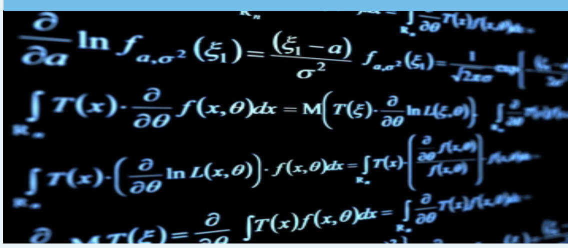
BUSINESSEUROPE

PLUGGING THE SKILLS GAP THE CLOCK IS TICKING

SCIENCE

TECHNOLOGY

ENGINEERING



MATHEMATICS

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WHO ARE WE?

BUSINESSEUROPE's members are 40 central industrial and employers' federations from 34 countries, working together to achieve growth and competitiveness in Europe.

BUSINESSEUROPE represents small, medium and large companies.

METHODOLOGY

This publication deals with the urgent situation concerning STEM (Science, Technology, Engineering and Mathematics) skills shortages in Europe and what measures governments, EU institutions, business and education providers should undertake to address it.

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FOREWORD

The importance of technological development for economic growth is well known. There is no reason to believe that the track record of STEM skills – Science, Technology, Engineering and Mathematics - as a factor for economic growth in the past will be any less convincing in the future. To believe this merely shows a lack of imagination. Looking back, ground breaking innovations all have one thing in common – no one thought initially that they would have such a fundamental impact on our lives, the way we organise work, tackle modern challenges and so forth. And one thing is certain: we are not running out of challenges.

> *Future inventions and incremental improvements to existing products and processes will not become a reality without individuals who can take the next steps of technological development.*

The lack of STEM-skilled labour will be one of the main obstacles to economic growth in the coming years. The good news is that there is not a lack of ideas and creativity on how to improve the alarming situation, especially not from business. **Companies across the EU have taken actions in order to increase the supply of STEM-skilled workers to European labour markets.** By involving in primary and secondary education and by providing a context for science subjects, the interest for such education could increase. However, companies cannot do this alone. **A stronger commitment and more joint efforts are needed from a broad range of stakeholders including governments and education providers at all levels.**

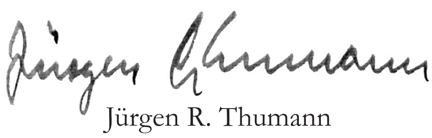
The action list for national governments includes re-orienting resources to STEM education, raising the attractiveness of such education by improving their quality and relevance, setting the right conditions for collaboration between business and education providers and attracting STEM-skilled workers from abroad. Moreover, the potential for EU-level cooperation could be better exploited, through intelligent use of programmes and instruments.

Turning to our major competitors, they have clearly put STEM skills at the top of their agenda. This is illustrated by the $100 billion US recovery package where the lion's share is allocated to education, research and development within STEM. Investments in scientific research and education as a share of GDP in countries like Japan and South Korea significantly exceed those of the EU.

Competitors are developing also in emerging economies. Their share of high-tech exports has grown impressively over the last 20 years. This success is not just about re-orienting resources to education and other priority growth-promoting fields. It is also about the wider set of policies put in place. The strategies of governments in BRIC countries, the USA and South-East Asia demonstrate a determination to take part in the race towards a technological lead.

The question therefore arises - ***what makes the EU so sure it does not have to step up its efforts as well?***

European policy-makers have so far been tardy to recognise the STEM skills shortage and its consequences, as well as to act on it. It seems there is a rather complacent belief that Europe performs well enough. As is shown in the paper, this is not the case. Instead, it is high time to move out of the comfort zone and to explore new ways to improve the supply of STEM-skilled labour.



Jürgen R. Thumann
President
BUSINESSEUROPE

IS THERE A EUROPEAN STEM SKILLS SHORTAGE?

It has been questioned whether there is a European STEM skills shortage in the first place. It is true that the number of STEM enrolments and graduates has increased in the EU over the past decade in absolute terms (from 630,400 in 1999 to 916,100 in 2008). This follows as a consequence of the larger number of people continuing to tertiary education overall. However, when the full picture of supply, demand and mismatches on European labour marketsis assessed, no doubt remains.

Supply

There are three main reasons why the future supply of STEM skills will be worryingly low:

A The inflow in relative terms is low

Compared with other subjects, the interest for undertaking STEM studies is falling in many EU member states. The share of graduates specialising in STEM subjects fell in relation to the total number of university graduates from 24.8% in 1999 to 22.7% in 2005. Evidence also shows that the drop-out rates among engineering students are above average.

Myth 1 *STEM skills do not open up as many career pathways as other studies*

One reason of why STEM is not an attractive study option for many scholars is that they perceive it to be a narrow and overly specialised education. It therefore does not fit with the desire to keep as many doors open as possible.

Killing the myth: Business should illustrate how not opting out on STEM subjects in school actually broadens possible future career paths. In Sweden, a campaign addressing this misperception was launched in 2009 called "NV – the broad study choice". It successfully communicated that STEM education gives the highest flexibility and broadest range of career choices after high school. Overall, 89% of Swedish 15 year olds saw the campaign.

