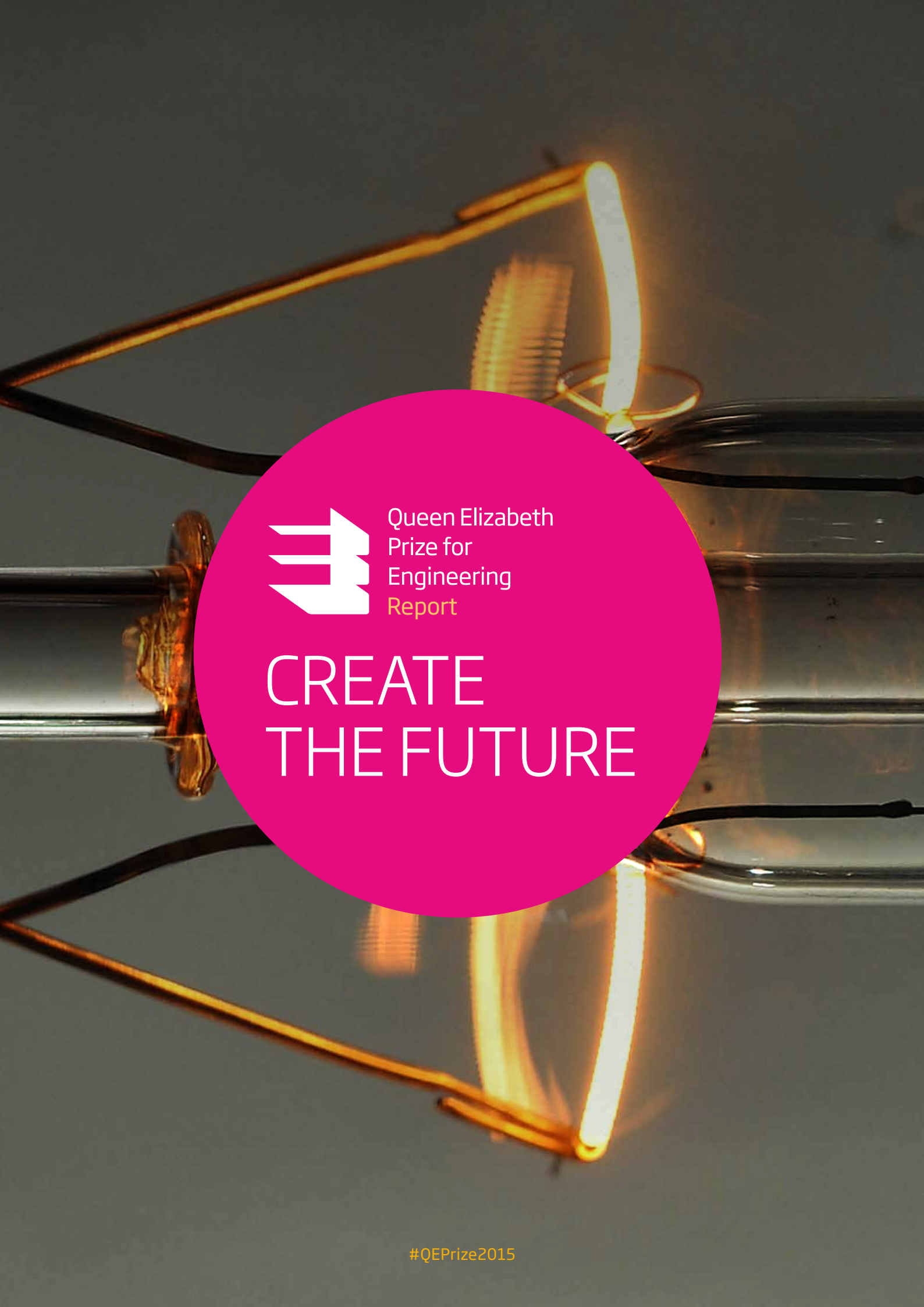
