme types and funding instruments and mechanisms but also fiscal incentives and levies and details as to necessary monetary dimensions (i.e. budgets to be allocated to specific new dynamic multi-stage interventions and ways of funding), need to be developed. Existing programmes need to be carefully analysed for their suitability for future use.

5.2 Funding programme landscape and typology

The future policy and funding programme landscape is likely to continue to be multi-faceted with a co-existence and combinations of different types of funding programmes with new dynamic multi-stage funding and incentives.

A segmentation and classification of the best practice candidate programmes revealed the typology described in chapter 4. The typology is based on an integrated framework describing the diversity of sources of funding – including public, private and donor sources – and the diversity of beneficiaries of fund expenditure based on the work from Ziderman³⁴ and expanded by the authors of the present report.

The best practice programmes allocated to each of the different types bear the most promising potential to reduce the high-tech skills gaps and highlight important elements which need to be in place to be successful either by continuing these programmes more or less in the existing format or with some necessary adaptations or in developing new funding programmes. The list of funding programmes include selected best practice programmes and instruments, which have been in place for many years or even decades, but also several relatively recent programmes with new funding types, which are somewhat disruptive and move away from ‘business as usual’ as further outlined above.

³⁴ Ziderman, Adrian 2003; taken from Johanson 2009

The different types of funding programmes were further described based on information or at least some indication of the impact, effectiveness and efficiency, scalability and sustainability of each programme. The latter was obtained by means of an intensive research and interviews with experts and those individuals responsible for or running the programmes. Unfortunately, this type of information often does not get disclosed by the organisations operating these programmes and not even in interviews. The same holds true for evaluation reports, which could contain this information but which are regularly not made available to the public or do not exist since many programmes have not (yet) been evaluated.

The results of this effort are described above in the main body of the report.

5.3 General conclusions

5.3.1 Coexistence of established and new disruptive programmes

After the analysis and discussion of different best practice funding programmes, experts agreed on the need for keeping ‘long time established and proven’ funding models and programmes (re-focussed where necessary and appropriate) but at the same time implementing innovative, remarkable and sometimes disruptive funding models following new principles. In terms of funding such activities, this may require eligibility rules in funding programmes to be modified to allow funding such innovative education and training operating models. This is emerging as a dynamic and vibrant area of education and training delivery where private education and training providers and so called EdTech start-ups are increasingly becoming active.

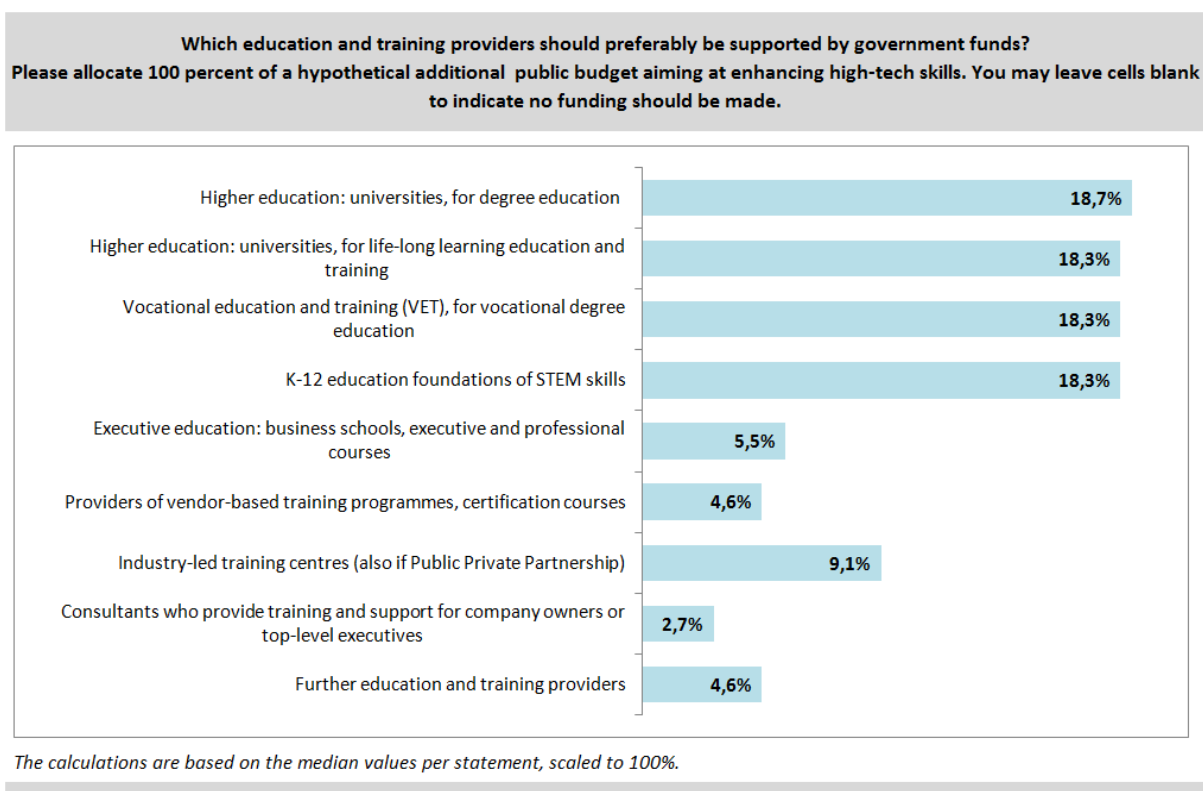
Experts expressed the view that those programmes to be funded need to have at least a mid/long-term perspective and should not focus on (but move away from) ‘quick fixes’. This should include thinking beyond existing structures and formats in the present education and training landscape and systems, and putting a much stronger emphasis on lifelong learning and further education. Currently only a very low 23% of companies in the EU provide ICT training to their workforce.³⁵ The participation rate of employees in further education and training in the EU28 is even lower and at an average just 11% in 2018 although with huge variations across the countries with 0.9% in Slovenia and a maximum of 29.6% in the UK³⁶.

The need for focussing on professional further education and lifelong learning is also reflected in the results from the first online expert survey. The surveyed experts have a rather clear view as to the type of training providers to receive public funding and for which type of training programmes this should be given. Still degree education in higher education ranks top of the list but it is closely followed by life-long learning education and further training through higher education institutions, vocational education and training for vocational degree education and K-12 educations of STEM skills.

³⁵ Eurostat: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=isoc_ske_itn2&lang=en

³⁶ Eurostat: https://ec.europa.eu/eurostat/statistics-explained/index.php/Adult_learning_statistics

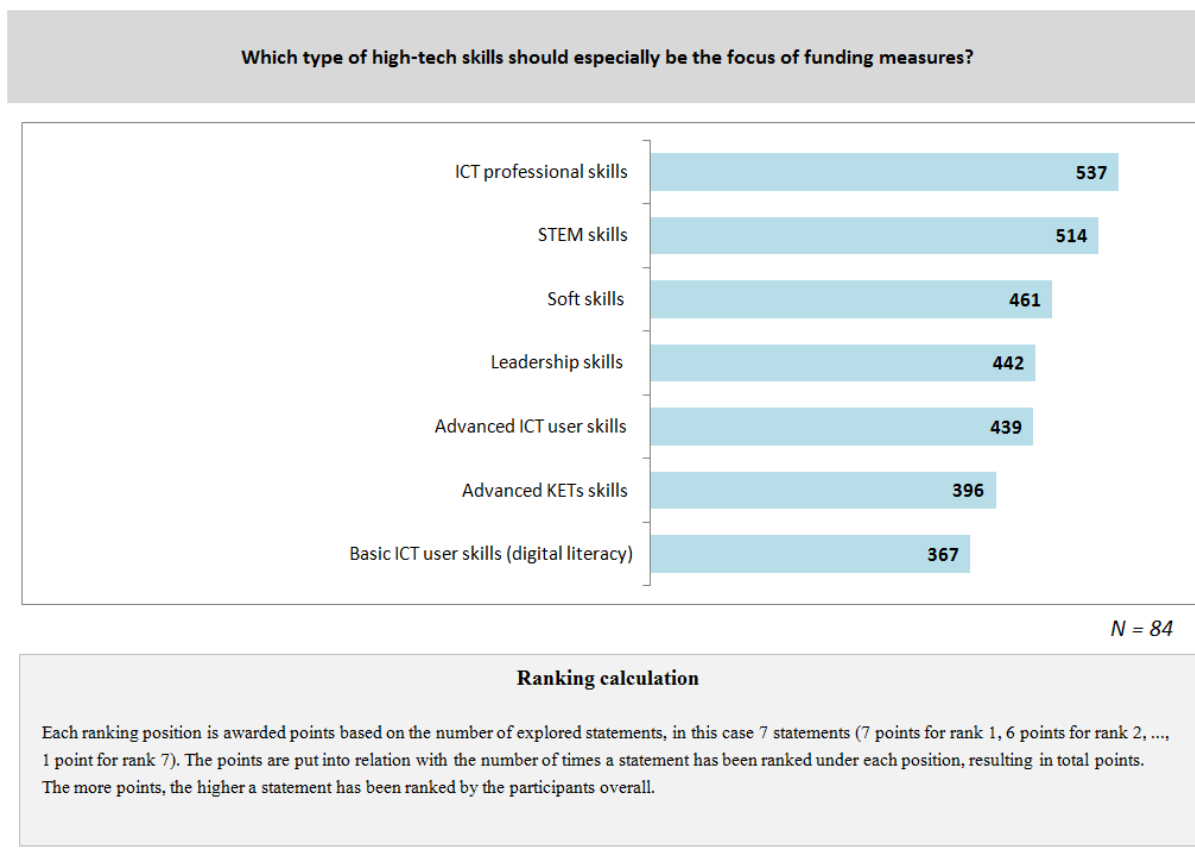
Figure 12: Proposed allocation of public funding to types of training providers – results from an online expert survey (Summer 2018)



Source: empirica online survey on 'High-tech skills for Europe', Summer 2018

When it comes to the type of high-tech skills the funding programmes should focus on, experts emphasise the importance of soft skills and leadership skills in addition to the professional and technical ICT or STEM skills.

Figure 13: High-tech skills which should become the focus of funding measures – results from an online expert survey (Summer 2018)

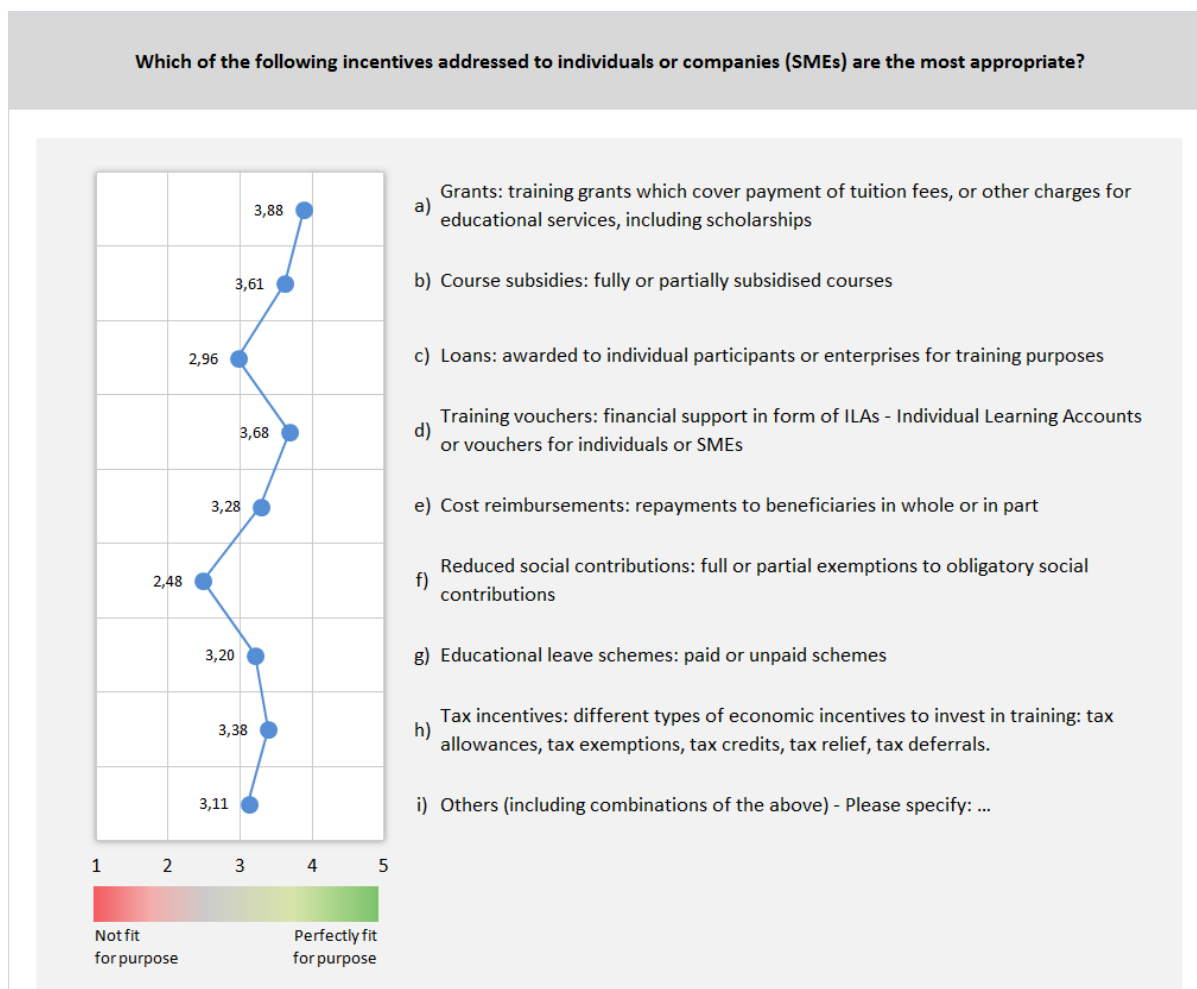


Source: empirica online survey on 'High-tech skills for Europe', Summer 2018

5.3.2 Spectrum of future high-tech skills funding programmes

What has become apparent already is that in order to be successful, policy requires the implementation of a rather broad spectrum of programmes ranging from top-level excellence programmes to the more technical ones at VET-level and instruments like vouchers addressed to and supporting SMEs and individuals. Additionally, and in terms of incentives, training grants which cover payment of tuition fees, or other charges for educational services, including scholarship, training vouchers and tax incentives or levies are seen by experts in our online survey as most appropriate specifically for SMEs. There is evidence from our analysis that these have proven to be suitable and successful in goal achievement in some policy contexts.

Figure 14: Appropriateness of incentives for skills training – results from an online expert survey (Summer 2018)



Source: empirica online survey on 'High-tech skills for Europe', Summer 2018

5.3.3 Learning from failures

The research team could identify a range of policies and funding programmes which can be described as failures from which to learn. These 'learning practices' provide a richness of information on management and governance structures and types of organisations and institutions which need to take responsibility to successfully run high-tech skills funding programmes and provide and at the same time ensure continuity and stability over a longer period of time. The insights gained have found their way into the recommendations.

5.3.4 European funding for cross-country implementation of (national) programmes

Experts expressed the view that Commission's support and funding for cross-country implementation of (national) programmes and instruments³⁷ would be an interesting option to be pursued and implemented by the Commission. Many initiatives presented at the workshops already have an international / global approach and as such 'built-in' transferability.

³⁷ that have proven to be sustainable, scalable and allow for transferability (this requires a better understanding of the necessary conditions for replication which need to be in place to achieve a successful transfer)

5.3.5 Funding programme rules and regulations to ensure involvement of key experts

Funding programmes also need to be critically reviewed with a view as to the types of activities related to skills development for the future included but especially those excluded from funding (e.g. the H2020 programme is not allowed to fund curricula development).

Furthermore, funding rules and regulations need to be analysed with a view of evaluating their appropriateness for attracting the key experts and stakeholders to most professionally carry out these tasks and whether these act as facilitators or constraints. For example, Erasmus+ programme sets very low maximum daily rates for experts to run, for instance, the Knowledge Alliance or Strategy Alliance activities and projects, which is excluding specific types of experts who are well-placed to do the job.

5.3.6 European Commission one-stop-shop supporting high-tech skills development, supporting scalability and replication of success stories

In interviews, at workshops and in consultation activities, experts also expressed the desire for the Commission to create an online one-stop shop for best practice presentation and access to programmes from different public and private providers. This one-stop shop could be used as an online learning tool and thereby help learning but also adopting and scaling up successful initiatives and programmes, and ensuring their implementation also in other European countries where these currently do not yet exist.

5.3.7 Concordance with the objectives of the European Commission's Multiannual Financial Framework 2021-2027 (MFF)

The present service contract comes timely since the currently running negotiations of the MFF offer the unique opportunity to ensure that – where appropriate - re-focussed funding mechanisms and programmes are put in place, and blockers and constraining factors are eliminated. The general ambition of and the Commission's objectives for future focussing the funding of high-tech and digital skills development as expressed for the European Social Fund+ (ESF+) is appreciated by experts. As one of the most significant funding opportunities of the Commission in the digital skills area, the ESF+ is supposed to aim at “improving the quality, effectiveness and **labour market relevance of education and training systems** to support acquisition of key competences including digital skills” and “**promoting lifelong learning, notably flexible up-skilling and re-skilling opportunities** for all taking into account digital skills, better anticipating change and **new skills requirements based on labour market needs**, facilitating career transitions and promoting professional mobility” (Article 4 (iv) and (vi))³⁸. These objectives are highly relevant for the future labour market and a successful digital transformation of European economies and societies.

5.3.8 Characteristics of funding programmes restricting their impact

The research conducted under this service contract has shown that major EU28 national government and European Commission's funding programmes aimed at high-tech skills and talent development have limitations as to impact creation. When analysing those policies and programmes identified in the selected number of EU28 Member States, it becomes apparent that these typically provide funding for the more academic and R&D-type development of requirements specifications and on that basis the development of new curricula, programmes

³⁸ Proposal for a regulation of the European Parliament and of the Council on the European Social Fund Plus (ESF+) (COM(2018)0382 – C8-0232/2018 – 2018/0206(COD))

and courses which are then piloted. At a maximum, piloting or some rather small-scale operation is achieved and aimed at by these types of funding programmes, and typically only for a very limited period of time.³⁹

The prevailing attitude and mindset in university administrations and other types of training organisations seems to be one of strong conservatism and can be described as “let’s experiment, run a pilot programmes but ‘don’t rock the boat’”. At least to some extent, this cautious behaviour can be explained by the traditional financing models of universities, based on number of graduates and research projects. Changing this model would also require breaking up with the ‘good old days’ and existing structures. It is against this background that there does not seem to be a strong interest at the administrative level in education and training organisations to change existing structures and operations and become more innovative in terms of further training development and delivery.

The vast majority of programmes analysed neither supports the ambition and intention to scale up piloted courses (and thereby creating a real impact in terms of talent development) nor moves towards sustainability in the market and full integration into functioning national education and training systems and structures. Activities funded are typically limited to feasibility studies or proof-of-concept studies with limited pilot demonstrations and some distance away from fully-fledged operation.

To this end, each funded programme needs to undergo an evaluation process in order to find out, among others, if there is a need for its future continuation in the current or adjusted form. Furthermore, each funded programme that needs to be continued, needs a clear continuity and (if relevant) scaling strategy. The strategy includes the aspects related to future objectives, its future form and specifically a financing scheme (‘business model’) for the future period, after the end of the initial funding.

In order to promote innovation in teaching/training, a clear top-down message is needed, which could take a form of rewarding educational institutions and teachers/trainers for introducing innovative approaches; these aspects need to be embedded in the assessment schemes for both organisations and individuals.

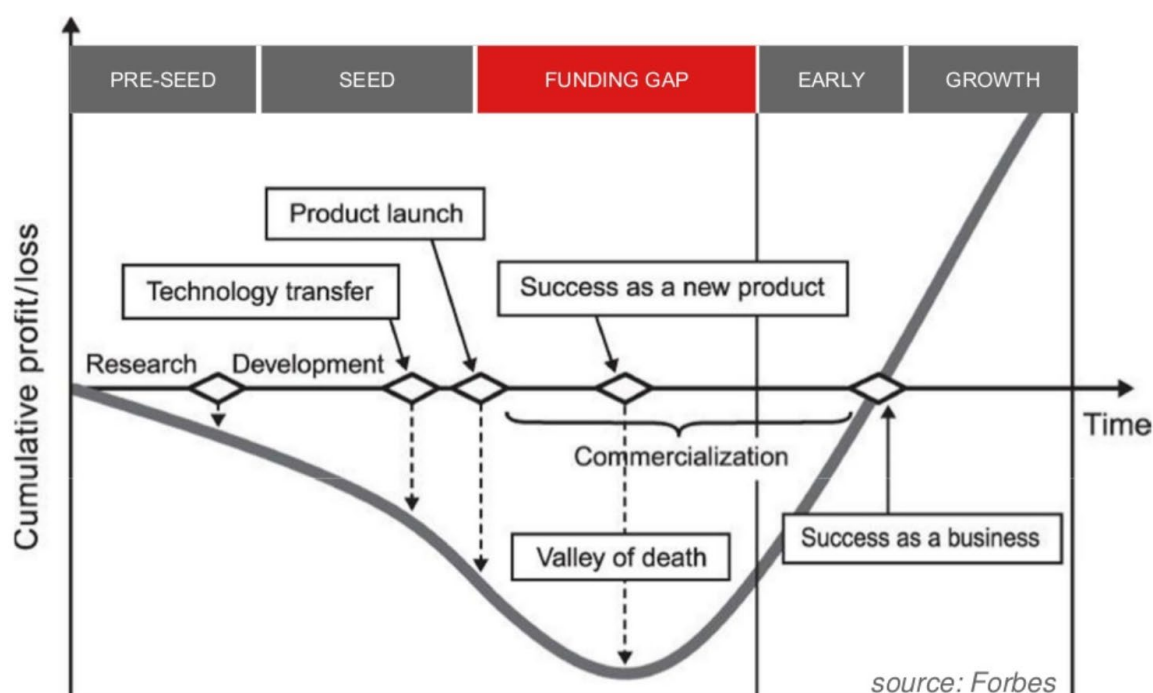
5.3.9 The ‘Valley of Death’ for funding programmes

The term ‘valley of death’ refers to the high probability that a start-up firm will die off before a steady stream of revenues is established. This period of time can be represented as an actual curve on a graph that shows the decline in capital. During this phase, it may be difficult for start-ups to raise additional capital.⁴⁰

³⁹ Typical funding programmes (selection of some major programmes) through which funding of skills development can be achieved include dedicated education and training funding programmes (e.g. Erasmus+ in general and specifically the instruments Knowledge and Strategy Alliances), regional development (ERDF) and human capital development programmes with employment-related project funding (ESF), skills development from a lifelong learning perspective through the European Fund for Strategic Investment (EFSI) often delivered in the context of Active Labour Market Policies (ALMPs), to achieve full labour market integration mainly for investments in infrastructure with only 4% of EFSI funding allocated to skills development, programmes for specific service delivery to the Commission (e.g. COSME), including skills-specific service contract awarding, R&D and innovation funding programmes (e.g. H2020) some of which including skills development as side issue, national funding programmes (e.g. JOBSTARTER + in Germany) testing and piloting additional qualification modules, regional training centre implementation popular for instance in the Netherlands etc. (see typology for more information).

⁴⁰ Death Valley Curve <https://www.investopedia.com/terms/d/death-valley-curve.asp#ixzz5VWYKmqO28>

Figure 15: The 'Valley of Death' in Venture Capital



Source: Samer Karam, CEO of alice: Bridging the Valley of Death - DigitalK 2014 - Sofia, Bulgaria

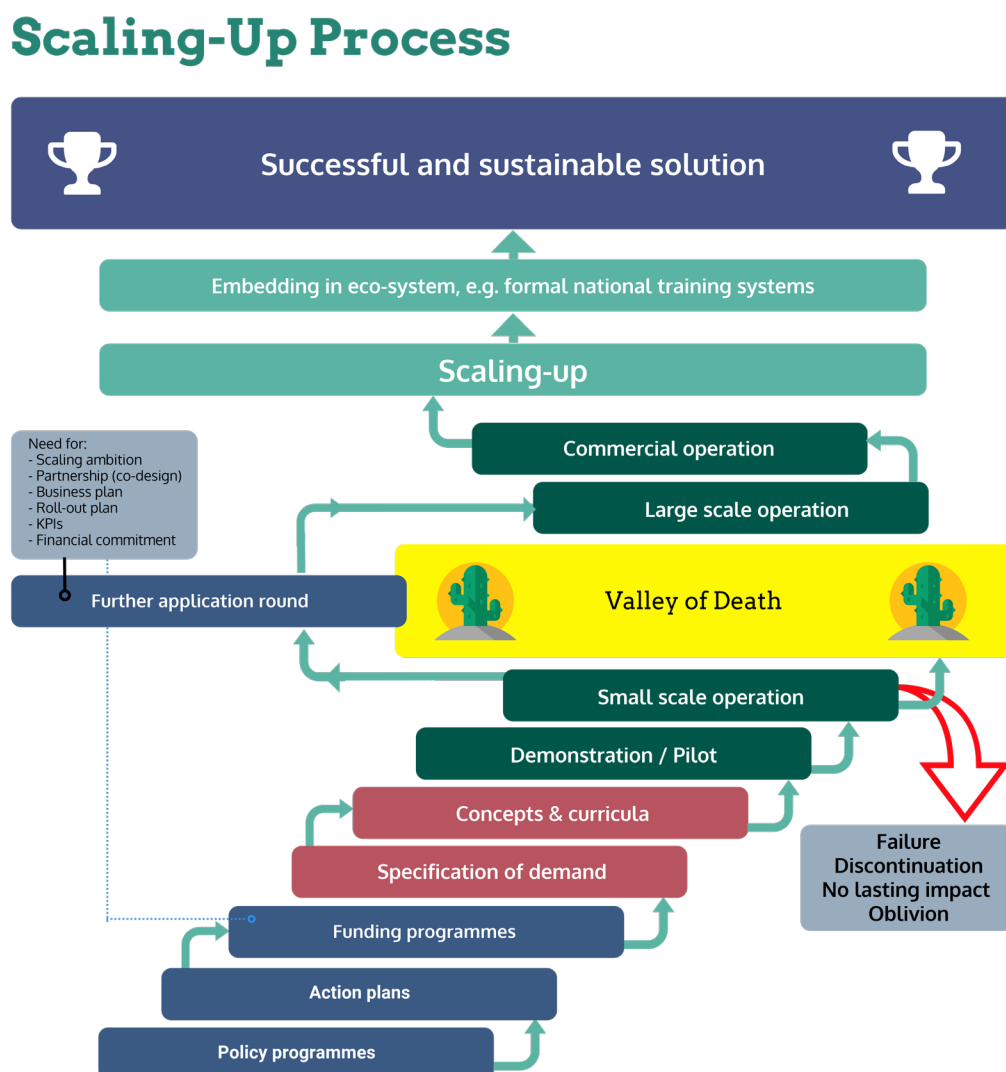
Our analysis revealed that the 'Valley of Death' concept can also be applied in the high-tech skills funding domain as already indicated in the introduction to this chapter. This is depicted in Figure 16 and describes the fact that existing funding in this area is to a large extent aimed at experimentation, test-of-concept, piloting or small-scale demonstration at the most.

Often the reason for the inability to move towards larger-scale and successful operation can be found in the lack of involvement of relevant (industry) stakeholders, who need to be involved right from the beginning in co-designing curricula and programmes and with a strong interest in investment to secure a continuous operation of programmes offering high demand skills training. Existing funding programmes often focus primarily on funding more R&D type activities of researchers and academics such as requirements specification, concept development and proof of concept through piloting, involving a limited number of subjects. It appears to be a field of experimentation also with rather limited interest among stakeholders in scaling up and later integration of successful programmes into a functioning formal education and training system, to make them more widely available and successful in larger-scale operation.

In order to overcome the 'Valley of Death', we propose universities and higher education and training institutions in general to find and adapt to a new role which, includes the continuation of their current role as higher education institutions offering study programmes leading to Bachelor and Master degrees. They should particularly see themselves also as professional further education and training providers. This would be in line with the European Commission objectives articulated in the MFF for "promoting lifelong learning, notably flexible up-skilling and re-skilling opportunities for all taking into account digital skills, better anticipating change and new skills requirements based on labour market needs".⁴¹

⁴¹ European Parliament: Draft opinion of the Committee on Women's Rights and Gender Equality for the Committee on Employment and Social Affairs on the proposal for a regulation of the European Parliament and of the Council on the European Social Fund Plus (ESF+) (COM(2018)0382 – C8-0232/2018 – 2018/0206(COD)) (18 September 2018)

Figure 16: Stairway to successful operation, scaling and sustainability of high-tech skills funding programmes



Source: empirica, 2019

Future funding programmes for high-tech skills development, up-skilling and re-skilling need to have a much stronger focus on the appropriate partnerships, ideally with default industry participation (especially for co-designing new curricula and programmes for professional further education and training). Greater engagement of the private sector is essential to ensure market relevance, faster and efficient technology and know-how transfer from industry to education and training institutions and vice versa. With reference to the new Erasmus programme, Digitaleurope expresses the opinion that “a default partnership with private sector will speed up and make effective an innovation transfer and reality check vs. the labour market’s needs”. Their view is that “a minimum one private sector actor shall be included in every consortium formed to deliver on projects’ objectives”.⁴²

Moreover, and in the future funding programme landscape there needs to be a strong focus on reaching beyond piloting and demonstration since these initiatives typically cease to exist after the funding has finished. To best

⁴² Digitaleurope: Digitaleurope’s Position on EU funding for digital skills in the next EU budget 2021-2027. Brussels, 8 October 2018

support promising initiatives, a new dynamic, multi-stages funding model could help to overcome the valley of death. For this purpose the various funding programmes existing at EU, national and regional levels should be more complementary and contribute to scale-up successful initiatives and rollout a wider uptake and adoption. This requires supporting initiatives with clear business and roll-out plans, concrete and quantifiable KPIs to be reached, and with a substantial commitment (including a financial commitment) for a significant future use of the newly developed training programmes, followed by their roll out. Funding applications should come from partner consortia either led by industry or with a strong involvement and commitment of industry players. Thought may be given to the ‘payment by results’ principle. This would imply that a substantial final part of the funding will only be paid after all KPIs (including roll out and business plan related KPIs) have been met. On the other hand, KPIs need not be too rigid from the outset given the agile approaches that many projects follow. The overall objective should be to prevent good projects from being ended before flourishing.

