WOMEN IN STEM

MATRIX Executive Summary, May 2018

MATRIX
NORTHERN IRELAND SCIENCE INDUSTRY PANEL

Executive Summary

With every MATRIX report published to date the issue of STEM skills shortages[1] has been prioritised as a barrier to growth in Northern Ireland's (NI) science & technology sectors. A major contributing factor to which is the significant gender imbalance across the STEM skills pipeline. The 2016 Advanced Manufacturing, Materials & Engineering (AMME)[2] and Digital ICT[3] reports documented continued, poor representation of women in their respective sectors, in particular.

Northern Ireland faces a significant STEM shortfall in the immediate term and that shortfall is set only to increase as future demand for STEM skills increases. Encouraging more women into STEM and subsequently supporting them to remain in this skills pipeline, could go a long way to solving those skills shortages. In examining the issue, MATRIX points to the persistent disengagement of girls in core STEM subjects between GCSE and A Level/FE as being absolutely critical:

In 1999, 11,943 boys and 11,104 girls were born in Northern Ireland.

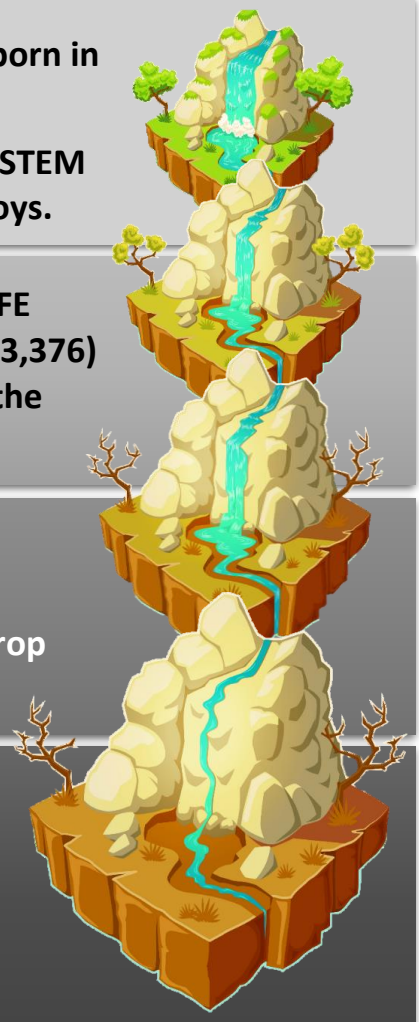
In 2014/15, 87.6%* of the girls (9,647) took STEM GCSEs, compared to 91%* (10,873) of the boys.

But when it came to Core STEM A levels or FE vocational exams in 2016/17, only 30.7%* (3,376) of girls took one. That compares starkly to the 85%* (10,221) of boys who did so.

So the decline in girls participating in Core STEM between GCSE & A Level/FE is anticipated to be 65%, compared to a 6% drop off for boys.

The gender imbalance in Core STEM participants can never recover from this catastrophic decline, so to understand the imbalance we must understand what puts girls off Core STEM at GCSE/A level/FE.

*Projections based on UK WISE rates of qualifiers.



[1] MATRIX Reports

[2] AMME Report. MATRIX. 2016

[3] Digital ICT Report. MATRIX. 2016

It follows therefore, unhappily, that not nearly enough of NI's young people go on to pursue a future career in STEM. By age 18, 83% of the region's total future workforce have turned their back on a career in those very priority sectors expected to deliver growth and prosperity for all. But the fact that so many girls in particular opt out makes this the single biggest challenge facing NI's government and employers today.

Only 7.8% girls currently pursue STEM to the point of employment in a STEM role.

That's the same % as in 2008 and in the modern vibrant economy that Northern Ireland aspires to be, that's a shocking supply chain failure. It is difficult to imagine a manufacturer running a production line where around 40% of the resource at the beginning never makes it to the end of the line, never mind onto the market, but that's what happens with Girls in STEM.

We must prepare for the economy we need to become

In an era where high growth in technology investment and industry is regarded globally as a key driver for productivity, it is those knowledge-intensive industries with the greatest potential to sell high value goods and services globally upon which a sustainable and resilient economy must be built.

The addition of higher value-adding jobs to the workforce is essential if overall competitiveness and the ever-widening' NI productivity gap' (NI now 17% behind UK average, 10% in 1997) is to improve.

Figure 1: Productivity - The Scale of the Problem[4]

[4] Sources: Box 1, NISRA; Box2, The NI Skills Barometer (UUEPC, 2017), Boxes 3 & 4, Understanding Productivity in NI (UUEPC, 2017)

Why are girls persistently disengaging with STEM?

A girl's motivation to pursue a Core STEM career can be influenced by self-confidence, stereotypes, educational environment, the perceived attractiveness of the sector and social factors including peers, parents, the presence of role models and media. Girls have lower levels of self- confidence in their ability than boys in mathematics and science and are less likely to continue in STEM education or pursue STEM careers, even within the context where they outperform boys.

