



WHITE PAPER

Women and ICT

Why are girls still not attracted to ICT studies and careers?

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Foreword

Viviane Reding, European Commissioner for Information Society and Media

ICT is the major driver of growth in productivity in the European Union. The ICT sector not only drives innovation, but fuels competitiveness in the global economy. Jobs in information and communication technologies (ICT) sectors like telecoms and the Internet are therefore key sources of growth and crucial for the growth of the economy. However, the EU's competitiveness depends on attracting and keeping skilled workers, especially in the high-tech sector, including women. But while a shortage of around 300,000 qualified engineers is expected in the EU by 2010, fewer than 1 in 5 computer scientists are women.

In short, Europe needs more "cyberellas" – women equipped with the e-Skills needed for the future. These skills are key to ensuring Europe retains a major role in the ICT sector of tomorrow. To tap this vast pool of talent, special attention must be paid to raising the participation of women in this field. I therefore warmly welcome collaboration with industry to ensure we open girls' minds to the opportunities that are there for them within the ICT sector. It is fundamental not only that no one is left behind but that the sector benefits from increased diversity and productivity gains that have been demonstrated to come from a better balance of women in top jobs and technical jobs.

This report shows why gender differences exist in the ICT industry and makes recommendations on how this might be addressed. In particular, it is crucial that we work together to address misguided perceptions of the ICT industry; we must help young people to see the excitement of this dynamic and fast-evolving sector.

In my view, this report should be required reading for industry, policy-makers and educators across Europe and beyond, and is a strong call to action for all concerned.

Jan Figel', European Commissioner for Education, Training, Culture and Youth

Lifelong learning opportunities for all underpin the future of the European Union. Twenty-first century skills – particularly in the area of information and communications technologies (ICT) – are essential to equip all of our citizens, regardless of gender or ethnicity, to contribute actively to the European knowledge society.

We know that European women are significantly under-represented across the board in ICT – from education and training programmes right through to high level careers in the sector, whether in academia or industry. This is a disadvantage for all: on one hand, lack of talent for the industry and on the other lack of opportunity for women entering the job market in the field of ICT. The lack of ICT-oriented women also impacts on future generations: both girls and boys are influenced by parents as key role models. Thus, Europe's young people rarely view ICT as an interesting or viable study or career option.

We also know that diversity and inclusion drive societal development, social cohesion, civic maturity and productivity. In a responsible, modern and competitive Europe, it is paramount to ensure that opportunities are open to men and women in equal measure, and to effectively understand and address factors that may act as obstacles to this goal.

It is therefore a great pleasure for me to welcome this Cisco white paper and its findings. This paper presents an interesting analysis of young people's attitudes towards ICT and does much to explain why we have a "leaky pipeline" of girls and women going into the sector. Its conclusions and recommendations should be read by all interested in education and training, from government decision-makers to educators and parents.

1. Executive Summary

1.1 Skills shortages

Studies indicate that Europe faces a widening ICT skills gap. This is of major concern because of the strategic importance of ICT in achieving EU ambitions in global competitiveness and the development of the knowledge society. Given the relatively low representation of women in ICT-related jobs, recruiting more females could help to close the skills gaps. However, proportionally few girls are currently entering the technology sector even from a relatively early age (tertiary education onwards), despite being regular leisure users of ICT tools.

This study pays special attention to the crucial 'pre-university' age of 15-18, when secondary-school girls are making decisions about subject specialisation in upper secondary, and selecting university courses for further studies.

1.2 Study objectives

- ▶ Examine teenage girls and boys' attitudes to ICT and ICT careers in secondary schools in five countries in Europe
- ▶ Verify whether there are differences in perception and/or aptitude between the genders
- ▶ Understand what might be putting girls off further studies and careers in ICT by:
 - Looking at the impact of role models on study and career choices
 - Assessing to what extent negative stereotypes affect girls' career choices in relation to ICT
- ▶ Develop recommendations on the basis of the research.

1.3 Methodology

The study was carried out in five European countries that are broadly representative of varying levels of ICT integration in both education and wider society. They are also countries that have strong cultural influence on their neighbours. Three groups of both genders were targeted by surveys in pilot schools with in each country: students, teachers and parents.

- ▶ Italy
- ▶ Poland
- ▶ United Kingdom
- ▶ Netherlands
- ▶ France

1.4 Findings: Girls still held back by stereotyped thinking, but attitudes may be evolving

Most girls drop out of ICT studies after secondary education. This can be attributed partly to lack of support from role models, persistent stereotyped views that the sector is better suited to men, a lack of understanding about what ICT jobs entail, and in some cases, how easy or difficult they find the subject. However, a key finding of the study is that girls generally like and enjoy ICT studies and are competent users of computers and computer operating systems.

- ▶ Girls are roughly equal to boys in aptitude in ICT at secondary level.
- ▶ Most girls enjoy studying ICT however this enjoyment does not often transmit into careers.
- ▶ Female role models generally exert strong influence on girls making decisions about further study/careers.
- ▶ These role models are not 'tech-savvy' – however most mothers surveyed are positive about ICT. Where mothers are most positive, daughters share these positive attitudes.
- ▶ Both students and role models generally believe that technology is better suited to men.
- ▶ Neither girls nor role models see ICT roles offering them chances to travel, to help others or to work independently. However feedback from Cisco HR and employees from a range of business functions including sales and engineering point to discrepancies between these perceptions and what tech workers think. This suggests that in many instances, teachers and parents are poorly educated about what ICT really entails.

A comparative analysis of the country findings yielded the following points:

- ▶ Polish female students have the most positive view towards ICT, ICT jobs and Internet networking careers, followed by Italy and the UK.
- ▶ Dutch female students have the most negative view and see ICT networking careers as better suited to men.
- ▶ In general, 50% fewer female students are interested in studying ICT in the future compared to the percentage that report liking ICT at school.
- ▶ Except in the Netherlands, over 50% of students are influenced by role models (parents, celebrities and teachers). In particular, male students look to male role models, and girls to female role models
- ▶ In general, the research found positive attitude towards ICT from female parents, especially in Poland, Italy and France – although this was much less the case in the Netherlands.

1.5 Conclusion

In addition to the impact the gender gap may have on projected skills shortages, the lack of women entering the ICT sector currently represents loss of talent for industry and loss of opportunity for females entering the job market. This pattern of under-representation of women in ICT is set to continue if more is not done to educate, support and encourage girls and their role models. We conclude that public-private collaboration could play a role in changing perceptions about industry, by giving access to more realistic and authentic information about ICT and ICT careers. In particular, closer cooperation education agencies and Ministries, together with industry, are needed to ensure accurate information about ICT is available to teachers, pupils and their parents. Numerous initiatives have been launched, but the mainstreaming of such initiatives is required to have a systemic impact.

2. Situation Analysis

2.1 Women and ICT: Filling the skills gap

The information and communication technology (ICT) sector represents 12 million jobs in Europe and 6% of EU GDP.¹ In spite of current economic fluctuations, the turnover of computers, software and IT services in Western Europe is expected to increase by 2% in 2009, to around € 315 billion.² However, the sector is under threat from Europe's changing demographics.