B Large-scale retirements ahead

The demographic change will have a large impact on several STEM professions. In the UK for instance, up to 70% of current high-skilled employees in the nuclear industry will retire by 2025. In relation to this, it should be mentioned that a substantial number of the teachers qualified to lecture in physics at tertiary and PhD level are also soon to retire. This means that the stock of such skills in the workforce is at stake. Eurostat data for the EU as a whole show that the base of the age pyramid for human resources in science and technology is narrower than the middle. This indicates a possible future scarcity of workers in the field of science and technology due to a relatively high outflow from the labour market.

C Low attractivity to foreign talent

In addition to the low supply of home-grown talent, Europe does not attract enough high-skilled workers, including within STEM, from other parts of the world. According to the Commission, "brains prefer other destinations; like the US, Canada and Australia" In the worldwide competition for highly qualified third-country nationals, the EU has so far done poorly.

Demand

Due to the foreseen large-scale retirements in STEM professions, business will have a high replacement demand in the years to come. In addition, the expansion demand is significant for this category of workers. Projections by Cedefop, the European centre for development of vocational education and training, of the expansion demand for different occupational categories show that technicians and associate professionals will have the highest expansion demand of all categories over the period 2010-2020 and among the highest replacement demand (over 20% growth for the period).

Not surprisingly, technicians and associated professions will have the highest employment rate, according to the Cedefop projections.

Chart 1 below illustrates the projected employment developments by occupational category in EU for 2010-2020.

BUSINESSEUROPE's members confirm this picture and describe the lack of labour equipped with STEM skills as one of the key obstacles to economic growth in the upcoming years.

Does a service economy reduce the need for STEM skills?

It has been argued that the structural shift to a service economy reduces the need for STEM-skilled workers and that this explains the lower interest of young people in studying STEM subjects. In this context, two aspects of business demand for STEM skills should be kept in mind:

- The service economy also has a need for these skills. This is illustrated for instance by the large number of people with ICT skills employed in financial services (over 70%) and the fact that 72% of employers in all sectors in the UK employ STEM-skilled people.
- Testimonies from BUSINESSEUROPE members show that the demand is increasing in particular in sectors where their respective country has a competitive advantage. Companies in these sectors are doing cutting-edge research and product development that is of strategic importance for the competitiveness of the EU overall. For instance, the ICT sector in the EU accounts for 50% of total productivity growth.

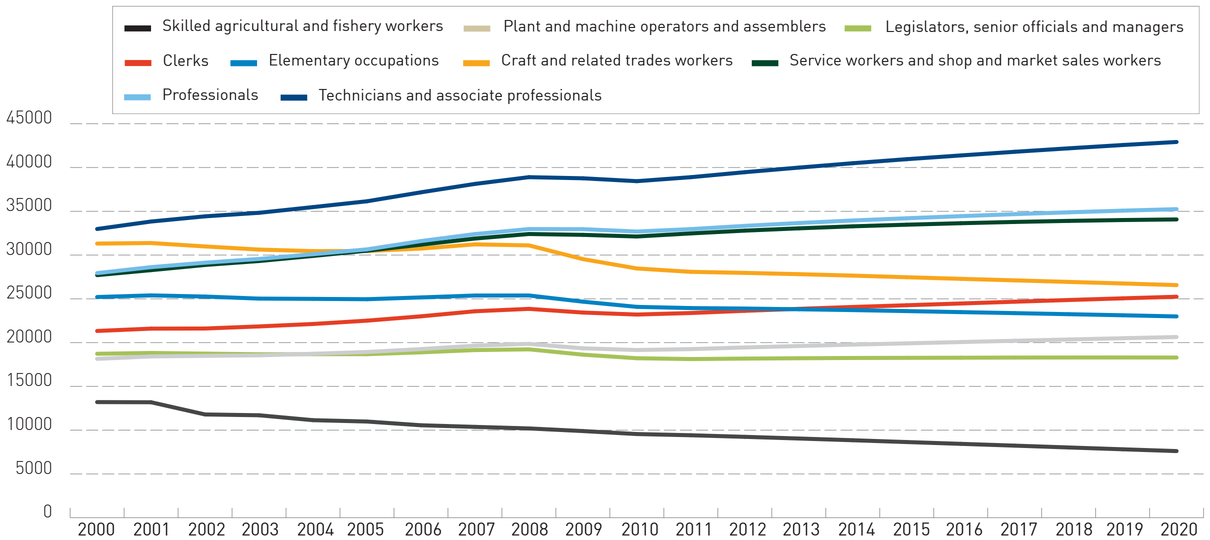
It is therefore a matter of concern that:

- The estimated shortage of qualified ICT staff in the EU will rise to somewhere between 384,000 and 700,000 jobs in 2015.
- Over 10,100 ICT practitioners are currently lacking in Italy, 18,300 in Poland, 41,800 in Spain and 87,800 in Germany.
- In Poland, expansion demand at sectoral level ranges from mechatronics to nanotechnology.
- Skills projections in Austria point to unmet expansion demand in industrial and electrical engineering, business administration and informatics.