Some of the funded projects and initiatives today but also in the future (even under revised funding conditions) will not become successful in the time frame given but need a long breath. For these, a further application round may be offered as a ‘second chance’. Selection needs to be based on strict evaluation criteria and the specification of and commitment to concrete KPIs and success criteria to be met in the short- and long-term. Funding should only be given after a thorough and demanding selection process.

A further measuring stick for success of a funding programme is the integration of its newly developed or re-focussed training programmes into an existing eco system, i.e. integration into the training portfolio and governance structure at business / university level.

5.3.10 Funding co-creation and delivery of professional training curricula and programmes

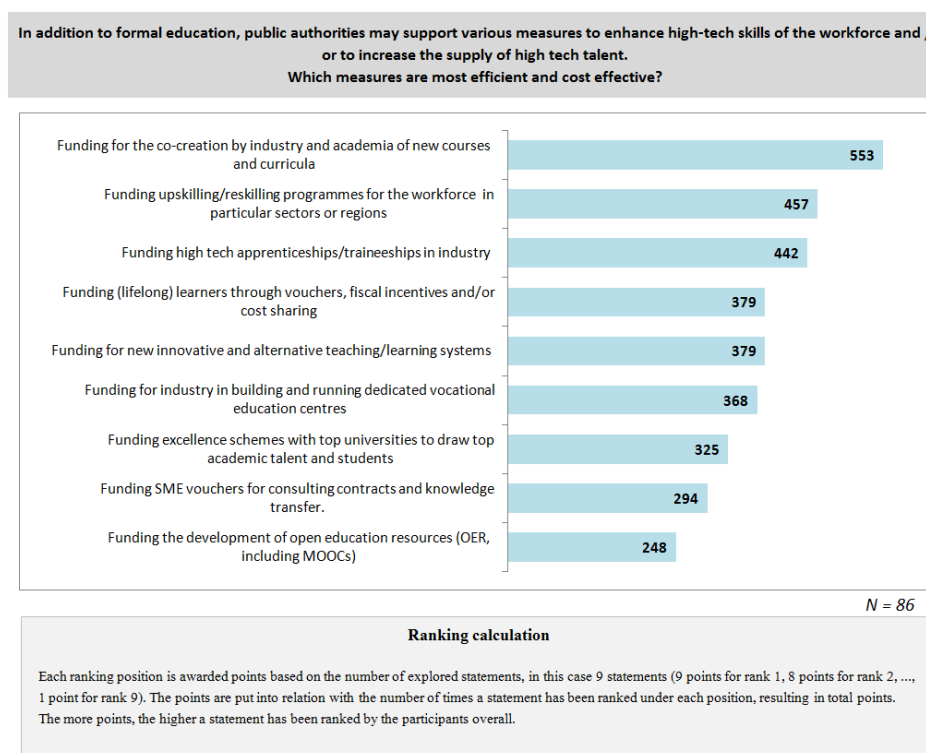
Funding for the co-creation and delivery by industry and universities and VET institutions of new professional and further training courses and curricula is seen as by far the most efficient and cost-effective instrument to enhance high-tech skills of the workforce.

Boosting the willingness of education/training providers to pursue innovative approaches

Co-creation programmes addressed to professionals can be seen as an opportunity for universities and other traditional education and training institutions. It will allow them to also become active and new players in the further education and professional training market. This requires their willingness to take up this opportunity and follow this new (professional) training pathway and leave aside the quite widespread conservatism and traditional perception of only being responsible for traditional higher education following the Humboldtian model of higher education (Humboldtian educational ideal).

Implementation, operation and scalability highly depend on the training providers’ ability and willingness to follow these additional (new) paths in the future, set up the necessary types of cooperation with industry and further relevant actors, find ways of integrating co-created courses into their portfolios and create the revenues, which would allow to run them on a regular and continuous basis, but also maintain and regularly update these. As highlighted above, in order to boost the willingness of education/training providers to pursue innovative approaches, a clear top-down message is needed. The latter could take a form of incentivising and rewarding educational institutions and teachers/trainers for introducing innovative approaches; these aspects need to be embedded in the assessment schemes for both organisations and individuals.

Figure 17: Effectiveness of types of training programmes funding - results from an online expert survey (Summer 2018)



Source: empirica online survey on 'High-tech skills for Europe', Summer 2018

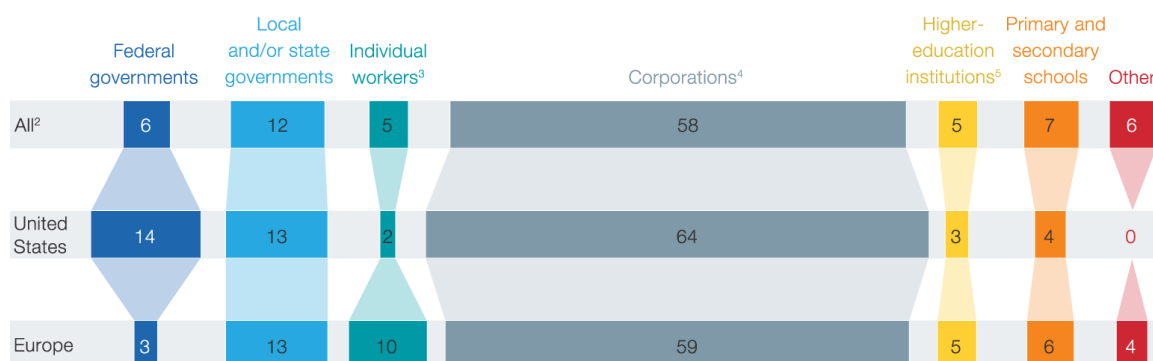
According to a recent McKinsey survey only a large number of private-sector business leaders feel either "somewhat unprepared" or "very unprepared" to address potential skills gaps. The majority felt "somewhat prepared", which according to the authors can "hardly (be seen as) a clarion call of confidence". The same survey also revealed that it should be the role of the corporations themselves to address any potential skills gaps over the next five years.⁴³

⁴³ Pablo Illanes, Susan Lund, Mona Mourshed, Scott Rutherford, and Magnus Tyreman: Retraining and reskilling workers in the age of automation. Article - McKinsey Global Institute - January 2018

Figure 18: Supposed leadership in skills gap

Which of the following groups or institutions should take the lead in addressing any potential skills gaps related to automation and/or digitization over the next five years?

Private-sector organizations with >\$100 million annual revenue¹ who view the skills gap as a top-10 priority
% of respondents



¹Total n=197 respondents.

²All includes rest of world.

³As in individuals building their own individual skill sets.

⁴Corporations addressing skills gaps and needs within their own workforces.

⁵Such as universities or community colleges.

Note: All analysis filters out "Don't know" responses from data set. Figures may not sum to 100 percent, because of rounding.

McKinsey&Company | Source: McKinsey panel survey, November 2017 (n=1,549); McKinsey analysis

Following the co-creation path described in this section which at the same time has to include a change of mindset at universities and VET providers and a development towards these institutions acting in a dual education and training role (first degree educator plus professional further training provider to corporations) could become a positive and helpful means for helping to close the skills gap and shortages.

Creating a synergy between traditional and disruptive education and training activities

Both, traditional degree-oriented education and training activities (leading to Bachelor and Master degrees but also PhD programmes) on the one hand and professional training programmes based on courses co-created with industry on the other, should become standard offers in university portfolios. Both should be offered and run as standard offers and in parallel. Best practices include co-creation funding programmes such as Expertkompetens in Sweden which is offering programmes and courses of a longer duration (>1 year) resulting in a professional MSc degree.

Expertkompetens (Graduate Professional Development Program) (Sweden)

The purpose of the Expertkompetens programme is to raise the expertise for knowledge-intensive business development and innovation among key individuals in companies. The objective is to develop and deliver courses on master level or higher where the expertise in strong research environments matches the strategic needs for expertise in companies. The prerequisites for applying for funding are that the applying higher education institutions (HEI) have to have a strong research and educational environment, are going to involve and engage the target group companies right from the start, and can prove that the institution is financially sustainable in the long-term.

The funding programme enables the development of research-related courses and education programmes for advanced-level professionals. This requires close collaboration between academic environment and companies in programme development work.

In the recent round of the funding programme 6 projects were selected and now receive funding.

Expertkompetens supports the development of education and training for advanced-level professionals. Courses and programs are developed by matching the skills and development needs of the business community with the knowledge and skills found in strong academic environments. As the course participants are

professionals, high demands are placed on flexible forms of education. This means that, through the support of the program, universities can develop leading positions in the international development and generation shift of online education. For companies, it means that employees can acquire relevant knowledge at the university, including research results generated there or globally. The developed courses will be incorporated into the institution's regular education programme and quality assured according to regular routines. The purpose of the programme is to provide professionals and companies with expertise for knowledge-intensive business development and innovation.

Co-production in course and programme development involves 8 universities and about 20 research institutes and trade organisations, >150 companies including SME as well as large companies such as

GKN Aerospace Sweden, Combitech Engineering, SCANIA, Ericsson, Telenor, Siemens Industrial Turbomachinery, ABB, SAAB, SKF, Volvo Powertrain, Skanska, Volvo Construction Equipment, Atlas Copco RockDrills, Alstrom Power Sweden).

The HEI receives funds for their costs for developing industry relevant flexible courses. This comprises costs for analysing the needs of development and expertise in the industry target group, developing digital pedagogic methods and training of academic staff in flexible learning methods. KK Stiftelsen also provides 50% of the costs of running the courses twice. Thereafter the courses are financed through the regular state system for financing higher education or by related companies in commissioned programs. The participating companies must cover their own contributions in the development work.

Until 2016 the total number of students following courses are >1000 and they represent about 300 different companies (50% of the companies have also participated in the course development). Courses are also becoming part of companies' learning system - GKN Aerospace Sweden has integrated programme courses into their strategic assessment of competence as well as into their competence developing process.

<http://www.kks.se/vart-erbjudande/vara-program/expertkompetens/>;

<http://www.kks.se/vart-erbjudande/vara-program/expertkompetens/expertkompetens-vidareutbildning-for-yrkesverksamma-hogutbildade/>

Models to be taken into consideration could also be the Professional Science Master's⁴⁴ (in the US) offers, and the German model of "dual studies" (Duales Studium) or the British postgraduate apprenticeships (see below), which are geared towards learners who study and are in paid work part-time and strive for a vocational and academic degree at the end of the programme. The employer works closely with the universities and is responsible for a good share of the learning outcomes.

Increasing the involvement of industry in the development of educational / training offer

Fully-fledged operation and sustainability can more easily be achieved if universities and industry turn towards professional further education more intensely than at present. Industry also needs to not only play an active part in the co-creation process but also become (more) prepared to invest in making use of these co-created offers and pay the related tuition fees required by universities for their (re-)financing. This should be eased by the fact that they themselves or at least other companies and industry players from their sector have co-designed and co-created courses and programmes with universities of their choice to ensure they best meet their needs.

The same approach could be transferred to and used in national VET systems, where further education and training is gaining in relevance and importance. However, existing VET systems do not (yet) seem to come up with the necessary openness and flexibility required for this. Best practices include funding programmes such as the JOBSTARTER+ programme in Germany. A specific programme funded offers support for the co-creation and development of additional qualification modules on 'digitisation' in the production industry. Funding also includes first piloting activities of these modules in real life VET environments in schools and companies. These trainings are rather demanding for the VET students also because they are designed as add-on modules, thereby increasing the training and work load quite significantly. In their present format and as long as the existing

⁴⁴ <https://www.professionalsciencemasters.org/>

curricula and programmes to which these are added are not cleared up and adjusted, these additional training modules are only suitable for year's best students for whom they are seen as real career-enhancing.

JOBSTARTER plus - Additional Qualification 'Digital Manufacturing Processes (Germany)

With the JOBSTARTER plus project "Additional Qualification 'Digital Manufacturing Processes'", the Young Talent Foundation for Mechanical Engineering responds to the changes in the mechanical and plant engineering industry with regard to Industry 4.0 and the associated challenges and opportunities in the design of a future-oriented education. Apprentices are prepared for a fully digitized workplace during their training.

The target group for the additional qualification 'Digital Manufacturing Processes' are ambitious trainees in the industrial and technical professions of mechanical and plant engineering. To start the additional qualification, the trainees should be in the 2nd or 3rd year of training. The additional qualification not only benefits the participants themselves, but also aims to make dual training in mechanical engineering more attractive for young people in the long term and at the same time to secure the demand for skilled workers in small and medium-sized companies. In particular, these companies are often for economic reasons unable to adequately respond to industrial developments with an adaptation qualification for their employees, employees and trainees.

The qualification comprises 200 teaching units and will be implemented within 15 months of training. Within these 15 months, 7 modules will be completed by the apprentices.

Upon successful completion and passing of the exam, the participants will receive an IHK (chamber of commerce) certificate and a certificate from the Young Talent Foundation for Mechanical Engineering "Additional qualification - Digital production processes" in addition to their professional qualification. The high quality of the additional qualification and the special commitment of the participants are thus adequately and verifiably documented and recommended for corresponding positions in the company.

With 34 participants in the first round (Dec 2016 - Feb 2018), the original target of 25 trainees was clearly exceeded. This proves the high demand for well-trained and future-oriented skilled workers. The second run was started in March 2018 with 43 participants.

The Federal Ministry of Education and Research (BMBF) is funding the "JOBSTARTER plus - Training for the Future" programme and its projects from federal funds and funds from the European Social Fund (ESF). The promotion of the JOBSTARTER plus program from the ESF is based on Regulation (EU) No 1304/2013 of the European Parliament and of the Council of 17 December 2013 (ESF Regulation) and Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013 (General Structural Funds Regulation).

<https://www.jobstarter.de/de/zusatzqualifikationen-49.php>

Digital apprenticeships in the UK are a relevant and flexible approach to addressing the need for talent in the ever growing tech industries. There are different types available: information technology, software developer, web design, data analyst, cyber security. Digital apprenticeships are offered at different levels (with equivalent educational levels): intermediate (GCSE), advanced (A level), higher (foundation degree and above), degree level (Bachelor's or master's degree). Digital apprenticeships and other reforms of qualifications from technical and professional education in the UK have started but not yet revealed the intended success. The number of apprenticeships in "Digital and technology solutions professionals" (level 6 and 7) has increased by 240%, from 411 to 1399 enrolments from the academic year 2015/16 to 2017/18. At the same time, the 2017 founded Institute for Apprenticeships is continuously reviewing and developing digital apprenticeship standards. Robust evidence as to the success of the introduction of digital apprenticeships and the overhaul of the college-based technical and professional education (TPE) system is not yet available because finishers from these programmes only gradually become available on the job market. It remains to be seen to what extent the picture will change over the longer term.

5.3.11 Portfolio of short and focused professional training courses as “stackable” Master degrees

Experts expressed the opinion that it would be worthwhile to unbundle existing and create new offers so as to cater for the increasing demand for short and focused education and training. In this context online delivery is likely to play a major role. Besides fully-fledged professional Master degrees the creation of a portfolio of short and focused high-tech skills education and training programmes and courses for professional and executive education as “stackable Master degrees” was brought into the discussion.

Designing education / training ecosystems around learners rather than education / training providers

Professional education and training should make full use of the unbundling of education, thus expecting the learner and not the university to be responsible for locating piecemeal learning bits within the greater academic context. This implies the individuals taking (more) responsibility for their further training and career advancement. At the same time and in order to offer the necessary training supply this requires universities and training providers to create shorter learning modules that foster continued learning. Education and training programmes and courses need to be re-designed to offer more short-term and highly specific courses aligned with specific employment opportunities. Industry and the private sector will have to partner with universities and other institutions to create the relevant programmes and smaller learning packages (e.g. learning ‘nuggets’ or ‘tapas’ or modules or ‘nano degrees’ as the WEF calls them).⁴⁵ This does not imply universities to discard the holistic approach to academic education but to enter into an additional new role of further professional training provider. Academic education is thus left to the longer-duration, “initial”, academic education aimed at a Bachelor and Master degree.

Moving from qualifications to skills-based notion

The focus on competences, and prioritisation of competence over certification, implies that in professional education, a skill-based notion of profession and vocation is preferred over a normative/legalistic, qualification-based definition.

Developing “stackable” degrees

Highest individual degrees of freedom with regards to combinations of modules notwithstanding, the development of “stackable masters” where students collect a number of smaller credentials and can progress toward a degree should be considered. Such offers can generate more demand as they incentivise continuous efforts in learning.

5.3.12 Disruptive funding and training programmes to become mainstream?

Disruptive programmes and institutions identified as best practices such as École 42 in France, Talent Club in Spain or WASP - Wallenberg Autonomous Systems and Software Program in Sweden are seen by many experts as a useful addition of the existing education and training systems. Others see programmes such as École 42 as ‘competing’ path to traditional education and training offering no certification and having serious quality issues in terms of IT professionalism since their approach and method is based on no curricula, no instructors, and simply run by peer-to-peer learning. Originally and set up through donor funding these were designed as measures addressed to women (Talent Club) or vulnerable groups of people with low or no education and school background as the target groups. In the meantime Talent Club is looking for alternative funding models making it independent of donors and not having been successful on that basically ceased to exist. Resulting from a massive oversubscription in terms of number of applicants, École 42 is moving away from serving the original

⁴⁵ This recommendation is in line with the Action Framework proposed by the WEF: World Economic Forum: Accelerating Workforce Reskilling for the Fourth Industrial Revolution. An Agenda for Leaders to Shape the Future of Education, Gender and Work. White Paper. July 2017

target group since other – more qualified and better educated individuals are being selected. However, donor funded special concept education schemes like École 42 still seem to contribute to closing a gap in attracting individuals who would normally not attend traditional training courses.

These types of schemes can be seen as ‘eye openers’ demonstrating completely new and radical approaches for IT and high-tech skills training, which seem to have a potential for success in terms of offering new and additional pathways into the labour market. However, final judgements need to await the availability of robust evaluation data.

The question remains whether such alternative, rather radical and disruptive pathways to IT jobs can or should be embedded in the traditional education and training system and as a consequence also into the formal financing and funding systems. This would require developing ways of how this type of training could become an additional education and training pathway (mainly) addressed to vulnerable groups of individuals who failed in the ‘normal’ education system. Ideally this would also require connecting these pathways to the (traditional) VET and Higher Education system which could in the long-run allow for obtaining formal education and training degrees and as such also become part of the existing formal financing and funding systems.

5.3.13 Successful ‘voucher systems’ and ‘excellence schemes’

Both types of funding programmes for up-skilling seem to fulfil a demand. They have a clear and straightforward approach and a clear magnitude. Evaluation reports come to positive results and conclusions as to their impact, effectiveness and efficiency.

Moreover, schemes of these types could be identified in many different countries. This has already resulted in a substantial amount of experiences from their operation and will continue to allow for learning from each other and also find ways and mechanisms to keep bureaucracy in running and administering such funding programmes at low levels.

This should also help find solutions to specific problems and challenges in excellence programmes specifically at the interface of industry and universities who sometimes seem to have different views as to the duration and intensity of the practical learning part.

Finally, it has to be acknowledged that free-riding / windfall effects will continue to occur in such programmes also in the future but through continuous learning and exchanging experiences it should be possible to keep these at a minimum.

6 Recommendations

The following recommendations are proposed for ensuring Europe has sufficient high-tech talent in the near future. The recommendations provide a roadmap for action at all levels in Europe and are to be taken forward by stakeholders in industry and academia, training providers at all levels, and by government and other stakeholders at Member State level and by the European Union institutions.

The recommendations have resulted from expert consultations in workshops, surveys and interviews. Several hundred experts were involved in this process and many made specific proposals.

6.1 Overview

In a nutshell, the work of the present service contract identified the **need for massive and highly effective and efficient investments** in skills development at European, national and regional level to re- and up-skill the European workforce. Currently a **dysfunction of the market** can be observed with **fragmented and dispersed training programme supply** operating at **small scale, lacking critical mass, scaling ambition and roll-out plan**. At the same time, **individuals are financially overburdened** and **employers unwilling to finance attendance of their employees at re- and up-skilling programmes**. These challenges need to be addressed urgently to come up with attractive funding programmes and incentives. This **requires massive investments and a shift of orientation and focus in funding**.

As an overall conclusion and recommendation, actions have to include several issues and address the following needs:

- Funding programmes must allow for **small-scale funding of a larger number of initiatives** to ensure piloting and demonstration of potential solutions to bridging the skills gap and to promotion and advocacy activities.
- Proven successful initiatives with scaling ambitions need **substantial** and differentiated funding intervention at the various stages of the life cycle to overcome the start-up ‘valley of death’ and grow to create impact and scale.
- As a prerequisite to receive the growth phase funding, initiatives need to come up with **robust and measureable KPIs** defined upfront and a scaling ambition together with specific business and roll out plans to ensure widest possible roll-out and talent creation at different qualification and skills levels.
- **Initiatives need to be demand driven and led**. Training providers need to change from the currently dominant supply side approach and become more demand-oriented and practice co-creation and delivery of training programmes.
- It needs to be ensured that supply of training and re- and up-skilling offers will create **highly innovative training solutions** and cover the entire spectrum of skills and skills levels.
- **Supply and demand have to meet and match each other**. The awareness of and motivation for the need for continuous education and training and life-long-learning needs to become more prevalent among the European workforce and citizens. The same holds true for industry and businesses whose willingness to pay needs to increase.

This requires the following actions to be taken:

- Establishment of **multi-stage funding** leveraging a ‘start small, fail fast’ mentality for rapid testing and validation of a large number of initiatives before allocating substantial funds, ensuring critical mass to those fewer initiatives with proven results and scaling ambition.

- **Individual learning accounts** offer the opportunity to empower working age adults to equip themselves with the skills needed to support their employability. They provide a new vehicle for funding continuous learning.
- Continuation of **'voucher systems'** addressed to consulting and training SMEs thereby allowing for a low threshold skills transfer into SMEs (national level).
- Continuation of funding of **'excellence schemes'** addressed to the creation of top-management talent (national level).
- Promotion and scaling of funding programmes and incentives which are addressed to the still widely **underserved and untapped markets for high-tech talent creation** including women, diverse target groups and individuals struggling with today's education and training systems.
- Evaluation of whether and how to best turn **'disruptive' funding and training programmes into 'mainstream'** financing and training pathways for specific target groups regularly dropping out of the formal education and training system today.
- Setting up a **one-stop-shop** to funding combining training and re-/up-skilling resources with simplified funding rules allowing relevant players (incl. industry) to easily partake.

6.2 Recommendation modules and proposals for action

To mobilise efficiently funding programmes and incentives to scale-up good practices a set of policy recommendations have been developed. Five modules will serve to guide policy makers and stakeholder groups at all level to design and implement their own strategies, programmes and initiatives in line at EU level to the new multiannual financial framework (2021-2027).⁴⁶ These – together with the recommendations for each topic area - will be further described in the following sections.

⁴⁶ Several proposals for EU funds and programmes over that period could support actions on skills: Asylum and Migration Fund; Digital Europe; European Agricultural Fund for Rural Development; European Globalisation Adjustment Fund; European Maritime and Fisheries Fund; European Regional Development Fund; European Social Fund +; Erasmus; Horizon Europe; InvestEU; Just Transition Fund; Reform Support Programme; and Single Market Programme.

Figure 19: Recommendations modules and recommendations



6.2.1 Vision and long-term strategy development (VISION)



- Best practice-based
- Scaling of proven successes
- Map onto national regulations
- World-class best practices
- Identify & include missing links and target groups

Develop a compelling vision for scaling-up re- and upskilling funding programmes and initiatives aligned with a longer-term strategy and commitment with greater investments at EU and national level to create a greater impact.

Europe is missing a clear and compelling vision and longer-term strategy in the area of high-tech skills development and of the re- and up-skilling of the workforce. The same holds true for national vision and strategy development at Member State level.

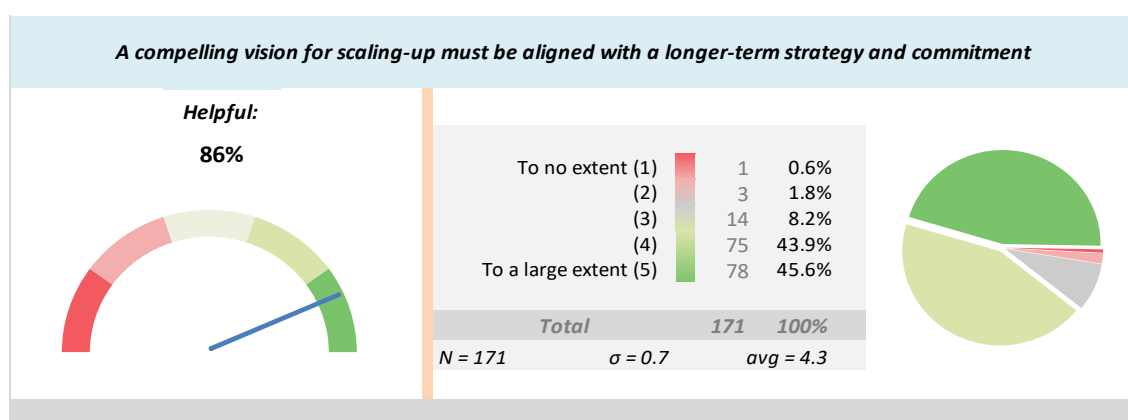
It is recommended that the vision to be developed should be best practice based, have a special focus on scaling based on proven successes, map onto national regulations, aim at world-class good practices, identify, and include missing links neglected to target groups, e.g. diverse groups of people, women and those struggling with the formal education system. This would help encourage all currently underrepresented populations to enter high-tech skills training and the labour market afterwards in order to increase workforce diversity,

talent pool and develop new creative and innovative resources for the industry. This also should include counselling and mentoring for smoothening the entry of underrepresented groups.

86% of experts surveyed agree to the need for a compelling vision for scaling-up re- and up-skilling funding programmes and initiatives aligned with a longer-term strategy and commitment including financial commitment of all stakeholders and policy levels concerned.

72% of the experts in the same survey are in favour of funding following an inclusive approach to reduce inequalities.

Figure 20: Expert support evidence for vision and long-term strategy development

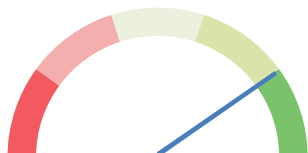


To what extent could the following recommendations enhance scalability and impact of high-tech skills initiatives?

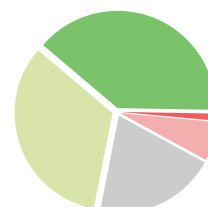
Be prepared for greater and substantial investments at EU and national level to create an impact

Helpful:

80%



To no extent (1)	2	1.2%
(2)	11	6.5%
(3)	34	20.1%
(4)	56	33.1%
To a large extent (5)	66	39.1%
Total	169	100%
N = 169	$\sigma = 1$	avg = 4

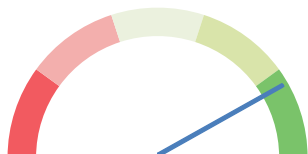


How would the factors below foster scalability and impact?

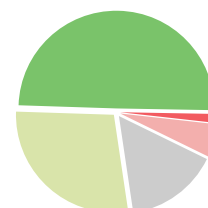
Strong leadership and longer-term commitment, based on a shared vision and strategy at EU and Member States levels

Helpful:

84%



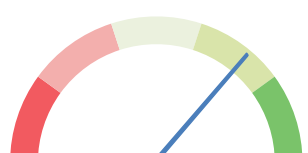
Would not help at all (1)	3	1.5%
(2)	11	5.5%
(3)	31	15.4%
(4)	56	27.9%
Would help a lot (5)	100	49.8%
Total	201	100%
N = 201	$\sigma = 1$	avg = 4.2



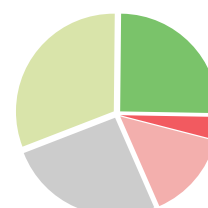
Funding should follow an inclusive approach to offer the same opportunities in all regions and reduce inequalities

Agree:

72%



Strongly disagree (1)	7	3.7%
(2)	27	14.4%
(3)	48	25.7%
(4)	58	31.0%
Strongly agree (5)	47	25.1%
Total	187	100%
N = 187	$\sigma = 1.1$	avg = 3.6



Source: empirica (2019): Online survey of high tech skills experts.

6.2.2 Development and operation of scalable multi-phase funding programmes and initiatives (HOW)



- **Multi-stage intervention funding model**
- **Differentiated life-cycle funding**
- **Upfront use of measurable KPIs**
- **Clear roll-out and business plan**
- **University role in re-/upskilling under new business model**

Develop and operate scalable multi-phase funding programmes and initiatives set up and based on the lessons learned and positive experiences from best practice cases allowing for differentiated life cycle funding of initiatives with upfront-defined measurable KPIs, scaling ambition and clear rollout and business plans. National Higher Education and VET providers to more strongly become re-/up-skilling players operating under new business and funding models where existing funding is no longer appropriate.

Funding programmes in professional training addressed to the operation and growth phase of training programmes and courses – especially those addressed to further education and training - should be established. This requires reconsidering the scope of funding and extending it beyond piloting activities as well as learning from good practice examples.

Applications for funding will have to have a clear business and roll-out plan as well as financial commitments.