- ▶ Forecasts³ suggest from 2015 onwards **deaths will outnumber births across the EU27 and population growth due to natural increase will cease.**
- ▶ The EU27 population is projected to continue to age, with the share of the population aged 65 years and over rising from 17.1 % in 2008 to 30.0% in 2060. **For every one person aged 65 or more in 2060 there will be only two persons of working age,** compared with four persons to one today.

Estimates suggest that 20 million new jobs will be created across the EU between 2006 and 2020. As a result of Europe's demographic challenges, another 85 million jobs will need to be filled to replace people who retire or leave the labour market for other reasons.

- ▶ CEPIS⁴ forecasts a **shortfall of 70,000 skilled ICT workers by 2010.**
- ▶ If employment rates amongst women remain at current levels, Europe can expect to see a shortfall of 24 million people in the active workforce by 2040. **If women's employment rates equal men's, then the projected shortfall drops to 3 million⁵.**

Despite this situation, very little has been done so far to address and encourage women, half of Europe's population, into ICT related careers, where they currently participate at only 24%.⁶

2.2 The leaky pipeline

Young people typically make critical career decisions between the ages of 13-17. At this point in their education they orientate towards or away from science and technology studies. An analysis of education data shows that at age 15, both girls and boys have roughly the same preferences and ability in science and technology,⁷ but as they progress towards adulthood, girls generally drop out of science, engineering and technology to pursue other subjects.

- ▶ 55% of tertiary education students are women;⁸ however, EU figures for 2007 show that computing and engineering female graduates are significantly outnumbered by male graduates. In 2004, 74% of computer science graduates were male in the EU 27 as opposed to 22% for females.
- ▶ While women are the majority in advanced research degrees (PhD) in natural sciences, EU statistics show that they are outnumbered by men by more than 60% in engineering and computing.
- ▶ 27.8% of computer and information systems managers are women, and among computer hardware engineers, a mere 9.6% are female.⁹
- ▶ Only 5.8% of senior academic positions in engineering and technology fields are held by women.¹⁰ The result is that ICT employers are recruiting from a predominantly male candidate pool.

2.3 What puts women off ICT?

Published research sheds some light on this. Girls and boys show differences in how they perceive computer science studies and careers. Girls more often associate the concept of ICT with hardware, algorithms and programming; whereas boys are more likely than girls to see ICT as socially-oriented.¹¹ Despite having equally good – or better – grades as male counterparts in maths, science and technology subjects, girls are often actively discouraged by families, teachers and career advisors from pursuing further studies or careers in the field.¹²

Similarly, while girls enjoy their chosen uses of computers, there is some evidence that they contrast these practices with stereotyped images of male computer users, IT companies and IT professionals: '[t]he

connectedness and digital mobility that girls take up for pleasure in their everyday lives do not carry into perceptions of IT workplaces as potentially enabling of cool and connected working lives'.¹³

2.4 Are women inherently less adept in science and engineering?

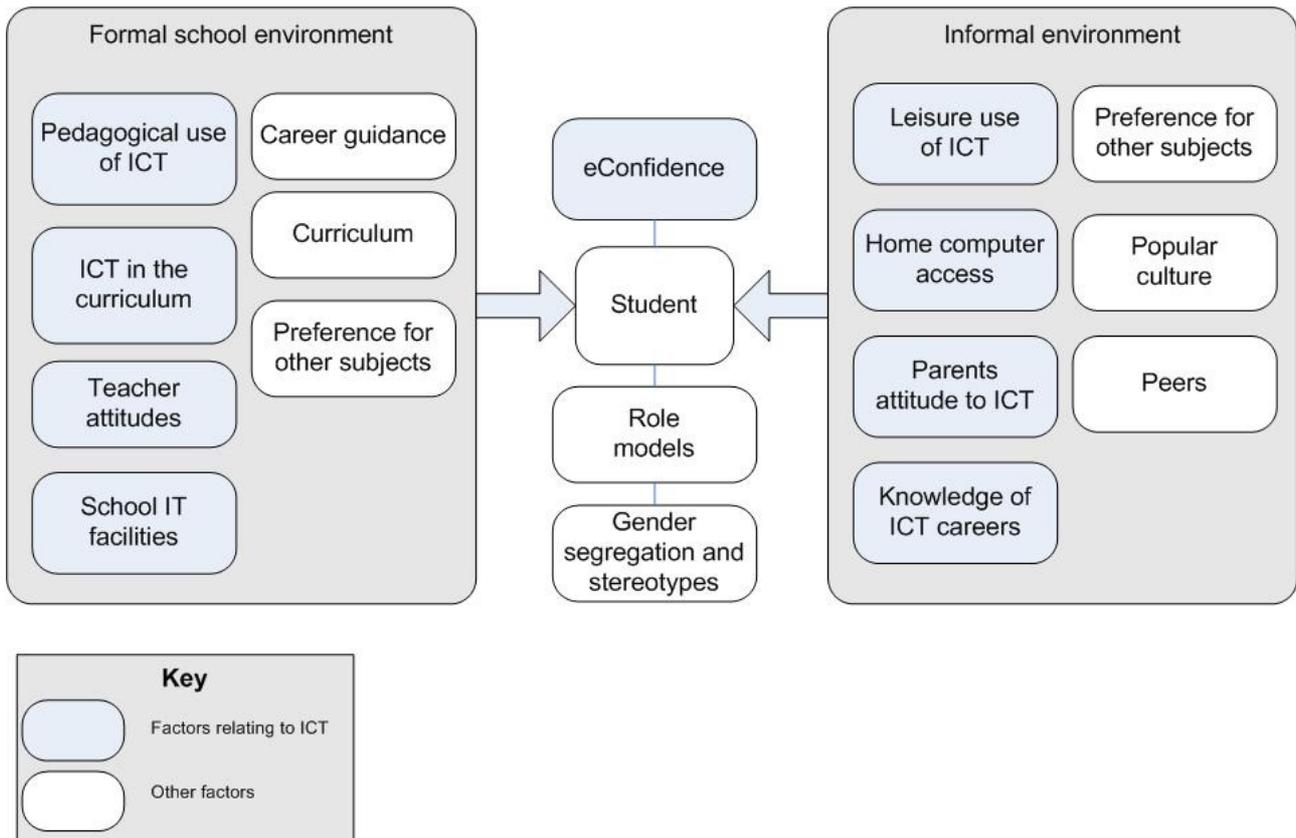
Women's basic capabilities in engineering and technology in comparison to those of men have been well documented. In Estonia, 44% of science and technology graduates are women,¹⁴ while in Lithuania and Latvia women outnumber men in PhD researchers in computing. Indeed, research indicates that in countries where gender discrimination is relatively low, girls have the same performance level in mathematics as boys.¹⁵ Cultural, sociological, economic and other factors play a strong role and have a negative impact on women's involvement in science, engineering and ICT.