Chart 1

Projected employment developments by occupational category in EU for 2010-2020

Source: Cedefop country workbooks 2011 (IER estimates based on E3ME and EDMOD)



Mismatches

In addition to assessing the supply and demand of STEM-skilled workers, the match between these should also be taken into account. The fact that there is a severe lack of STEM-skilled workers and at the same time high unemployment rates overall indicates in itself that there are structural mismatches on European labour markets. As illustrated by the Belgian example, the diplomas of graduates simply do not match the specialisations which companies are looking for. It is important to assess the shortages of STEM skills in a nuanced way, differentiating between different sub-groups of STEM skills. As an example, acute shortages of certain bio-scientists in integrative science like pharmacokinetics and drug metabolism co-exist with an excess of bio-scientists in other fields.

What are the consequences?

As recovery starts to pick up worldwide, Europe risks being left behind if we lack the workforce European companies require to get the wheels turning again.

Shortages of engineers and scientists will lead to a loss of domestic market share, loss of international trade share and lower productivity levels. On a company level, such shortages could well put planned investments at risk and affect location decisions. Recently a decision was taken by Airbus, the world's biggest aeroplane maker, to carry out a greater proportion of its engineering work in India. This is a direct result of the lack of qualified engineers in the UK, Germany and France. Analysis performed by Deutsche Bank shows that offshoring of R&D often follows as a consequence of a lack of skilled employees. Another consequence of the insufficient supply of STEM skills becomes obvious if we only look around us. Science, technology, engineering and mathematics are what our modern society to a large extent is built upon. Infrastructure solutions, health care and the vast majority of products and services that we take for granted in our daily lives would not be a reality without technological development. Modern societal challenges like climate change and the ageing of our population will require new solutions, based on the outcome of continued technological development.

Box 1. SHORTAGES BLACK ON WHITE

Germany

Evidence from Germany shows that the shortage of STEM-skilled workers is not a cyclical problem but a structural one. In 2008, which was a boom year for business activity, over 114,000 people with such skills were missing. Obviously, this figure decreased during the economic and financial crisis, but is now already picking up again and reached 117,000 in February 2011.

Austria

In Austria, it was clear that business suffered from STEM skills shortages also before the recession. After a moderate ease during the economic and financial crisis, shortages are now increasing again and, in 2010, 77% of Austrian companies reported difficulties in recruiting talents in the field of technology and production.

United Kingdom

The demand for science and technology professionals in the UK will grow by 18% by 2014 compared with 4% growth for all other occupations. This translates into 775,000 new roles that will require high-level STEM skills by 2014. The UK expansion and replacement demand taken together will by then result in a total of 2.4 million positions requiring high-level STEM skills.

Belgium

In Belgium, the shortage of engineers is particularly important in spite of 2,000 engineers graduating each year. In 2009, the number of unfilled vacancies for engineering professions reached 2,500. Moreover, a survey by USG, an employment service provider, reveals that three quarters of human resource managers interviewed expect the situation to become worse in the upcoming years. Consequently, 28% of the companies in the survey envisage making concessions on the diplomas of job seekers to fill the vacancies.

Poland

The Polish supply versus demand gap for engineers in general reached 38% in 2007. This lack of labour, in particular within construction, has immediate effects on the infrastructure development of the country. For instance, it creates difficulties to implement the $ 38 billion road and motorway construction programme planned for 2007-2013.

HOW CAN BUSINESS HELP?

It is easy to find good examples of business initiatives aiming to come to terms with the shortage. The European Round Table of Industrialists has defined the role of business as providing meaningful life and career contacts to STEM classes, role models for students and information on STEM careers. Building on these key areas and on the rich pool of good practices, the following five key areas of how business can help have been identified:

A Providing a context

One field where business is putting in an important effort to make a difference is increasing the interest of scholars for science.

The first step towards tackling this lack of interest is to analyse what causes it. Studies show that young people turn away from scientific studies for many reasons. They find it difficult or not relevant to their lives, which creates a negative perception of STEM professions. It is also unclear to them what a career in STEM means. Here business has a clear role to play, already at primary and secondary education levels.

Companies should obviously not take over the work of teachers. The role of business lies in providing a context and showing how science is used to solve real-world problems. In Austria for instance, the recently launched SPICI project (Success stories about professions in cool industries) involves scientists and engineers from industry visiting pupils in their schools to do "story telling" on how they use science in their work. At the same time, pupils visit companies to carry out short, hands-on experiments. Based on these experiences, the project team develops novel lecturing material which combines theoretical background knowledge and practical applications, derived from the real-world challenges faced by industry. (See box 2).

B Lifelong learning for teachers

Companies could also play a part in the lifelong learning of teachers, providing secondment opportunities within the company. In some member states, the relationships between schools and companies are fairly common (64% of employers in the UK are in close contacts with schools) whereas in other member states such links are hindered by red tape and sceptical attitudes among authorities, the public and the schools themselves towards company involvement in education.