Interviews with women in STEM careers across NI found that resilience and determination to succeed, despite the potential barriers, are key. However, the interviewees recorded a supportive home environment where STEM experiences were the norm and the presence of strong role models and mentors as being every bit as important.

At Primary School level

- A shortage of science expertise within primary schools across NI means just 12% of NI pupils in year 5 (age 9) are taught by teachers who have a science specialism and 18% by teachers who have a maths specialism (international averages, 38% and 41% respectively). A 2017 NI assembly research paper identified broader STEM issues in NI's primary schools:-
- The science and technology elements were underdeveloped in 54% of schools inspected;
- While 91% of teachers surveyed felt very prepared to teach maths (above international average), only 54% felt as ready to teach science (below international average).

At Secondary School level

- Gender dynamics in the classroom and school environment are critical. Teachers must be equipped to be proactive in STEM classes, to be aware that boys can easily take over in mixed classes, and to encourage girls to engage in the full breadth of STEM learning.
- Girls' learning outcomes in STEM can also be compromised by psychological factors such as maths or test anxiety and stereotype threat about their ability in STEM;
- Education providers are not adequately equipped with up-to-date knowledge of the various pathways to further study, STEM roles and careers.

At Tertiary level

- Only 14.8% of women pursue further study of core STEM to tertiary level, compared to 35.6% of men with women particularly underrepresented in engineering (14%) and computer science (16%).
- Both male and female staff in tertiary institutes have been found to present behaviours which subtly favour male students (staff more likely to respond to emails from male students, spend more time mentoring and more likely to seek participation from males in class). The presence of a female lecturer has a positive impact on women's participation.
- Careful consideration of course titles may contribute to more women enrolling on core STEM (traditionally male-dominated) courses e.g. greater cognisance of girls' career ambitions to bring solutions to the world for greater societal benefit.

In employment

- Despite women comprising almost half (48%) of the entire workforce in NI their representation in non-traditional, STEM occupations remains low.

- Women in STEM leadership roles, i.e. management, directorships and as senior officials remain underrepresented across all STEM fields (17% average).
- A critical point in the STEM women's career path arises during their mid-late 40s: representation at higher levels drop by 6% from 22% ; and continues to shrink until by retirement only 6% of science, research, engineering and technology professionals in NI are women.
- A recent Royal Academy of Engineering (RAE) report highlighted: "The perception that there is no 'crisis of inclusion' or burning platform, to drive action (rather a consistent pattern of low levels of inclusion with regard to women engineers)", as a potential barrier in addressing the fact that only 11% of UK engineering professionals being female.

Creating a more inclusive, respectful and meritocratic employment culture is fundamental to driving diversity in the workplace. Employers committed to proactively addressing gender gaps by embedding diversity strategies, will in turn secure increased growth and prosperity for all.

Conclusion

MATRIX isn't denying the need to attend to other important diversity challenges across the STEM workforce. Absolutely not - more can and should be done. However, as an economy facing ever increasing STEM skills and competitiveness challenges the biggest 'potential win' is indisputably engaging the untapped potential of half of the total workforce, NI's talented girls.

Who knows? In tackling the issues preventing girls from pursuing STEM, it may become more accessible and attractive to more boys too – and all to the good. But we must be clear - if we only promote STEM as an exciting and attractive education or career prospect without first tackling the gender issues set out above; then, at this point in 2018, as with the decade before, we are accepting that we are facing another 10 years of STEM supply stagnation – a further 10 years where the number of girls studying STEM between GCSE and A Levels drops by 65%, year-in, year-out.

And in real terms what that means for society is another generation of girls unable to fulfil their potential, unable to explore the world and wonder of engineering, as it touches every part of our lives - from spaceships to ice skates, the bubbles in chocolate bars to life saving cancer treatment. We are denying our young girls – some of the brightest and most creative talent at our disposal - the chance to make a positive difference to the future of the world around us.

The Prize? NI 2030: STEM READY

- Government commitment to strike out on an ambitious and confident footing could establish Northern Ireland as an **exemplar STEM region.**
- By 2030, **33%** of young people moving into STEM careers are girls
- Every child leaving primary school knows what an engineer does
- Girls can see themselves in **any STEM role**
- Senior management teams in STEM are **fully inclusive** and representative of a diverse workforce

Next Steps

Establishment of a DfE led, cross-departmental working group to develop (by year-end) a STEM action plan fit to deliver NI STEM-ready by 2030.

Recommendations

Leadership & Coordination

Encompassing government, industry and 3rd party representation, with authority to put in place:

- Transformative vision and commitment – challenge the status quo (based on the improvement of science capital to secure future economic and broader societal benefit)
- Address issues identified in relation to existing 'cluttered and complex' support landscape
- Coordination – to support collaboration and share best practice learning
- Key metrics
- Impact measurement

Visibility of STEM

The need to promote awareness of STEM careers is vital, in particular the promotion of:-

- STEM roles to children, parents, subject teachers and careers teachers – at all levels: primary, secondary and tertiary.
- All viable education and career pathways and visibility of earning potential.
- Development of resources to reflect future work opportunities – e.g:
    - Inspirational role models and celebration of women in STEM in NI campaign.
    - NI mentorship programmes (industry – schools; 3rd level students to secondary schools; secondary level pupils to primary schools).
    - Kitchen table skills barometer.
    - NI STEM businesses – case studies.