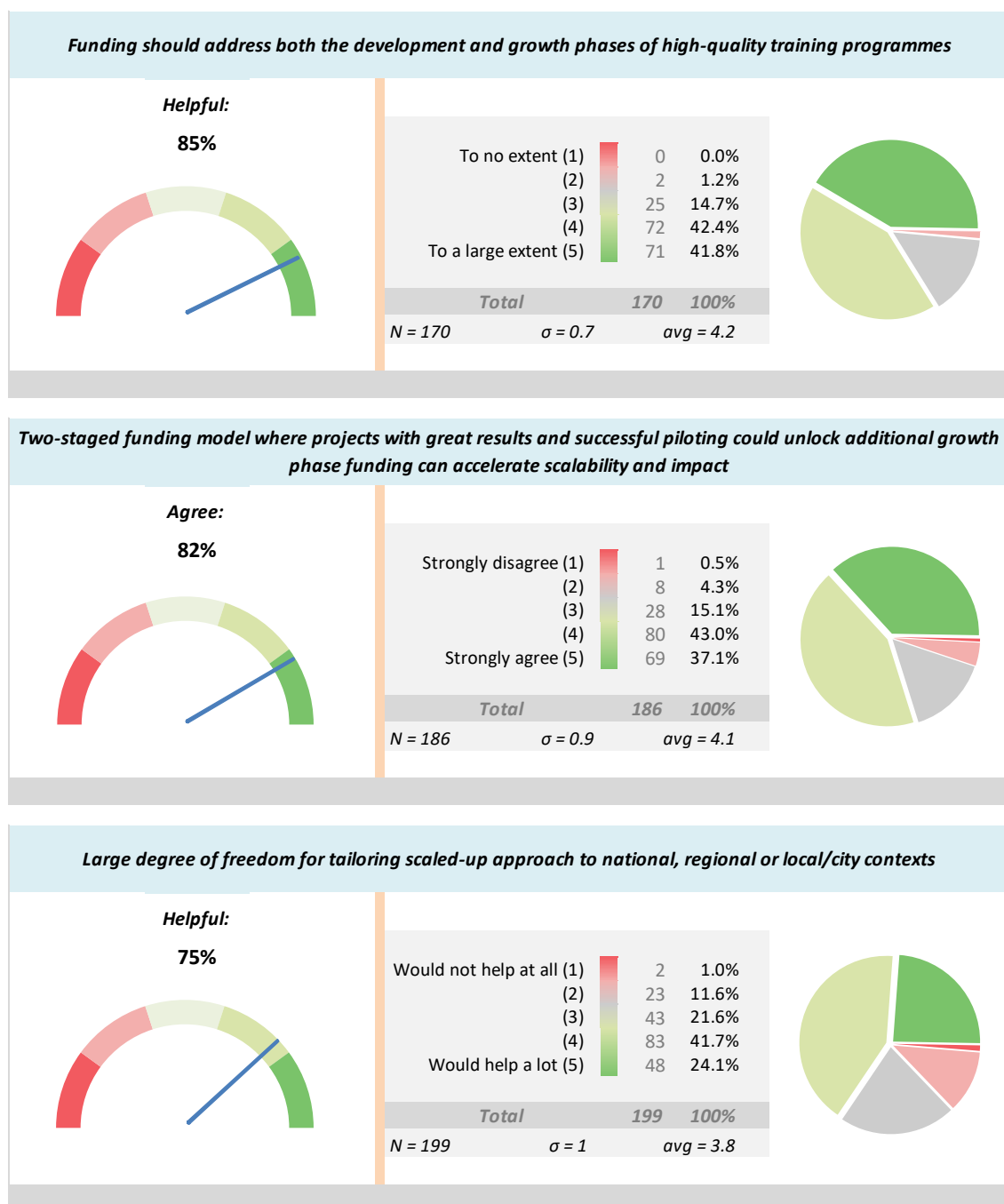
82%, i.e. the vast majority of European experts are in favour of a multiple-stage funding model to unlock additional funding for growth and accelerate scalability and impact.

85% state that funding should address both, the development and growth stages of high-quality training programmes offering a differentiated life cycle funding of initiatives. A special focus should be on programmes with a special focus on initiatives with measurable KPIs and clear roll-out and business plans upfront. Universities and VET institutions need to be encouraged to a role in re-/up-skilling operated under new business models.

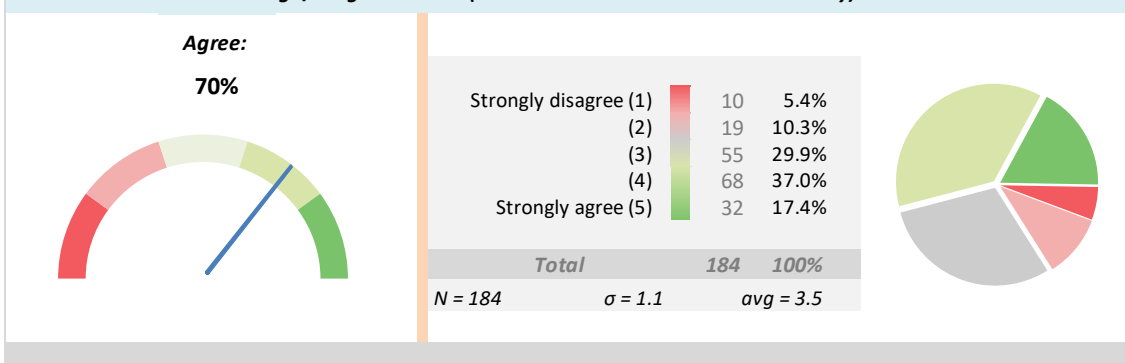
The vast majority of experts - 70% - involved in the present activity argue for an annual assessment and ranking of high-tech skills initiatives according to an agreed set of KPIs with awards and go/no-go decisions. This would help to reallocate resources if and where necessary.

73% argue for the reallocation of funds from failing initiatives to those which are performing well. Finally, 79% indicate that current calls for proposals do not offer sufficient time for setting-up strong partnerships. Evaluation and contracting should be processed faster.

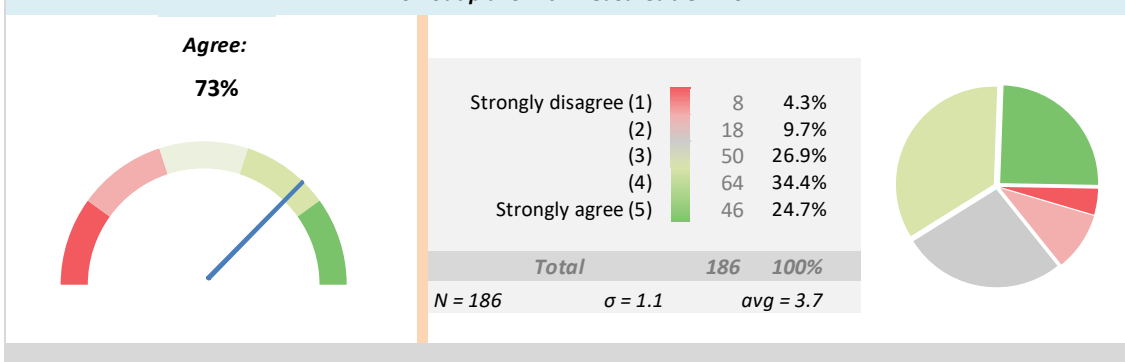
Figure 21: Expert support evidence for development and operation of scalable multi-phase funding programmes and initiatives



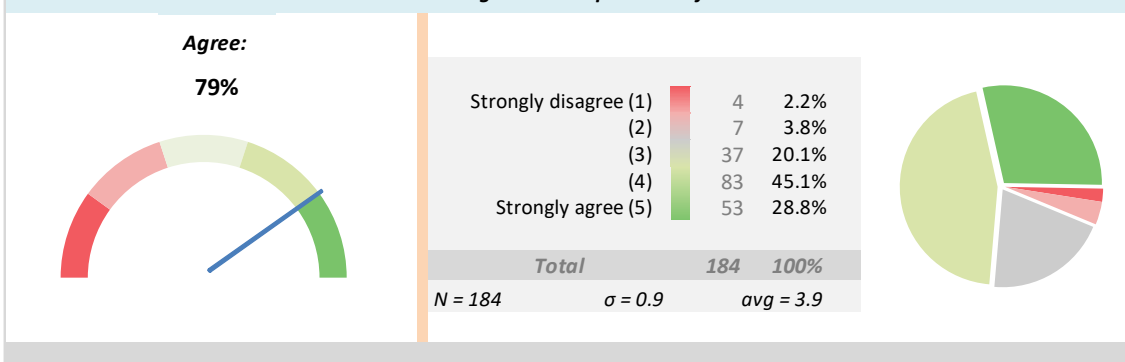
High-tech skills projects should be assessed and ranked annually according to an agreed set of KPIs with awards and go/no-go decisions (to reallocate resources when necessary)



Funds should be reallocated from failing projects to those with successful results, piloting and viable business and roll-out plans with measureable KPIs



Sufficient time for partner consortium building to ensure that strong partnerships can be built. Evaluation and contracting should be processed faster



Source: empirica (2019): Online survey of high tech skills experts.

6.2.3 Massive investments for new and innovative ways of funding (FUNDING)



- **EU investment exploited and leveraged at national and regional level**
- **Funding with new and greater focus on roll-out and growth phase funding**
- **One-stop shop funding at all levels**
- **Strengthen 'voucher' & 'excellence' schemes**
- **Develop and pilot innovative financial instruments**

The EU and Member States to prepare for substantial and massive investments in skills development as well as re- and up-skilling funding programmes and initiatives following a dynamic multiple stage funding model with a focus on growth, including the promotion of successful 'voucher' and 'excellence' schemes, the development of a world class curriculum and explore the development of Individual Learning Accounts. These programmes and incentives also need to address underserved and untapped markets (women, diverse groups, SMEs) and develop proposals of how 'disruptive' schemes could become mainstream pathways for specific target groups as part of an overall formal education and training eco system.

Europe should be prepared for greater and substantial investments at EU and national level to create an impact. These will require large EU investment leveraged at national level, a dynamic funding with specific focus on growth phase funding. With its multi-stage funding and dynamic funding approach and a specific focus on growth phase funding it may consider 'payment on delivery' as funding principle at least for the growth phase funding part.

There is almost unanimous agreement among European experts for the need of more substantial and large-scale

investments in skills development as well as re- and up-skilling in Europe. Europe should be prepared for greater and substantial investments at EU and national level to create an impact. These will require large EU investment leveraged at national level, a dynamic funding with specific focus on growth phase funding as expressed by 80% of European experts.

81% of experts see co-creation and delivery of re-/up-skilling programmes between industry and training providers as a must for effective funding programmes to be operated as a one-stop-shop. High-tech skills development needs to be integrated in a coherent and complementary way in the future funding programmes (2021-2027) as argued by 84% of experts. Such a one-stop-shop approach is seen as the most favourable option to counter negative effects and developments stemming from the currently fragmented and dispersed funding programmes market.

Moreover, a very high 86% of experts express a strong need for reviewing and simplifying funding rules to be more inviting to partake for industry partners. Successful 'voucher' (e.g. go-digital for SMEs in Germany) and 'excellence' schemes (e.g. Industrial PhDs in Denmark or Software Campus in Germany) should be continued.

Individual Learning Accounts (ILA) offer opportunities to empower adults to equip themselves with the skills needed to support their long-term employability. First generation ILAs were started in countries like Sweden, the UK and Austria and date back to the early years of this century. They provide a vehicle for funding continuous learning.

The European Commission through its Structural and Investment Funds (e.g. ESF) could support the setting up of ILA schemes at national level specifically for training for priority skills or strategic sectors (e.g. digital and green skills)

This kind of solution has been implemented in 2016 in Singapore, where the [SkillsFuture Credit](#) aims to encourage individuals to take ownership of their skills development and lifelong learning. All Singaporeans aged 25 and above receive an opening credit of S\$500. The government would provide periodic top-ups, so they can accumulate their credit.

Given the fact that just 55% see (student) loan systems as fit for purpose there is an argument for activities to be started for the development of income sharing agreement loans. This could be seen as an incentive for the creation of a stronger demand for innovative training solutions.

72% argue that funding should follow an inclusive approach. Underserved and untapped markets (women, diverse groups), those struggling with the formal education system and 'neglected' markets (SME owner/managers) should be addressed and an evaluation carried out to identify ways for 'disruptive' schemes following new pedagogical models to become mainstream (e.g. École 42 in France).

The European Commission and EU Member States need to be prepared for large-scale investments to kick-start this development, and should think of simplifying the financial rules for grants and operations. The Commission proposed substantial budgets for the future multi-annual financial framework (2021-2027) and a significant increase in research, innovation and digital fields. 14.7% of the budget are foreseen under the heading 'Single Market, Innovation and Digital', which will include the digital Europe programme and InvestEU programme to support – amongst others – advanced digital skills development.

The European Commission proposed a new funding programme entitled Digital Europe, which is part of the "Single Market, Innovation and Digital" chapter of the EU's long-term budget proposal. It builds on the Digital Single Market strategy launched by the Commission in May 2015 and its main objective is to boost Europe's digital transformation to the benefit of citizens and businesses. The Commission's proposal foresees €9.1 billion Euro over the period 2021-2027 to be spent on five areas including 'Digital skills' for which €700 million are foreseen to support advanced digital skills through long- and short-term training courses and on-the-job traineeships. A further €1.3 billion will support the digital transformation of public services and their EU-wide interoperability. It will foresee digital innovation hubs providing access to technological expertise of digital transformation projects. Digital Innovation Hubs are today one of the key elements of the Digitising European Industry strategy.

The Commission expects that the new Digital Europe programme will complement and create synergies with other related MFF proposals, in particular the Connecting Europe Facility (CEF) and the Horizon Europe programmes.⁴⁷

In the discussion among the experts at workshops these expressed the view to invest a smaller funding budget for initiatives in the first phase, more substantial funding for phase two ('explore and demonstrate') and most of the available budget for the rather small number of initiatives to make them 'grow and prosper' in phase three and to become 'stars'. Funding for those described in the category 'mainstream' should mainly come from indirect funding schemes taking the format of user incentives which could be further developed to a European 'Income Sharing Agreement' further described below to allow for an identical financing scheme throughout Europe.

The future financial budgets should be allocated to phases in a dynamic multiple-stage funding model with a strong focus on growth phase funding. It should move away from pure 'watering can' funding of initiatives which at maximum reach a piloting or demonstration phase with very little impact on larger scale re-/up-skilling of the European workforce.

⁴⁷ <http://www.europarl.europa.eu/legislative-train/theme-new-boost-for-jobs-growth-and-investment/file-mff-digital-europe-programme>

Different types of incentives – whether financial or tax-related – have shown successes. However, they are not available in all EU Member States and not easily accessible, which makes them invisible to a significant number of European employees.

Given the fact that just 55% of surveyed experts see the multiple (student) loan systems in European countries as fit for purpose there is a strong argument for activities to be started for a European loan system comparable to an 'Income Sharing Agreement' (ISA) at European level. This could be used as a better incentive for the creation of strong demand and innovative training solutions.

Incentivising the demand side for re- and up-skilling should reach beyond tax incentives and direct subsidies for instance by offering special conditions for loans for financing training on a larger scale. Installing such a loan system at European level would have the chance to result in a large-scale system. This would make it attractive and increase the likelihood for financial service providers to become active.

A European ISA should be established as an individual loan for adult learners to foster and increase their participation in high-tech skills development, re- or up-skilling programmes. Typically these would be courses of a short duration. The ISA would be operated as a homogenous financing scheme throughout Europe to empower individuals in their career change or progression on the one hand and – as a result of a massively increasing demand - facilitate scaling of innovative and successful training solutions by supporting a European market demand.

Today no satisfactory European level solutions exist to massively finance large-scale adult high-tech training as well as re-/up-skilling. Country specific offers exist which provide individual financing based on an individual's experience (e.g. learning vouchers in Germany, or "compte professionnel de la formation" in France). Further public or private financing options are very specific local offers with no or little potential for transferability and scalability. At the same time, the conditions for such bank loans are not very attractive for individuals.

There is an urgent need for action since many adults are in need of retraining, and at the same time, many companies experience great difficulties to recruit tech talent. However, potential learners often do not have the financial capacity to upfront fund a re-/up-skilling course at costs typically between 5,000 -15,000€, nor can they borrow from a bank easily. At the same time, companies who need to recruit are not ready to finance training of the employees since they may run the risk of the re-/up-skilled employee leaving the company and pursuing a career elsewhere after successful completion of the training.

Dedicated financial instruments of "[Income Sharing Agreement](#)" type exist in the US with several financial service providers to take the risk (e.g. [Vemo](#), [Leif](#) or [Goal Structured Solutions](#)). Schools that offer such a programmes include [General Assembly](#), [Holberton school](#), [MakeSchool](#) and many others.

In the UK, a similar type of agreement "[Human Capital Contract](#)" has been [examined recently](#) and is currently evaluated and assessed by the FCA (UK financial regulator).

In Germany, [CHANCEN EG](#) developed an Income Share Agreement instrument that is used within Germany since 2016.

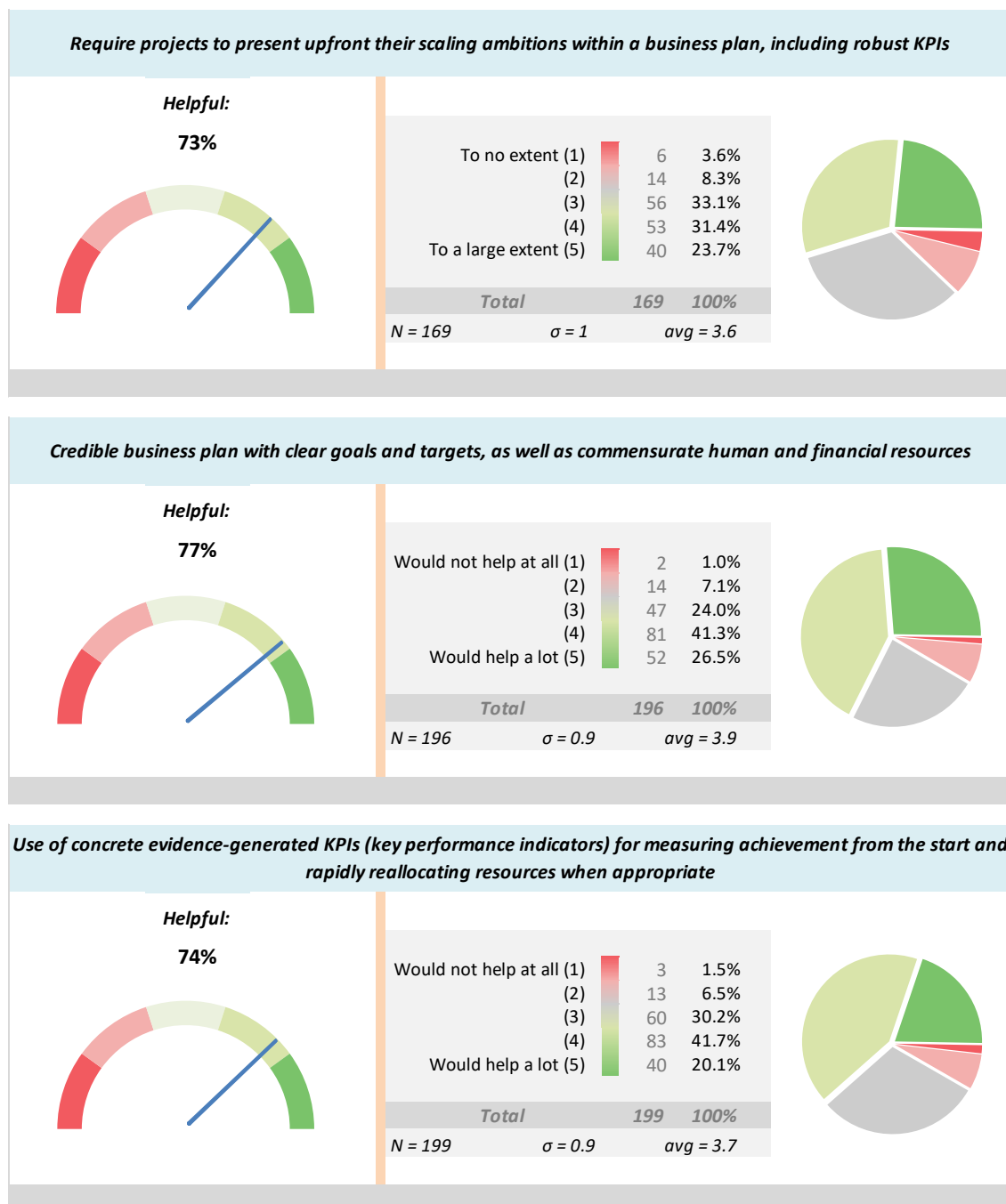
However, these types of solutions are barely emerging in most other European and the existing ones have one thing in common: they are expensive, thereby unattractive and hardly used.

To help European training and re-/up-skilling providers scale rapidly and massively and creating a strong for re-/up-skilling, financing solutions for students should be diverse, online and European. As first actions of the European Commission we propose the Commission to:

1. Establish a European Income Sharing Agreement and offer a high-tech skills student loan that can be contracted easily online by all European students admitted in pre-certified training programmes, disregarding the country of origin or of studies (~1% for 1-5 years)

2. Clarify the legal framework for a European version of an Income Sharing Agreement and encourage European financial service providers to develop a pan-European offering so that different training providers and students can benefit.

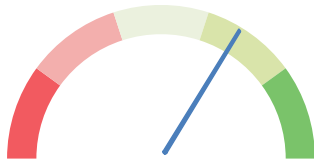
Figure 22: Expert support evidence for massive investments for new and innovative ways of funding



Funding by results should be a major funding principle implying that a substantial part of the funding would only be paid after KPIs have been met

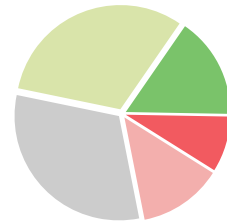
Agree:

66%



Strongly disagree (1)	16	8.6%
(2)	24	13.0%
(3)	58	31.4%
(4)	58	31.4%
Strongly agree (5)	29	15.7%

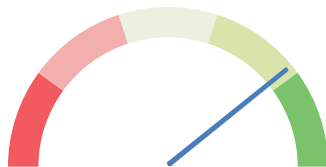
Total	185	100%
N = 185	$\sigma = 1.1$	avg = 3.3



Simplicity and coherence should be achieved through a one-stop-shop gateway to all relevant EU and national funding programmes and instruments

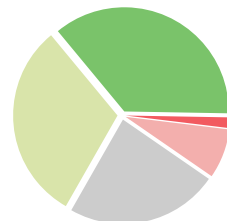
Helpful:

78%



To no extent (1)	3	1.6%
(2)	14	7.7%
(3)	43	23.6%
(4)	56	30.8%
To a large extent (5)	66	36.3%

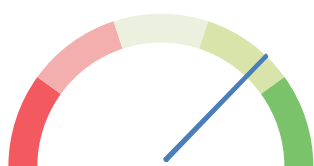
Total	182	100%
N = 182	$\sigma = 1$	avg = 3.9



Dedicate funds to initiatives reaching a critical mass of learners

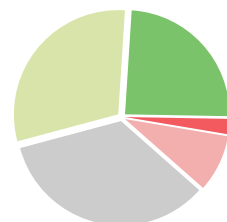
Helpful:

73%



To no extent (1)	4	2.4%
(2)	15	8.9%
(3)	58	34.3%
(4)	51	30.2%
To a large extent (5)	41	24.3%

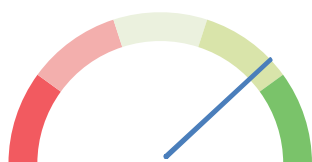
Total	169	100%
N = 169	$\sigma = 1$	avg = 3.7



Dedicate funds for building a “world class” scheme focused on upskilling and fostering top talent

Helpful:

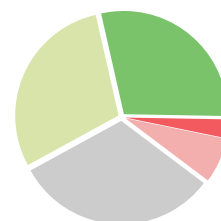
75%



To no extent (1)	5	2.9%
(2)	12	7.1%
(3)	54	31.8%
(4)	50	29.4%
To a large extent (5)	49	28.8%

Total 170 100%

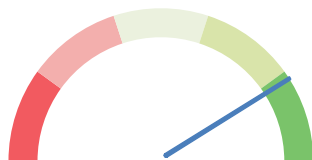
N = 170 $\sigma = 1$ avg = 3.7



Co-creation and -delivery of re-/upskilling programmes between industry and training providers is a must

Helpful:

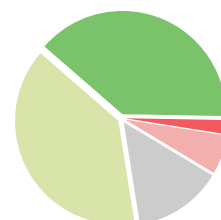
81%



To no extent (1)	4	2.2%
(2)	11	6.1%
(3)	25	13.9%
(4)	70	38.9%
To a large extent (5)	70	38.9%

Total 180 100%

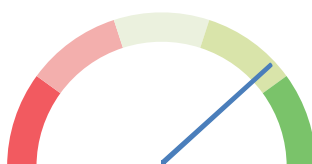
N = 180 $\sigma = 1$ avg = 4.1



Adoption of a demand-driven and industry led orientation

Helpful:

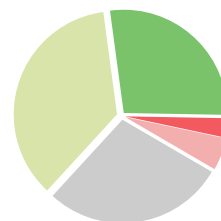
76%



Would not help at all (1)	6	3.0%
(2)	10	5.1%
(3)	56	28.4%
(4)	71	36.0%
Would help a lot (5)	54	27.4%

Total 197 100%

N = 197 $\sigma = 1$ avg = 3.8



Source: empirica (2019): Online survey of high tech skills experts.

6.2.4 Means to guide future policy development (WHAT)



- Feasibility study: Integration of new learning principles
- Career path tracking
- Workforce credentialing alternatives
- Complementary integration of 'high-tech skills' in funding programmes

Develop policy briefs and guidance for future policy development aimed at the integration of new learning principles into current education and training, career path tracking to better understand developments in the area of labour market demand for skills and competences and the knock-on effects on current education and training systems, workforce credentialing alternatives to formal qualifications for quality assurance purposes and necessary for the recognition of skills of applicants among (potential) employers. Guidance is needed for 'practitioners' for the complementary integration of emerging re-/up-skilling programmes co-created and delivery with industry into formal education and training and high-tech skills funding programmes.

Means to guide future policy development include the recommendation for a feasibility study on the integration of new learning principles and pedagogies, a study to develop methods for career path tracking, and further activities towards additional low-threshold workforce credentialing. 81% of experts would like to

see activities started to identify ways of integration of newly developed re-/up-skilling programmes into an existing formal education and training eco system.

Career path tracking is seen as an important approach for obtaining more information on the skills background of professionals needed in the market and best understand developments for necessary actions to be taken by relevant stakeholders. Despite the stagnating figures of ICT graduates over the last years, industry has 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. Nevertheless, they seem to fill a gap but very little is known about the qualification background of lateral entries. Career path tracking of high-tech workers is seen as an urgent need to obtain more information on this issue, better understand developments and take best possible action at all levels and by all actors concerned ranging from policy to education and training.

Finally, certification fulfils the role of quality assurance and skills recognition where Europe may want to take a leading role. The European level is seen as the most appropriate level for interventions in this area by more than 60% of experts. More than 30% argue for national level actors to become active.

6.2.5 High-tech skills hubs to connect key actors (NETWORKING)

NETWORKING High-tech Skills Hubs to connect key actors

- Library of training programmes & curricula
- Best practices exchange platform
- Low threshold certification options
- Brokerage activities / platform
- Exchange platform on 'how to motivate for life-long-learning'

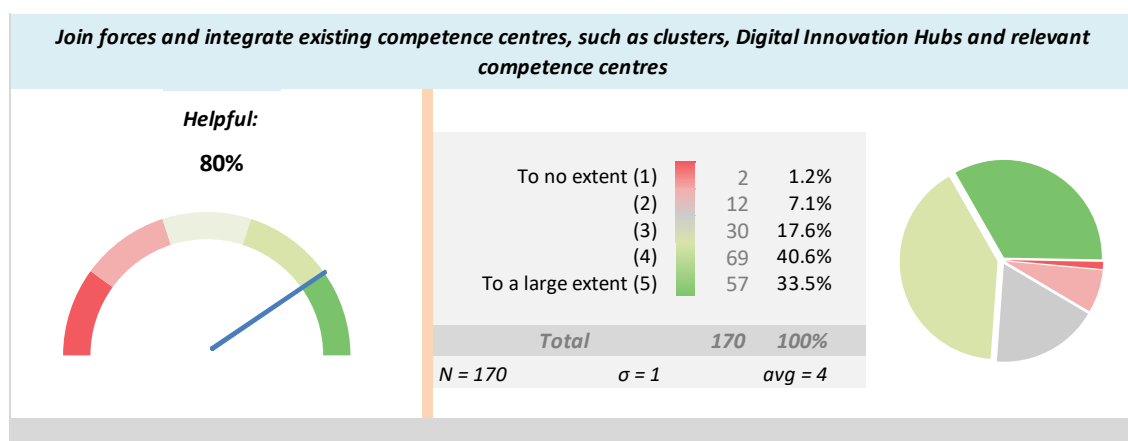
Key stakeholders in all Member States and regions are asked to join forces and integrate competence centres, such as clusters, digital innovation hubs and VET excellence competence centres connecting key actors and offering a catalogue and library of training programmes, curricula and best practices exchange mechanisms, certification options, and a platform for exchange of experience on how to motivate and prepare the workforce for lifelong-learning.

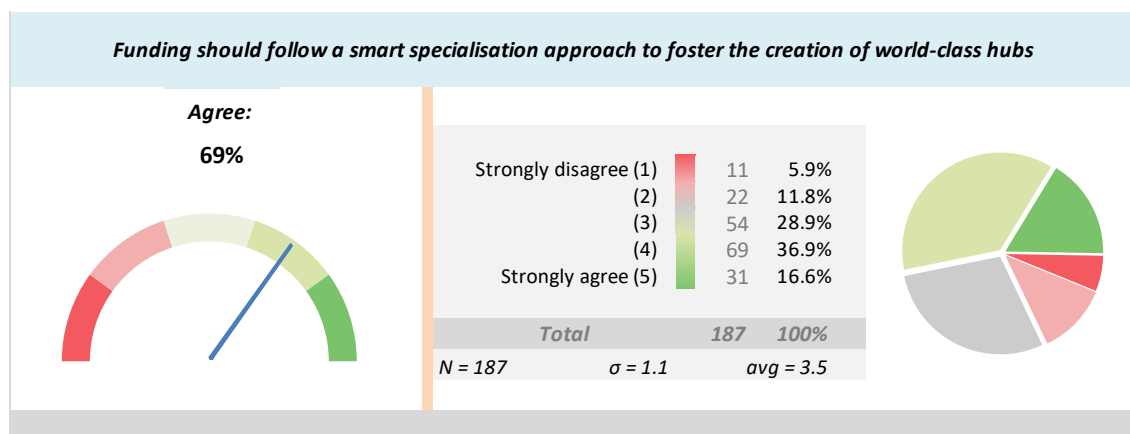
Digital Innovation Hubs and other infrastructure in high tech skills are a valuable source of leading edge tech knowledge and industry proximity. Their experience and existing networks should be built on and closely integrated in the funding landscape.