Box 2.
PROVIDING ROLE MODELS AND RAISING AWARENESS

In France, six companies (Areva, EADS, France-Télécom, Schlumberger, SNCF and Technip) joined forces in the C.Genial project created in order to raise the attractiveness of scientific studies. It aimed to put the science taught in schools in a context, in order to explain the crucial importance of technological advancements for the society at large. One of the actions undertaken to this end was to invite engineers to science classes at schools, notably to discuss science ideas of the students.

The German member federations of BUSINESSEUROPE, BDA and BDI, founded an initiative in 2008 called "MINT create future!" Financially it is supported also by Deutsche Telekom and other business partners with the aim of increasing the public awareness of the importance of STEM skills. Around 3,500 STEM ambassadors have contributed to the success of the initiative, which so far has led to networking between more than 31,000 companies and over 33,000 schools and universities, reached more than 3 million students. The patron of the BDA/BDI initiative "MINT create future" is the physicist and current chancellor of Germany Dr Angela Merkel.

C Sharing equipment and improving relevance

At higher levels, cooperation between education providers and business is vital not only to increase the interest for STEM but also for the relevance of the studies. The possibilities for partnerships between companies and higher education institutions are many. They include giving lectures, offering apprenticeships or even inviting groups of students to perform laboratory work in the company's facilities.

During an education in molecular biotechnology for instance, the student will require access to a wide range of costly high-tech equipment spanning many disciplines. Although the responsibility for providing the necessary equipment lies with the university, performing laboratory work or research projects at the companies that actually develop the instruments enables the student to acquire skills for which there is a direct demand among local companies. It also gives access to the most updated versions of the instruments and a chance to apply theoretical skills on real-world scientific tasks. In addition, it allows both universities and companies to share costs and know-how. For the individual student, it gives work experience, networks and an insight into STEM careers.

Myth 3 *Lack of attractive career paths?*

According to a 2008 study by the European Round Table of Industrialists (ERT), one of the key reasons why young people do not wish to study STEM is their perception that it lacks jack attractive career paths The 2006 PISA assessment shows that 56% of 15 years olds in the OECD area find science useful for further studies but only 21% said they would like to spend their life doing advanced science.

Killing the myth: There are numerous examples of entrepreneurs who have created successful businesses out of technological innovations. Specific STEM skills in combination with generic competencies like entrepreneurship and creativity are a strong combination for aspirants of a stellar career. A CBI survey confirm that science careers are well rewarded – scientists and engineers have an average starting annual salary of £22,200 – higher than finance, HR or marketing roles.

Myth 2 *Further technological development in EU27 redundant?*

The ERT has also showed that the more developed a country is, the less the young are inclined towards careers in STEM. Young people in the EU could be led to believe that further technological development would be redundant. Moreover, they care more about who they will be rather than what they will be, and wish to work with something meaningful that fits their values and concerns.

Killing the myth: Therefore, there is a case for business to better communicate how further technological development, and thus STEM skills, are crucial in coming to terms with modern societal challenges, including climate change. Being able to make a difference in this respect is an overlooked trademark of science careers.

D Communicating future skills needs

Employers also have a responsibility to communicate their future skills needs. Skills forecasts could be useful, but only to a certain extent. Even more important areways for business to be consulted in "real-time" on the supply and design of courses. In Germany one out of three members of a university board comes from the business world. This allows for a more flexible process in which educational pathways are continuously adapted to labour market needs. However, the role of business in these boards should be not only to involve in operational issues but also to give strategic counselling to the university At the same time, it is important to note that company involvement could create a win-win situation at all levels, including on the level of the actual teaching. This should not be viewed as a one-way communication of how well skills match demand. Instead, it is an opportunity for companies to connect the content of courses to activities within the company and thereby providing a real-life context for what students are learning.

E Killing myths

Another area where business can play a part is to identify and kill myths preventing the younger generation from choosing a career in science. Some of these myths are outlined below, along with a description of how business initiatives could address or already have addressed the issue successfully.

NATIONAL GOVERNMENTS NEED TO ACT NOW!

Re-orient resources to STEM education of high quality and relevance

With government budgets under pressure and an urgent need to reduce public debt, resources should be reoriented to priority areas of key importance for economic growth. Education is such a priority.

It is also a long-term investment, and as such it risks being set aside in favour of policies that deal with current demand conditions, in spite of economic growth models showing the importance of high quality education. For sustainable development, governments must not let this investment slip down the policy agenda.

However, it is crucial that the education system spends its scarce resources in an efficient manner – training a work force with skills that are economically viable. Business considers STEM education of high quality and relevance to be a priority for public spending. In the UK for instance, 52% of businesses call on the government to protect funding for STEM at university level, as one of two main actions for the UK government to undertake to come to terms with the shortage.