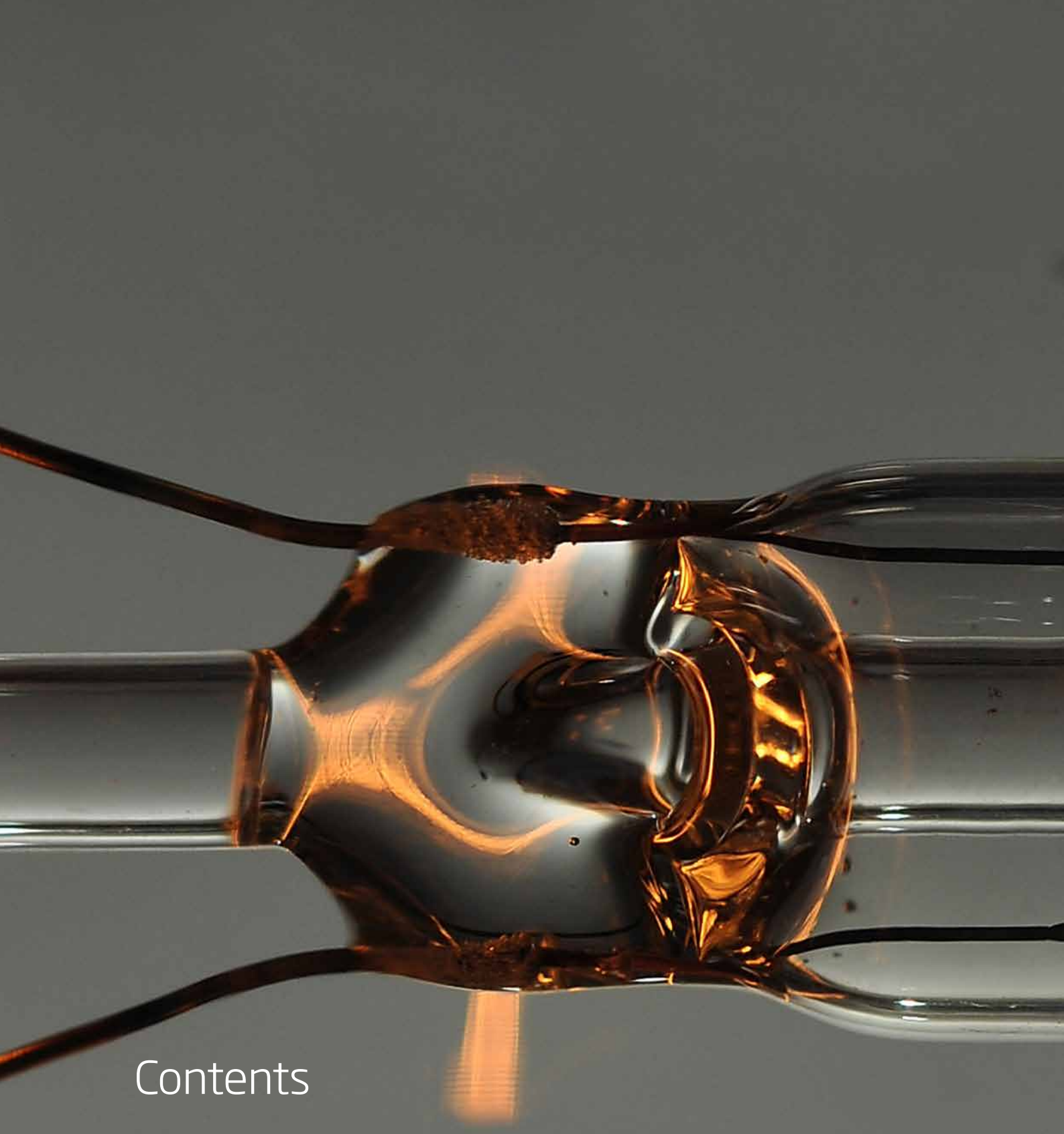