80% of experts recommend this as a means to disseminate and enhance the scalability and ultimately the impact of the funding of high-tech skills initiatives. 25% of experts see the European regions as the key actors for any interventions and for funding of high-tech skills centres, clusters and hubs. 40% allocate this task predominately to the national level and 35% see the

European Commission as the most appropriate for interventions in this area.

Figure 23: Expert support evidence for means to guide future policy development





Source: empirica (2019): Online survey of high tech skills experts.

7 Annexes

7.1 List of experts from the informal expert group

The following more than 100 experts have confirmed their participation in this expert group and are actively involved and working in different phases of the project. Each expert is assigned to a type of organisation and a high-tech skills category (Digital or AT (Advanced Technologies)).

ASS	Associations, networks and organisations of different type representing e.g. sectors of industry, professional groups etc.
BLUE	Experts from the European Commission Blueprints for Sectoral Cooperation on Skills [Contact details to be provided by EASME / European Commission]
CERT	Certification, accreditation, examination, quality testing and assessment technology providers
CLU	Cluster organisations
COAL	Experts from the national coalitions for digital jobs and skills in the EU Member States
CONS	Consultants working in the area of the present service contract
DSJC	Contacts from the organisations which submitted pledges to the Digital Skills and Jobs Coalition
EDU	Education and training providers or experts from all levels of education (higher, executive, VET, secondary schools) as well as professional education and training
EMPL	National employment agencies
EC	European Commission
GOV	Government representatives
IND	General industry and IT industry representatives
RES	Experts from research and academia
STAFF	Experts from staffing and recruitment companies
TRADE	Trade union representatives

Type	Name	Surname	Role	Organisation	Country	Category
IND	Saima	Adney	Senior Regional Director, EMEA	Microsoft	DE	DIGITAL
EDU	Mehmet	Akşit	Full Professor	University of Twente	NL	DIGITAL
ASS	Geert	Asselbergs	Project manager internationalisation & Coordinator of European network of national STEM platforms	STEM Coalition (PBT)	NL	AT
RES	Robert	Atkinson	President	Information Technology and Innovation Foundation	USA	DIGITAL
EIT	Christoph	Auch	Professional Education Lead	EIT KIC Climate	DE	DIGITAL
EDU	Liz	Bacon	Professor	University Greenwich	UK	DIGITAL
EIT	Rahul	Bansal		EIT Climate		DIGITAL
ASS	Silvia	Barbieri		Assinter Italia	IT	DIGITAL
EDU	Luciano	Baresi	Professor	Politecnico di Milano	IT	DIGITAL
ASS	Francis	Behr		Syntec numérique	FR	DIGITAL
EDU	Maksim	Belitski	Associate Professor in Entrepreneurship and Innovation	Reading University	UK	DIGITAL
ASS	Bernd	Böckenhoff	CEO + DSJC Pledge	Academy Cube	DE	DIGITAL
DSJC	Sharon	Boyle	DSJC Pledge	GMIT Mayo Campus	IE	DIGITAL
GOV	Wouter	Bronsgeest	Strategisch Adviseur CIO Belastingdienst	Ministerie van Financiën	NL	DIGITAL

Type	Name	Surname	Role	Organisation	Country	Category
EDU	Peter	Bryant	Professor of Entrepreneurship	ie business school	RES	DIGITAL
	Mr.	Budinsky		IT Association of Slovakia	SK	DIGITAL
ASS	Carm	Cachia	Executive Coordinator	eSkills Malta Foundation, Malta, Malta Information Technology Agency	MT	DIGITAL
DSJC	Siverio	Carugo	DSJC Pledge	DIDASCA - Italian Cyber Schools	IT	DIGITAL
RES	Mirko	Cesarini		CRISP Research Centre	IT	DIGITAL
RES	Joao	Costa	Founder	HighSkillz	PT	multi
EDU	Olivier	Crouzet	Director	IT Education	FR	DIGITAL
EIT	Rima	Dapous	Education Director	EIT KIC Raw Materials	DE	DIGITAL
EIT	Sjoerd	De Vries		EIT Digital	NL	DIGITAL
GOV	Pieter	de Witte	Head Strategic Partnerships Science domain	Netherlands Organisation for Scientific Research (NWO)	NL	AT / DIGITAL
GOV	Maarten	de Zwart	Responsible for IPP programmes	Netherlands Organisation for Scientific Research (NWO)	NL	AT / DIGITAL
ASS	Alejandro	Debenedet	Founder	itwnet	NL	DIGITAL
ASS	Rocco	Defina		Fondazione Politecnico di Milano	IT	DIGITAL
ASS	Emir	Demircan	Manager, Advocacy & Public Policy	SEMI-Europe	BE	MNE/AMT
ASS	Eva	Diedrichs	Managing Director	IMPROVE European Innovation Management Academy EWIV	DE	DIGITAL
EDU	Marc	Durando	Executive Director	EUN European Schoolnet	BE	DIGITAL
CLU	Heinz-Martin	Esser	Management	Silicon Saxony Management GmbH	Germany	MNE
IND	Fabrizio Vittorio	Famà	Senior Vice President HR & Corporate Affairs	Lfoundry	IT	AT
DSJC	Fiona	Fanning	Director Certiport + DSJC Pledge	Certiport	BE	DIGITAL
EDU	Ezio	Ferrero	Senior Advisor	Gruppo Pragma	IT	DIGITAL
EDU	Marco	Ferretti	President of the Italian Computer Society & Full Professor, CINI end GII Deputy	University of Pavia – Dept. Information and Industrial Engineering	IT	DIGITAL
EDU	Maria Laura	Fornaci	Senior Project Manager. Program Business in Society	Fondazione ISTUD	IT	DIGITAL
RES	Manuel	Fradinho Duarte de Oliveira	Senior Project Manager, key expert ManuSkills initiative	SINTEF	NO	multi
IND	Carlos	Freixas	Director of Marketing	Roche Diagnostics	ES	AT
ASS	Alfonso	Fuggetta	CEO at CEFRIEL and Politecnico di Milano	CEFRIEL - Digital Innovation	IT	DIGITAL
RES	Todor	Galev	Senior Analyst, Economic Program	CSD Center for the Study of Democracy	Bulgarien	DIGITAL
EDU	Fátima	Gallo	Director Digital Talent	ISDI and ISDI ACADEMI	ES	DIGITAL
ASS	Filip	Geerts	Secretary General	CECIMO (European Association of the Machine Tool Industries)	BE	AMT
EIT	Frank	Gielen	Education Director	EIT InnoEnergy	BE	DIGITAL

Type	Name	Surname	Role	Organisation	Country	Category
ASS	Krzysztof	Glomb	President	Cities on the Internet, Factory of the Future	PL	DIGITAL
DSJC	Danny	Gooris	DSJC Pledge	ORACLE	BE	DIGITAL
GOV	Sandy	Grom		Department for Culture, Media and Sport	UK	DIGITAL
EDU	Ivaylo	Gueorguiev	Program Manager	ESI-CEE	BG	DIGITAL
EIT	Mikolaj	Gurdala	EIT Health Innostars Education and Innovation Manager	EIT Health		DIGITAL
CERT	Nicholas	Haber	Director, STEM and CTE	Certiport	USA	DIGITAL
EIT	Patrick	Hartigan	Head of Masterschool	EIT Digital		DIGITAL
EDU	Hans-Ulrich	Heiss	Vice-president	TU Berlin	DE	DIGITAL
ASS	Mika	Helenius	CEO	TIVIA	FI	DIGITAL
RES	Greet	Heylen	HR Manager	Flanders Make	BE	AM
IND	Diem	Ho	Manager of University Relations (EMEA)	IBM	FR	DIGITAL
IND	Kay P.	Hradilak	Enterprise Chief Consultant	SAP	DE	DIGITAL
IND	Paul	Hunter	Director, IMD's Corporate Learning Network ELIG vice-chair	IMD	CH	DIGITAL
IND	Elmar	Husmann	Secretary General	ELIG Foundation	DE	DIGITAL
EDU	Valentina	Ivanova	Professor	New Bulgarian University	BG	DIGITAL
ASS	Mara	Jakobsone	Vice President	LIKTA	LV	DIGITAL
RES	Renata Anna	Jaksa	Director	ICEG European Center	HU	DIGITAL
EIT	Calle	Jansson		EIT Digital	SE	DIGITAL
CERT	Carsten	Johnson	Area Manager	Cisco Systems GmbH - Networking Academy Program	DE	DIGITAL
EDU	Ville	Kairamo	Head of Demola Network	Demola International	FI	DIGITAL
CERT	John	Keppler	Sr. Manager, Certifications & Professional Education	IEEE	USA	AT
ASS	Dimitris	Kiritsis	Professor, Chair, IFIP WG5.7 – Advances in Production Management Systems	EPFL - École polytechnique fédérale de Lausanne, SCI-STI-DK: ICT for Sustainable Manufacturing Group ICT4SM	CH	AT
CONS	Marianne	Kolding	Vice President	IDC Europe	UK	DIGITAL
ASS	Reinhard	Lafrenz	Secretary General	EU Robotics	BE	AT
CONS	Silvia	Leal	Academic Director	IE Business School (ES)	ES	DIGITAL
DSJC	Ana Isabel Vitórica	Leoz	DSJC Pledge	Basque Department of Economic Development and Infrastructure, Directorate of Entrepreneurship, Innovation and Information Society	ES	DIGITAL
EDU	Mark	Lester	Director of Partnerships Development	FutureLearn	UK	DIGITAL
EDU	Weizi	Li	Associate Professor of Informatics; Associate Director of Informatics Research Centre	Henley Business School	UK	DIGITAL
DSJC	Felipe	Lodi	DSJC Pledge	WorkFlow ICT	IE	DIGITAL
CERT	Chiara	Mainolfi		APMG	IT	DIGITAL

Type	Name	Surname	Role	Organisation	Country	Category
CONS	Sue	Martin	Business Transformation Consultant	Business Transformation Consultant	DE	DIGITAL
EIT	Cristian	Matti	Knowledge and Learning Manager - Transitions Hub	EIT KIC Climate		DIGITAL
RES	Stefano	Menon	Support to research and innovation / digital learning and collaboration	Politecnico di Milano	IT	DIGITAL
EDU	Victor	Molero	Academic Director	ISDI	ES	DIGITAL
EIT	Ursula	Mühle	Education Director	EIT Health	DE	DIGITAL
STAFF	Bramjan	Mulder		sde staffing groep	NL	DIGITAL
STAFF	Richard	Narine	Senior Vice President Solutions Center	Randstad Global Client Solutions	NL	DIGITAL
COAL	Valentin	Negoita	National Coalition for Digital Skills and Jobs	SKILLS 4IT	RO	DIGITAL
GOV	Pantelis	NIKOLAIDIS	European and International Relations	Ministry of Interior and Administrative Reconstruction	GR	DIGITAL
EDU	Timo	Nyberg	Senior Fellow	Aalto University School of Science	FI	DIGITAL
ASS	Andrea	Parola	General Manager	European e-Skills Association	BE	DIGITAL
ASS	Juan Pablo	Peñarrubia	Presidente CCII	CCII	ES	AT
IND	James	Perham-Marchant	Director, Government and Academic Affairs, EMEA	John Wiley and Sons	UK	DIGITAL
CERT	Richard	Pharro	CEO	APMG International	UK	DIGITAL
ASS	Andrius	Pleckaitis		Innovation and e-skills development	LT	DIGITAL
DSJC	Fabrizio	Porrino	SVP Global Public Affairs	Facility Live		DIGITAL
EDU	Goran	Radman	Vice Dean of International Cooperation	Algebra University College	HR	DIGITAL
COAL	Lucien	Reuter	National Coalition for Digital Skills and Jobs	Digital Skills Coalition Lëtzebuerg	LU	DIGITAL
EDU	Malin	Rosqvist	Research Coordinator	Research Institute of Sweden RISE ICT/SICS Västerås	SE	DIGITAL
DSJC	Francesco	Ruberto	DSJC Pledge	eSkills for Volunteers		DIGITAL
ASS	Liesbeth	Ruoff - van Welzen	Voorzitter SIG Onderzoek en Onderwijs	NGI - Platform voor IT-professionals	NL	DIGITAL
RES	Ulrich	Scherf	Professor Advanced Materials (Top 100 Materials Scientists)	University of Wuppertal, Germany	DE	AM
RES	Pietro	Siciliano	Director of Research	Institute for microelectronics and microsystems IMM-CNR	IT	AT
ASS	Claire	Skentelbery	Director General	Nanotechnology Industries Association (NIA)	BE	NT
IND	Malcolm	Skingle	Director, GSK Medicines Research Centre & Chair of SIP Board	GlaxoSmithKline	UK	AT
DSJC	Mark	Smith	DSJC Pledge	Ada, National College for Digital Skills	UK	DIGITAL
RES	Peter	Stanovnik	Associate Professor	Institute for Economic Research	SI	DIGITAL
DSJC	Lilia	Stoyanov	DSJC Pledge	Transformify		DIGITAL
EIT	Johan	Thys	Cross-KIC Human Capital Project Manager (InnoEnergy)	EIT InnoEnergy	BE	DIGITAL
RES	Dirk	Torfs	CEO	Flanders Make	BE	AM

Type	Name	Surname	Role	Organisation	Country	Category
GOV	Heidi	Torro		Ministry of Finance Finland	FI	DIGITAL
ASS	Michael	Tøttrup	Ledelseskonsulent	PROSA - Association of IT-professionals	DK	DIGITAL
ASS	Austeja	Trinkunaite	Secretary General	CEPIS	BE	DIGITAL
ASS	Aggelos	Tsakanikas	Scientific Advisor, Assistant Professor National Technical University of Athens	Foundation for Economic and Insutrial Research (FEIR/IOBE)	EL	DIGITAL
ASS	Freddy	Van den Wyngaert	Secretary General	EuroCIO	BE	DIGITAL
CONS	Niels	van der Linden	Senior Consultant	Capgemini	NL	DIGITAL
IND	Saskia	Van Uffelen	CEO	Ericsson BeLux	BE	DIGITAL
DSJC	Audrie	van Veen			NL	DIGITAL
RES	Desirée	van Welsum		Amsterdam Economic Board	BE	DIGITAL
ASS	Dimitra	Vasilia	EU Public Affairs Manager	CECIMO – European Association of the Machine Tool Industries	BE	DIGITAL
EIT	Martin	Vendel	INDEK, Department of Industrial Economics and Management Division of Industrial Marketing and Entrepreneurship	Royal Institute of Technology	SE	DIGITAL
GOV	Jens	Vermeersch	Assistant to the Director	GO! Onderwijs van de Vlaamse Gemeenschap	BE	DIGITAL
DSJC	Apa	Vincenzo	Project Coordinator	Associazione Futuro Digitale	IT	DIGITAL
GOV	Olle	Vogel	Program Coordinator	KK Stiftelsen	SE	DIGITAL
GOV	Gerard	Walker	Senior Economist	Future Jobs-Skills-Work Insights	IE	DIGITAL
RES	Michael	Zibrowius	Economist, Kompetenzfeld Berufliche Qualifizierung und Fachkräfte/ Vocational Education and Training	Institut der deutschen Wirtschaft Köln e.V./ Cologne Institute for Economic Research	DE	DIGITAL

7.2 Expert contacts and interviews (empirica)

Name	Surname	Organisation	Role, area of work
Laura	Adamoviča	Deep White	PR Project Manager
Maxim	Asjoma	Hasso Plattner Institut	Referent der Geschäftsleitung
Natalie	Barkei	Bitkom	Project Manager Smart School & Digital Women Bitkom eV
Robert	Debus	DLR	Förderprogramm 'Digitale Medien in der beruflichen Bildung'
Christine	Domgörgen	experience IT c / o Bitkom Servicegesellschaft mbH	Project Management
Barbara	Dorn	BDA	Abteilungsleitung Abt. V Berufliche Bildung
Jeremy	Edwards	National Nuclear Laboratory	
Muhammad	Farmer	British Institute of Technology England (BITE)	President, Global Nuclear Skills Institute
Peter	Gabriel	iit	Stellvertretender Projektleiter der Begleitforschung "Autonomik für Industrie 4.0"
Ingrid	Godefroy	Arts et Métiers Acceleration	Managing Director
Susanne	Gokus	acatech	Stellv. Leiterin Themenschwerpunkt Bildung und Fachkräfte / Wiss. Referentin
Harry	Goldingay	Aston University	
Margit	Grauen	Information Technology Foundation for Education (HITSA)	Program Manager
Daniel	Haines		DGWF - German Association for University Continuing and Distance Education
Tim	Hart	Oxford Innovation Centres	Isis Enterprise, BioEscalator
Martin	Hoffmann	Ruhr-Universität Bochum	NanoTecLearn
Ian	Jackson	National Nuclear Laboratory	
Laura	Juvonen	Technology Industries of Finland Centennial Foundation	
Henning	Kagermann	acatech	President
Uwe	Klinck	Bundesagentur für Arbeit	Förderung/Qualifizierung/ESF/EGF Geschäftsbereich Integration und Fördern
Michal	Konwicki	Project manager	Microsoft and CISCO West Pomeranian for SMEs
Stephanie	Kowitz-Harms	Körber-Stiftung	Projektleitung MINT-Regionen
Ursula	Kraus-Weber	Bundesagentur für Arbeit	Geschäftsbereich Integration und Fördern Referentin IF 42 – Koordination/Kooperationsmanagement
Heidi	Krömker	Technische Universität Ilmenau	NanoTecLearn
Dietrich	Labruier	Projekträger Jülich	Ansprechpartner Förderprogramme: Spitzencluster-Wettbewerb, Forschungscampus
Thomas	Lange	acatech	Leiter Themenschwerpunkt Bildung und Fachkräfte
Arkadiusz	Lefanowicz	Director of Academy for Commanding Public IT Administration	Akademia Zarządzania IT Administracji Publicznej (Academy of Commanding Public IT Administration)
Mattias	Lundberg	Swedish Foundation for Strategic Research	Scientific Secretary
Christoph	Meinel	Hasso Plattner Institut	Professor and Scientific Director and CEO of the Hasso Plattner Institute for Software Systems Engineering GmbH (HPI).
Jasmine	Mühlbach	experience IT c / o Bitkom Servicegesellschaft mbH	Project Management
Marcus	Netzel	EuroNorm GmbH, Projekträger des Bundesministeriums für Wirtschaft und Energie	Projektleiter go-digital
Erik	Neumann	EIT ICT Labs	Software Campus Project Manager
Lars	Nielsen	Linköping University	

Name	Surname	Organisation	Role, area of work
Fiona	Nightingale		KTN UK
Luise	Ortloff	acatech	Wissenschaftliche Referentin
Clemens	Otte	BDI	Referent Digitalisierung, Innovation und Gesundheitswirtschaft
Francine	Papillon	CEA	MINATEC
Mandy	Pastohr	RKW	Fachbereichsleiterin: "Unternehmensentwicklung und Fachkräftesicherung"
Jean-Yves	Plu	Thales	Head of Cybersecurity Programme
Magda	Puzanska		Szkola Gospodarki Cyfrowej (School of Digital Economy)
Christina	Ramb	BDA	Abteilungsleitung Abt. IV Arbeitsmarkt
Edo	Regtop	ptb	
Bengt-Göran	Rosén	Halmstad University	
Antonio	Saravia	red.es	Deputy Director
Roel	Schelland		
Oliver	Scherr	DLR	go-inno
Claudia	Schreier	BIBB	
Merja	Sjöblom	TIEKE	
Dawid	Szaranski	Director of the Programme	Sektor 3.0
Jane	Thomsen	IFD	
Matthew	Turner	Cardiff University	Project Manager for Ips
Rachel	Vanier	Station F	
Roxanne	Varza	Station F	Director
Jildau	Vellinga	ptb	
Cecilia	Warrol	Teknikföretagen	
Florian	Welter	FZ Jülich	-
Lutz	Wenzel	Bundesamt für Wirtschaft und Ausfuhrkontrolle (BAFA)	Project Manager go-digital
Dirk	Werner	IW	Leiter des Kompetenzfelds Berufliche Qualifizierung und Fachkräfte. Geschäftsführer der IW JUNIOR gGmbH
Christian	Willems	Hasso-Plattner-Institut	Technischer Leiter openHPI
Karin	Wilson	Swerea IVF	
Johannes	Winter	acatech	Office Manager Lernende Systeme – The Platform for Artificial Intelligence
Thomas	Zuleger	Federal German Ministry of Economics and Energy (BMWi - VI4C)	Head of Unit
			Jeden IT - Polish Programmers

7.3 Experts interviewed and invited to workshops (empirica)

Name	Surname	Organisation	Role
Geert	Asselsbergs	pbt netwerk	
Thierry	David	Ministère de l'économie et des finances	
Pieter	de Witte	NWO	
Pieter	de Witte	NWO	
Linda	Debernardi		
Stephan	Dietrich	BIBB	
Muhammed	Farmer	British Institute of Technologies	
Harry	Goldingay	Astomn University	
Nicola	Hutchins	New Economy Manchester	
Sian	Jones	Alacrity Foundation	
Anna	Kaminska	Fundacja Edukacyjna Perspektywy	
Katharina	Kanschat	BIBB	Head of Programme Unit JOBSTARTER
Nikolai	Kimbel	Nachwuchsstiftung Maschinenbau	Projektleiter "Zusatzqualifikation Digitale Fertigungsprozesse"
Ronald	Kleijn		Hogeschool van Amsterdam
Saskia	Lavoo	Program Coordinator	
Arkadiusz	Lefanowicz	Academy for IT Management and Public Administration	
Mattias	Lundberg	Foundation for Strategic Research	
Pieter	Moerman	pbt netwerk	
Michael	Monerau	DIRECCTE, Haute-Normandie	Head, Regional Economic Development Department
Alexander	Nickel	Nachwuchsstiftung Maschinenbau	
Claude	Renard		
Kristi	Rhan	Information Technology Foundation for Education (HITSA)	Chair
Keith	Ridgeway		University of Sheffield, AMRC Training Centre
Michiel	Scheffer	Provincie Gelderland	
Bianka	Siwinska	Fundacja Edukacyjna Perspektywy	
Malcolm	Skingle	GSK	
Kees	Slingerland	ACE Automotive Center of Expertise	CEO
Eva-Maria	Soja	BIBB	
Louis	Spaninks	CA-ICT	
Carlos Bertrand	Sundheim	Generation Spain	
Dawid	Szaranski	Information Society Development Foundation	
Matthew	Turner	Cardiff School of Computer Science & Informatics	
Mark	van der Heijden	Provincie Gelderland	
Jorg	van Velzen		Senior policy advisor Ministry of Economic Affairs and Climate Policy (Techniekpact)
Nadia	Verdeyen	Hogeschool Utrecht	Directeur Center of Expertise Smart Sustainable Cities
Nadia	Verdeyen		
Baukje	Vetter	Make IT Work	Project Manager, Make IT Work
Olle	Vogel		
Christian	Wiegmann	Nachwuchsstiftung Maschinenbau	
Britta	Ziebell	Nachwuchsstiftung Maschinenbau	Projektassistentin "Zusatzqualifikation Digitale Fertigungsprozesse"

7.4 Expert contacts and interviews (PwC)

Name and Surname	Organization	Role	Country	Stakeholder from
Prof. Des McMorrough	London Centre for Nanotechnology, United Kingdom	Director	United Kingdom	Academia
Hans Bosch	Netherlands Enterprise Agency	National Contact Point (NMBP)	Netherlands	Supporting structure
Jorg van Velzen	Ministry of Economic Affairs and Climate	Techniekpact Coordinator	Netherlands	Government
Mikk Antsov	University of Tartu	National Contact Point	Estonia	Academia
Greg Green	Welsh Government	Head of R&D Projects	UK	Government
Sian Jones	Welsh Government	Strategy ICT Manager	UK	Government
Fabrizio Pirri	Politecnico di Torino	Professor	Italy	Academia
Kees Slingerland	Automotive Centre of Expertise	Director	Netherlands	Supporting structure
Linda van Hoeij	HighTech Institute	Office Manager	Netherlands	Industry

7.5 ‘Learning practices’ from the UK

Several policies and funding programmes were identified which are not necessarily good practice candidates since they do not meet the selection criteria or ceased to continue operation but which - for different reasons - can be seen as ‘learning practices’. These practices help us draw lessons when evaluating the success of funding programmes and defining important elements to watch out and things to avoid for the future in the area of high-tech skills training funding programmes.

The UK seems to be a country with a number of interesting policies and funding programmes in the skills area which for different reasons ceased to exist. We nevertheless have analysed some of them since the country and its policy as well as the funding programmes no longer pursued constitute good ‘learning practices’. Understanding the reasons for and learning from such examples and failures will be of importance in the process of deriving and developing recommendations.

Learning practices referred to in this section include the following.

Overview of ‘learning practices’ programmes from the UK

Country	Title of the ‘learning practice’
UK	UK Commission for Employment and Skills (UKCES) <i>[discontinued]</i>
UK	The TechPartnership <i>[discontinued]</i>
UK	LearnDirect <i>[likely to be discontinued]</i>
UK	Industrial Partnerships
UK	City Region Deals

7.5.1 The UK skills policy landscape

In the last three decades the UK has seen 61 Secretaries of State responsible for skills and employment policy (compared with 18 for schools policy and 16 for higher education). Between them, they produced 13 major Acts of Parliament. The policy area has been moved between departments or been shared with multiple departments no fewer than 10 times since the 1980s. This means that the Government has created a growing lack of “organisational memory” at political and official levels.⁴⁸ This has contributed to a lack of consistency and stability in the system.

The government is trying to create more stability. In a recent interview with the authors of this report, a UK government expert described the UK skills policy landscape still as “quite varied with a lot of activity much of which is not transparent”. He pointed out that there have also been “quite a few recent changes with much of the BIS (now BEIS) skills activity moving to the Department for Education and the Department for Digital, Culture, Media & Sport (DCMS) leading on digital skills”.

Government have stated that they wanted to “put control back into the hands of employers so they will gain the skilled workforce they need to compete globally” and started the UK vocational skills reforms. These have been underway for the last three years and are transforming the skills system and putting employers “in the driving seat”.

Further rather recent developments include the closure of the UK Commission for Employment and Skills (UKCES) and The Tech Partnership which may leave a vacuum in this policy field.

The **UK Commission for Employment and Skills (UKCES)** was a non-departmental public body that provided advice on skills and employment policy to the UK Government and the Devolved Administrations. Government funding for UKCES was withdrawn in late 2016 which led to its inevitable closure in March 2017.

On 4th October 2017 it was announced that the **Tech Partnership** would cease its operations in September 2018. The Tech Partnership, and its predecessor organisation e-skills UK, played key roles in driving up digital skills across the UK. Led by a partnership of industry leaders – CEOs from across the digital industries and CIOs from right across the economy – they worked with educators, government and other stakeholders to ensure the UK has the digital skills to thrive in the global economy. However, certain Tech Partnership activities will be preserved by agreements formed with third party organisations. As of August 2018 the Tech Partnership’s Higher Education programmes, both degrees and degree apprenticeships, are intended to be transferred to a separate company limited by guarantee called Tech Partnership Degrees. This includes the transfer of the industry-accredited Tech Industry Gold degrees – IT Management for Business (ITMB) and Software Engineering for Business (SEfB) – and the Tech Industry Gold degree apprenticeships. Other Tech Partnership activities also have new homes agreed, and transitions are underway to the organisations shown in the following table.

Area of work	Includes	New organisation
TechFuture	<ul style="list-style-type: none"> • TechFuture Classroom • TechFuture Girls • TechFuture Badges • TechFuture Ambassadors 	City & Guilds www.cityandguilds.com
Higher Education (Degrees and Degree Apprenticeships)	<ul style="list-style-type: none"> • Tech Industry Gold accreditation • IT Management for Business (ITMB) and Software Engineering for Business (SEfB) 	Tech Partnership Degrees www.tpdegrees.com

⁴⁸ Malcom Skingle, gsk presentation at High-Tech Skills for Europe workshop on 30th January 2018 in Brussels

Area of work	Includes	New organisation
Apprenticeships	• Digital Degree Apprenticeships	
	• External Quality Assurance	NSAR www.nsar.co.uk
	• Certification	Instructus Skills www.instructus-skills.org
	• Levels 2, 3,4 employer support	BCS www.bcs.org
Essential Digital Skills	• Skills Framework	DfE www.gov.uk/df

Source: The Tech Partnership Website⁴⁹

In interviews carried out as part of our work it became apparent that the government recognises a need to develop a better understanding of digital skills activity (both public and private) and also to better coordinate activity. It is argued that the recent Digital Strategy sets out HMG digital skills initiatives and the intention to establish a Digital Skills Partnership to help coordinate this activity.

7.5.2 VET in the UK

Background

The OECD report from 2009⁵⁰ described the specific strengths of the VET system in England and Wales as a system committed to a steep improvement in the level of workplace skills, with substantial resources having been made available for this task, the conscious attempt to engage employers, VET policy making being dynamic and innovative as well as flexible and allowing for tailor-made training solutions for employers. In the 2015 OECD report it is stated that “higher apprenticeships are growing fast and are highly valued by employers and students. They could play a very important role in raising the status of the whole apprenticeship sector.”⁵¹

The challenges described in the 2009 report included the ones of employer engagement, the need for a very strong lead from government to deliver set targets, policy structures being both more complex and unsustainable than in most OECD countries inhibiting employer engagement, fragmented, with inadequate attention to international experience. The OECD report explicitly welcomes and supports the establishment of the UK Commission for Employment and Skills (UKCES) for simplifying and stabilising the UK VET system. The 2015 OECD report even states that “England enjoys a strong base of research expertise, and good data. The UK Commission for Employment and Skills (UKCES) plays an important role in providing strategic policy advice to government, based on the input of employers and unions.”⁵² It therefore came as a surprise that the UKCES has recently been closed (see above).