Improve attractiveness of STEM educations

As scholars optout from science at young ages, the problem of low attractiveness of STEM subjects must be addressed at early levels. A Dutch initiative called the Bèta Techniek posed questions to youngsters aged 12-24 about how their attitudes towards science. The survey showed that individual experiences with science in school at young ages play a vital role in future career choices. The more a child is exposed to and involved in science, and the more positive reinforcement he or she receives from teachers, the stronger the motivation for choosing a STEM subject later.

Raising interest for science and inviting business to take a more active part in education goes hand in hand. Companies are well-suited to provide a context that would make science classes more exciting and also increase understanding of what a STEM career is all about. The negative attitudes that sometimes prevent schools from creating links with business should be actively fought. One way to do this is to roll out best practices of such collaborations and encourage municipalities to take an active part in encouraging company involvement in education. In many member states, the responsibility for education at primary and secondary level lies with the municipalities or regions.

Box 3.
MUNICIPALITIES AND BUSINESS JOINING FORCES TO RAISE INTEREST FOR STEM

Between the years 2003 and 2006, a project called Science Team K took place in the municipality of Kalundborg, Denmark. It had the financial support of H. Lundbeck A/S, an international pharmaceutical company and several other business partners were involved in the activities. The aim of the initiative was to increase the interest of scholars on primary and secondary level in science and technology. Over 2,500 students in the Kalundborg area participated together with their science teachers. Among the many results of the project were an increased interest in science among girls aged 14-16. It also improved the qualifications of teachers, created informal networks between schools and led to a higher confidence of teachers in their profession. The many actions undertaken within this project are now being rolled out across Denmark.

Furthermore, governments have a responsibility to ensure that the education system addresses the gender disparity when it comes to attitudes towards science. According to an assessment carried out in 2006 by the International Student Assessment (PISA), 15-year-old boys thought significantly higher of their own science abilities than did the girls. At the same time, the girls in the assessment outperformed boys their age in the tests. In the most recent PISA study published in December 2010, there was no statistically significant difference between the performance of girls and boys in science, but girls keep opting out from science at young ages.

This shows that there is a potential to improve the confidence of girls to study science.

By doing so, we would address another societal challenge in the same go, which is the gender pay gap. To a certain extent, this is caused by the different career choices made by men and women. Other factors obviously also come into play that must be dealt with, but encouraging girls to aim for career paths which are well rewarded on the labour market is an important action to narrow the gap. Moreover, guidance officers who provide advice to the younger generation on their career choice could play an important part in improving the attitudes for science and counter-acting negative stereotypes. Consequently, they need to be well informed about the career opportunities within STEM.

Improving quality of courses

Based on the results of the PISA study published in December 2010, concluding that there is room for improvement in the EU Member States performance would be an understatement. South-East Asian economies like Japan, Singapore and Korea are found at the top, together with Finland. Fifteen-year-olds from Shanghai, who for the first time participated in this OECD ranking, left participants from the rest of the world standing. 15-year-olds in many EU member states delivered mediocre or below average results (see chart 2). In addition, only two European universities (Cambridge and Oxford) are in the top ten of the Shanghai ranking of the world's universities.

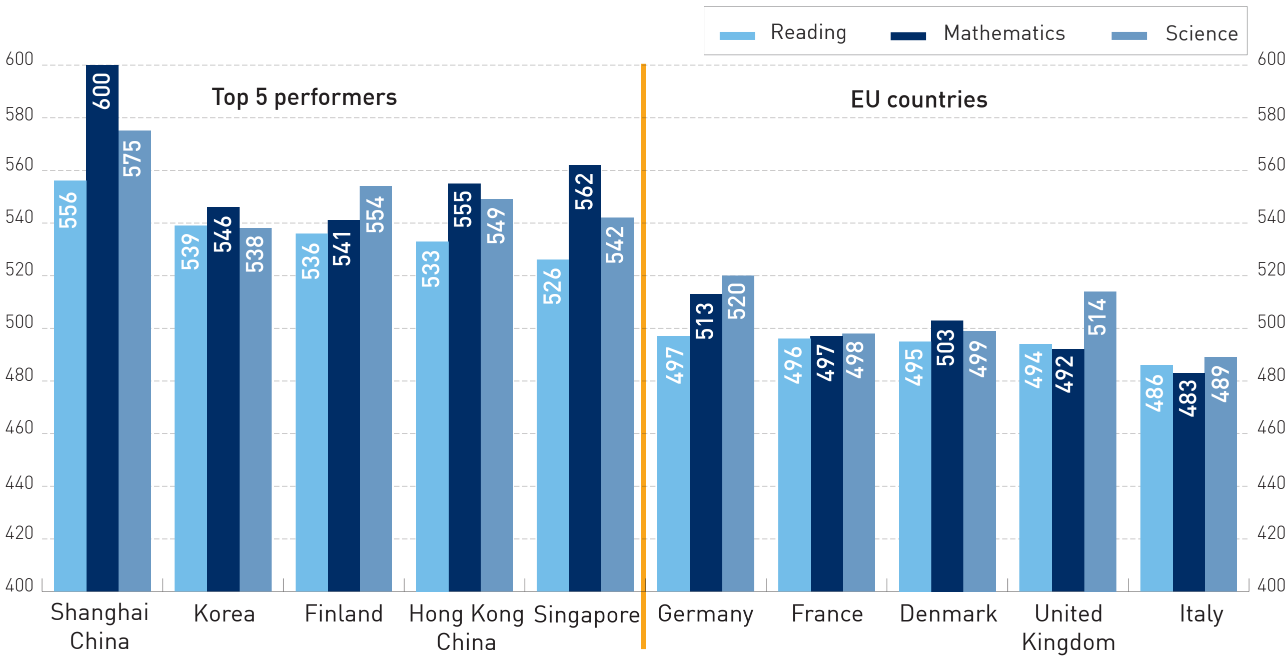
This is simply not good enough for an economy which set out to be the world's most competitive knowledge economy.