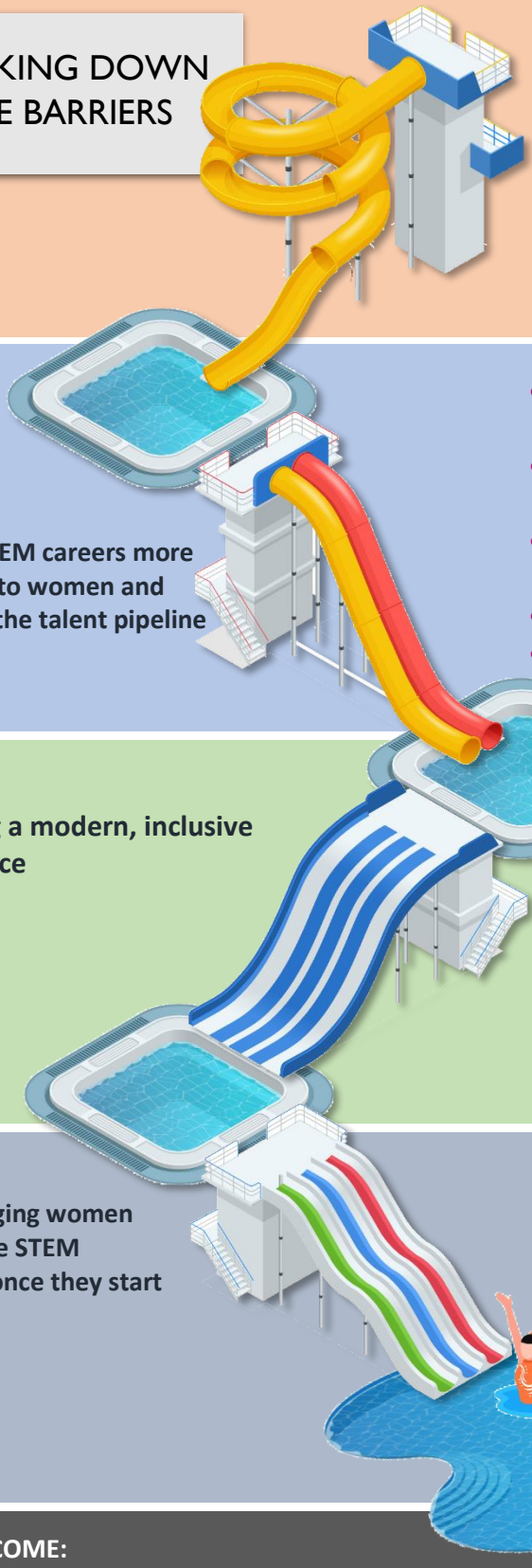
STEM Teaching

- Promotion of gender-neutral learning environments -teacher training to include STEM-specific focus on gender awareness and removal of stereotypes / unconscious bias training.
- STEM areas (e.g. engineering) embedded in initial teacher training and primary curriculum.
- Review need for STEM qualifications beyond GCSE for primary teacher training (explore incentives/use of quotas) and PGCE applicants.
- Time-tabled STEM-specific CPD for teachers, led by industry, with applied industry experience; and STEM-specific industry engagement for pupils.
- Review of metrics at policy level (realign grading towards employability measures). Provide an effective alternative to current league tables to incentivise / drive behaviour.
- Explore incentives to pursue courses in demand by industry (e.g. bursaries/fee reductions) – promoted alongside aspirational career pathways showcasing earning potential and real-world application of learning.

Workplace

- Inclusion and diversity education programme – articulate the return on investment.
- Promotion of benefits / celebration of pro-active employers.
- Re-setting the modern workplace – educate employers around needs of "millennials".
- STEM quality 'award' within the Gender Diversity Charter Mark NI (e.g. Athena Swann adapted /applied to business).

BREAKING DOWN THE BARRIERS



Good STEM organisation and leadership at government level

- A strong overall STEM strategy
- A clear vision for STEM in NI
- Full coordination of existing and new initiatives

Making STEM careers more attractive to women and nurturing the talent pipeline

- Industry promoting opportunities and diversity
- Language used – applied to societal benefit
- Aspirational work placements & internships
- Role models
- Mentorship programmes

Creating a modern, inclusive workplace

- Inclusive culture
- Unconscious bias training
- Innovative recruitment - returnships
- Flexible working
- Visibility of pay structures

Encouraging women to pursue STEM careers once they start a family

- Affordable childcare
- Shared parental leave

THE OUTCOME:
The potential of the entire population to embrace STEM is realized, driving innovation and economic growth, building a better place to live.

33% of core STEM workforce is female.