Finally, the OECD also already in 2009 recommended the use of compulsive measures including training levies to encourage employer support for training closely linked to the apprenticeship system. Such a levy system is now in operation in the UK.

⁴⁹ <https://www.thetechpartnership.com/news/final-update-on-legacy-plans/> visited: 21 August 2018

⁵⁰ OECD: Learning for Jobs – OECD Reviews of Vocational Education and Training: England and Wales, 2009

⁵¹ OECD Reviews of Vocational Education and Training – Key Messages and Country Summaries. 2015, p. 33

⁵² OECD Reviews of Vocational Education and Training – Key Messages and Country Summaries. 2015, p. 33

Some key initiatives

Industry Partnerships

An Industrial Partnership brings together employers across an industry sector to lead the development of skills, with a focus on growth and competitiveness. Eight partnerships have been set up in the UK covering the aerospace, automotive, creative, nuclear, digital, energy & efficiency, science and tunnelling (construction) industries. Each industrial partnership is chaired by a major employer and is a platform for businesses of all shapes and sizes in the sector to define and influence skills priorities. While the shape and scope of each partnership is defined by its employers, all partnerships share a commitment to tackling skills shortages, testing innovative training solutions with their sector, and overcoming the skills shortages that have restrained the entire set of sectors from achieving their potential. They are supported by trade unions, trade and professional bodies and sector skills councils. Through collaborative action, they aim to improve the skills and employability of their current and future workforce, and in doing so increase productivity, build their capacity to innovate, and strengthen their position.

The 8 pilot industrial partnerships had the following commitments to be achieved by the end of the funding period in March 2017:

- Define and co-ordinate the skills and talents needed by their industries and the people who will work in them now and in the future.
- Engage 16,000 young people to find out about or experience working in these sectors.
- Provide continuous professional development to 44,000 people in work by delivering nearly 9,000 apprenticeships.
- Support 3,100 people to become higher skilled / specialists in industry targeted areas.
- Continue to lead the development of new trailblazer standards.

Government had provided funding for the initial phase (2013 – 2017) of establishing Industrial Partnerships. The partnerships were funded up to March 2017 through a co-investment model, with the Government investing £131 million through its Employer Ownership Pilot (EOP) fund. The fund is managed by the Skills Funding Agency, part of the Department for Business Innovation and Skills. Government investment is matched by cash and in-kind from the employers, creating a total fund of £354 million: for every £1 of Government investment, businesses are investing £1.70.

It is unknown to the authors of the present report how well the different Industry Partnerships are still performing. Hardly any or no information is made available. It appears as if most of the Industry Partnerships are operating at a rather small level or no longer after the initial government funding period came to an end.

The Science Industry Partnership (SIP) can be seen as a positive example and has also been considered in the present study as a best practice candidate funding programme. It successfully uses the UK tax system with its apprenticeship levy. SIP can be seen as an example of what needs to be done and in place to be successful what - apparently – was not achieved in the other Industry Partnerships.

The UK government with matching funds from industry spent 52 million GBP (<https://www.gov.uk/government/news/52-million-boost-for-skills-and-training-in-uk-science-sectors>) for getting the SIP partnership and membership organisation set up and operational which was preceded by an 18 months phase of needs and requirements analysis.

SIP managed to keep momentum, despite the fact that all government money came to an end. SIP offers apprenticeships from Level 2 to 6 (Level 5 – 8 under development) following the ‘earn and learn’ principle.

Apprenticeship Levy

The UK tax system with its Apprenticeship Levy has been very supportive since it allows companies offering apprenticeships to claim back their contribution. It came into effect in April 2017 after the UK government's promise of 3 million new apprentices by 2020. The levy applies to employers in England, who have an annual pay bill above £3m. The levy is 0.5 per cent of the annual pay bill. All employers will receive a £15,000 annual allowance, to be offset against the bill. This effectively means that employers with an annual pay bill of £3m or less pay no levy. From May 2017 employers not paying the levy, who offer apprenticeships to 16 to 18 year olds, receive 100 per cent of the cost of the training from the Government, up to the maximum funding bands. Employers will have to pay 10 per cent of the cost of the apprenticeship training for those aged 19 and over and the Government will pay the remaining 90 per cent, up to the maximum funding bands. This support applies to all age groups. For non-levy businesses with less than 50 employees there is also a new £1000 incentive towards apprenticeships for taking on someone aged 16 to 18.

Experts see the Apprenticeship Levy on large employers as a good plan to urge them to offer apprenticeships which allows them to claim the money back for training. However, a year after its launch, the media and press report that the apprenticeship levy is not applied as the instrument it was meant to be used for. According to The Guardian "the Open University found that businesses paid £1.39bn into the levy but drew down just £108m for training, because they wrote off the levy as just another tax". It continues by stating the obviously "some employers reject the new higher standards for apprenticeships that were introduced with the levy. They have been unwilling to create quality apprenticeships that must last at least a year, with a day a week for training courses. What companies had previously badged "apprenticeships" were often low-quality internal training of older staff. Research by the Resolution Foundation found that fewer than half of the trainees even knew they were apprentices."⁵³

These are important results from the introduction and application of a funding programme in combination with a fiscal incentive / levy programme which provide valuable information for the development of recommendations.

Learndirect

Learndirect Ltd is a private company owned by the private equity firm Lloyds Development Capital (LDC). It was formerly owned by the Ufi Charitable Trust, a not-for-profit organisation and privatised by David Cameron's coalition government in 2011 by selling it to and its parent Ufi Limited to LDC. Learndirect has a network of learning centres in England and Wales, and also runs some courses online. In March 2017, Ofsted inspectors gave the company the lowest possible rating, leading to Learndirect seeking court review and an injunction on the publication of this poor result. The court lifted the reporting restriction on 14 August 2017.⁵⁴ Subsequently, the Department for Education stated that it would withdraw all funding from Learndirect, placing the future of the organisation at risk.⁵⁵

Learndirect has become the biggest recent scandal in VET in the UK. Learndirect's owners and managers were accused of raking in millions of pounds of taxpayers' money while overseeing a "catastrophic decline" in

⁵³ Toynbee, Polly (9 April 2018): Young people are being cheated of the skills needed to get good jobs. The Guardian: <https://www.theguardian.com/commentisfree/2018/apr/09/young-people-cheated-skills-jobs-brexite-education> (retrived 23 April 2018)

⁵⁴ Ponsford, Dominic (14 August 2017). "FE Week successfully challenges training giant Learndirect's legal gag on revealing damning Ofsted report". The Press Gazette: <http://www.pressgazette.co.uk/fe-week-successfully-challenges-training-giant-learndirects-legal-gag-stopping-it-from-reporting-damning-ofsted-report/> (retrieved 23 April 2018).

⁵⁵ Neate, Rupert (16 August 2017). "Department for Education pulls all Learndirect contracts and funding". The Guardian: <https://www.theguardian.com/education/2017/aug/15/government-pulls-all-learndirect-contracts-and-funding> (retrived 23 April 2018)

standards.⁵⁶ An anonymous expert describes it as “a case of quasi-systematic failure, improvisation and amateurism”.

The Institute for Public Policy Research (IPPR) think tank calculated that the Learndirect has received £631m of public money since its controversial privatisation. An FT/FE Week investigation found that in the four years since it was sold off, its parent company spent 84% of its cash generated by the operating business, most of which came from the taxpayer, on payments to managers and financiers.

Joe Dromey, a senior research fellow at the IPPR, said it was “truly shocking” that Learndirect’s owners, which ultimately include Lloyds Bank, appear to have “raked in vast amounts of public money, extracted tens of millions of pounds from Learndirect, loaded the company with debt, overseen a catastrophic decline in standards, and tried to stop the truth coming out”. “The owners of Learndirect have some very serious questions to answer,” he said. “This should be investigated by the Public Accounts Committee, and if Learndirect goes down, government should seek urgently to reclaim as much public funding as possible from their irresponsible owners.”

Dromey said that not only was the alleged mismanagement at Learndirect shocking, it was also the result of the systemic failure of public policy. “It was the government which privatised Learndirect, encouraged competition, reduced controls on quality and slashed funding in the system. They set the conditions in which this disaster played out. Government must urgently learn the lessons of the scandal at Learndirect, and act to ensure it never happens again.”

Taken from: Neate, Rupert (16 August 2017). “Department for Education pulls all Learndirect contracts and funding”. *The Guardian*: <https://www.theguardian.com/education/2017/aug/15/government-pulls-all-learndirect-contracts-and-funding> (retrieved 23 April 2018)

Again, these are important results from the introduction of a funding programme and its change of governance structure and ownership which provide valuable information for the development of recommendations.

City Region Deals

A City Region Deal is an agreement between government and a city. It gives the city and its surrounding area certain powers and freedom to:

- take charge and responsibility of decisions that affect their area,
- do what they think is best to help businesses grow,
- create economic growth,
- decide how public money should be spent.

A larger number of such deals have been proposed (and set up) since 2015.⁵⁷ Several of these proposals have a skills component but it is unknown, how much of them relate to high-tech skills development.

Two examples from the first wave include the ‘Leeds City 14-24 Apprenticeship Academy’ and ‘Manchester City Apprenticeship & Skills’. The Leeds City 14-24 Apprenticeship Academy is described as a flagship initiative for a proposal to build the Academy with support from the government and the region's business partners. It is a wider apprenticeship proposition which includes the 14-24 Apprenticeship Academy (investment of £6.2m) and an Apprenticeship Training Agency, especially for SMEs (£8m) as well as business-to-business campaigns. The Manchester City Apprenticeship & Skills scheme is a proposal to engage SMEs in delivering 6,000 new apprentices. The proposal is to work with a population of up to 100 employers over 2 years, at a cost of £2.8m.

⁵⁶ Neate, Rupert (16 August 2017). “Department for Education pulls all Learndirect contracts and funding”. *The Guardian*: <https://www.theguardian.com/education/2017/aug/15/government-pulls-all-learndirect-contracts-and-funding> (retrieved 23 April 2018)

⁵⁷ Ward, Matthew: City Deals. Briefing Paper, Number 7158, 22 November 2017, House of Commons Library

The Project "Capacity Building: Advanced and Higher Level Apprenticeships" which aims to stimulate demand for advanced and higher level apprenticeships at levels 3, 4 and 5 is for example launched by the Hub.

7.5.3 General assessment

The 'learning practices' illustrate how a lack of consistency and stability in the education and training system can negatively impact necessary skills development activities. Furthermore, some of these practices seem to demonstrate that often they manage to continue operating at a rather small scale or no longer once the initial government funding period ceases.

Organisations set up by government to simplify and stabilise the education and training and especially the VET system whose establishment were explicitly welcomed and supported by the OECD are no longer in operation. This now leaves a vacuum in the provision of strategic policy advice to government, based on the input of employers and unions.

Furthermore, the Learndirect case demonstrates an example of the introduction of a well-intended funding programme which failed after it changed governance structure and ownership, resulting in mismanagement and the responsible actors overseeing a catastrophic decline in quality standards. It has also been described by some experts as a systemic failure of public policy.

Finally, further investigations are needed as to the skills development related activities of the City Region Deals proposals. Information on these is very scarce, responsibilities fuzzy, responses poor, concrete implementation and operation of skills training obviously not taking place or at least in doubt. The further analysis will hopefully shed some light on which of these activities continue to be active and successful in terms of high-tech skills development and whether these can be seen as effective and efficient funding mechanisms and programmes.

The analysis of these 'learning experiences' provides valuable input for the development of recommendations for the establishment of future-oriented national and European funding programmes in the area of high-tech skills development and thereby help governments – not only in the UK - to learn the lessons and act to ensure that scandals like Learndirect never happen again.

7.6 High-tech skills funding programmes: Best practice candidates

7.6.1 DIGITAL best practice candidate programmes

Expertkompetens (Graduate Professional Development Program)	
Country	Sweden
Short description & objectives	<p>The purpose of the Expertkompetens programme is to raise the expertise for knowledge-intensive business development and innovation among key individuals in companies. The objective is to develop and deliver courses on master level or higher where the expertise in strong research environments matches the strategic needs for expertise in companies. The prerequisites for applying for funding are that the applicant HEI has to have a strong research and educational environment, is going to involve and engage the target group companies right from the start, and can prove that the institution is financially sustainable in the long-term.</p> <p>The funding programme enables the development of research-related courses and education programmes for advanced-level professionals. This requires close collaboration between academic environment and companies in programme development work.</p>

Expertkompetens (Graduate Professional Development Program)

In the recent round of the funding programme 6 projects were selected and now receive funding. These have developed and now offer professional training programmes on:

- Remote monitoring and diagnostics of electrical/mechanical systems/products
- Master's Education in software development (PROMPT)
- Social Media and Web Technologies for Innovation
- Expert in Production Engineering
- Sustainable Wood Building Technology
- Online Master in Cast Metals Engineering.

Expertkompetens supports the development of education and training for advanced-level professionals. Courses and programs are developed by matching the skills and development needs of the business community with the knowledge and skills found in strong academic environments. As the course participants are professionals, high demands are placed on flexible forms of education. This means that, through the support of the program, universities can develop leading positions in the international development and generation shift of online education. For companies, it means that employees can acquire relevant knowledge at the university, including research results generated there or globally. The developed courses will be incorporated into the institution's regular education programme and quality assured according to regular routines. The purpose of the programme is to provide professionals and companies with expertise for knowledge-intensive business development and innovation.

Co-production in course and programme development involves 8 universities and about 20 research institutes and trade organisations, >150 companies (SME as well as large companies like GKN Aerospace Sweden, Combitech Engineering, SCANIA, Ericsson, Telenor, Siemens Industrial Turbomachinery, ABB, SAAB, SKF, Volvo Powertrain, Skanska, Volvo Construction Equipment, Atlas Copco RockDrills, Alstrom Power Sweden)

The following professional training programmes are typical ones which can be used to illustrate the type of programmes funded through the Expertkompetens funding programme:

- PROMPT: <http://www.promptedu.se/>
- Expertkompetens sociala medier och webbtteknologi för innovation och tillväxt: <https://lnu.se/mot-linneuniversitetet/Organisation/fakulteten-for-teknik/utbildning/expertkompetens-sociala-medier-och-webbtteknologi-for-innovation-och-tillvaxt/>
- Diagnos på distans: <https://www.bth.se/om-bth/organisation/fakulteten-for-teknikvetenskaper/tisb/diagnos-pa-distans/>
- Gjutmagistern: <http://ju.se/studera/kompetensutveckling---uppdragsutbildning/tekniska-hogskolan/aktuella-utbildningar/program-och-kurser-inom-det-giuteritekniska-omradet/projektet-gjutmagistern.html>
- ProdEx – Expert i produktionsteknik: <https://www.hv.se/forskning/forskningsprojekt/teknik/prodex---expert-i-produktionsteknik/>

The submission deadline for the current (2017) step 1 call (Step 1 includes the investigation, planning and commencement of the education activities whereas step 2 comprises the development and implementation of the entire planned course offer / training programme) for submissions is 18 January 2018.

Expertkompetens (Graduate Professional Development Program)	
Duration	Ongoing
Budget	<p>All applications/projects that fulfil the requirements are accepted. (Financial resources are not a limiting factor)</p> <p>The budget per project ranges from 2 – 5 million Euro.</p>
No. of applicants	About five applications from HEIs per year.
No. of approved applicants	<p>Six projects at HEIs in step 2 and two projects in step 1. No project has yet been completed.</p> <p>Depending on program, i.e. on area of competence and involved industry, the number of students following courses (of typically 3-5 ECTS), is 50-150 per year.</p> <p>Students represent approx. 300 companies, whereof 50 % also participated in course development.</p>
Type of funding	The HEI receives funds for their costs for developing industry relevant flexible courses. This comprises costs for analysing the needs of development and expertise in the industry target group, developing digital pedagogic methods and training of academic staff in flexible learning methods. KK Stiftelsen also provides 50% of the costs of running the courses twice. Thereafter the courses are financed through the regular state system for financing higher education or by related companies in commissioned programs. The participating companies must cover their own contributions in the development work.
Main stakeholders	KK-stiftelsen (Stiftelsen för kunskaps- och kompetensutveckling)
Stakeholder(s) from	Industry and universities
Scope 1	National
Scope 2	Digital
Main target group	Industry and universities
Impact	<p>Examples of results so far:</p> <p>Until 2016 the total number of students following courses are >1000 and they represent about 300 different companies (50% of the companies have also participated in the course development).</p> <p>Courses becoming part of companies learning system - GKN Aerospace Sweden has integrated programme courses into their strategic assessment of competence as well as into their competence developing process</p> <p>After completing courses employees have advanced within their organizations – 25% of the students in the Gjutmagistern/Online Master in Cast Metals Engineering have advanced within their organizations.</p> <p>Developing work directly related to training activities in courses have resulted in new products/processes</p> <p>The project PROMPT received the “European Digital Skills Award 2016”</p>

Expertkompetens (Graduate Professional Development Program)

	Since new business relevant research based knowledge are crucial for competitiveness the impact cannot be overestimated. Flexible online courses on a high academic level are a new option for most companies and employees. This requires a new behaviour among employees – which always takes time to develop - to take advantage of this option. Therefore, we foresee a growing number of students from industry in the coming years. This can be exemplified by the Volvo Group University which supports and encourages employees to follow courses in the programme.
Scalability (and transferability)	The courses are web-based with digital lectures, e-meetings and discussions forums. Typically, there are also one or two f2f meetings for introduction and laboratory work. Some courses are fully online, and open for international students. In principle, the courses have built-in scalability.
Sustainability	Provided that the courses are updated and in line with the needs in industry, sustainability is considered to be high.
URL	http://www.kks.se/vart-erbjudande/vara-program/expertkompetens/ ; http://www.kks.se/vart-erbjudande/vara-program/expertkompetens/expertkompetens-vidareutbildning-for-yrkesverksamma-hogutbildade/

Katapult

Country	The Netherlands
Short description & objectives	<p>The world is rapidly changing; technological progress is swiftly and permanently altering our everyday lives. Globalization and technology advancement bring about permanent changes in the economy changing the structure of the labour force, and creating new jobs while at the same time threatening traditional lines of work.</p> <p>The Netherlands has an open economy which thrives on international trade. As Europe's 7th largest economy, 5th largest foreign investor and investee, 4th largest importer, 2nd largest exporter, and leading exporter of agricultural products, the Netherlands earns 33% of its income from the export of goods and services alone.</p> <p>To keep up with this fast track to innovation, we are constantly reconsidering our science, technology and innovation policy and encouraging dynamic collaboration between the Dutch government, the education and the business sectors.</p> <p>To meet changing job requirements, government and private sector have joined forces to accelerate change and invest in conversion of the workforce. Dynamic partnerships were formed, referred to as Centres of Expertise (Higher Education) and Centres for Innovative Craftsmanship (Vocational Education).</p> <p>This powerful and effective public private collaboration quickly gained tremendous support: the network of Centres started in 2011 with a few pilots, and has expanded to over 150 fully operational Centres in 2017. This network is called Katapult. These Innovative Centres of Expertise and Innovative Craftsmanship represent collaboration between entrepreneurs, vocational schools, higher education institutions and government in various sectors.</p> <p>They are an active cross-pollination between research & education and valorisation & entrepreneurship. Shared investments of both public and private parties are embedded in driving it</p>

Katapult	
	and solid business models that create financial viability. Variation and autonomy is a key characteristic: each Centre creates its own niche and market value.
Duration	2010 - ongoing
Budget	Government investment 2010-2017 of over 200 million, and at least 200 million funding from businesses and regional governments.
No. of applicants	Over 300 applicants over the years
No. of approved applicants	150 public-private partnerships
Type of funding	Triple-helix: businesses, education institutions, regional and national governments.
Main stakeholders	The Ministry of Education, Culture and Science, the Ministry of Economic Affairs, Platform for Science and Technology
Stakeholder(s) from	Government, industry, universities
Scope 1	National
Scope 2	High-tech skills training
Main target group	Students, employees to receive lifelong learning training, SME-businesses to contribute towards innovation
Impact	<p>Participation of over 6000 businesses, nearly all education institutions, 4000 teachers and over 50.000 students. Impact is amongst others – measured by funding per business; on average, each PPP receives between 200k and 500k of private funding.</p> <p>Case studies are performed to assess the socio-economic impact via the BETA method; the indirect effect can add up to ten times the investment (other programs such as European Space Agency (ESA), de Conseil Européen pour la Recherche Nucléaire (CERN) realised effects between 290% en 350%).</p>
Scalability (and transferability)	The programme is already beyond the pilot phase and is scaling up. There is a two-way strategy: first, each PPP needs to be sustainable before being allowed to scale-up. For scale-ups, additional finance might be available, which can mean approaching new businesses and operating cross-sectoral. Second, as each PPP has only limited scaling-up potential, since the PPPs are regionally oriented, new PPPs can be started over the next four years.
Sustainability	PPPs receive funding for four years, after this period there is the possibility for scale-up funding. Each PPP needs to provide its financial sustainability after four years; 50% of PPPs manage within four years, 75% after six years. There are some difficult challenges concerning sustainability which mostly have to do with commitment of businesses (long-term funding) and large education bureaucracies where it is relatively difficult to change current practices. Both are vital for sustainable models.
URL	English folder https://wijzinkatapult.nl/default.aspx
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JOBSTARTER plus – Funding programme for company-based vocational education and training (VET)

Country	Germany
Short description & objectives	<p>JOBSTARTER plus: Funding programme for company-based vocational education and training (VET)</p> <p>The Federal Ministry of Education and Research is supporting the improvement of the regional training structures through the JOBSTARTER plus programme. This programme (and its predecessor JOBSTARTER) has already supplied funding for more than 430 innovative projects (Since 2006, 123 since 2014) in vocational education and training. All these projects are helping to create additional traineeships in the regions and are offering various measures to support companies that have little or no experience with training, for example, companies in the sector of high technology. They also support companies to enhance or stabilize their engagement in VET. The core instrument of the projects' activities is the External Training Management. Other goals of the funding e.g.: integration of migrants and refugees, integration of student dropouts in the dual training and improvement of regional structures.</p> <p>Programme structure and the volume of funding</p> <p>JOBSTARTER contributes to achieve the goals of the National Alliance for Initial and Further Training 2015-2018 – Pact for Career Training and Skilled Manpower Development in Germany.</p> <p>Funding at regional level</p> <p>JOBSTARTER provides funding for regional projects which help to create additional in-company traineeships in small and medium-sized enterprises (SMEs) as well as to recruit suitable trainees. Improved cooperation between local stakeholders is supposed to strengthen regional responsibility for vocational education and training and at the same time contribute to structural developments.</p> <p>Selection of projects</p> <p>Projects are selected via annual calls for proposals. These are based on the respective current funding announcement, which defines the conditions for funding and lays down thematic priorities. The projects are implemented, among others, by chambers of trade and industry, local and educational institutions, unions, municipalities and companies.</p> <p>Digitisation</p> <p>One of the current lines of funding: "Initial and Continuing VET in the 'Economy 4.0' – Structures of support for SMEs in the process of adjustment of Vocational Education". 20 regional projects support small and medium enterprises on issues related to dual vocational training on topics related to "digitisation" and "automation", providing advice on how to develop related company-internal training methodically and didactically.</p>
Duration	JOBSTARTER plus: 2014-2022
Budget	2014-2020: 108,8 million Euros (of which 61 million Euros are co-financed by the European Social Fund)
No. of applicants	300
No. of approved projects	123
Type of funding	Financial grants for personnel costs and business trips
Main stakeholders	<p>Federal Ministry of Education and Research (BMBF)</p> <p>Federal Institute for Vocational Education and Training (BIBB)</p>

JOBSTARTER plus – Funding programme for company-based vocational education and training (VET)

Stakeholder(s) from	Industry, VET training providers, chambers, unions
Main target group	Small and medium-sized enterprises, micro and small enterprises
Impact	<ul style="list-style-type: none"> About 64.000 training places acquired Establishment of sustainable cooperation structures and networks of the VET stakeholders in the regions beyond the period of funding Strengthening of the regional responsibility of the stakeholders of the dual VET system Establishment of training structures in specific economic sectors Development and testing of additional qualifications Improvement of the attractiveness of VET Strengthening of in-company VET in the migrant community Stabilization and increase of SME's readiness and capability to enter vocational training
URL	www.jobstarter.de

„go-digital" funding programme (Förderprogramm "go-digital")

Country	Germany
Short description & objectives	<p>go-digital is a voucher-based subsidy system (an application process is not required), including a government 50% subsidy (approx. 12.500 Euro) for consultant work of around 20 days for an SME to train and support them on 'digitalisation', and matched by an additional 50% of the overall budget from an SME. The authorised consultant receives the voucher and the government share of the money after completion of work and the additional 50% from the SME. The programme operates with a low level of bureaucracy and effort to be spent due to an online form completion through the consultant for voucher receipt and dealing with the financial issues after completion of the work. "go-digital" is targeted at small and medium-sized enterprises (SMEs) in the commercial sector and the trades with its three modules "IT security", "digital market definition" and "digitized business processes". The programme provides consulting and training services to keep pace with the technological and social developments in the area of online commerce, business day digitization and the increasing security requirements for digital networking.</p> <p>Supported are consulting / training services in a selected main module with, if necessary, secondary modules with a subsidy rate of 50 percent to a maximum daily consultancy rate of 1,100 Euros. The maximum amount of funding is 30 days in a period of half a year. The "go-digital" program was successfully implemented in 2015/16 in the model regions of Saxony (including the Halle area) and in the Ruhr area. Model projects were successfully completed in 2015/16. In the period 2015/16, 277 consultancy projects with a total volume of EUR 2,275,324 were funded. A total of 178 authorization applications were submitted by the consultants, 151 of which were approved.</p> <p>The 2nd phase was launched in September 2017 with a budget of around 5 million Euro. As of November 2017 several thousand SMEs showed an interest and around 400 applications were already submitted. For the coming years an annual budget of between 10-12 million Euro has been given as a potential budget figure.</p>
Duration	<p>Pilot phase: 2015 – 2016</p> <p>Phase 2: 2017 – ongoing</p> <p>approx. 400 are expected to be funded in the ongoing phase 2 which started in 2017. Budget: phase 1 (2015-2016): 2.275 million Euro,</p>

„go-digital" funding programme (Förderprogramm "go-digital")	
Budget	Phase 1: 2.275.324 Euro Phase 2: 5.000.000 Euro
No. of applicants	Phase 1: 178 Phase 2: 400 (expected)
No. of approved applicants	Phase 1: 151 with 277 funded projects Phase 2: 400 expected
Type of funding	50% public funding by BMWi
Main stakeholders	Federal Ministry for Economic Affairs and Energy (BMWi)
Stakeholder(s) from	Government
Scope 1	National
Scope 2	Digital
Main target group	Industry: SMEs only
Impact	Phase 1 results are judged as successful since evidence could be provided that with an investment of around just 8.000 Euro real impact could be achieved in terms of enabling SMEs to keep pace with digital developments in their area of business. It resulted in the implementation and operation of a second phase of the programme with a substantially higher budget. Implementation of phase 2 resulted in a few procedural and administrative changes which helped to minimize bureaucracy and keep access requirements at an absolute minimum level making it very easy for SMEs to make best use of the subsidy.
Scalability (and transferability)	Scalability is seen as a straightforward activity and therefore judged as high. As demonstrated through the move from phase 1 to 2 a linear increase of the overall budget increased the number of applicants benefiting from the programme in the same way. There seems to be an even higher demand in industry bearing the potential for even further expanding the subsidy voucher system. This will be decided on after the first year of operation of phase 2 probably in late 2018/early 2019.
Sustainability	As long as government continues this type of programme sustainability is deemed high since this is a programme with a very modest investment per applicant and at the same time helping to make a difference to the way SMEs familiarise themselves with latest digital developments and operate in the further digitalised industrial world. Similar schemes exist in other countries with similar results and achievements.
URL	https://www.bmwi.de/Redaktion/DE/Artikel/Digitale-Welt/foerderprogramm-go-digital.html

Software Campus – Leadership skills excellence programme for ICT talents	
Country	Germany
Short description & objectives	Software Campus is a unique cooperation between government, education and industry that supports young researchers in ICT. Each participant leads his or her own ICT project, which is funded by the Ministry of Education and Research. Apart from that, the candidates receive high quality

Software Campus – Leadership skills excellence programme for ICT talents

leadership training by the participating industry partners. Therefore, they collaborate with a partner company, where they are mentored by an experienced manager and contribute with their research.

Software Campus was originated from the idea to create a new generation of leaders with an advanced ICT background since the new leaders have to have both economic competences and excellent ICT skills.

A total of 21 stakeholders, consisting of universities, research institutions and companies, contribute to the multi-stakeholder partnership. Industry partners^[1] include major names such as Huawei, ZEISS, TRUMPF, Merck, Software AG and Datev. It was a major priority to include companies from different economic sectors and foster a platform for precompetitive work.

The first steps for Software Campus were taken at the German National IT Summit in 2010. Industry, universities and the Federal Government have set up Software Campus in order to promote the development potential of young talents and to help create a new generation of managers with an advanced ICT background. Software Campus is aimed at outstanding PhD and Master students of information technology from other disciplines with the relevant IT knowledge. Software Campus seeks to bring together the most successful leadership trainings provided by the industry partners involved.