Differences in the way males and females communicate may contribute to assumptions about women's competency in engineering and technology. PISA reveals boys to be more confident than girls in using computers for routine tasks, accessing the Internet and high-level tasks (e.g. web page construction, creating a computer program and using software to find and remove computer viruses).¹⁶ However, further research measured both self-reported skill and objectively assessed skills, and found perception in difference in skills may be a product of boys' over-confidence and girl's under-confidence rather than any real difference in aptitudes.

2.6 What about role models?

Other influencing factors include parents' expectations and their general familiarity with ICT. A study of 348 students in the UK shows that parents' expectations have a strong influence on career decisions: boys being more directly influenced by their fathers, girls by their mothers.¹⁷ This is important when we consider that 'computer-savvy' parents are three times more likely to be male than female.¹⁸

The absence of female role models has been identified as an important deterrent for women considering a role in sectors not traditionally viewed as 'female friendly'.¹⁹ A Greek study showed that female teachers have more negative attitudes towards computers and greater anxiety about them which may affect girls' perspectives. A range of influencing factors on women is shown in the diagram below. The factors in the centre are those which are intermediate between the formal and informal environments that influence students.



3. Country Analysis

3.1 Italy

- ▶ No substantial difference in ICT knowledge and aptitudes between male and female students
- ▶ Italian female students like ICT but do not go on to further study or ICT careers
- ▶ Drop-out rate (girls who like ICT but choose not to pursue further study): 61%
- ▶ Possible cause: influence of “negative” role models:
- ▶ Male parents/teachers use PCs and know more about ICT than their female counterparts
- ▶ This older generation also sees ICT as a “man’s world”
- ▶ Female students are competent in ICT and enjoy it, however they do not intend to study it at tertiary level or pursue ICT career paths.
- ▶ Interestingly, the younger male generation is more positive than any other group about girls’ aptitudes and potential. This may indicate that attitudes are evolving.

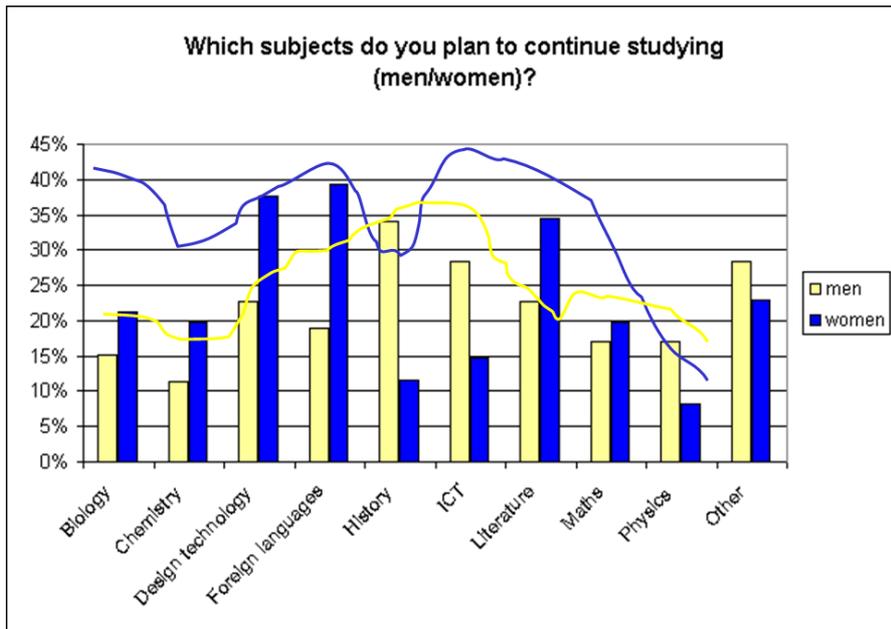


Figure 1:

Columns: Subjects students plan to continue studying.

Lines: Students' relative interest in the different subjects (calibrated to match "columns" scale)

Blue: female students

Yellow: male students

3.1.1 Negative perceptions, female parents and teachers pushing girls away from careers in ICT

When asked to appraise the importance of role models in choosing further study or career paths, female students reported the following:

- ▷ More than 50% have a role model, of which 58% say their role models are female – i.e. the majority of female students are more influenced by other women than by men
- ▷ 52% cite female relatives and teachers as the greatest influence in study and career choices.

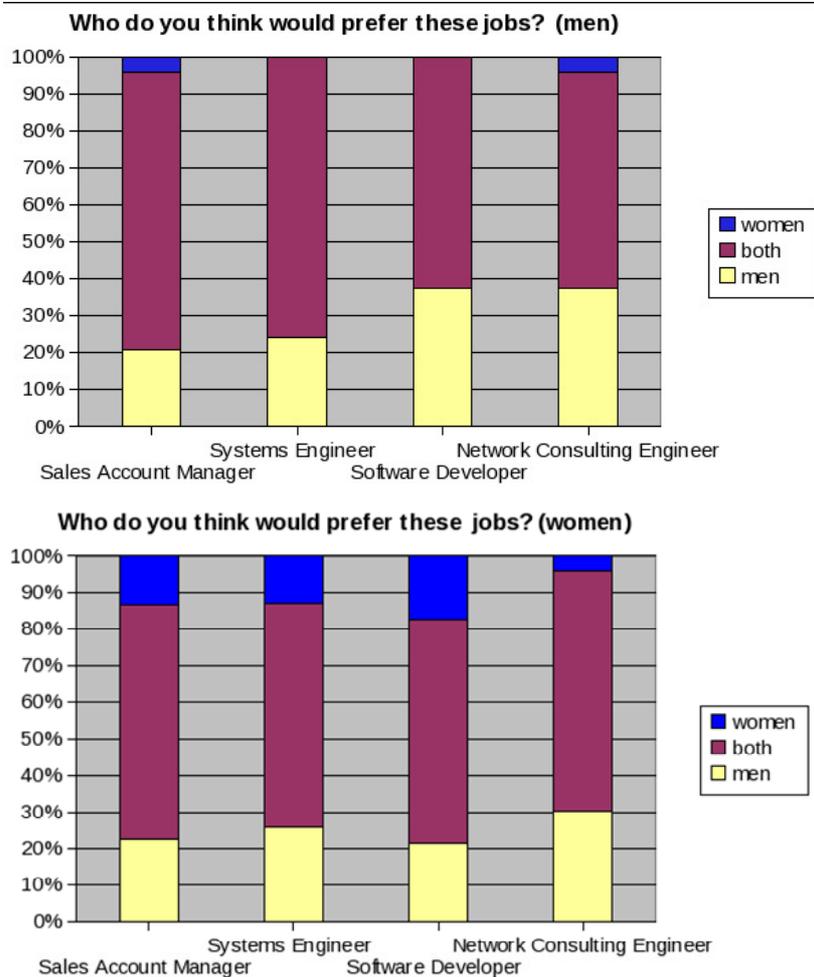
This group of female role models were surveyed about ICT aptitudes, computer use, networking skills and attitudes towards the ICT sector in general. The following were significant findings:

- ▷ **ICT knowledge is considerably lower amongst women** than men in the older age groups (1950s generation).
- ▷ **Women use PCs less than men** in role model gender groups. In the student groups the difference was negligible.
- ▷ **Only 5% of women in role model groups have basic networking skills** – when asked to assess their ability to resolve home connectivity issues. This compares poorly to men at 41%, male students at 41% and female students at 27%.
- ▷ 70% of both male and female Italian students use PCs during their free time for more than half an hour per day. This compares to 60% of the male parents and only 40% of the female parents.