US President Barack Obama called the results of the PISA survey a "Sputnik moment", referring to the fact that the baseline of performance in science and mathematics has now drastically shifted, just as it did in 1957. The economies with the best performing school systems will be the winners in this global race towards technological development and competitiveness.

Chart 2

Reading, mathematics and science performance of 15-year-olds in top-achieving countries and selected EU countries

Source: PISA study 2010



The quality of the European education system needs to be improved on all levels - primary, secondary, tertiary and post-graduate. A good place to start is to make sure teachers, at all levels, have the right skills and competencies. Evidence show that post-16 science is best taught by teachers with a specialism in a particular science, but shortages threatens the provision of good education in science at this level. More qualified personnel in early childhood education are also important to improve performance later on. Governments have an important responsibility to upgrade the quality of teacher education and to update their professional skills by putting in place schemes for lifelong learning.

Moreover, school management and teaching methods needs to be modernised, including through more liberty given to teachers to choose their teaching methods as long as they are in accordance with the educational standards of the national attainment agenda. Focusing on learning outcomes, while providing a greater differentiation in learning approaches, equips the pupil with good tools for lifelong learning.

Improving relevance of courses

While respecting the need for different kinds of education, including those that primarily aim at expanding the borders of knowledge, education providers must take their responsibility in providing educations that lead to employment. This holds true regardless of whether future employers are likely to be in academia, the private sector or some other part of the public sector.

Improving the responsiveness of the education system to labour market demands does not only regard the specific skills acquired during an education. Generic competencies like adaptability, creativity and entrepreneurship are becoming increasingly important for employers. One example which illustrates this is the survey on STEM skills in Belgium performed by USG, a Belgian employment service provider, and reported on in box 1.

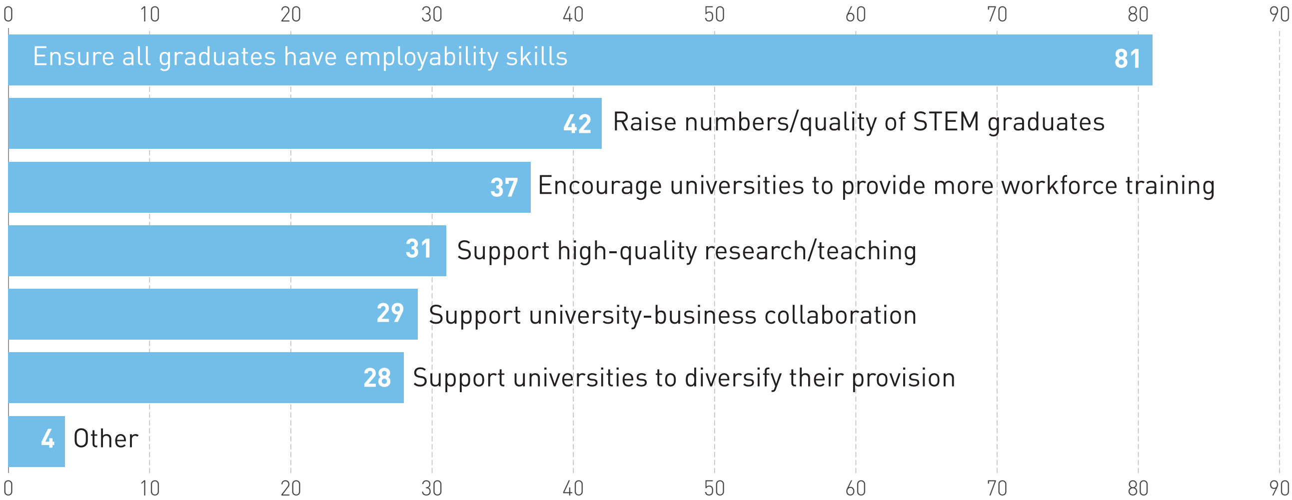
Although companies answered that they would have to make concessions on diplomas and consequently put in place their own, in-house training programmes to compensate for this, not a single company reported a willingness to lower their expectations of the soft skills of individuals to be recruited. This reflects a solid recognition from companies that the personality of the engineer to be recruited needs to be compatible with the organisational culture.