The concept of Software Campus rests on five interlinked pillars:

1. Participants are given the task of realizing ICT projects of their own. They are in charge of personally managing the entire process of their IT projects with the assistance of partners from research and industry: from project planning to the application for funds to management and team coordination all the way to the conclusion of the project. Every project is funded by the German Federal Ministry of Education and Research for a maximum project term of two years, with the bestowal of grants up to €100,000.
2. Participants are given the opportunity to further develop their leadership skills, methodology expertise, social skills and personal skills within the scope of a six-module program in the Executive training programs. Software Campus' industry partners are contributing their most successful executive training methods to the programme to systematically and strategically enhance the participants' inherently existing potential.
3. All participants are personally supported by an executive of their partner from the industry within the scope of a confidential and protected relationship. This Mentoring provides the participants with insights into the everyday work life of senior IT executives. That way, they learn management skills from the industry's top decision makers, including strategy development; technology, innovation and patent management; or human resource management. In addition to the mentoring, the participants are also entrusted into the capable hands of professional experts.
4. During the internship phase of Software Campus participants get the opportunity to gain practical experience by exploring the application aspects of their research projects while obtaining valuable insights into the in-company processes of their industry partners. Moreover, they get the chance to personally build up their networks at the company by brushing up existing contacts and establishing new contacts.
5. Every participant immediately becomes part of an active network of current and future IT executives, founders of leading German IT companies and renowned experts from science and

^[1] <http://www.softwarecampus.de/partner/>

Software Campus – Leadership skills excellence programme for ICT talents

	<p>research. The alumni of Software Campus will establish a future network of their own, and they are the future holders of responsible positions.</p> <p>A first target was to include around 100 ICT PhD students from ICT-related disciplines into the programme by the end of 2012. By 2014 a total of 159 PhD students had entered the Software Campus. By 2017 260 students have entered the programme, 83 graduated already.</p> <p>The total budget amounts to €50 million, funded by the Federal Ministry of Education and Research in addition to the mostly in kind contributions of the industry partners amounting to about the same budget.</p> <p>Industry partners include major names such as DATEV eG, Scheer Holding, ZEISS, Huawei, TRUMPF, Rohde & Schwarz, Software AG, Merck and Holtzbrinck Publishing Group. Academic partners are TU Berlin, TU Darmstadt, Karlsruher Institute für Technologie, TU München, Deutsches Forschungszentrum für Künstliche Intelligenz, Fraunhofer IuK-Verbund, Ludwigs-Maximilians-Universität München, Friedrich-Alexander-Universität Erlangen-Nürnberg, Universität Stuttgart, TU-Dresden, and Universität Paderborn.</p>
Duration	2011 - Ongoing
Budget	50,000,000 Euro (with 25,000,000 Euro from the Federal Ministry of Education and Research)
No. of applicants	500
No. of approved applicants	260 (by 2017)
Type of funding	Each PhD or Master candidate and project is funded by the German Federal Ministry of Education and Research for a maximum project term of two years, with the bestowal of grants up to €100,000 for the university employing the PhD candidate.
Main stakeholders	Federal Ministry for Education and Research (BMBF); programme managed by: EIT ICT Labs Germany GmbH and DLR
Stakeholder(s) from	Large industrial companies, mostly multi-nationals Technical universities and research institutes
Scope 1	National
Scope 2	Digital leadership
Main target group	PhD candidates and Master students with computer science background
Impact	The impact on high-tech skills development for future top decision makers in industry is considered high, as the scope and focus of the Software Campus is bringing together national top players in this field and fully targeting the high-tech skills topic.
Scalability (and transferability)	<ul style="list-style-type: none"> Scalability is considered to be high. The initiative is considered to be highly scalable towards an involvement of further industrial companies including larger SMEs, the public sector and further higher and executive education and training institutions (reaching beyond the top technical

Software Campus – Leadership skills excellence programme for ICT talents

	<p>universities) and possibly not only addressed to PhD but also Master students, should this be desired by its founders and operators, to attract more actors and achieve larger coverage. Replication on a larger scale requires rather high investments should this model be replicated 1:1.</p> <ul style="list-style-type: none"> • Transferability is considered to be rather high. The model offered by the initiative is highly transferable to different contexts. The strong dependence on a cooperation model of the above actors and the necessity of rather substantial funding could make it challenging to transfer to other geographical regions. However, replication of the Software Campus in other European regions may also be feasible with less investment and funding.
Sustainability	<p>Software Campus is one of the very few leadership skills development excellence initiatives funded through a combination of private and public sources, integrating industry and higher education and training, with a strong link to practice and mentoring, gaining work experience in a company and practical problem solving through carrying out and leading a project dealing with an issue of relevance for the company.</p> <p>With the present shared funding model it can be considered to be highly sustainable.</p>
URL	http://www.softwarecampus.de/start/

IFD - Innovation Fund Denmark: Talent programme: Industrial PhD

Country	Denmark
Short description & objectives	<p>Innovation Fund Denmark exists since 2014. It invests in new knowledge and technology creating growth and employment in Denmark. In 2017, Innovation Fund Denmark invested DKK 1.25bn (approx. 170 million Euro) in new initiatives to create growth and employment in Denmark. Innovation Fund Denmark is running three overall programmes:</p> <ol style="list-style-type: none"> 1. Grand Solutions - for substantial investments and long-term projects/partnerships where the focus is on research, technology, experimental development and market development; 2. InnoBooster - for small enterprises and entrepreneurs with sound development plans and 3. Talents - for recent graduates or postgraduate researchers aiming to become entrepreneurs or to secure a research career in the private sector. <p>In the 'Talent' programme investments in talents are carried out through InnoFounder which is for entrepreneurs with a good idea and who just finished their higher education or are about to finish. 'Industrial PhD' focuses on research talents with courage in a career in business. The scheme provides work experience in a company while studying at the university.</p> <p>IFD provides grants for business PhDs or post-doc projects. An Industrial PhD funded by IFD is a three-year business-oriented research project and PhD education, conducted in collaboration between a company, an Industrial PhD candidate and a university.</p> <p>An Industrial PhD student is employed in the private sector company and enrolled at the university. The private sector company applies for funding for the project from Innovation Fund Denmark, and the student is employed by the company and receives a salary during the entire Industrial PhD project. The student shares her/his working time between the company and the university, and spends all the work time on the Industrial PhD project. The project allows the Industrial PhD to carry out a research project where results are applied in an enterprise setting. The company gets a</p>

IFD - Innovation Fund Denmark: Talent programme: Industrial PhD

	<p>candidate able to carry out a high quality research project and create results that can lead to commercial gain. At the same time, the company strengthens its relations to existing and new collaboration partners at the university. The public sector research institution strengthens its relations to the business sector, and a foundation for new research is created.</p> <p>A business postdoctoral project is made up of a collaboration activity between companies and public research institutions regarding the solution of a specific research and development tasks. An Industrial Postdoc is employed in the private sector company and collaborates with the research institution. The private sector company applies for project funding from Innovation Fund Denmark. The Industrial Postdoc is employed with a salary in the company during the project. The project gives the Industrial Postdoc a unique competency boost in her/his career development by combining research competencies with a business sector mindset and experiences. The company has the possibility of solving specific research and development tasks whilst strengthening its relations to existing and new collaboration partners at universities. The public sector research institution strengthens its relations to the business sector, and a foundation for new research is created.</p>
Duration	1970 – ongoing
Budget	21 million euro pr. year
No. of applicants	155 per year, 2160 applicants since 2002
No. of approved applicants	98 approved applications in average pr. year
Type of funding	The private sector company applies for funding for the project from Innovation Fund Denmark, and the student is employed by the company and receives a salary during the entire Industrial PhD project. The student shares her/his working time between the company and the university, and spends all the work time on the Industrial PhD project. The project allows the Industrial PhD to carry out a research project where results are applied in an enterprise setting.
Main stakeholders	Danish companies or companies with a branch in Denmark, Danish and international universities, entrepreneurs, Danish Ministry of Higher Education and Science, The Danish Business Authority (incl. the Market Development Fund), local growth houses (Væksthuse),
Stakeholder(s) from	Government, industry, universities
Scope 1	National
Scope 2	Digital leadership
Main target group	PhD candidates and companies
Impact	The programme leads to growth and employment on a macroeconomic level and on individual level it develops research talents with a commercial insight. Individuals educated at a high level and gain insight into 2 different sectors by working at a company and studying at university, creating a bigger pool of talents (medium impact). Cooperation between research institutions and private companies

IFD - Innovation Fund Denmark: Talent programme: Industrial PhD

	is seen as leading to innovation and exchange of perspectives. The impact on the individual level is estimated to be high, on society as a whole the impact is estimated as medium.
Scalability (and transferability)	<p>Scalability is considered to be medium. The programme could easily be expanded if more funding was allocated but it is not given, that there would be enough qualified applicants. But in the administrative sense, the programme can easily be scaled up. There is no up-scaling plan and no such plan foreseen. An expansion could include companies not located or having a branch in Denmark, but this is not seen as relevant for the Danish society.</p> <p>Transferability is considered to be high. The programme could easily be transferred to another country.</p>
Sustainability	The financial commitment is secured in the long term. Funding is only coming from public authorities.
URL	https://innovationsfonden.dk/en/applications?category[]=1 https://innovationsfonden.dk/en/application/erhvervsphd

Demola - Innovation Ecosystem combining the talent of students with company R&D activities and university research

Country	Finland, Sweden, Denmark, Norway, Spain, France, Lithuania, Latvia, Hungary, Portugal, Mexico, Namibia, South Africa and Japan
Short description & objectives	<p>Demola is an international organisation that facilitates co-creation projects between university students and companies, either locally or internationally.</p> <p>Demola is an alliance of various partners including universities, their faculties, researchers and students, as well as companies, local agencies and a growing number of Demola Centres around the globe which is truly international and interdisciplinary. It operates a co-creation concept that is geared to solve real challenges. Every project has an outcome – be it a new concept, a demo, or a prototype. The project results enable better further investment decisions in innovative concepts. If the partner company finds the outcome useful, the company can license or purchase the outcome, and take it for further development. The Demola process and professional facilitation ensures that the work is systematic and runs on schedule. This way, the work itself can be as creative as possible, but the process keeps things under control both in terms of time and deliverable. Demola is a framework that makes it easy for partners to come in and cooperate. Each partner has a clear role, and the work is guided by simple procedures. Contracts, intellectual property rights, licensing models, and other legal requirements are in place and meet international business standards and practices.</p> <p>Demola offers new ways and practices for collaboration between businesses, students and universities. For companies and other organisations, Demola offers an opportunity to test and co-create innovative solutions with multidisciplinary university student teams and researchers. The Demola was launched in Tampere, Finland in 2008 and has subsequently expanded to 14 countries in Europe, Latin America, Africa and Asia.</p> <p>Projects and challenges are developed jointly by companies, public sector and universities. Multidisciplinary teams are formed from students from multiple universities and participating staff from partner companies and organisations. Demola is internationally part of universities' education and research processes providing a unique opportunity to create inspiring</p>

Demola - Innovation Ecosystem combining the talent of students with company R&D activities and university research

	<p>combinations of knowledge. Numerous laboratories of Demola alliance universities are as well available to the Demola co-creation teams. A typical local Demola site carries out about 30-100 projects per year with variety of students and project partners.</p> <p>Demola's roots lay in Tampere and was initiated by major industry partners such as Nokia and local universities. Part of initial development was enabled by ERDF funding. The idea generated from a shortcoming identified by decision-makers in industry, namely the impression that more practical, multidisciplinary and co-creation oriented innovation environments are needed and that the previous ones were too inward-looking. In response, leading international innovation centres were studied and the Demola concept developed with the goal to deliver concrete results in more customer focused, down-to-earth, agile, cost-efficient and effective way, making best use of innovative methods of collaboration between talented students, companies and universities.</p> <p>Companies and other organisations operating as partners benefit from fresh ideas and approaches to challenge their current perspectives as well as from access to a pool of young talents eager to collaborate in real-life projects for developing solutions to challenges defined with the partner. University students benefit from the opportunity to add real-life work experience into the conventional path towards a career and from opportunities to establish their start-ups based on Demola project results. Demola sites are run by local partners together with global network with extensive experience in supporting innovation processes and start-up creation. In 2012, the Demola Network received the Baltic Sea Region Innovation Award.</p>
Duration	2008 – Ongoing
No. of approved applicants	10 000+
Type of funding	Service fees from the partner organisations, university education and research operations.
Main stakeholders	Demola alliance partners
Stakeholder(s) from	Industry, universities
Scope 1	International
Scope 2	Digital
Main target group	Industry, universities, students
Impact	<p>The key results of Demola highlight the engagement of more than 1000 partner companies and more than 70% of the results claimed for business use and further development. In addition, new jobs and new companies have been created.</p> <p>Demola sites have had significant impact on creating new culture of cooperation between experts from multiple knowledge areas as well as supported university business cooperation. Also several corporate partners have developed internal innovation processes based on their learnings from Demola cooperation.</p>

Demola - Innovation Ecosystem combining the talent of students with company R&D activities and university research

Scalability	<p>Scalability is considered to be high. The initiative is considered to be highly scalable towards an involvement of further industrial companies including SMEs larger corporations, the public sector and further higher and executive education and training institutions. Replication on a larger scale requires rather high investments should this model be replicated 1:1.</p> <p>The Demola project approach is highly transferrable to other industry-university settings. The key features that should be considered are the neutral location (not in the university, not in a business), the approach to ownership of results balancing industry and student perspectives and the staffing of the facility.</p>
Sustainability	<p>Demola operates on a region-wide basis and opens new opportunities via its international ecosystem and as such is highly sustainable since it can be operated on a reasonable and limited budget. The model was developed in Tampere, Finland where all three universities and City of Tampere were engaged in the project.</p> <p>The establishment of Demola as a neutral ground location, not dependent on any one partner or university, has allowed flexibility in growth and has given confidence to potential new partners when joining. Running in a cost-efficient and agile manner has allowed quick reactions to changing environments and events. Focusing on producing concrete demo results has helped to lead a change in the mind-set of innovation thinking in local environments.</p>
URL	https://www.demola.net/

École 42

Country	France (Paris), USA (Fremont, California)
Short description & objectives	<p>École 42 aspires to find and educate talents in the IT area and wants to fill the gap of IT professionals in today's France economy. École 42 wants to do this regardless of the social or school background, giving a chance to young people (from 18 to 30 years old) without any diploma who are motivated to learn more about coding and develop labour efficient skills. Selection takes place on the basis of talent and motivation, no diploma is required.</p> <p>École 42 is a private information-technology school in France and in the U.S. which was created in 2013. It is founded by Xavier Niel, Nicolas Sadirac, Florian Bucher and Kwame Yamgnane and funded by Xavier Niel, a French telecom tycoon. The training at École 42 takes approximately 3 years. The training is accessible to every young person who is interested in ICT, no matter whether he or she possesses an academic degree.</p> <p>The final selection of the candidates who want to become a student at École 42 consists of a four-week intensive computer programming course called piscine (engl.: swimming-pool). Only the most motivated candidates succeed. Through this process, 3.000 students out of 70.000 candidates are selected for the piscine. Only 900 remain as the new incoming group. The selection process takes place three times per year (July, August, and September, 1000 each time).</p> <p>The training of École 42 is based on a system of self-education, namely peer-to-peer- and project-based learning. There are no teachers at École 42 and no lectures. The program is completely free of charge and does not issue any diploma or degree. The purpose of École 42 is to provide a full three-year long computer specialist education to young people in preparation for digital jobs in the</p>

École 42	
	<p>dedicated sector, and in the other sectors as well as part of the unavoidable digital transformation. The overall goal is to increase the number of digitally-skilled employees in France.</p> <p>École 42 offers many opportunities for the professional integration of its students, i.e. enterprise-projects and internships:</p> <ul style="list-style-type: none"> • After the first year: mandatory internship, 4 to 6 months • After two years: optional internship, part-time • At the end of the formation: mandatory internship, 6 months
Duration	2013 - Ongoing
Budget	70 million euros for 10 years (2013-2023) – Paris campus
No. of applicants	70,000 (2017)
No. of approved applicants	900 (2017); since 2013, 3500 students have been enrolled, nearly 900 each year
Type of funding	The program is funded by the French billionaire and entrepreneur Xavier Niel
Main stakeholders	Xavier Niel, Nicolas Sadirac, Florian Bucher, Kwame Yamgnane
Stakeholder(s) from	--
Scope 1	(Inter)National: France and USA
Scope 2	Digital
Main target group	Young people (from 18 to 30 years old) without any diploma who are motivated to learn more about coding and develop labour efficient skills
Impact	<p>Since 2013, 3500 students have enrolled, nearly 900 each year. Today (2017), 75 students completed the full curriculum, and 600 launched their career before the end of the curriculum, due to very good job opportunities.</p> <p>École 42 receives very good feedback from companies: the expected skills are present and fit the needs of the market and 1/3 of the companies after the first internship state that the students are 100% ready to launch their career.</p>
Scalability (and transferability)	Setting up and running comparable programmes requires a substantial investment. Xavier Niel has decided to also start the programme in the US. Further plans on up-scaling are not know at present.
Sustainability	The programme funding is secured as long as Xavier Niel is willing to fund it, or decide to change the present funding model (e.g. use of another individual/company funding, royalties from partnerships, ...). One of the major influence factors of this could be the success of the École 42-graduates in the labour market.
URL	

Industrial Doctorates	
Country	Netherlands
Short description & objectives	<p>The State Secretary for Education, Culture and Science recently made a financial boost available to benefit a programme for PhD students who partly work at knowledge institutions and partly in industry: Industrial Doctorates. This call is open to researchers from all scientific domains in cooperation with companies. This can be any type of company and especially Small and Medium Enterprises (SMEs) are invited to join.</p> <p>The aim of this Industrial Doctorates call is to make intensive collaboration possible in PhD projects within both a knowledge institution and a company in every scientific area. This will strengthen or create the scientific knowledge acquired and the collaboration in a PPP and contributes to talent development in research. Additionally it provides an opportunity to apply or further develop the scientific knowledge acquired relatively quickly (parallel to or after the doctoral research) and to make optimal use of the knowledge from a company in the research. This programme is still at the pilot stage.</p>
Duration	2017 - ongoing
Budget	<p>The maximum grant from The Netherlands Organisation for Scientific Research (NWO) that can be applied for per project is 222,563 euros. This budget is primarily intended for the personnel costs (217,563 Euro) and the associated bench fee (5,000 Euro) for a PhD project for a period of maximum four years on the basis of a full time appointment at a knowledge institution recognised by NWO. In the case of non-standard appointments and associated costs (shorter, smaller, longer due to part time appointment), the amounts stated in the proposal must be calculated in proportion to a full time appointment. In the case of a part-time appointment, the maximum period to complete the doctoral research is five years. An overview of all the financing programmes that candidate can apply for is provided here: https://www.nwo.nl/onderzoek-en-resultaten/programmas/</p>
No. of applicants	<p>The main specific conditions that apply are:</p> <ul style="list-style-type: none"> • In the budget, a distinction is drawn between graduating or graduated master's students (compartment I) and employees who are already employed by the participating company (compartment II); • the proposal may not be submitted for positions that are currently vacant; • the proposal must relate to existing public-private partnerships (PPP) or create a new convincing PPP; • each main applicant may only submit one application per round; • in each project co-funding by the company is required (less in case of an SME); • each company may be awarded a maximum of one project in each compartment.
Type of funding	Government and industry
Main stakeholders	Government and NWO
Stakeholder(s) from	Industry and government
Scope 1	National

Industrial Doctorates

Scope 2	Digital
Main target group	Industry and universities
URL	http://www.stw.nl/en/content/industrial-doctorates

Make IT Work!

Country	Netherlands
Short description & objectives	<p>Make IT Work is an initiative which makes it possible for highly educated people (bachelor, master, PhD) with no specific IT background to retrain to an IT position at higher professional education level and start directly in a job. Students are selected for Make IT Work through a tool. Employers and prospective students meet during an employers' market. When the employer and the candidate have an agreement, the candidate can participate as a student in the retraining to become a Software Engineer, Security Specialist or Business & Data Analytics Specialist. In addition to programming, attention will also be paid to cooperation and communication skills. The aim of the project is to offer the course participants a good and up-to-date course in the first part, so that the course participants can start working at one of the participating companies or institutions in the second part of the retraining.</p> <p>The students follow intensive training in a full-time course of five months and then work for six months, where they go to school one evening a month for networking and learn about trends in IT. The employer pays the retraining costs and offers an employment contract of six months for 40 hours per week with a market-based salary.</p> <p>In 2015 the Amsterdam University of Applied Sciences (AUAS) started with Make IT Work for the specialisation of Software Engineer. At the beginning of April 2017, Make IT Work, in collaboration with MyBit, started the retraining to software engineer in the media sector. As of February 2018, the conversion courses Security Specialist and Business & Data Analytics will also be offered by the Amsterdam University of Applied Sciences.</p> <p>The programme was part of the region plan that has been set up in cooperation with the Economic Board of Amsterdam. Within this sector plan ten measures are taken to educate or re-train people for sectors filled with chances and opportunities. The metropole region of Amsterdam, the ministry of employment and social cases and the employers all invested in the programme.</p> <p>This project is for the re-training of educated professionals in ICT. Half of the retraining costs are paid by the Ministry of Social Affairs and Employment the other half is financed by the employer, whereby the latter amounts to 6,000 Euro per employee. In September 2017 the government defrayment stops and at this moment the AUAS runs the programme stand-alone without any financial support by the government. Employers' payment is still 6.000 Euro and students contribute 1000 euro without any other fee cost. USP of this project is that the AUAS covers all necessary steps in the program, like hunting and selection, education and connect with companies who are involved.</p>
Duration	2015 - ongoing
Budget	The total budget is unknown. Re-training costs: 7,000 Euro per employee
No. of applicants	<p>Profile of applicants:</p> <ul style="list-style-type: none"> • Diploma from a higher professional education institute or university. • Knowledge of Dutch and English

Make IT Work!

	<ul style="list-style-type: none"> • Good analytical skills. • Good communication and advising skills • Ability to work accurately • Ability to work independently as well as in a team. • Proactive attitude • Available for 40 hours a week <p>Training can only start when 10+ persons enrolled.</p>
No. of approved applicants	More than 400 students follow the program and work within the IT departments of participating companies, 97 percent still work at the company where they started at the beginning of the Make IT Work re-training. The 20 th course will start on 2 nd of September 2019.
Type of funding	There is no funding of the programme anymore (until September 2017 there was funding through the government).
Main stakeholders	Main stakeholder is the Amsterdam University of Applied Sciences and other participating Universities of Applied Sciences
Stakeholder(s) from	Universities, companies (formerly also government)
Scope 1	National
Scope 2	Digital
Main target group	Commercial Companies, students, universities
Impact	More than 400 students follow the programme
Scalability (and transferability)	Instruction of working together with other universities throughout the Netherlands with the aim to expand the programme
Sustainability	It's a sustainable business model which is expanding in The Netherlands.

Techniekpact

Country	Netherlands
Short description & objectives	<p>The Technology Pact is a joint initiative of central government, the business community, the trade unions, and the education community and the regions. The five regions of the Netherlands have their own Technology Pact. Participants are the Ministry of Economic Affairs, the Ministry of Education, Culture and Science, the Ministry of Social Affairs and Employment, the Confederation of Netherlands Industry and Employers (VNO-NCW), MKB Nederland, FME Association, Metaalunie, the top sectors, the technology industries, FNV, CNV, PO-Raad, VO-Raad, the Netherlands Association of VET Colleges, the AOC Council, the Netherlands Association of Universities of Applied Sciences, the Association of Universities in the Netherlands, 3TU.Federation, NRTU, Interstedelijk Studenten Overleg, the five regions (North, East, Southeast, Southwest Wing and Northwest Wing).</p> <p>Techniekpact aims at:</p> <ul style="list-style-type: none"> - Improving the alignment between secondary education, vocational education and higher education. - Help primary education teachers improve their skills in the area of Science & Technology education.

Techniekpact	
	<ul style="list-style-type: none"> - Strengthen public-private partnerships in support of primary and secondary education. - Make optimal use of technically-skilled staff and their talents and retain them for individual companies - and the overall technology sector by investing in sustainable employability <p>The purpose of the Techniekpact programme is to increase the number of technically educated people in the Netherlands. The first technical pact was signed in 2013, by employers, educational institutes and the government.</p> <p>However, after all the work people put into to fulfil this goal, some vacancies in the technical sector are still hard to fill. The Executing Institute for Employees Insurance published statistics which clearly showed that there would still be rather large shortage in multiple technical and ICT jobs by 2020. That is the reason why the Dutch government made the second technical pact and signed it on the 18th of April 2016 with the following guidelines and 12 goals:</p> <ol style="list-style-type: none"> 1. All the primary schools to teach the subject: Science and technology. 2. Teacher training to improve their skills in the subject science and technology. 3. Strengthen public private partnerships within education. 4. Ensure that significantly more students in secondary education aim for a more technical skills profile. 5. Improve alignment of secondary education and higher vocational and higher professional education. 6. Professionalise teachers working in secondary education. More teachers with a relevant master. 7. Educational institutes and companies to cooperate when training teachers. 8. Making the public partnerships in higher vocational education more sustainable. 9. Schools and companies to cooperate when deciding on the programmes in schools. 10. Integral cooperation of regional and sectoral networks. 11. Cooperation between higher educational institutes and companies and more attention to international technical talent. 12. Maintaining craftsman by investing in sustainability.
Duration	2013 - ongoing
Budget	<p>There is no overall budget available for implementation the Techniekpact. However, it is known that public and private institutions support the project through:</p> <ul style="list-style-type: none"> - Regional Investment Fund MBO (Regionaal investeringsfonds mbo) for sustainable public-private cooperation in vocational education. Central government, employers and the region will each contribute EUR 100 million. - Regulation Sector Plans (Regeling Sectorplannen) for tackling unemployment reduction and improvement of functioning of the labour market. - (Impuls Teachers Deficiencies (Impuls Leraren Tekortvakken) for the development of an integrated approach to train teachers in the teaching of science and technology education.) <p>Businesses in the designated top sectors will make 1,000 scholarships available annually for technology-related study programmes at the universities of applied sciences and research universities</p>

Techniepact	
No. of applicants	No figures provided by the representative at the Ministry of Economy
No. of approved applicants	No figures provided.
Type of funding	Public-private partnership
Main stakeholders	Ministry of Education, Ministry of Economic Affairs, Ministry of Social Affairs and Employment, pupils of primary and secondary school, students
Stakeholder(s) from	Industry, education and training institutions, government, trade unions, primary and secondary schools,
Scope 1	National
Scope 2	Digital, ICT and engineering
Main target group	Industry and universities
Impact	<ul style="list-style-type: none"> • 4,2 % of the primary schools offer T&S • 22% of the students studying at the level of basic vocational and sector vocational education choose a Beta profile. • 50% of the students studying at the level of higher professional education and university choose for a beta profile. • 32 % of higher vocational students choose a technical study. • 29% of higher professional students and university students choose a beta technique subject. • 3% subject focused 2nd degree teacher.
Scalability (and transferability)	<p>The results of this project appear to be highly scalable.</p> <p>The initiative has already a national scope and is coordinated by representatives from the Dutch government, employers, employees, top sectors and education. By dynamically adapting to the need of the different regions of the Netherlands, the Techniepact ensures flexibility and adaptability of its activities.</p> <p>The National Technology Pact Steering group has formulated a future expansion plan and specific targets until 2020. Among these, the initiative aims at increasing the appeal of transfers and learning to vocational and higher professional education, with focus on women.</p> <p>Further expansion of the Twente technology pact monitor to include the entire Overijssel region and – if possible – East, and alignment of the entire chain with learning pathways and routes are also key areas for attention</p> <p>The business community aims to offer work placement positions or apprenticeships to all students in technical vocational programmes. This expansion effort will help to ensure and maintain a 30 percent intake rate at technical vocational programmes.</p>

Techniekpact	
	Moreover, existing inspirational examples in the area of cross-sectoral and intersectoral mobility will be shared with other technical education and research funds.
Sustainability	<p>The activity is perceived as highly sustainable. The continuity of this initiative depends on the successful collaboration between the public and private sector. By stimulating and facilitating PPPs within the (vocational) education community, the Technology Pact ensures the sustainability of existing infrastructures.</p> <p>90 PPPs have been established since 2013. These centres can count on a stable financial support by educational institutions, the business community and government authorities.</p> <p>All the involved partners are jointly responsible for safeguarding the sustainability of these collaborations and ensuring that successful centres can independently maintain their quality standards.</p>
URL	https://www.techniekpact.nl/

Generation Spain	
Country	Spain (focus here), also, Italy, France, UK in Europe. And 8 other countries around the world.
Short description& objectives	<p>More than 1.2 million youth are unemployed in Spain; almost three times as many are underemployed. And the problem is likely to get worse, with dire consequences. Among them: economic underperformance, social unrest, and individual despair. According to Gallup research canvassing 130+ countries, more than anything else in the world—more even than family or freedom—people want a good job. That, they say, is the key to everything else.</p> <p>Yet, despite high unemployment, companies cannot find the talent required to fulfil their existing positions (i.e., 23% of companies in Spain). A McKinsey & Company 2012 survey of more than 150 education-to-employment programs in 25 countries found two critical areas of need</p> <ul style="list-style-type: none"> ▪ Scalability: Today, the majority of youth employment programs that train and place youth in jobs serve less than 1,000 people annually, with even leading programs serving less than 5,000 annually. We need a lower-cost and quality-assured model that can be replicated rapidly in different country and industry contexts. ▪ ROI for learners and employers: Few programs gather robust evidence on their results post job placement. Young people want to know the pay off in terms of personal and financial well-being. And, employers cite lack of evidence on such measures as productivity, quality, and retention, as a major reason for why they do not invest more in training. <p>Generation was founded in 2014 by McKinsey & Company, as an independent non-profit, with the specific goal of bridging these gaps. Our methodology as seven components, which tackle every obstacle in the end-to-end employment value chain.</p> <ol style="list-style-type: none"> 1. Jobs and direct engagement with employers. Generation is an employer-driven program. Before launching in any city, they work with employers to confirm job vacancies into which Generation program graduates can be placed and they work hand-in-hand in developing curricula. 2. Recruitment of candidates. Generation targets youth who are hardest-hit by unemployment. Their recruitment process is based on intrinsics, commitment, and requirements of the profession. 3. Integrated work-readiness training. Generation's short and intensive training program is anchored on repeat and intensive practice of the most important activities (what they call