Both students and their role models were surveyed on attitudes towards typical ICT jobs. The following findings are particularly salient:

- ▷ Parents / teachers (especially female) have a more negative view of these jobs (not much travelling, nor improving the world, nor meeting customers)
- ▷ Travel and working with people are desirable attributes for female students. The study surveyed Cisco Human Resources and Cisco employees for feedback on what jobs typically entail. The following discrepancies were found:
 - Cisco said that 65% of jobs involve meeting customers. Only 35% of girls and 50% of mothers and teachers believe this.
 - Cisco said that 100% of jobs help people or improve the world in some way. Only 55% of girl and 40% of parents and teachers believe this.

An important conclusion emerged from the study in terms of attitudes towards the sector in general. The older generation continue to see the sector as better suited to men. When surveyed about male and female aptitudes across a number of typical ICT roles, the following answers were obtained from parents and teachers: from Figures 2 and 3 it can be seen that more than 20% of parents and teachers see Internet working jobs as better suited for men. In the case of female parents up to 40% perceive men to be better at them.



Key to figures 2 and 3:

Bars: parents and teachers views on who do they think is better suited for different Internet networking Careers: 1. Sales account Managers, 2. Systems engineers, 3. Software developers, 4. Network consulting engineers.

- ▷ Yellow: men are better.
- ▷ Red: both are equally good.
- ▷ Blue: women are better.

Figure 2: men's views; **Figure 3:** women's views

3.1.2 Key observations: Italy

Although Italian girls are not going into ICT careers, they are keen on studying the subject. Attitudes towards ICT itself are generally positive – not just amongst the girls, but also their mothers and female role models. Italian boys are also positive about girls' abilities. This enthusiasm should be harnessed to form the basis for positive change.

3.2 Netherlands

- ▷ Female students have very little interest in Internet networking careers and ICT in general. This low level of interest is evident at a relatively young age.
- ▷ ICT careers and studies thus not attractive for female students.
- ▷ Drop-out rate: 54%
- ▷ Source of dislike unclear: students report little influence from parents and teachers.
- ▷ Even parents are not interested in ICT.

Female students do not intend to study ICT in the future and consequently are not interested in Internet networking jobs. They do not find ICT interesting or easy and don't like it as much as other school subjects despite using ICT in leisure time as much as other countries.

3.2.1 Why are Dutch girls so demotivated?

Across both genders very little interest in ICT was reported with girls in particular showing very little enthusiasm:

- ▷ **Female students not interested in learning about computers and their existing knowledge is low.** Almost 70% of female students had no knowledge of Linux for instance, and little or no interest in acquiring new computing skills.
- ▷ **Almost 60% of female students think ICT is more difficult than other subjects** compared to 25% of male students.
- ▷ **Only 35% of female students can repair their home Internet connection** compared to 69% of their male peers

Influence of role models?

- ▷ Parents registered even less interest than students in improving ICT knowledge – with up to 80% of mothers reporting poor knowledge and interest in operating systems.
- ▷ Less than 30% of male students and **fewer than 40% of female students claim to have a role model.**
- ▷ Of these, majority **is influenced by relatives** (35% of female students and 48% of male students).
- ▷ **Teachers do not have much influence on students' choice of further studies or careers.** Only 10% of female and no male students refer to teachers in this context.
- ▷ Students are therefore making career decisions relatively independently based on their likes / dislikes for school subjects.

Perceptions of ICT jobs

- ▷ Fewer than 20% of female students believe that autonomy or independence are features of ICT careers– compared to 60% who expressed interest in working alone or independently.
- ▷ Students believe qualities like creativity to be of relatively little importance – most see creativity as key attribute in ICT careers.

- ▷ Discrepancies between Cisco feedback and respondents' views on more 'desirable' attributes such as helping others and improving the world were noted: less than 30% of girls think that tech jobs help the world for instance.
- ▷ Less than 10% of female students think women are better at systems engineering, network consulting and software development compared to men. None of them think women would be better at software development than male peers.

3.2.2 Key observations: Netherlands

By 15, Dutch girls are struggling with and have lost interest in ICT as a subject, which suggests that the pipeline in the Netherlands begins to leak at an earlier stage than in the other countries surveyed. The majority of Dutch girls find ICT harder than other subjects compared to the other countries surveyed. The scope of this study is not large enough to address this specific case in greater depth. Further research into curricula and teaching methodology may shed light on the situation.

3.3 United Kingdom

- ▷ No substantial difference in ICT knowledge, use and aptitudes between male and female students
- ▷ **ICT is the favourite subject of most British female students**– and they even plan to study ICT at university.
- ▷ Despite this, British female students' interest in Internet networking jobs is very low
- ▷ Drop out rate: 43%
- ▷ Possible causes:
 - Jobs not seen as matching their main interests: autonomy in the workplace and helping others
 - Jobs perceived as better suited to men
 - Role models are not confident in women for these jobs.

Female students are competent in ICT and enjoy it. They do want to continue to study the subject at tertiary level but are not interested in Internet networking jobs specifically.

When surveyed about their ICT competencies, both genders reported similar skills and knowledge across a range of computing tasks. ICT is the most popular school subject among female students in Britain. Both genders plan to continue studying ICT for future studies. However, there is a clear difference in their interest in Internet networking jobs – boys are interested in these jobs, while girls are not.

3.3.1 Why are these ICT-oriented girls not attracted by Internet networking jobs?

- ▷ 80% of girls want the chance to be independent in their work environment - only 30% believe a job in ICT can provide this.
- ▷ 90% of girls are looking for a job that enables them to help others; **only 60% of girls and less than half of parents and teachers see ICT roles in this light.**
- ▷ **Cisco reports that 100% of jobs involve helping others and improving the world – there is a big discrepancy between what the industry says and what girls and their role models believe in this regard.** While female students, parents and teachers consider only about half of Internet networking jobs help people and even less than half improve the world.