In order to equip students with adaptability and other generic competencies, teaching methods and the way courses are designed needs to change. In concrete terms, this means for instance more emphasis on entrepreneurship education as a horizontal element in all STEM educations. It also means creating cross-disciplinary courses building on collaborations between different faculties in different disciplines. One important ingredient of adaptability in this context is a solid basis in mathematics. It gives the confidence and "language skills" necessary to understand the logics of different systems, regardless of the discipline. For the performance of scholars and students in STEM educations overall, governments should put more emphasis on mathematics in national school systems. The negative perception of mathematics as being disproportionally challenging compared with other subjects in terms of work load should be addressed.

Box 4.
More focus on mathematics

In 2009, an obligatory mathematics exam was introduced in Poland for all students finishing secondary school education. Without passing this exam, students will not achieve their certificate from having finished secondary education. The test existed up until the 90s when it was abolished, a decision which has been much criticized. Now it is re-introduced along with mathematics programs at both primary and secondary level. This reflects an increased recognition of the vital role mathematics plays as a basis for further studies.

Chart 3
Top priorities in higher education for the UK government according to business
Source: CBI skills survey 2010



For the individual learner, this leads to the ability to apply studies in one scientific field in another and thereby the possibility to make a shift of career and find job opportunities in a broad range of sectors. Bringing in knowledge from another professional background to the new occupational field could also create highly attractive recruitment profiles. As an example, knowledge in informatics applied to molecular biology results in a perfect match for companies dealing with protein engineering, a growing field within life science.

From business, voices are raised for governments to do more to improve relevance of educations. In the UK for example, 81% of employers want to see the government working with universities to ensure all graduates develop employability skills (see chart 2).

Set the right framework for collaborations between companies and education institutions

In spite of its high level of involvement in addressing the STEM skills shortage, business could do even more provided conditions would be more favourable. National governments should set the right framework to stimulate business initiatives.

This includes cutting red tape for company involvement in education. Simplified procedures to provide apprenticeships and opportunities for companies to be part of the management of educational institutions are necessary measures.

Governments also have a responsibility to create incentive systems for educational institutions to cooperate with the private sector. Positive financial incentives through additional public resources allocated to educational institutions conditional on the degree of collaboration with companies could be one way. However, finding ways to estimate this degree is not easy. In some countries, the share of private funding of the public education institution has served as a basis. The use of independent employability rankings is another option. It is also essential that principals and deans have the possibility to give incentives to teachers and scientists who collaborate with business.

> *“Ultimately, only education providers themselves can make the change of attitude happen that is necessary for constructive links with business and in order to explore the mutual benefits of collaborations.”*

This regards teachers in schools, including at primary and secondary level, as well as personnel within academia.

One way to overcome the scepticism against creating links with companies is to clearly state what is expected from the collaboration from the perspective of the school or university. Instead of fearing that the different roles of business and the education system get mixed up, it should be explained what is acceptable and not, for instance to avoid indirect promotion of products and services. The Dutch collaboration platform called Bèta Techniek is a good example on how to clarify roles of participating actors. Agreements are set up on the level of the school with the point of departure that schools are the experts; they decide what their approach is in the collaboration. Participants in the agreements could involve local companies, politicians and employer organisations.

Needless to say, the education provider could very well be the actor coordinating a larger collaboration project. In Finland for instance, the faculty of science of the University of Helsinki coordinates an umbrella organisation consisting of representatives from Finnish technology industries, chemical industries, forest industries and other stakeholders. Together, these members arranges science fairs, supports the lifelong learning of teachers, develop new teaching material, etc.

Cooperation between schools/university and business is also hampered by the low level of recognition within the educational institution of the value of experiences gathered in external environments, including from business. By increased recognition of this in internal human resource policies and in recruitments of teachers, researchers and other personnel, career paths that span different environments in society would become more common.

Ensure participation in the global brain circulation

The attractiveness of Europe to skilled immigrants should not be over-estimated. Only 3% of scientists in the EU are third-country nationals. Moreover, a Deutsche Bank Research survey that compared the preferences for working in the USA/ Canada, the UK, Germany, Australia or India among Indian IT students put the UK in third place and Germany at fifth. In the US, 16% of all scientists and engineers are immigrants.

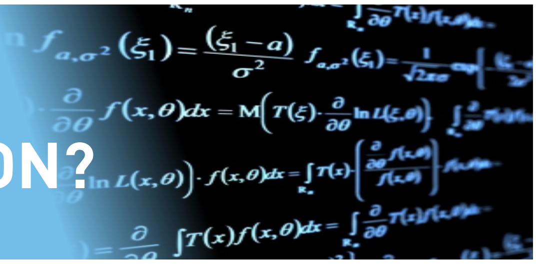
However, instead of fearing a brain drain of highly skilled individuals, EU member states should focus on making Europe attractive enough to be part of the global brain circulation. Both the worlds of business and research are becoming increasingly mobile. This trend should not be fought but capitalised upon. For instance, experiences acquired in foreign environments, by both EU nationals and third-country nationals, could be better used. The long and complex admission procedures that third-country nationals moving to the EU for an employment currently experience hamper the attractiveness of the EU for key talents, like scientists and researchers. The Blue Card Directive aiming to facilitate admission procedures for highly-skilled immigrants is a step in the right direction although conditions for admission are too strict.