Queen Elizabeth Prize for Engineering Report

CREATE THE FUTURE

#QEPrize2015



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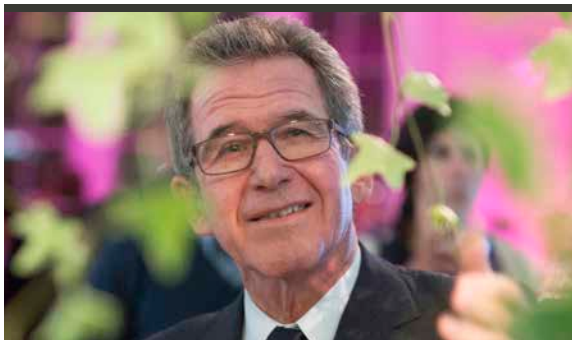


Lord Browne of Madingley
Chairman, Queen Elizabeth Prize for Engineering Foundation

The Queen Elizabeth Prize for Engineering celebrates the very best feats of engineering, and the engineers who make these feats possible. By sharing international successes and rewarding pioneering innovations that are of global benefit to humanity, the QEPrize seeks to inspire the next generation of innovators, creators and leaders.

In this first *QEPrize Create the Future Report*, we have examined the views of those outside the profession in ten key economies: Brazil, China, Germany, India, Japan, South Africa, South Korea, Turkey, the United Kingdom and the United States of America.

As an engineer myself, I was heartened by the report's findings. People around the world recognise that engineering is a key driver of both progress and innovation, and that it will play a vital role in solving the challenges that humanity will face in the years to come.

Two findings in the report stand out. The first is about purpose. The majority of people in the UK and the USA think that engineers are driven by the desire to fulfil a purpose in society, rather than to make a profit. That is encouraging, because in my experience, profit is the reward which comes from defining very clearly the contribution you make to society. This report suggests that not all countries feel the same way about engineers. I hope that the QEPrize will help to change that.

The second finding which stands out is that stereotypes about engineers are beginning to fall apart. The world no longer looks to engineers just for bridges and buildings, but for improvements to renewable energy technologies and solutions to global healthcare challenges. The majority of countries we surveyed have a gender-neutral view of engineering, while in the world's largest emerging economies, almost as many women as men say that they are interested in engineering. This bodes well for a future in which diversity of thought and unconventional thinking will be more important than ever.

Having said this, there is no room for complacency. The report also indicates that engineering is, at times, poorly understood. Young people in particular feel that an engineering degree is too expensive, and that they may encounter difficulties in building a career. Interest in STEM subjects is high, but interest solely in engineering lags some way behind.

The Queen Elizabeth Prize for Engineering exists to celebrate engineering achievements and to inspire the next generation of engineers. Backed by our global donor companies, our trustees, our judges and our growing network of young QEPrize Engineering Ambassadors, we remain committed to ensuring that engineering shapes the future.

Queen Elizabeth
Prize for
Engineering
Report

OUR FIRST CREATE THE FUTURE REPORT

This is the first *QEPrize Create the Future Report* on public attitudes to engineering. The report is based on a survey of 10,000 people across 10 countries which makes it the first international survey of its kind.

We have combined the data points with commentary from world leading engineers, business leaders and academics, which adds depth and context to the findings.

We are hugely grateful for the contributions from the QEPrize judges, trustees and donors.