More than 50% of female students have a role model:

- ▶ 74% role models are female – the majority of female students report they are more influenced by other women than by men
- ▶ **59% cite female relatives and teachers** as the greatest influence in study and career choices

This group of female role models was surveyed about attitudes towards Internet networking jobs. The following were significant findings:

- ▶ Female role models have stereotyped views, seeing the **sector as more appropriate for men.**
- ▶ **Female teachers are less confident of women's ability** to work in networking jobs such as systems engineers than mothers in general.
- ▶ Fewer than **15% of mothers think women are better suited** to networking jobs. None of them think that women would be better suited for software development. In contrast, around 10% of fathers think women are better than men for this job.
- ▶ **This pattern extends to other jobs in the sector such as sales: mothers believe that boys are better suited to these roles**

3.3.2 Key observations: United Kingdom

British girls are dropping out of ICT at a later stage than other Europeans. Significantly, their interest in the subject at secondary level persists into tertiary education; but this is where the pipeline begins to leak.

The situation in the UK might be described as being both bad and good. Bad in the sense that a pool of talented and motivated girls is not being sufficiently encouraged pursuing careers in ICT. But good in that enjoyment of the subject and solid academic prowess may form the basis for positive change.

3.4 France

- ▶ Female students in the French sample struggle with ICT – it's not one of their favourite subjects, and fewer than half say they find it easier than other subjects
- ▶ Female students do not intend to study ICT at tertiary level and are not interested in Internet networking jobs, apart from those in the area of sales.
- ▶ Drop out rate: 24% (*note: drop out rate is higher amongst boys: 34% who like ICT drop out of further study*)
- ▶ French female students are strongly influenced by parents of both genders and cite them as key role models in their choice of future studies and jobs
- ▶ Possible causes:
 - Negative perception of the sector among students and their role models
 - Parents and students believe networking roles are better suited to men.

Girls have basic computing skills, but find ICT hard and do not intend to study it

When surveyed about their use and ICT, both female and male students report similar use and knowledge of various computer-based activities and tasks. However, female students don't mention ICT as one of their favourite subjects at school– they prefer foreign languages and history. When surveyed about their plans for future study, few female students (between 20 and 25%) plan to study ICT at tertiary level.

Unsurprisingly, female students display very low interest in networking careers. The percentage of female students intending to pursue such career paths is very low compared to male students– with the exception of sales roles (42% of female students are interested in sales versus 12% in the other networking careers).

3.4.1 What is the problem with ICT?

Female students find ICT more difficult than their male counterparts.

Around **55% of female students (compared to only 40% of their male peers) find ICT more difficult** than other subjects.

Female students responded to questions on their perception of activities involved and competencies needed for four networking roles. The following were significant findings:

- ▷ 90% of girls want to work autonomously, however only 50% believe they could do this in ICT
- ▷ Only 20% of female students think that networking jobs involve travel to different countries – but it is important for the majority of female students – 80% of them would like to travel in their future jobs – which is also reflected by their interest in foreign languages.
- ▷ Helping others is also crucial for female students but few think they will have this opportunity in ICT.
- ▷ **Cisco said that 100% of jobs entail helping others compared to just 35% of girls, teachers and parents.**

When asked to appraise the importance of role models in choosing further study or career paths, female students reported the following:

- ▷ 61% of female students have a role model, of which 55% are female and 45% male – French girls in the sample are almost equally influenced by female and male role models.
- ▷ Female students are strongly guided by their parents. 64% cite relatives as their greatest influence in study and career choices.
- ▷ Only 2% report feeling influenced by teachers.

The most influential group of role models (parents) was surveyed about the ability of men and women to work in ICT. The following were significant findings:

- ▷ Both female and male role models see networking jobs as better suited to men.
- ▷ None of the female role models believe that women would be better at systems engineering or network consulting engineering
- ▷ None of the male role models think that women are better suited to systems engineering or software development. Less than 10% of them see women as better suited for the role of network consulting engineer.
- ▷ Sales are considered as better suited to women, but still only 15% of both female and male parents suggest that women may outperform men in these roles.

3.4.2 Key observations: France

In France it was found that female students are being equally influenced by men and women. Both gender role models exert a relatively high influence over girls. When devising strategies to engage and galvanise young women, government, educators and the industry should be mindful of this. Also, it was found that the ICT drop-out rate amongst French boys is higher than amongst girls. More research here may shed light on why this is the case.

3.5 Poland

- ▷ **ICT is Polish girls' favourite school subject** and both genders report similar knowledge and competence in computing. However girls do not go on to further study or ICT careers.
- ▷ Drop out rate: 48%
- ▷ Possible causes:

1. Negative influence of parents

- Polish parents' use of PCs and knowledge of ICT is very low
- Parents do not see Internet networking careers as 'female friendly'

2. Few positive role models with ICT-oriented profile

- High influence of celebrities on young people and very low influence from teachers. Female students mainly identify with actresses as role models.

3. Negative perception of networking jobs

- Female students don't see these jobs as offering enough opportunities for leadership, independent work, and travel.

Female students are skilled in ICT and rate it as their favourite subject at school, however fewer than half of them intend to study it at tertiary level or pursue ICT career paths.

3.5.1 What is putting girls off?

Parents in Poland are the least likely to use ICT at work, and have a negative view of ICT jobs and careers. They may be proactively discouraging their daughters from continuing to study technology.

When asked to appraise the importance of role models in choosing further study or career paths, female students reported the following:

- ▷ Polish girls are strongly influenced by female role models– 58% of female students have a role model, of which 70% are female.
- ▷ 50% cite female relatives as the greatest influence in study and career choices – however 40% of mothers surveyed do not use a PC for work and have less ICT competency than male respondents.
- ▷ 32% cite famous people as their greatest influence in study and career choices. **Celebrities – particularly actresses for female students– inspire young people more than teachers.**

When female role models (female parents) were surveyed about ICT aptitudes, computer use, networking skills and attitudes towards the ICT sector in general they indicated the following:

- ▷ Almost 40% of female parents never use a PC at work. They use PCs less than men in role model gender group.
- ▷ Parents have poor computing skills – mothers in particular. Little to no knowledge of operating systems other than Windows was reported.
- ▷ Female role models perceive the Internet networking industry as a male world, as much as male parents do. Students also see networking jobs as better suited to men– though to a lesser extent than parents.
- ▷ Encouragingly, though, female students have proportionally more faith in their own abilities than boys have of girls, across a range of networking roles.

Both students and their role models were surveyed on attitudes towards typical ICT jobs. Amongst the salient findings were the following:

- ▷ Female students don't see these jobs as offering enough opportunities to become leaders and work independently – attributes to which they aspire.
- ▷ They think these jobs do not involve enough travelling.
- ▷ **An important discrepancy emerges between what Cisco says and students' and parents/teachers' attitudes: Cisco employees report that all jobs involve helping others. Only 65 % of girls and 35% of the parents and 45% of the teachers believe this.**

3.5.2 Key observations: Poland

A positive finding is that even if the Internet networking industry is seen by students and parents as a male world, girls still have relatively high confidence in their own abilities in networking and computing. Female students seem also to perceive a role for women, and believe they may outperform men in some areas.

Actresses and celebrities were also found to influence girls significantly more than teachers. It may be that specific measures that involve these groups may help galvanise and encourage girls in ICT.