	<p>'breakdown moments') of the target profession, integrating the relevant technical, behavioural, and mind-set skills in every program module every day.</p> <ol style="list-style-type: none"> 4. Social-support services. To allow Generation learners to manage their lives during the training and focus on learning, they provide social-support services where needed and mentorship from "life mentors" (professional mentors paid by Generation). Mentorship continues during the first three months after graduation, as graduates adjust to their new jobs. 5. Community. They aim to develop Generation alumni networks in which graduates can come together socially, nurturing a supportive environment. 6. Return on investment. They rigorously track Generation's short- and long-run impact with regard to the well-being of participants, return on investment for employers, and program efficacy. 7. Data. Data lies at the heart of their work. From the day that youth apply to the program, they begin tracking their data through the recruitment process through the bootcamp through placement and through job performance. They use this data to develop insights about the current effectiveness of their program, and to improve their outcomes further.
Duration	2014 - ongoing
Budget	Spain: 2.400 € per graduate for 6 week bootcamp to 3.200 € for 12 week
No. of applicants	<p>Varies by market and program, some benchmarks ratios of what we might to see in terms of application-to-seat in Spain:</p> <ul style="list-style-type: none"> ▪ ~4:1 for Java Development ▪ ~10:1 for Digital Marketing ▪ ~20:1 or higher for Excellence in Point of Sales
No. of approved applicants	<p>Globally: >27,000 enrolled to date</p> <p>Spain: ~1,800 enrolled to date</p>
Type of funding	<p>Generation is dedicated to achieving a self-sustaining model, with program operating costs covered predominantly by participating employers and governments. Private donor funding is typically targeted to catalyse the launch of new programs and/or geographies.</p> <p>Generation Spain's funding is structured as follows:</p> <ol style="list-style-type: none"> 1. Public Programs (~ 70% by volume in 2019) – Generation works with European Social Fund intermediaries, such as EOI (Escuela de Organización Industrial) and Fundación INCYDE (Chamber of Commerce Foundation), which cover up to 92% of eligible program costs. Remainder is covered by Generation or private co-funders e.g., Google.org. 2. Private Programs (~30% by volume in 2019) – Costs are funded by specific companies for which they develop tailored training programs.
Main stakeholders	<p>Employers: Committing to hire graduates and contribute financially on a per-hire basis. Ultimately changing hiring and talent development practices.</p> <p>Learners: Participate in Generation programs, share impact with us after placement, and encourage peers in a similar situation to participate.</p> <p>Governments: Providing sustainable funding through public programs. Connecting Generation to learners in need via national employment services.</p> <p>Providers: Implement programs in partnership with Generation and to the Generation methodology. Adopt Generation monitoring and evaluation approach.</p>
Stakeholder(s) from	All sectors: private, public and social

Scope 1	Global: 12 countries (Spain, Italy, UK, France, USA, Brazil, Mexico, Kenya, Pakistan, India, Hong Kong, Singapore)
Scope 2	Digital
Main target group	Unemployed youth between 18 and 29 years
Impact	<p>To date, more than 27,000 young adults have graduated from the Generation program, which prepares them for careers in 100 cities and 250 locations across twelve countries, Generation works with more than 2,800 employer partners and a wide range of implementation partners and funders. 80% of Generation graduates attain employment within 90 days of program completion. 66% are still employed at 1 year post-placement.</p> <p>Generation measures ROI for learners and employers, as well as overall cost effectiveness in the education-to-employment space:</p> <p>Learners:</p> <ul style="list-style-type: none"> Global: The majority of our graduates are in jobs that place them at or above the 50th income percentile for their national youth peers, and are registering income increases of 2-6X what they were earning prior to Generation. They have cumulatively earned over EUR 90 million to date. 55 percent of Generation graduates are female, and 42 percent have dependents. Spain snapshot: More than 1800 young people have graduated from Generation Spain since 2014. Out of them, ~950 students from digital marketing programs, >250 from web development programs and 30 from the Robotic Process Automation program. 80% of graduates have attained employment. Out of the young people employed, 52% have an indefinite contract. These results are well above the employability ratios for young people participating in Youth Guarantee training programs published by the EU for the FY 2015 (53% employed at 6 months). <p>Employers:</p> <ul style="list-style-type: none"> Global: Generation has > 2.800 employer partners across our countries. Nearly 84 percent of our employers say that Generation graduates outperform their peers; similarly, 84 percent of our employers would hire Generation graduates again. Spain snapshot: 83% of employers say that Generation graduates outperform peers. 98% of Generation Spain's >830 employer partners would hire their graduates again. <p>Cost-effectiveness: Generation has developed a measure that we call 'cost per employed day', which is akin to a total cost of ownership metric – it combines cost per student with the employment rate and the retention rate to assess our return on investment. They also examine wage level relative to cost per student, as another indicator of Generation's value.</p>
Scalability (and transferability)	The long-term plan is to move towards a self-sustaining model that is entirely funded by employers and government. They expect increased support from European Social Fund intermediaries as Generation Spain's employability results have proven to be well above other training programs and after being selected by the EU as a best practice in terms of use of ESF. Additionally, they expect a higher number of programs being financed by private companies.
Sustainability	<p>Generation is dedicated to achieving a self-sustaining model, with program operating costs covered predominantly by participating employers and governments. In 2018, Generation achieved 60% self-financing from these channels across our global portfolio. In Europe, our major sources of sustainable funding are:</p> <ul style="list-style-type: none"> Spain: European Social Funds of which >€5 million allocated to date and we hope more in future. Employer contributions are also increasing - 30% of 2019 graduates will be from private-funded programs. FR, IT, UK: Employer contributions, averaging 40-80% of total costs per graduate at point of hire
URL	www.generation.org

Contact	<p>Alexandra Hay-Plumb</p> <p>Global Director of Partnerships, Generation</p> <p>Mail: alexhp@generation.org</p> <p>Tel.: +44 7812 068 613</p>
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IT FOR SHE

Country	Poland
Short description & objectives	<p>IT for SHE is a programme which aims to increase the participation of women in the high tech industry, by helping talented female students from IT faculties to enter the labour market. There are three main actions of the programme. The first is the Women in Tech Camp where the 130 best IT female students in Poland take part in a hackathon, workshops and mentoring. The second action is the Kids in IT, where 50 volunteer female students from IT departments teach 1,000 kids in rural areas basic coding, how to use 3D printers, Arduino programming and robot building. The third element is the Mentoring Program for female IT students, which is run by representatives of technology companies in Poland. The selected women get to work with mentors for six months on their professional and personal development.</p> <p>In 2017, IT for SHE was awarded with European the Digital Skills Award 2017 in the "Women in IT" category and thereby acknowledged as the most successful programme in Europe for women in IT.</p> <p>The 3 main actions of the program IT for SHE are:</p> <ol style="list-style-type: none"> I. The largest in Europe, 5-days inspirational "Women in Tech Camp" for 130 IT girls <p>In September 130 girls from entire Poland were invited for a 5-days "Women in Tech Camp," full of inspiration, activities and networking. The participants of the camp were the best IT students from Poland. The tech camp program consisted of: 1st Day – Welcome Day – with Women in Tech Hackathon, Artificial Intelligence Workshop and integration workshops, 2nd Day – Tech skills Day – 40 tech workshops run by specialists from partner companies, 3rd Day – Role Models and Mentoring Day – presentations by 6 great women from the IT industry and a short mentoring session with 80 mentors from tech companies from all around Poland, 4th Day – Career and soft skills Day – soft skills workshops, 5th Day – Final Day – Inspiration to take away – How to solve social problems by new technologies – final session with participation from international organisations like UNICEF, Amnesty International, PAH and social activism in the area of new technologies.</p> <p>More about Women in Tech Camp agenda: http://camp.itforshe.pl/</p> <ol style="list-style-type: none"> II. 1000 Kids in IT – Volunteering Campaign encouraging young women, female IT students, to teach children from small towns and villages programming and new technologies. <p>Last summer 50 volunteers (female students from IT departments) from 19 Polish technical universities visited for 5 days primary school children from small towns and villages in Poland and to teach them programming and technology – for free. The children learned, among others: basic coding, using of 3D printers, Arduino programming and robot (LEGO) building. Key element is the fact, that kids from small communities, their parents and teachers were able to observe the young female students in the role of experts in the fields of IT and new technologies. It was a great inspiration for little girls to invent their own professional future.</p> <p>The movie about the IT for SHE Voluntary Program: https://youtu.be/3NwJslS-Sls</p>

IT FOR SHE

	<p>III. Mentoring Program for female IT students, run by representatives of the best technology companies in Poland</p> <p>Female students and graduates of faculties of all Polish technical universities and the IT departments of universities were encouraged for application to IT Mentoring Program. They had a possibility to select one of 35 great mentors – employees of partner companies (from tech and HR fields) and work with them for 6 months on their professional and personal development. During the program there was opportunity to develop skills in the field of: programming, new technologies, project management, career planning and leadership. It was a unique, individual relationship with high profile experts from the top IT companies (partners are from Cisco, Intel, Ericsson, Citi, Google, Samsung, P&G, Goldman Sachs)</p> <p>Profiles of mentors participating in the program: http://itforshe.pl/program-mentoringowy/teksty/4-mentoring</p> <p>IV. Women in Tech Summit – the greatest event for women in technologies in this part of Europe, planned for 27-28 November 2018 in Warsaw. It will gather 1000 women, those just entering the high-tech world and those already stepping up on a career ladder. The idea of the conference is to present the potential women bring into the high-tech industry, IT, science, and the start-up world, and their contribution to the creation of the efficient ecosystem of innovations. Women in Tech Summit will be the place for ambitious women who want to gain newest tech-knowledge, broaden their professional contacts and advance their career in the high-tech industry. There will be grants for young talented women from Ukraine, Belarus, Russia and Central Asia to cover their travel costs and attendance.</p> <p>Along with the conference and networking meetings, there will be a Career Fair, where high-tech companies will present their job offers and universities their postgraduate and specialist courses.</p>
Duration	ongoing
Budget	EUR 100,000
No. of applicants	600
No. of approved applicants	300
Type of funding	Private – high tech industry
Main stakeholders	<p>Perspektywy Education Foundation:</p> <p>http://www.perspektywy.org</p> <p>http://www.perspektywy.org/index.php?option=com_content&task=view&id=38&Itemid=34</p>
Stakeholder(s) from	Industry, non-profit organisation
Scope 1	National
Scope 2	Digital

IT FOR SHE	
Main target group	Female computer science students and professionals, kids from small cities – both genders
Impact	<p>This year (2017) 130 students participated in the Women in Tech Camp; they expanded their knowledge and skills and became volunteers. This way a network for women in IT was created – women who support the IT for SHE project and are its ambassadors in the media. During classes for children we could present women as IT experts. This is a very important aspect, as in many places the stereotypes that women are no good in technology are still active. The beneficiaries of our program also include children from small towns – thanks to modern teaching aids they learned a lot about new technologies. They still keep in touch with the volunteers and eagerly wait for future meetings. The schools gained new approaches to teaching computer science.</p> <p>We are also planning for the program to result in the special initiative – Women in Tech Summit 2018</p>
Scalability (and transferability)	<p>The scalability of the project is strong – especially the “volunteering” part. It will be enough to encourage not 50 but e.g. 250 IT students to participate and we will be able to inspire not 1000 children from small towns and underprivileged families (like we did last year), but 10,000!</p> <p>There is a potential for scalability also in the project’s partnership structure, allowing create its mutations in further regions. We have received a proposal to create something similar in Germany, basing it on the willingness to cooperate in the joint pool of high-tech industry partners.</p>
Sustainability	The project is supported by partnership with high-tech industry representatives and by the Perspektywy Education Foundation – a non-profit organisation, along with volunteer activity. No public institutions are involved in it.
URL	http://www.itforshe.pl/

E-DIG	
Country	Sweden
Short description& objectives	<p>E-DIG is a web-based learning platform for digitalisation in development, operation and change of production with combined education opportunities addressed to industry to strengthen digitalisation skills in Swedish industry. Some of the challenges the project addresses and seeks to manage through a digital knowledge platform are:</p> <ul style="list-style-type: none"> - Understanding the possibilities and challenges of digitization - Common goal image and consensus for digitization - Flexible forms of learning, training and learning - Mental barriers for the introduction of digital tools - New skills needs - Interest in technology in the education system - Future skills supply in industry. <p>The project is part of Vinnovas programme Den smarta digitala fabriken, which aims to promote the digitalisation of Swedish industry.</p>

E-DIG	
Duration	2016-2018
Budget	Around 404.000 Euro from Vinnova (4 million SEK)
No. of applicants	The training platform it is open for anyone.
No. of approved applicants	The training platform it is open for anyone and as many as possible.
Type of funding	Government funded
Main stakeholders	Swerea IVF together with ABB, CGM, Chalmers tekniska högskola, Good Solutions Sweden, Göteborgs Tekniska College, Prevas, SKF, Swedish Match, Volvo Lastvagnar, Volvo Personvagnar and XMReality
Stakeholder(s) from	Industry, Education and training providers
Scope 1	National
Scope 2	Digital
Main target group	Professionals in industry (operators, maintenance technicians, manufacturing technicians, education actors)
Impact	They cannot see any impact yet, the web page have just been realised to public
Scalability (and transferability)	The intention is to add more material and also add some type of tests and maybe forums. The intention is that the web page should be used by companies and in education on high school to university level. They hope to be able to translate the web page into English in the future.
Sustainability	Provided that the courses are updated and in line with the needs in industry, sustainability is considered to be high.
URL	https://www.swerea.se/edig www.edig.nu

7.6.2 AT best practice candidate programmes

Imec.academy	
Country	Belgium
Short description& objectives	IMEC INTERNATIONAL is a world-leading high-tech research centre driving the digital economy combining longstanding leadership in microchip technology with in-depth expertise in software and ICT. It performs world-leading research in nanoelectronics and delivers industry-relevant technology solutions. Imec is headquartered in Leuven, Belgium, and has offices in Belgium, the Netherlands, Taiwan, USA, China, India and Japan. The staff of about 2,500 people includes almost 800 industrial residents and guest researchers. Imec has been a global leader in the domain of nanoelectronics for more than 30 years, and has innovated applications in smart systems for the Internet of Things (IoT), Internet of Health, and Internet of Power. It has built an extensive and worldwide partner network,

Imec.academy	
	<p>as well as in Flanders, and has generated successful spin-offs. Imec created the Imec.academy, imec's learning institute, which offers specialized courses on nanoelectronics and digital technology and engages in research on educational technology. Its technical training programs combine world-class expertise with hands-on applications for the local and international industry, academia and the imec employees. With its smart education research, imec strives to increase learning effectiveness by using smart technologies. Imec.academy has 20 courses on open offer per year. The offer is continuously growing, especially due to online offerings. All the courses are IP-free and contain knowledge that is a direct outcome of Imec's R&D and application domains.</p> <p>The main objectives of imec.academy are:</p> <ol style="list-style-type: none"> 1. Enable imec in establishing a learning ecosystem to increase employees' abilities and achieve goals. How? By providing a qualitative learning offering, supported by smart technologies. 2. Enrich industries and academia to explore the impact of disruptive technologies on core activities by being a top-level education partner, sharing key R&D expertise, insights and findings. 3. Inspire emerging markets to explore & experience the benefits of having imec as a future R&D partner by sharing key insights through a variety of knowledge sharing activities. 4. Identify and explore smart learning technologies that can disrupt the current landscape by being a key research and business partner for smart education projects.
Duration	1984 - ongoing
Budget	Imec.academy creates >1 million Euro revenues/year (including customised programmes abroad).
No. of applicants	See below
No. of approved applicants	The around 20 courses are attended by more than >500 participants/year.
Type of funding	<p>Government and external revenues.</p> <p>Funding institutions (imec as a whole): Industry (70%), Flemish government (10-15%), European projects (rest).</p> <p>Imec.academy receives its funding mostly by generating revenue with its open offer, offering customized courses for external customers and by supporting and participating in EC programmes. This includes the EUROPRACTICE IC Service funded through the H2020 program which brings ASIC design and manufacturing capability within the technical and financial reach of any European company and academia. The EUROPRACTICE IC Service, offered by IMEC and Fraunhofer, offers low-cost ASIC prototyping and ASIC small volume production ramp-up to high volume production through Multi Project Wafer - MPW - and dedicated wafer runs. In addition training of engineers and researchers on IC design and relevant process technologies is an essential part of the EUROPRACTICE programme.</p>
Main stakeholders	Imec.academy, Flemish government, industry partners
Stakeholder(s) from	Government, industry, universities

Imec.academy	
Scope 1	Global
Scope 2	KETs and digital
Main target group	Students, professionals, industry
Impact	The impact is both towards the imec staff by providing a learning and development offer that creates the skills set to perform world-class R&D, customer intimacy and operational excellence in everything that imec does. imec.academy also helps to increase the branding of imec in its eco system by sharing first-hand IP free R&D results and helping its partners in educating their employees.
Scalability (and transferability)	The replicability of the imec.academy is questioned since it would require a very substantial upfront investment and the willingness of partners to share their knowledge which is doubted.
Sustainability	Imec.academy is building a new business model that helps to secure a base revenue beyond the open offer by using and offering more online and blended types of learning. Also a search for new markets for the customized programs helps to secure a continuous grow of the revenue.
URL	https://www.imec-int.com/en/academy

Automotive Centre of Expertise	
Country	Netherlands
Short description& objectives	<p>The Automotive centre of expertise is a knowledge centre focused on automotive innovation. It has been set up as cooperation between Fontys University of Applied Sciences, University of Applied Sciences Arnhem and Nijmegen and University of Applied Sciences Rotterdam. It was set up in 2011 with these objectives in mind:</p> <ol style="list-style-type: none"> 1. Increasing the amount of students choosing an automotive higher professional education programme. 2. Increasing the amount of people that have an automotive background that find jobs in the automotive companies. 3. Increasing the quality of education and focusing more question based education. 4. Strengthening practice based research within higher professional education. <p>Automotive centre of expertise is part of a bigger programme, and in the Netherlands you can find multiple centres of expertise focusing on different subjects. These centres of expertise fall under the educational institutes and get their funding via the government. These centres are meant to give the educational institutes a focus on their research.</p> <p>They are present in both higher vocational education and higher professional education. The vocational education centres have a strong connection to the employment market. These centres for innovative craftsmanship for vocational education and centres of expertise for higher professional education should grow into internationally well-known centres where only the best students study.</p>

Automotive Centre of Expertise	
	The Dutch government, specifically the ministries of education, culture and research and economics, will in the forthcoming years provide 28 million Euro for these centres.
	2011 - ongoing
Budget	<p>For the centres of expertise programme there has been 28 million Euro provided by the government. Co-funded by the Ministry of Education and the Netherlands Enterprise Agency. The latter provides funding in terms of subsidies for every R&D-intensive project of ACE. Additional funding comes from the (low) tuition fees and business partners. The public finance will last for 2 more years and is at approx. 1 million Euro/year.</p> <p>The overall annual budget is 3 million Euro.</p>
No. of applicants	Universities themselves choose the top students that later participate in the programme; the initiative itself does not have such information.
No. of approved applicants	1200
Type of funding	Public-private partnership
Main stakeholders	Government and industry, MBO/HBO students, research
Stakeholder(s) from	Industry and government
Scope 1	National
Scope 2	Automotive
Main target group	Industry and universities
Impact	<p>Recently, a letter was written by the secretary of the minister of economics which contained a very short mid-term review. It was stated that the Higher professional education institutes and the universities do their best to implement the programme. To conduct this mid-term review a review commission was set up. They based this information on the yearly reports from different institutes and the extra information the institutes gave about their progress. Also conversations were held with the different institutes.</p> <p>All the institutes have succeeded in focusing more on their point of interest. This means that all the institutes are allowed to keep the contribution they received from the selective budget.</p>
Scalability (and transferability)	Scalability is considered as high. They intend to become the Automotive Centre of Expertise for Benelux, not merely NL. The current CEO intends to maintain the initiative focused only in the automotive sector. It is easily transferrable in other countries due to the relatively simple business model.
Sustainability	Sustainability is perceived as high. It started in 2011 and now is fully operational with plans for extension. The Ministry of Education and the Netherlands Enterprise Agency have had a long-term vision in supporting the programme. Multiple streams of funding make it easily sustainable.

Automotive Centre of Expertise

URL

<https://www.rijksoverheid.nl/actueel/nieuws/2010/07/15/rijk-investeert-28-miljoen-in-kenniseconomie>

<https://www.acemobility.nl/>

<https://www.zuyd.nl/onderzoek/centres-of-expertise>

<https://fontys.nl/Innovatie-en-o>

JOBSTARTER - Digital manufacturing processes - Additional qualification for the future career in INDUSTRY 4.0! (Digitale Fertigungsprozesse - Zusatzqualifikation für die berufliche Zukunft in INDUSTRIE 4.0!)

Country

Germany

Short description & objectives

With the project "Additional Qualification 'Digital Manufacturing Processes'", the Young Talent Foundation for Mechanical Engineering responds to the changes in the mechanical and plant engineering industry with regard to Industry 4.0 and the associated challenges and opportunities in the design of a future-oriented education. Apprentices are prepared for a fully digitized workplace during their training.

The target group for the additional qualification 'Digital Manufacturing Processes' are ambitious trainees in the industrial and technical professions of mechanical and plant engineering. To start the additional qualification, the trainees should be in the 2nd or 3rd year of training. The additional qualification not only benefits the participants themselves, but also aims to make dual training in mechanical engineering more attractive for young people in the long term and at the same time to secure the demand for skilled workers in small and medium-sized companies. In particular, these companies are often for economic reasons unable to adequately respond to industrial developments with an adaptation qualification for their employees, employees and trainees.

The qualification comprises 200 teaching units and will be implemented within 15 months of training. Within these 15 months, 7 modules will be completed by the apprentices. Each of them will be completed with a learning success examination:

- M1: service and maintenance processes
- M2: Automation technology
- M3: Fundamentals of Data Protection and Data Security
- M4: design and manufacture with CAD / CAM systems
- M5: designing CNC manufacturing processes
- M6: additive manufacturing processes
- M7: Economic Contexts of Industry 4.0

Upon successful completion and passing of the exam, the participants will receive an IHK (chamber of commerce) certificate and a certificate from the Young Talent Foundation for Mechanical Engineering "Additional qualification - Digital production processes" in addition to their professional qualification. The high quality of the additional qualification and the special commitment of the

JOBSTARTER - Digital manufacturing processes - Additional qualification for the future career in INDUSTRY 4.0! (Digitale Fertigungsprozesse - Zusatzqualifikation für die berufliche Zukunft in INDUSTRIE 4.0!)

	<p>participants are thus adequately and verifiably documented and recommended for corresponding positions in the company.</p> <p>The qualification takes place at the Carl Miele vocational college in Gütersloh and at the Berufskolleg Kreis Höxter in Brakel.</p> <p>With currently 34 participants in the first round (Dec 2016 - Feb 2018), the original target of 25 trainees was clearly exceeded and proves the high demand for well-trained and future-oriented skilled workers. The second run will start in March 2018 and the young talent foundation Mechanical Engineering expects a similar high response.</p>
Duration	2016 – 2019
Budget	499.000,-€
No. of applicants	34
No. of approved applicants	1st round: 34 apprentices; 2nd round: 43 (as of 28 th February 2018)
Type of funding	The Federal Ministry of Education and Research (BMBF) is funding the second funding round of the "JOBSTARTER plus - Training for the Future" program from federal funds and funds from the European Social Fund (ESF). The promotion of the JOBSTARTER plus program from the ESF is based on Regulation (EU) No 1304/2013 of the European Parliament and of the Council of 17 December 2013 (ESF Regulation) and Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013 (General Structural Funds Regulation).
Main stakeholders	<p>Federal Ministry of Education and Research (BMBF)</p> <p>Federal Institute for Vocational Education and Training (BIBB)</p> <p>Young talent foundation Maschinenbau in Ostwestfalen / Young Talent Foundation for Mechanical Engineering</p>
Stakeholder(s) from	Industry, VET training providers
Scope 1	National
Scope 2	Advanced Manufacturing Technologies
Main target group	Apprentices, VET students
Impact	For the participants, there are no costs for the additional qualification. The additional qualification gives young people the opportunity to develop the processes of a smart factory along the value chain and to acquire unique expertise for future changes in the sense of Industry 4.0. And this already during your training. Thus, they already set themselves apart from the competition during their training for their professional career, which is a great advantage for all participants.

JOBSTARTER - Digital manufacturing processes - Additional qualification for the future career in INDUSTRY 4.0! (Digitale Fertigungsprozesse - Zusatzqualifikation für die berufliche Zukunft in INDUSTRIE 4.0!)

	<p>As a lot of digitalization will change in the future, these young people will find a way that will help them, their business and the economy in the future to deal with these changes.</p> <p>Experience of a first-time apprentice: An apprentice of an SME was already integrated by his training company into a digitalization group before completing his training and the additional qualification. After graduation, the trainee takes over project responsibility in the field of digitization.</p> <p>There will be changes in the field of digitization, and apprentices will start learning and learning about these changes directly during their training. Many companies need professionals and well-trained skilled workers. Thus, the individual participants have a competitive advantage over other trainees.</p> <p>The additional qualification not only benefits the participants themselves, but also aims to make dual training in mechanical engineering more attractive for young people in the long term and at the same time to secure the demand for skilled workers in small and medium-sized companies. In particular, these companies are often for economic reasons unable to adequately respond to industrial developments with an adaptation qualification for their employees, employees and trainees.</p> <p>In addition, the company is more attractive in the external presentation, because they offer their potential trainees this option of additional qualification.</p> <p>The target regions Gütersloh / Beckum and Brakel are characterized by a strong medium-sized economy. Over 70% are small and medium-sized companies. The goal is logical to make dual training more attractive. This can be achieved with the additional qualification 'Digital Manufacturing Processes', as it gives trainees better career opportunities. The additional qualification increases the knowledge and competences of the trainees on the one hand, which brings greater satisfaction with the work situation and strengthens the motivation. On the other hand, companies are increasing their attractiveness for future applicants for apprenticeships in this field. The additional qualification thus represents a competitive advantage in the competition for the High Potentials. In addition, through the transfer of knowledge, the companies additionally receive qualified specialists in the field of digital production processes.</p>
Scalability (and transferability)	<p>Due to the high level of networking and the degree of familiarity of the young talent foundation mechanical engineering in industry, a transfer to other target regions is possible. The project managers work closely with the industrial and social partners from the outset to achieve a wide dissemination of the results. The transferability into further training companies is ensured by the practical relevance and connection of the association to its members and their customers. A transfer to neighbouring training occupations such as cutting machine operator already took place in the course of the project. Workers 'and employers' organizations of the metal industry are involved in the transfer.</p> <p>Due to the high demand, a transfer to other occupational groups took place during the first phase of the project. In addition to the actually intended occupational field of the industrial mechanic, other occupational groups have been added. For the second round, all technical and industrial apprentices can take part in the additional qualification in the second and third year of apprenticeship.</p> <p>Since autumn 2017, the Young Engineers' Foundation for Mechanical Engineering and the Ministry of Economic Affairs and Education have been working hard to establish this additional qualification as a pilot model in other regions in North Rhine-Westphalia. In mid-2018, 30 vocational colleges (5-6</p>

JOBSTARTER - Digital manufacturing processes - Additional qualification for the future career in INDUSTRY 4.0! (Digitale Fertigungsprozesse - Zusatzqualifikation für die berufliche Zukunft in INDUSTRIE 4.0!)

	vocational colleges in each district) in the Federal State of North-Rhine Westphalia (with a population of 16 million citizens) are to train teachers and trainers from the region to implement the additional qualification in their vocational colleges as of mid-2019.
Sustainability	<p>At present there is no such type of additional qualification of this kind available for trainees. However, training in digitization in the future will be necessary for all companies. The participating companies use the additional qualification to bring in future digitization experts. In the future, these professionals will be able to support digitization in the company as a point of contact and in training new colleagues.</p> <p>Further regions have been and will be informed and acquired during the entire project period. At trade fairs or industry events, the project is reported about and advice is given. Together with the IHK (chambers of commerce) Bielefeld and Münster a certificate for the additional qualification was adopted. The alternative would have been to change in the overall training framework, but this would have taken many years, and the pace of rapid innovation in digitization could not have been addressed in a timely fashion.</p> <p>This is a fully funded project and during the project period any type of marketing is not considered.</p>
URL	https://www.jobstarter.de/de/zusatzqualifikationen-49.php

Alliance Industrie du Futur

Country	France (Paris)
Short description & objectives	<p>On July 20, 2015, the Alliance Industrie du Futur was officially created. Its role is to support French companies and especially SMEs in the modernization of their industrial processes and the transformation of their economic model by new, digital and non-digital technologies. It has two exceptional measures to support companies that will invest in the modernization of their production capacities:</p> <ul style="list-style-type: none"> • € 2.5 billion in tax benefits for companies investing in their production capacities and; • € 2.1 billion of additional development loans distributed by Bpifrance to SMEs and mid-cap companies. <p>The alliance created several working groups. The objective of the working group GT 03: 'Man and Industry of the Future' of the Alliance Industrie du Futur is about the impact of the digitisation of the value chain on the organisation of work and the implications on the provision of initial and continuous training. The Future Industry Alliance brings together public and private actors. It was founded by 11 founding members. It now has 34 active or associate members in 4 colleges: academic organizations, technological research organizations, professional organizations and corporate finance organizations.</p>
Duration	2017 - Ongoing
Budget	In total, several billion Euros massive investment programme; of this 150 million investment will be in vocational training for coming years
No. of applicants	e.g. 4000 companies went through the digital check

Alliance Industrie du Futur

No. of approved applicants	
Type of funding	Different measures, including tax benefits and loans
Main stakeholders	Industry
Stakeholder(s) from	Industry
Scope 1	National: France
Scope 2	Digital
Main target group	Industry
Impact	To be seen
Scalability (and transferability)	To be seen
Sustainability	
URL	http://www.industrie-dufutur.org/ ; http://www.industrie-dufutur.org/aif/

Industrial PhD 2017

Country	Sweden
Short description & objectives	<p>The Industrial PhD 2017 programme offers grants funding an industry doctoral or licentiate student's research, in collaboration between industry and academia. The grant runs for two to five years and shall result in a doctorate (Ph.D.) or licentiate exam. SSF expects to fund 12-24 projects each with between SEK 1.25 and SEK 2.5 million each (including indirect costs) in this call for proposals. The student shall work at least 80% of their working time at the company for the entire period of the grant. Two persons shall serve as supervisors for the doctoral or licentiate student during the period of the grant – one at the higher education institution (HEI) and one at the company. The overall budget of the programme is around 3 million euros (SEK 30 million) which would result in an average grant of around 125.00 Euro. There are three different types of grants:</p> <ol style="list-style-type: none"> 1. Industrial PhD 4-5 years – 2,5 million SEK 2. The person has a licentiate degree and will obtain a PhD after two years – 1,25 million SEK 3. Licentiate degree in two years – 1,25 million SEK
Duration	2017 - 2022
Budget	Around 3 million euros (30 million SEK)
No. of applicants	Approx. 60 (call 2018 is open now)
No. of approved applicants	Between 12-24 can be approved/call. 48 approved PhD-projects is running now (from 2014-2017)

Industrial PhD 2017

Type of funding	Grant from SSF to HEI. This grant cover approx. 50% of total PhD budget.
Main stakeholders	Stiftelsen för Strategisk Forskning (Swedish Foundation for Strategic Research, SSF)
Stakeholder(s) from	Non-profit organisation
Scope 1	National
Scope 2	KETs, Digital
Main target group	Universities, students
Impact	The purpose of the programmes is to contribute to needs driven excellent research within SSF's areas of activity and to foster cross-fertilization between academia and industry. This can also lead to greater knowledge of the different conditions under which people work in academia and industry. Examples of KPIs are patent, technology transfer, new co-operation HEI and industry, co-publications industry-academia.
Scalability (and transferability)	The programme is sustainable. The board of the SSF decides on the budget annually.
Sustainability	SSF board decides annually on budget and Calls for Proposals (Call text). The program started 2014 and has annual calls. SSF have a contract with the HEI which regulate the conditions of the grant. HEI and the company have a separate contract regulating IP, economic conditions and other issues.
URL	https://strategiska.se/utlysningar/utlysningar-under-beredning/industrial-phd-2017/

Science Industry Partnership (SIP)

Country	UK
Short description& objectives	<p>The Science Industry Partnership (SIP) is one of the eight industrial partnerships in the UK bringing together employers across an industry sector to lead the development of skills, with a focus on growth and competitiveness. It is chaired by GlaxoSmithKline aims to design the vocational training and skills programmes needed by the life sciences and industrial science sectors. It supports Government strategies for Life and Industrial Sciences. To build a globally competitive science-based industry in the UK the sector needs a supply of young people with capability, drive and ambition. In addition the partnership will support the development of the existing workforce to acquire the skills needed to adopt new technologies and innovate new products and services. The SIP is running six employer designed and driven pilot skills programmes. The Industry Degree Scheme and SMART Apprenticeships are just two examples of the innovative skills programmes led by the partnership; both providing practical experience within businesses that play an active role in shaping the learning to meet business and learner needs.</p> <p>The SIP also aims to create a Skills Strategy for the sector; aligning to the Government strategies; running an Employer Board and a number of sub groups working with stakeholders and partners to design and deliver skills solutions, creating an accredited network of training providers including centres of excellence, and developing an employer owned system for accrediting new qualifications and assessment.</p>

Science Industry Partnership (SIP)

SIP is the lead strategic employer member forum for science industry skills. Its main goal is to meet the sector demand for a skills workforce at every level, utilizing the home skills market. Its Operational Plan includes the following targets:

- Apprenticeships: ambition is for 20,000 apprentices in the next 5 years
- Influence on a new system for Apprenticeship Levy to support members
- Project Funding: new opportunities, so far raised £348k in operational phase
- Careers: build an active network of SIP Careers Ambassadors
- Innovation in Skills: build a responsive online platform to ensure innovation in skills
- Skills Strategy, Workforce Development and Higher Education etc.