Brazil


China


Germany


India


Japan

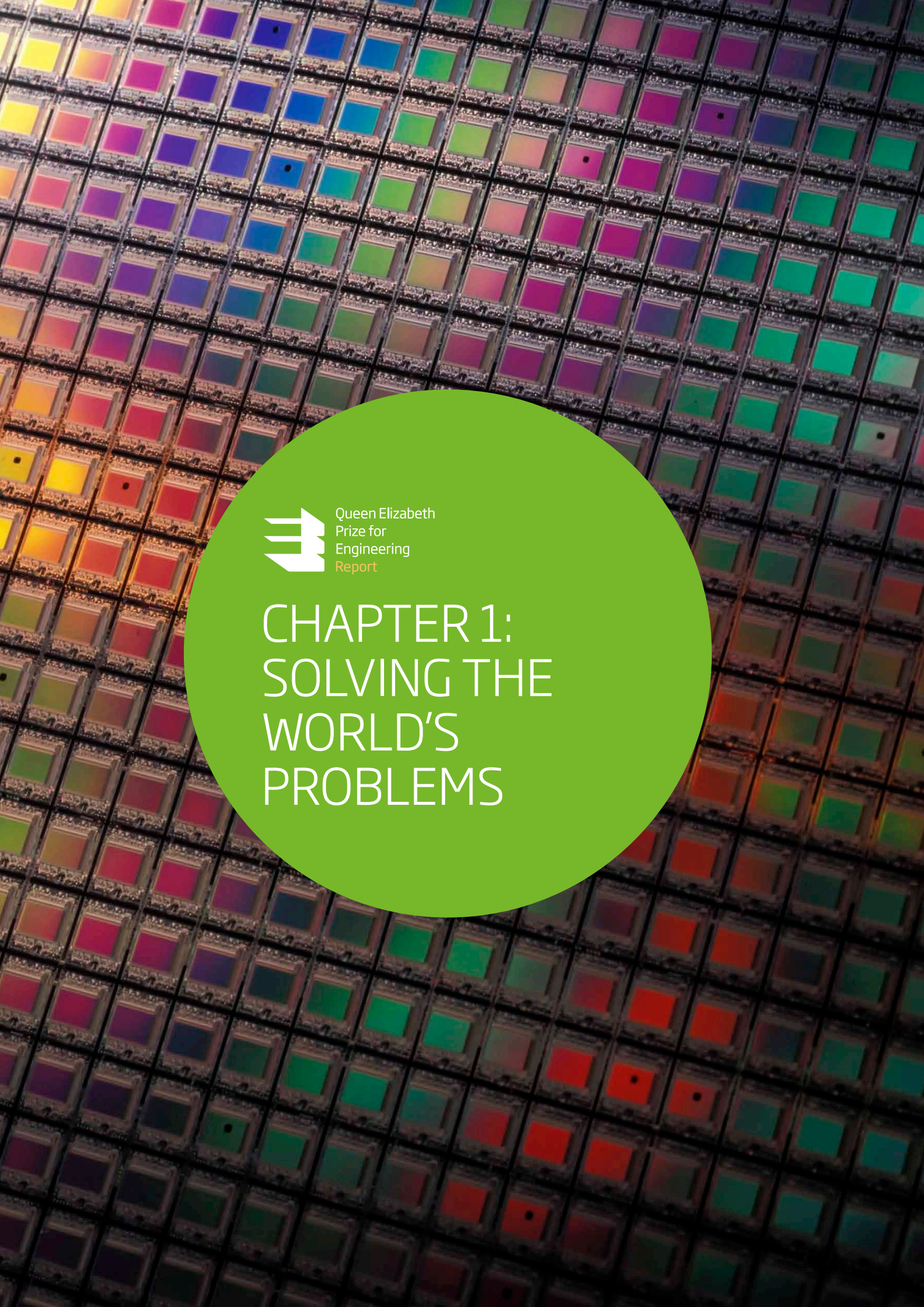

South Africa


Republic of Korea


Turkey


UK


USA



Queen Elizabeth Prize for Engineering Report

CHAPTER 1: SOLVING THE WORLD'S PROBLEMS

All over the world, people believe engineering holds the key to human progress

All over the world, people believe engineering holds the key to human progress. Yet, while recognising the sector's role in powering innovation, people also want the sector to do more when it comes to solving the planet's most pressing problems.

People feel that engineering could and should lead the way in building a better, more sustainable world of tomorrow in areas including renewable energy, transport infrastructure, healthcare, reducing social inequality and data security.

The good news is that they believe it can be done. People are united in their respect for the engineering sector's positive influence on society in the past. More importantly, nine in ten of them believe it can now provide solutions to the environmental, social and infrastructure challenges of the future.