4. Summary findings

4.1 Just because you like ICT, it doesn't mean you'll go into ICT

Who says women don't like ICT? In four out of five countries surveyed, the majority were interested in the subject. In the UK and Poland, nine out of 10 women were ICT-philes. And in France, the ratio of ICT lovers to ICT haters was still nearly 50:50. It seems clear that attitudes are evolving positively.

But this interest in ICT does not always seem to transmit into careers in technology. There appears to be little correlation between liking ICT and choosing an Internet networking career, apart from in the case of Poland.

4.2 You don't have to be technical to encourage your daughter into a networking career

There is little correlation between a mother's ICT know-how and the likelihood that her daughter will choose a career in ICT. **What *does* make a difference is enthusiasm.**

Mothers influence their daughters. In our Italy and Poland studies we found mothers with very limited computing skills, yet they had a high opinion of ICT – and that made all the difference to their daughters' levels of interest in working in the sector.

When contrasted with the Netherlands and France, where mothers' interest in ICT – and daughters' interest in ICT careers – was lowest, it is clear that what counts when it comes to getting a girl a career in ICT is their mother's level of interest, not ability, in the subject. See Figure 4 and country tables below.

Female role models may not have a strong ICT profile; however our studies indicate that harnessing their enthusiasm can make all the difference.

Influence of female role models on female students

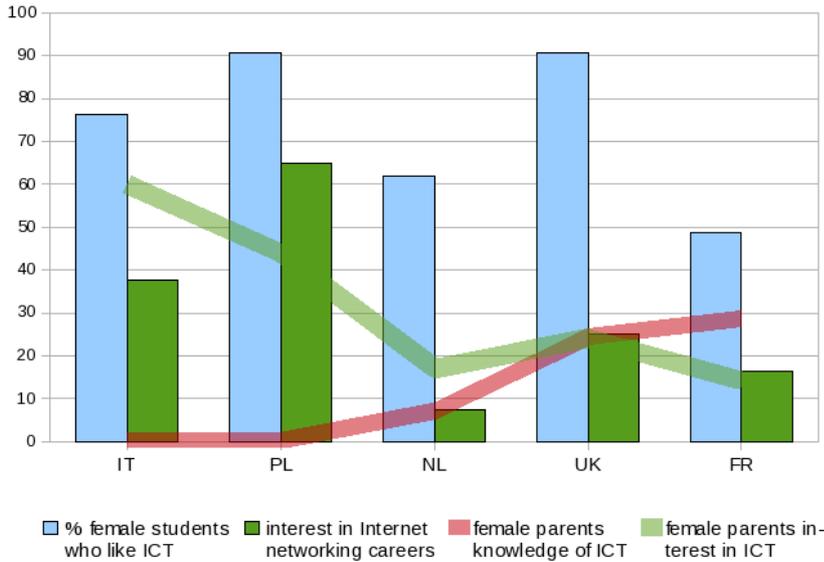


Figure 4:

- Blue columns: percentage of female students interested in ICT
- Green columns: percentage of female students interested in Internet networking careers.
- Red line: female parents' knowledge of ICT
- Green line: female parents' interest in ICT

4.3 Women don't want to compete in a man's world

When looking at female student's perspectives on ICT, the idea of men being better in this area had a profound effect. In essence, **the more the students saw ICT careers as being more of a man's preserve, the more other more positive perceptions of ICT (liking it, intending to study it, providing travel, etc.) were depressed.**

Thus, in Italy and Poland, where fewer than a third of female students believed men were better suited to ICT jobs, only one positive attribute per country garnered a lower score – in other words, attitudes across the board were more positive (in Italy, that respondents would continue to study ICT; in Poland, that ICT careers would provide travel opportunities).

Conversely, in the Netherlands, the only country where more than half of female respondents thought men were better at ICT jobs, only two positive attributes were listed by a greater proportion of women in the survey—that they liked ICT and that it could be used to help others.

Female students' view

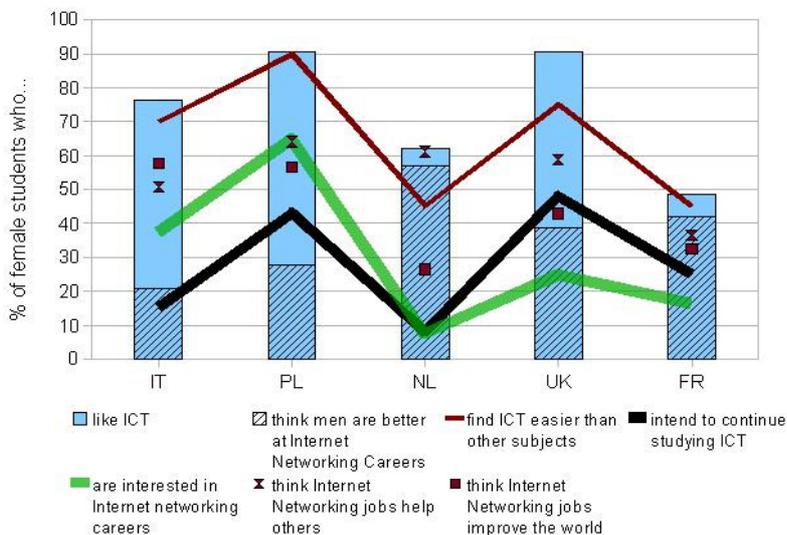


Figure 5:

- Shaded columns indicate women who believe ICT sector to be inherently better suited to men
- Blue columns: percentage of female students interested in ICT
- Red line: % of women who find ICT easier than other subjects
- Black line: % of women who intend to continue studying ICT
- Green line: % of women interested in Internet networking careers
- Symbols: percentage of women who think these activities are involved in Internet networking jobs.

4.4 Women are still in the dark about opportunities and benefits of ICT roles

The study interviewed Cisco Human Resources and employees across a range of roles for an industry view of what a range of jobs typically entail. This was then contrasted with the opinions and perceptions of girls and their role models: mothers and teachers. The graph below demonstrates that there are some significant discrepancies between the 'reality' and what girls – *and importantly, what teachers and mothers* - think. This is particularly true of **helping others and improving the world** in some way, which most girls aspire to according to survey findings.

The study surveyed girls on what they wanted out of a career. Amongst other things, they wanted to travel, work with others and help other people (see figure 6 below).

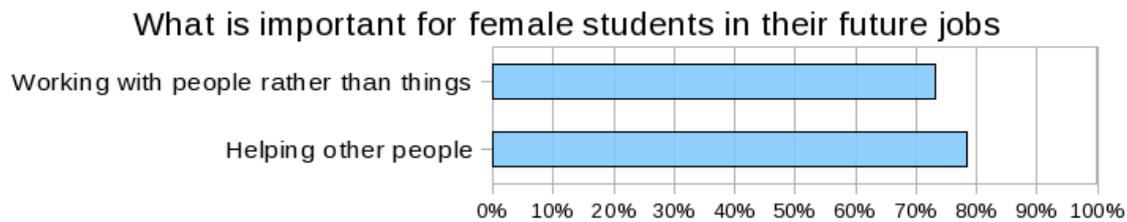


Figure 6:

- Blue columns: percentage of female students who find these activities important in their future jobs.