Since 2015, the SIP has supported or delivered:

- 7,500 new Apprenticeship starts in the science sector
- £765,000 of skills investment through funded projects
- 376 new SIP Ambassadors for industry
- 170 new science industry placements and a national network of skills partners investing in skills
- 6 new Apprenticeship Standards ranging from Level 2- Level 6
- With a further 7 Standards in development including Level 5- Level 8
- 3 best practice brochures published for employers, apprentices and students
- A range of policy and position papers on skills issues submitted to Government including the Sector Deals for Life Sciences and Industrial Sciences.

By 2020, the SIP's ambition is to see:

- 20,000 Apprentices into the science sector
- £3m of new investment on skills programmes into the sector
- 1000 new SIP Ambassadors for industry
- 300 new science industry placements
- A national network of skills partners investing in skills
- A suite of Apprenticeship Standards for occupations required by Industry
- An annual SIP Survey on apprenticeships (incl. data on levy raised and spent) published October 2018.
- Occupational map regularly updated and work to develop and publicise a plan for new standards completed.

Duration 2015 – ongoing

Budget The UK government - with matching funds from industry - spent 52 million GBP (<https://www.gov.uk/government/news/52-million-boost-for-skills-and-training-in-uk-science-sectors>) for getting the partnership and membership organisation set up and operational which was preceded by an 18 months phase of needs and requirements analysis. SIP managed to keep momentum, despite the fact that all government money came to an end.

Science Industry Partnership (SIP)	
No. of applicants	
No. of approved applicants	
Type of funding	The UK tax system with its apprenticeship levy has been very supportive since it allows companies offering apprenticeships to claim back their contribution. It came into effect in April 2017 after the UK government's promise of 3 million new apprentices by 2020. The levy applies to employers in England, who have an annual pay bill above £3m. The levy is 0.5 per cent of the annual pay bill. All employers will receive a £15,000 annual allowance, to be offset against the bill. This effectively means that employers with an annual pay bill of £3m or less pay no levy. From May 2017 employers not paying the levy, who offer apprenticeships to 16 to 18 year olds, receive 100 per cent of the cost of the training from the Government, up to the maximum funding bands. Employers will have to pay 10 per cent of the cost of the apprenticeship training for those aged 19 and over and the Government will pay the remaining 90 per cent, up to the maximum funding bands. This support applies to all age groups. For non-levy businesses with less than 50 employees there is also a new £1000 incentive towards apprenticeships for taking on someone aged 16 to 18.
Main stakeholders	Government, industry, SIP chaired by GlaxoSmithKline
Stakeholder(s) from	Government and industry
Scope 1	National
Scope 2	Digital, KETs
Main target group	Industry, professionals, apprentices
Impact	<p>Since 2015, the SIP has supported or delivered:</p> <ul style="list-style-type: none"> - 7,500 new Apprenticeship starts in the science sector - £765,000 of skills investment through funded projects - 376 new SIP Ambassadors for industry - 170 new science industry placements and a national network of skills partners investing in skills - 6 new Apprenticeship Standards ranging from Level 2- Level 6 - With a further 7 Standards in development including Level 5- Level 8 - 3 best practice brochures published for employers, apprentices and students - A range of policy and position papers on skills issues submitted to Government including the Sector Deals for Life Sciences and Industrial Sciences.
URL	https://www.gov.uk/guidance/industrial-partnerships-an-overview#science http://www.scienceindustrypartnership.com/

NanoTecLearn - E-learning for education and training in micro-nano-integration (project within the technical programme 'Digital Media in Vocational Training')

Country	Germany
Short description & objectives	<p>The aim of the NanoTecLearn project was to develop a knowledge platform for technicians, masters, students as well as experts and engineers with or without a didactic background as teachers, which enables a targeted and efficient knowledge update in the field of micro-nano-integration. NanoTecLearn has set itself the goal of developing an e-learning offer for these needs and putting it to practical use in selected companies. The aim was to design it so that it can be adapted to the requirements of the different target groups of learners and teachers. In addition, it had to be developed in a way to ensure that new findings from research can be integrated quickly and easily into the learning content.</p> <p>The platform is hosted at</p> <ul style="list-style-type: none"> the computer centre of Technische Universität Ilmenau and operated at the Centre of Micro- and Nanotechnologie for students of microelectronics, micro- nanotechnology, physics, chemistry and chemistry Regionales Berufsbildungszentrum des Kreises Steinburg and operated for the training and further education of Microtechnologists for semiconductor and microsystems technology, advanced training (Bachelor level), employees from the semiconductor and microsystems technology sector, lecturers and academic councils. <p>The platform will be installed at the Ruhr-Universität Bochum (RUB) and operated for students of microelectronics, micro- nanotechnology, physics, chemistry and chemistry and electrical engineering (thin film electronics & 2D electronics).</p>
Duration	2014-2017
Budget	783,307 Euro
No. of applicants	<p>N/A</p> <p>At present, a total of about 300 people in training and further education as well as several hundred students at the Technical University of Ilmenau use NanoTecLearn. In the future the Ruhr-Universität Bochum (RUB) as well the ZGH: Center for Interface-Dominated High Performance Materials wants to use the platform for teaching.</p>
No. of approved applicants	N/A
Type of funding	100% public funding
Main stakeholders	<p>Technische Universität Ilmenau - Zentrum für Mikro- und Nanotechnologien</p> <p>Elektronische Mess- und Gerätetechnik Thüringen (ELMUG) eG,</p> <p>Fachbereich Mikrotechnologie RBZ des Kreises Steinburg ,</p> <p>Micro-Hybrid Electronic GmbH,</p> <p>MNT Mikro-Nanotechnologie Thüringen e. V.,</p> <p>Siegert Thinfilm Technology GmbH,</p>

NanoTecLearn - E-learning for education and training in micro-nano-integration (project within the technical programme 'Digital Media in Vocational Training')

	TETRA GmbH
Stakeholder(s) from	Research, industry
Scope 1	National
Scope 2	Micro and nano electronics
Main target group	Industry, training providers
Impact	<p>NanoTecLearn made the invisible of nanotechnology visible. Simulation of microscopes, microscope images, interactive formulas and learning texts arouse the interest in this field and lead to the following results:</p> <ul style="list-style-type: none"> • Trainees and students deepen their knowledge in this field and choose a corresponding occupation. • Career changers – a large fraction of employees in this field - quickly familiarize themselves with the job • Employees in a company receive further training. <p>The tangible advantage for the participants is that they can acquire micro- and nanotechnological skills even without access to the cleanroom and expensive equipment.</p> <p>For the semiconductor and microsystems technology sector, the competence of the employees prevents mistakes and the processes run more stable and reproducible.</p> <p>The acquired competence improves the career advancement of the employees and fosters innovation power of start-up companies as well as established small and medium-sized enterprises.</p> <p>All in all, this will strengthen the semiconductor and microsystems technology sector and the large companies they supply.</p> <p>At present, a total of about 300 people in training and further education as well as several hundred students at the Technical University of Ilmenau use NanoTecLearn. In the future the Ruhr-Universität Bochum (RUB) as well the ZGH: Center for Interface-Dominated High Performance Materials wants to use the platform for teaching.</p>
Scalability (and transferability)	<p>Scalability of the content</p> <p>The structure of the content, i.e. the map of knowledge reflects interfaces as a key issue. These can easily be supplemented with new topics such as high performance materials, laser annealing, monomolecular layers and adhesion promoter.</p> <p>Scalability of the didactic concept</p> <p>Teachers can integrate the modular content flexibly into their own didactic concepts, with their own texts, images and formulas. Learners can choose learning units of different sizes, the smallest being MicroLearning for on-the-go use on the smartphone, which only takes 10 minutes. Three-dimensional image can be experienced with google cards on the smartphone.</p> <p>Scalability of the technical concept</p>

NanoTecLearn - E-learning for education and training in micro-nano-integration (project within the technical programme 'Digital Media in Vocational Training')

	<p>The software architecture provides the following features:</p> <ul style="list-style-type: none"> • NanoTecLearn can be run on common/common server platforms; so-called LAMP servers (Linux, Apache, MySQL, PHP) • as a web application platform-independent • use of standard software/technologies (HTML5, JavaScript, WebGL,...) • builds on free software; license costs do not represent a barrier • the platform itself is available as open source software and can therefore be adapted and further developed. • platform can be operated both on the Internet (public) and in a company network (intranet) • decoupled content libraries; allow separation into public base library and company-confidential library with appropriate secrecy • editors for creating microscope images exist for additional content (booklets, samples) • Guides for creating and maintaining sample sets and stereo recordings are available. • a style guide is available to ensure the consistent design of further content.
Sustainability	<p>The open source concept gives every user the opportunity to develop his own business model:</p> <ul style="list-style-type: none"> • Public educational institutions such as Technische Universität Ilmenau, Ruhr-Universität Bochum (RUB) and Regionales Berufsbildungszentrum des Kreises Steinburg use it for their own training. • Further training providers, such as the Regionales Berufsbildungszentrum des Kreises Steinburg, can carry out further training for companies with the platform for a fee. • Companies can manage their in-house knowledge and use it for their in-house training. <p>Moreover, commercialisation was not the object of the Federal Ministry of Education and Research project.</p>
URL	https://www.tu-ilmenau.de/nanoteclearn/projekt/

7.7 Online survey questionnaires

High-Tech Skills for Europe

Scaling up Best Practices and Re-focusing Funding Programmes and Incentive

Service Contract

No. EASME/COSME/2016/033

Survey questionnaire

QUESTIONS

GENERAL DEMAND

DEMAND for high-tech skills

- 1) Do you agree or disagree that in your country there are difficulties for employers to find employees with relevant high-tech skills?

Response options:

- Strongly agree
- Agree
- Disagree
- Strongly disagree

FUNDING MEASURES

- 2) In addition to formal education, public authorities may support various measures to enhance high-tech skills of the workforce and / or to increase the supply of high tech talent. Which measures are most efficient and cost effective?

Please choose (drag and drop), and rank the following funding measures.

1 means most effective.

- Funding for industry in building and running dedicated vocational education centres
- Funding for the co-creation by industry and academia of new courses and curricula
- Funding for of new innovative and alternative teaching/learning systems⁵⁸
- Funding excellence schemes with top universities to draw top academic talent and students
- Funding SME vouchers for consulting contracts and knowledge transfer.

⁵⁸ Such as project or challenge based learning approaches, for students who might have difficulties in the traditional system, e.g. Ecole 42's approach, se: [https://en.wikipedia.org/wiki/42_\(school\)](https://en.wikipedia.org/wiki/42_(school))

- Funding high tech apprenticeships/traineeships in industry
- Funding the development of open education resources (OER, including MOOCs)
- Funding (lifelong) learners through vouchers, fiscal incentives and/or cost sharing
- Funding upskilling/reskilling programmes for the workforce⁵⁹ in particular sectors or regions
- Other (please specify)

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

FOCUS

- 3) Which type of high-tech skills should especially be the focus of funding measures?
Please choose and rank up the following skills areas

- STEM skills
- ICT professional skills⁶⁰
- Basic ICT user skills (digital literacy)
- Advanced ICT user skills
- Advanced KETs skills⁶¹
- Soft skills⁶²
- Leadership skills⁶³

1	(drag and drop, items to be moved around in this list)
2	
3	

⁵⁹ With co-funding from industry

⁶⁰ Software engineering, application development, networks operations, system administration, cloud computing, cyber security, IoT, data analytics, artificial intelligence, AI, IT management etc.

⁶¹ Engineering and professional skills in: micro-electronics; nanotechnology; industrial biotechnology; advanced materials, photonics, and advanced manufacturing technologies

⁶² Problem solving, critical thinking, communication, teamwork etc.

⁶³ Here especially: having strategic vision for technology, digital transformation, and taking innovations to market

4	
5	
6	
7	

SATISFACTION with current education and training offers

4) How satisfied are you with high tech skills provided by education and training organisations?

High-tech skills education and training providers	Very satisfied ++	Somewhat satisfied +	Neutral 0	Somewhat dissatisfied -	Very dissatisfied --
a) Higher education: universities, degree education	()	()	()	()	()
b) Higher education: universities, life-long learning education and training	()	()	()	()	()
c) Vocational education and training (VET), vocational degree education	()	()	()	()	()
d) K-12 education foundations of STEM skills	()	()	()	()	()
e) Executive education: business schools, executive and professional courses	()	()	()	()	()
f) Vendor-based training programmes, certification courses	()	()	()	()	()
g) Industry-led training centres (also in Public Private Partnership)	()	()	()	()	()
h) Consultants: training and support for company owners and executives	()	()	()	()	()
i) Further education and training programmes of other training providers	()	()	()	()	()

5) Which education and training providers should preferably be supported by government funds? Please allocate 100 percent of a hypothetical additional⁶⁴ public budget aiming at enhancing high-tech skills. You may leave cells blank to indicate no funding should be made.

Training and education providers	Percentage
a) Higher education: universities, for degree education	__%

⁶⁴ i.e. Taking as a given the existing funding for schools and universities

Training and education providers	Percentage
b) Higher education: universities, for life-long learning education and training	__%
c) Vocational education and training (VET), for vocational degree education	__%
d) K-12 education foundations of STEM skills	__%
e) Executive education: business schools, executive and professional courses	__%
f) Providers of vendor-based training programmes, certification courses	__%
g) Industry-led training centres (also if Public Private Partnership)	__%
h) Consultants who provide training and support for company owners or top-level executives	__%
i) Further education and training providers	__%
Still to be allocated	100% (this is to be dynamic in the questionnaire, i.e. the figure goes down as percentages are allocated)

INSTRUMENTS

- 6) Which of the following incentives addressed to individuals or companies (SMEs) are the most appropriate? Please tick one box per row

Financial and fiscal incentives	Not fit for purpose (1)	Fit for purpose in exceptional cases (2)	Moderately fit for purpose (3)	Fit for purpose in many cases (4)	Perfectly fit for purpose (5)
a) Grants: training grants which cover payment of tuition fees, or other charges for educational services, including scholarships	()	()	()	()	()
b) Course subsidies: fully or partially subsidised courses	()	()	()	()	()
c) Loans: awarded to individual participants or enterprises for training purposes	()	()	()	()	()
d) Training vouchers: financial support in form of ILAs - Individual Learning Accounts or vouchers for individuals or SMEs	()	()	()	()	()
e) Cost reimbursements: repayments to	()	()	()	()	()

Financial and fiscal incentives	Not fit for purpose (1)	Fit for purpose in exceptional cases (2)	Moderately fit for purpose (3)	Fit for purpose in many cases (4)	Perfectly fit for purpose (5)
beneficiaries in whole or in part					
f) Reduced social contributions: full or partial exemptions to obligatory social contributions	()	()	()	()	()
g) Educational leave schemes: paid or unpaid schemes	()	()	()	()	()
h) Tax incentives: different types of economic incentives to invest in training: tax allowances, tax exemptions, tax credits, tax relief, tax deferrals.	()	()	()	()	()
i) Others (including combinations of the above) – Please specify: ...	()	()	()	()	()

RECOMMENDATIONS

- 7) Given the topics addressed in this questionnaire, do you have any potential recommendations one could give to policy makers regarding the funding for high tech skills? Please specify:

POSSIBLE INTERVIEW AND QUOTATION of STATEMENTS

- 8) Are we allowed to call you to get further information
- 9) Can we quote from your written recommendations?

Please tick the relevant box

- () Anonymously
- () By name
- () Not at all

CONTACT DETAILS (voluntary)

- Name, surname
- Organisation or field of activity
- Role
- E-mail address
- Telephone number



Online Survey

High-Tech Skills for Europe

Focus, Scale and Impact

Dear Expert,

We would like to invite you to provide your opinion to improve the funding of high-tech skills in Europe.

- It should not take more than 15 minutes of your time.
- Please tick the boxes. You can share further thoughts in sections highlighted in yellow (optional).
- The deadline for completion is the **5th of April 2019**.

Answers will be presented anonymously in an aggregated format. If you add comment(s), please specify whether you agree to be quoted anonymously, by name, or not. In any case, please indicate your field of activity and country of residence.

By participating in the survey, you are giving permission for the investigator to use your information for research purposes. We will send a summary of the results to all respondents.

This survey is conducted as part of a service contract for the European Commission by empirica and PwC.

See: www.leadership2019.eu

Our report will be discussed at a high-level conference on “Skills for industry strategy 2030” in Brussels on 19-20 June 2019.

Thank you very much in advance for completing the questionnaire

Please feel free to complete the yellow boxes in **English or in your own language**.

Should you have questions please contact us by e-mail or telephone:

Tobias.Huesing@empirica.com (Tobias Hüsing) or Eriona.dashja@empirica.com (Eriona Dashja);

Telephone: +49 228 98530-0

Disclaimer: The European Commission is not responsible for the content of the survey.

Success factors for ensuring greater scalability and impact of high-tech skills initiatives

Initiatives and projects often face challenges in scaling, i.e. moving beyond proof of concept, small scale results, piloting, and rolling out at a larger scale (and hence to realise maximum impact).

- How would the factors below foster scalability and impact?

	Please rate				
	1 Would not help at all	2	3 →	4	5 Would help a lot
Strong leadership and longer-term commitment, based on a shared vision and strategy at EU and Member States levels	()	()	()	()	()
Large partnerships, with engagement of key players from industry, education and training, and social partners	()	()	()	()	()
Adoption of a demand-driven and industry led orientation	()	()	()	()	()
Credible business plan with clear goals and targets, as well as commensurate human and financial resources	()	()	()	()	()
Use of concrete evidence-generated KPIs (key performance indicators) for measuring achievement from the start and rapidly reallocating resources when appropriate	()	()	()	()	()
Large degree of freedom for tailoring scaled-up approach to national, regional or local/city contexts	()	()	()	()	()
Integration of newly developed re-/upskilling programmes into an existing formal education and training eco system	()	()	()	()	()
Any other success factors or good ideas (optional):					

	Please rate				
	1 Would not help at all	2	3 →	4	5 Would help a lot

1. Overall approach to funding of high-tech skills initiatives

- To what extent do you agree or disagree with the following statements?

	Please rate				
	1 Strongly disagree	2	3 →	4	5 Strongly agree
Funding should be concentrated on fewer and larger projects to reach a critical mass, visibility and create impact	()	()	()	()	()
Funding should follow a smart specialisation approach to foster the creation of world-class hubs	()	()	()	()	()
Funding should follow an inclusive approach to offer the same opportunities in all regions and reduce inequalities	()	()	()	()	()
Two-staged funding model where projects with great results and successful piloting could unlock additional growth phase funding can accelerate scalability and impact	()	()	()	()	()
Funding by results should be a major funding principle implying that a substantial part of the funding would only be paid after KPIs have been met	()	()	()	()	()

	Please rate				
	1 Strongly disagree	2	3 →	4	5 Strongly agree
High-tech skills projects should be assessed and ranked annually according to an agreed set of KPIs with awards and go/no-go decisions (to reallocate resources when necessary)	()	()	()	()	()
Funds should be reallocated from failing projects to those with successful results, piloting and viable business and roll-out plans with measureable KPIs	()	()	()	()	()
Initiatives should be developed based on clear empirical evidence of skills shortages and trends in a specific sector and/or region etc.	()	()	()	()	()
Successful initiatives which managed to pass through the 'growth' phase and have managed to scale should be rolled out nationally and regionally	()	()	()	()	()
Sufficient time for partner consortium building to ensure that strong partnerships can be built. Evaluation and contracting should be processed faster.	()	()	()	()	()
Any other statements or good ideas (optional):					

2. Funding principles to enhance scalability and impact of high-tech skills initiatives

- To what extent would the funding principles below ensure that public funding is spent on initiatives that are scalable and create the highest impact?

	Please rate				
	1 To no extent	2	3 →	4	5 To a large extent
Simplicity and coherence should be achieved through a one-stop-shop gateway to all relevant EU and national funding programmes and instruments	()	()	()	()	()
Funding rules should be simple for industry, especially start-up innovators, when contributing to training initiatives	()	()	()	()	()
Daily rates should reflect the actual costs of industry and be the same for all EU programmes	()	()	()	()	()
Partner consortia are encouraged and helped to establish relevant legal entities to exploit and scale up results	()	()	()	()	()
Structural funds must be encouraged to support the roll-out of the results from highly successful EU projects	()	()	()	()	()
Funding programmes should address both the “piloting” and “growth” phases based on KPIs, business and roll-out plans	()	()	()	()	()
Co-creation and -delivery of re-/upskilling programmes between industry and training providers is a must	()	()	()	()	()
Any other specific principles or good ideas (optional):					

3. High-tech skills funding on regional, national and European level

It is important to consider the best possible architecture, complementarity and priority of intervention (regional vs. national and vs. European level).

- Which level is the most appropriate for the following types of intervention?

	Please select		
	Regional	National	European
Funding aiming at increasing the high-tech talent pool	()	()	()
Funding aiming at basic skills and disadvantaged groups	()	()	()
Long term sectoral strategy and future occupational skills needs	()	()	()
Funding of high-tech skills centres, clusters and hubs	()	()	()
Identification and promotion of best practices	()	()	()
Development of high quality training content (world-class)	()	()	()
Adaptation/Translation/Customisation of high quality training content	()	()	()
Development of the high quality standards for mobility, recognition, certification etc.	()	()	()
Financial incentives directed at individual learners or SMEs	()	()	()
Financial incentives directed at developers and providers of training	()	()	()
Advice and guidance on high-tech skills acquisition	()	()	()
Funding for upskilling/reskilling significant percentage of the workforce	()	()	()
Rolling-out, adapting and scaling up best practices	()	()	()
Other comments or good ideas (optional):			

4. Recommendations to enhance scalability and impact of the funding of high-tech skills initiatives

Based on our research, we have drafted the following recommendations.

- To what extent could the following recommendations enhance scalability and impact of high-tech skills initiatives?

	Please rate				
	1 To no extent	2	3 →	4	5 To a large extent
Be prepared for greater and substantial investments at EU and national level to create an impact	()	()	()	()	()
A compelling vision for scaling-up must be aligned with a longer-term strategy and commitment	()	()	()	()	()
Funding should address both the development and growth phases of high-quality training programmes	()	()	()	()	()
Integrate high tech skills development in a coherent and complementary way in the future funding programmes (ESF+, ERDF, EaSI, Erasmus+, Digital Europe etc.)	()	()	()	()	()
Review and simplify funding rules to be more inviting to partake for industry partners	()	()	()	()	()
Require projects to present upfront their scaling ambitions within a business plan, including robust KPIs	()	()	()	()	()
Dedicate funds to initiatives reaching a critical mass of learners	()	()	()	()	()
Dedicate funds for building a “world class” scheme focused on upskilling and fostering top talent	()	()	()	()	()
Join forces and integrate existing competence centres, such as clusters, Digital Innovation Hubs and relevant competence centres	()	()	()	()	()
Where projects are experimental, piloting, exploring or risk sharing - require an evidence based analysis of future scaling-up potential	()	()	()	()	()
Other recommendations (optional):					

5. Financial incentives

Based on our research, we have identified the following types of incentives in EU Member States.

A) Types of financial incentives

- Which incentives to learners and employers do you think are most fit for purpose?

	Not fit for purpose / should be avoided	Fit for purpose in exceptional cases	Moderately fit for purpose	Fit for purpose in many cases	Perfectly fit for purpose
To individual learners					
a) Subsidies, grants, scholarships and vouchers to individuals to (partly) cover payment of tuition fees, or other charges for educational services	()	()	()	()	()
b) Loans (to be paid back) awarded to individual participants for training purposes	()	()	()	()	()
c) Training vouchers which grant a lump sum of financial support over a lifetime in form of ILAs - Individual Learning Accounts for individuals	()	()	()	()	()
d) Educational leave (unpaid) which constitutes a legal entitlement for unpaid leave for a certain period of time	()	()	()	()	()
e) Educational leave (paid for by employer) which constitutes a legal entitlement for paid leave for a certain period of time	()	()	()	()	()
f) Tax incentives to individuals: different types of economic incentives to invest in training: tax allowances, tax	()	()	()	()	()

exemptions, tax credits, tax relief, tax deferrals					
To employers, including SMEs					
g) Loans awarded to enterprises for training purposes	()	()	()	()	()
h) Reduced social contributions to employers: full or partial exemptions to obligatory social contributions	()	()	()	()	()
i) Tax incentives to employers: different types of economic incentives to invest in training: tax allowances, tax exemptions, tax credits, tax relief, tax deferrals	()	()	()	()	()
j) Obligation to invest a certain amount of e.g. the payroll sum in training activities, with tax levy for those which do not comply	()	()	()	()	()
k) Worker retainment rights which entitle employers to a certain financial compensation if a worker leaves in a certain period after receiving employer paid training or leave	()	()	()	()	()
Other					
i) Others (including combinations of the above and other target groups) – Please specify:					

B) Incentives design

- To what extent do you agree or disagree with the following statements about incentive design?

	Please rate				
	1 Strongly disagree	2	3 →	4	5 Strongly agree
There should be special incentives for learners and employers encouraging learning of <u>high-tech skills</u> , i.e. the incentives should be better for high-tech than for learners of other vocational/professional skills	()	()	()	()	()
Eligibility of incentives should be strictly dependent on neediness and economic situation of recipients	()	()	()	()	()
Incentives should be specific and higher for certain target groups (e.g. based on gender, age, educational level, size of company, sector, unemployment etc.)	()	()	()	()	()
Any comments or good ideas (optional):					

6. Thank you for your answers. For our statistics and analysis by sector, please state your country and affiliation:

Please pick your country from the drop-down list:

Please tick the relevant box:

- ☐ Policy development / ministry / European Commission etc.
- ☐ Professional association / industry association / lobbyist
- ☐ University / Business School
- ☐ VET
- ☐ Independent training provider
- ☐ Coach / consultant
- ☐ Certification / accreditation institutions
- ☐ Industry (industries USING IT / high tech)
- ☐ IT / high tech sector (IT / high tech CONSULTING AND MANUFACTURING industries)
- ☐ Public sector organisation
- ☐ Trade Union
- ☐ Researcher
- ☐ Other, please specify ...

7. Possible interview and quotation of statements

a) Are we allowed to call you or e-mail you if further questions arise?

Please tick the relevant box:

() Yes

() No

b) Can we quote from your written recommendations?

Please tick the relevant box:

() Anonymously

☐ By name

☐ Not at all

8. Please share your contact details if you allow us to contact you or want to stay in touch. We remind you that this is voluntary.

Name:

Surname:

Organisation:

Role:

E-mail address:

Telephone number:

9. Do have any other comment?

☐ I have no other comment. Please submit the survey

Any other comment

NB: You are not required to give an answer here, but feel free to share additional thoughts if you wish. It will be appreciated.

(Submit)

Thank you!

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