Facilitating intra-corporate transfers of employees from an affiliate outside the territory of the EU to an affiliate in a Member State is vital for companies to have access to the personnel they need, for instance to ensure development projects. The draft directive on intra-corporate transferees of July 2010 is overall to be welcomed as it would help bring transparency and simplification to admission procedures of intra-corporate transferees.

In the wake of the crisis, protectionist tendencies have increased on many European labour markets towards immigration of third country nationals. Scepticism towards immigration, especially in times of recession, is often linked to fears that jobs would be lost. The fact of the matter though is that an inflow of workers from third countries to the EU is vital for the recovery from the crisis, and thereby create more job opportunities overall.

This being said, a successful immigration policy has to include more than facilitated admission procedures. An attractive range of educational opportunities, an open culture and long-term prospects for talented individuals are also of major importance.

WHAT IS THE POTENTIAL IN EU-LEVEL COOPERATION?



Although shortages in STEM is a common feature of EU labour markets, lack of labour supply for specific professions still differ from one member state to another. This points to the importance of facilitating geographical and occupational mobility. Only around 2.4% of Europeans currently live in another member state. EU institutions have an important role to play to address the obstacles that remain to making use of the right of free movement.

In addition, EU programmes play a role promoting such mobility for researchers and STEM skilled at different levels, including through the Erasmus programme, the ERC and Marie Curie grants. Moreover, the development of the European Research Area, the European Higher Education Area and the cooperation in vocational education and training are ambitious and important processes.

However, the lack of coordination between these processes will reduce the chances of a successful implementation of their tools and programmes. Rather than continuing to develop separately, a more concordant approach should be sought in order to develop a European Learning Area, where learners can easily transfer from one education system to another, both across borders and between different levels.

To this end, a shift towards a learning outcome approach in national credit and qualifications systemsis needed. By rewarding the actual output of studies rather than input measures like duration of studies, skills and competencies will become more easily transferrable between education systems, regardless of where they were acquired. This approach might be particularly important when it comes to educations providing a supply of engineers and technicians.

By the end of the day, being able to apply theoretical knowledge to solve real-world problems is the main objective of such educations. Means to measure this ability should be developed. Therefore, it is important to ensure the implementation of remaining steps of the European Qualifications Framework.

Further to the existing programmes, industrial PhD schemes should be established through the support of the Marie Curie Actions. These already enable intra-EU (and associated states) fellowships for researchers with at least four years of professional experience or a doctorate degree. Broadening the scope to promote also mobility of industrial PhDs would not only be beneficial for the exchange of knowledge between member states but also between business and academia. Another important tool in this respect is the European Institute of Innovation and Technology. Among other things, it will encourage higher education institutions to develop new education programmes aiming to integrate entrepreneurship, innovation and risk management.

Box 5. Industrial PhD schemes a success story in Denmark

In Denmark, performing PhD studies within a joint project between private actors and a university has been an established possibility for research students for many years. In practice, it means sharing the working time between the partners of the project, enabling the researcher to transfer knowledge between the two environments. The university could also be a foreign one, as long as a Danish university is then connected to the project as a third partner.

CHECKLIST FOR ACTION!

With the continued importance of technological development for economic growth outlined, the existence of a shortage of STEM skilled in Europe concluded and its consequences analysed, the case has been made for taking firm action to come to terms with the situation. For this, a checklist has been put together, reiterating the shared responsibility of different actors.

Employers and employer organisations should

- ❑ Provide a context for science studies by involving in education at all levels
- ❑ Kill myths and give positive role models of STEM skilled from the business world
- ❑ Communicate future skills that businesses need and ensure educational courses are adapted accordingly
- ❑ Contribute to the lifelong learning of teachers

Governments should

- ❑ Re-orient resources to STEM education
- ❑ Raising the attractiveness of such educations by increasing quality and relevance
- ❑ Set the right conditions for collaboration between business and education providers
- ❑ Ensure participation of the EU in the global brain circulation

Educational providers should

- ❑ Address scepticism against creating links with business, including at primary and secondary level, and explore the benefits that collaboration could lead to
- ❑ Better recognise value of experiences from a business environment in recruitments and internal human resource policies
- ❑ While respecting the need of different kinds of studies, take their responsibility in providing courses that lead to employment

Individual learners should

- ❑ Recognise their responsibility in making informed study choices
- ❑ Be confident enough to go for a career in a STEM discipline

EU institutions should

- ❑ Reduce barriers to geographical and occupational mobility
- ❑ Ensure remaining steps of a shift towards a learning outcome approach in the national credit and qualification systems on both vocational and higher education levels
- ❑ Make better use of the different EU level programmes and cooperation instruments through more points of contacts between their governance structures and through increased compatibility and interoperability of these tools
- ❑ Establish industrial PhD schemes financed through the Marie Curie Actions

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