- ▶ Working with and helping others are attributes that almost 80% of girls are looking for in a career.
- ▶ Only 46% of girls believe that they will meet and help others and improve the world by going into the ICT sector.
- ▶ Only 39% of their parents and teachers believe that they will achieve these goals going into ICT careers.

How does this compare to technology workers' views?

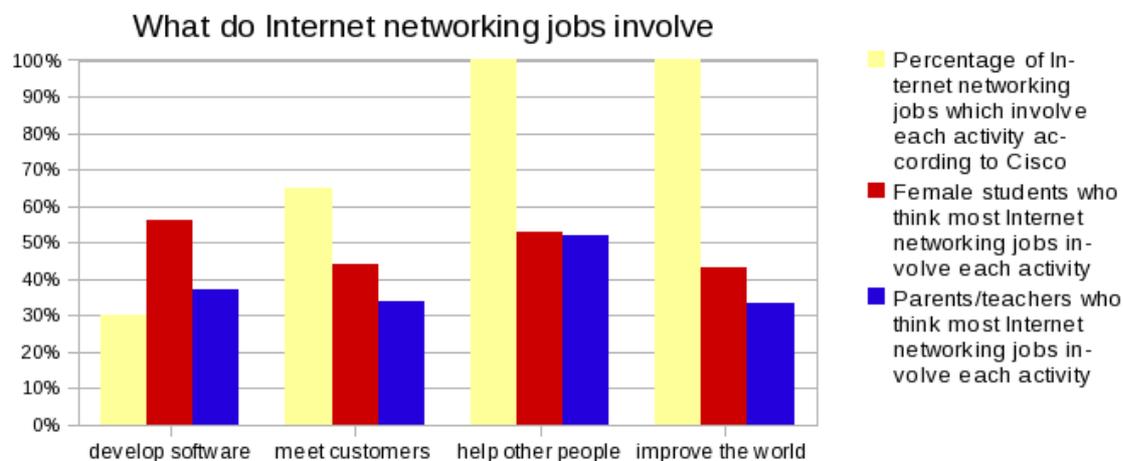


Figure 7:

- Cisco data vs. perceptions of Internet networking jobs among female students and role models

- ▶ 55% of female students and 38% of parents and teachers think most Internet networking jobs involve software development, although only 30% of the jobs do.
- ▶ Only 45% of female students and 35% of parents and teachers think most Internet networking jobs involve meeting customers. According to Cisco, 65% of these jobs involve meeting customers.
- ▶ Although Cisco thinks all Internet networking jobs help other people and the world, only 45% of female students and 32% of parents and teachers see it this way.

So girls and those who influence their career choices, although they may like and enjoy technology, still fail to see the ICT sector or ICT jobs providing them with an opportunity to meet key career goals.

This is a view that is not shared by Cisco employees, working in a variety of business functions, who reported that depending on the role or job within the ICT industry, or indeed within ICT jobs supporting different industries, **there was scope to achieve any of the career objectives cited by girls.**

4.5 Gender and country comparisons

The survey samples from each country were limited in size and scope, which means that a comprehensive country ranking across the range of factors studied would not yield meaningful results. However some interesting comparisons were gleaned.

- ▶ Polish female students have the most positive view towards ICT, ICT jobs and Internet networking careers, followed by Italy and the UK.
- ▶ Dutch female students have the most negative view and see ICT networking careers as better suited to men.
- ▶ In general, 50% of female students drop out of further studies even when they like ICT at school.
- ▶ Except in the Netherlands, over 50% of students are influenced by role models (parents, celebrities and teachers). In particular, male students look to male role models, and girls to female role models
- ▶ In general, we saw positive attitude towards ICT from female parents, especially in Poland, Italy and France – although this was much less the case in the Netherlands.

4.5.1 Women

▶ Drop-out rate for tertiary ICT studies and ICT careers

	FR	IT	NL	PL	UK
% of students interested in ICT	49	76	62	91	91
% of students planning to study in tertiary	25	15	8	43	48
% of students interested in networking careers	17	38	8	65	25
Drop-out rate – % students who despite liking ICT will not continue to study it	24	61	54	48	43

➤ Overall comparison students/role models and interest in ICT

	FR	IT	NL	PL	UK
% of students interested in ICT at secondary, tertiary and career level	30	43	26	66	55
% of parents of students at pilot schools	54	55	28	44	30
% of teachers of all subjects	79	50	27	50	29

4.5.2 Men

➤ Drop-out of male students in ICT

	FR	IT	NL	PL	UK
% of students interested in ICT	71	79	89	89	90
% of students planning to study in tertiary	37	28	45	69	67
% of students interested in networking careers	43	48	35	53	45
Drop-out rate – % students who despite liking ICT will not continue to study it	34	51	44	20	23

➤ Overall comparison (male population)

	FR	IT	NL	PL	UK
% of students interested in ICT at secondary, tertiary and career level	50	52	56	70	67
% of parents of students at pilot schools	63	33	42	36	50
% of teachers of all subjects	71	54	47	87	31

5. Recommendations

In this section, we present the key issues highlighted by the study and recommendations to address these issues.

5.1 Issue 1: Girls intend to study foreign languages and are interested in travel

The survey results yielded the following findings:

- ▶ A majority of girls (in 3 out of 5 countries) intend to study foreign languages at tertiary level, and most girls expressed an interest in travel
- ▶ Girls also said that they would be interested in jobs that helped others and improved the world, but did not believe that ICT roles could help them do this.

On the basis of this data, we recommend:

- ▶ Integrating ICT into other courses e.g. foreign language studies, with curricula that could be embedded in degree courses
- ▶ Study exchanges based on ICT– Erasmus- or eTwinning-style technology courses organised as exchanges between schools and colleges in different countries
- ▶ Community outreach projects involving organised by schools and colleges with corporate sponsorship – e.g. creating networks for under-served communities linked to travel or exchange programmes

5.2 Issue 2: Female students dislike ICT at school

In France and the Netherlands where girls expressed dislike for ICT as a subject, we recommend a deeper analysis of curricula and teaching methodology to understand. Further research is needed which may point to a need for curricular reform and increasing focus on ICT topics that are attractive to girls, including:

- ▶ The creative use of ICT (e.g. multimedia, gaming, graphic design)
- ▶ Demonstrating the role of ICT in serving society's wider needs (e.g. green IT)
- ▶ Cooperative school projects with girls in countries where ICT is seen favourably (e.g. UK).

Girls' performance and competence in ICT is often similar to boys'. However, they see the subject as more difficult. To address this, we recommend:

- ▶ Confidence-building measures, such as girls IT clubs after school.
- ▶ Helping girls explore IT in a less formal situation, ideally with female IT experts to support them.

5.3 Issue 3: Girls lack positive ICT- oriented role models

In all countries, female students are more influenced by role models than their male counterparts, and in particular, turn to female role models when making career and study choices. We therefore recommend:

- ▶ Increased and regular exposure to ICT-oriented women to encourage them to participate more in the field.
- ▶ Support through initiatives such as IT shadowing days, where girls meet female ICT professionals and students, and get a chance to discuss frankly about their experiences are therefore crucial.
- ▶ Developing and deploying more awareness-raising materials on IT careers (such as online portals and campaigns) which focus on female role models.
- ▶ Schools and businesses should also cooperate further to ensure ICT-oriented women visit schools as part of careers days

5.4 Issue 4: Teachers and parents consider that ICT and ICT careers are better suited to men

In all countries, teachers and parents typically hold stereotyped views of the sector. It is of key importance to give parents and teachers a more balanced perspective via:

- ▶ Better support for school staff such as teachers and career advisors, to give them a clearer idea of IT career options e.g. awareness-raising materials and campaigns, training sessions with IT companies, and 'open days' for local schools to visit IT facilities.
- ▶ ICT companies improving awareness of the role of women in their sector, by ensuring that consumer-marketing materials include gender diverse messages and images.

5.5 Issue 5: Girls see a mismatch between perceived job attributes and what they want from their 'dream job'

Girls in all countries expressed the desire to help others, to travel and to have a high degree of autonomy and independence in their future careers. When asked about ICT, they did not expect to find roles that would fulfil these aspirations. The study surveyed Cisco HR representatives and employees who did not share the same views: particularly in the fields of helping others and having a role to play in helping the world. The industry could contribute here to rectify perceptions by:

- ▶ Encouraging young IT professional women in companies to get involved in outreach activities to meet girls at secondary schools and give them a clearer picture of what jobs entail
- ▶ Engaging in school-organised career activities involving ICT companies
- ▶ Focusing recruitment campaigns on the key skills and activities that women are attracted to
- ▶ Increasing broader understanding of the ways in which the sector contributes to helping communities, for instance in the fields of education and health care.

All of the recommendations entail closer cooperation between the public and private sectors, in particular, IT companies and the education system. Due to the fast-moving nature of the sector, education actors need further support from industry to ensure that accurate information and opportunities are available to teachers, pupils and their parents

Multi-stakeholder initiatives are of particular value (see annex 2 for examples), as they avoid ethical challenges for the school system by permitting cooperation with more than one company, while also encouraging industry to speak with a common voice on ICT and ICT careers. Mainstreaming of such initiatives is of utmost importance to have a systemic impact.

5.6 Girls as users

Substantial research has been done into how girls interact with the Internet, and their habits as technology 'consumers'. A recent study²⁰ from Becta, for instance, shows that girls use technology more for social networking and creative purposes, whilst other data²¹ indicates that girls are predominantly 'joiners', 'spectators' and 'creators' online. European girls are highly involved in reading, sharing, and commenting on content like videos and blogs. If the trend continues, these numbers will grow even more.

Suggestions here might include:

- ▶ 'Women in ICT' websites, groups and forums: community building around the gender gap, women studying and working in the industry
- ▶ Harnessing the reach and attraction of media such as blogs, discussion boards for women to promote discussion and share information about ICT. Energizing women in ICT to blog and video blog would allow for the socialization of role models: a scarce resource in this field.

ANNEX 1: METHODOLOGY

A total of fourteen schools in five countries were surveyed. The table below lists the pilot schools chosen and their features.

Location	Name of school	Number of girls aged 15-18	Number of boys aged 15-18	Level of ICT infrastructure	Hours/week of ICT education for students aged 15-18	Using ICT in the classrooms
Mossley, Scotland, UK	Mossley Hollins High School	115	110	High	3	High
Stalybridge, Cheshire, UK	Copley High School	360	410	High	4	High
UK	Hyde Technology College	n/a	n/a	High	5	High
Latina, Italy	Liceo Artistico di Latina	282	101	Medium	4	Low
Italy	I.P.S.I.A. Gaslini di Genova Bolzaneto	80	300	Medium	5	Low
Italy	Istituto Di Istruzione Superiore "S. Weil" Treviglio	470	161	High	5	Medium
Netherlands	St. Aloysius College	206	216	High/Medium	2	Medium
Goes, Netherlands	Ostrea Lyceum	708	613	High	1 to 3	Medium
Netherlands	RSG Brokdele	n/a	n/a	Medium	n/a	Medium
Paris, France	Lycée Jules Siegfried	250		High	5 to 8	High
Paris, France	Lycée Polyvalent et CFA DORIAN	460	n/a	Medium	4 to 6	High
Sosnowiek, Poland	Zespół Szkół Elektronicznych i Informatycznych	39	687	High	13	High
Katowice, Poland	VI Liceum Ogólnokształcące	341	173	Medium	4	Medium
Kielce, Poland	Zespół Szkół Informatycznych im. Gen. J. Hauke Bosaka	52	490	High	14	Medium

Data analysis

Within each of the three groups (students, parents and teachers), the answers of the respondents were divided according to gender. The data was then analysed by calculating the percentage of respondents who chose each answer to a given question, within each subgroup (age/gender). These percentages were then plotted and correlations observed.

The maximum standard errors in the sample using the simplified margin error formula:

Standard error = $2 \cdot \sqrt{[p(100-p)/n]}$, where p is the data value and n is the size of the sample, is:

- ▶ Students: ~ 10%
- ▶ Teachers: ~ 20%
- ▶ Parents: ~ 15%

These standard errors are double within each gender sample (i.e. while the data from the students has a maximum margin error of 10%, when studying the data of female students, this data has a maximum margin error of < 20%). These errors were taken into account when analysing data correlations.

This research deals with discrete data. Its samples have been taken from 5 different European countries and, in each of them, 3 different groups have been distinguished inside the population. There was no bias in the selection of the neither schools nor respondents.

Out of an average of 193 respondents per country 108.4 were students, 33.2 teachers and 51.4 parents. The smallest sample had 28 respondents. To further improve the statistical viability of the research, gender and age were also taken into account. The stability of opinion varied between questions consistently with respondents' personal traits.

For instance, it was found that in Italy the ICT knowledge is much lower amongst women than men in the older age groups. This correlates to more men furthering their careers than women in the 1950s.

ANNEX 2: MULTISTAKEHOLDER INITIATIVES

Initiative	Description	Stakeholders	Website
European Schoolnet	Network of 31 Ministries of Education, aiming to promote use of ICT in education. Close partnership with major IT firms since inception.	Ministries of Education, IT suppliers,	www.europeanschoolnet.org
e-Skills Industry Leadership Board	Network of 31 Ministries of Education, aiming to promote use of ICT in education. Close partnership with major IT firms since inception.	IT companies, European associations for education and training	www.e-skills-ilb.org
Women's Forum Sci-Tech Girls Day	Annual event – part of the Women's Forum - for young girls to meet women active in science and technology.	IT and science companies, educational bodies	http://tinyurl.com/q5y54j

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