The world is looking to engineers to address some of humanity's most important challenges.

1

While the current role of engineering is seen as inspiring new innovations, people are calling for a drastic shift in focus, with "solving the world's problems" moving from **7th** place in roles for engineering in the present to **1st place** for roles for engineering in the future.

2

There is faith in engineering to **solve the world's problems**. There is particular faith in engineering solving **environmental** and **infrastructure** challenges.

3

Within the next 20 years, people want to see engineering **improve renewable energy** and **healthcare** and are very **optimistic** it will achieve this.

Professor Choon Fong Shih
University Professor, National University of Singapore, Singapore

One of the most encouraging findings of the *QEPrize Create the Future Report* is its highlighting of the faith the general public place in engineers and engineering to deliver changes which will be of great benefit to society. As engineers we must all be mindful of this responsibility.

The report shows that the optimism people feel for the ability to drive innovation is not limited to any single economy. Across each of the ten markets people are looking to engineering to solve the world's problems.

The Queen Elizabeth Prize for Engineering greatly encourages the engineering community by recognising and rewarding their outstanding innovations as well as by raising the profile of engineering.

By recognising the achievements of the world's leading engineers the Queen Elizabeth is working to ensure that sufficient young people are inspired to take advantage of the opportunities offered by a career in engineering and to meet the challenges of the future.

ENGINEERING HAS PLAYED A LARGE PART IN CREATING OUR PAST, AND IT IS AGREED IT WILL PLAY A CRITICAL ROLE IN OUR FUTURE

Engineering's contribution to our past and future is unanimously agreed across markets

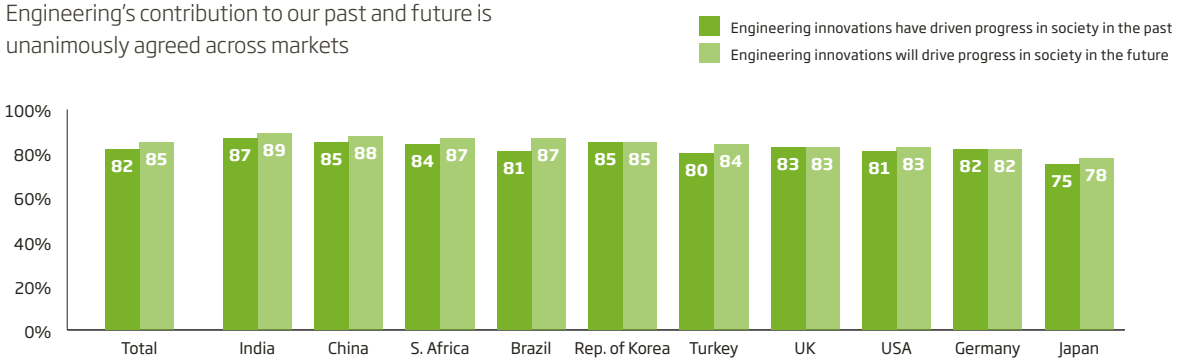


Fig.1. Below are some statements about engineering's contribution to society. Please indicate on the scale below how much you agree or disagree with the following // Base: All Respondents 10341. Net: Doing a little /a lot Net: Somewhat / Strongly agree.

Bob Dudley
Group CEO, BP

I am an engineer. I serve mankind by making dreams come true. This line was reportedly found pinned to a site hut during the construction of the spectacular Konkan railway in western India. It reminds us that engineers have played a central role in creating today's advanced technological society – from the steam turbine to the smart phone, the internal combustion engine to the internet. Many challenges have been overcome – but as soon as one problem is solved, another comes along, even more demanding.

The world of energy is a case in point. More energy is required to lift millions from poverty. Yet we need energy to have less environmental impact. Resolving that paradox is one of the great missions of this century. It will require the best brains. So we should ensure young people understand the opportunity – to be an engineer and to shape the future.

THE PERCEIVED ROLE OF ENGINEERING IS SHIFTING TO SOLVING THE WORLD'S PROBLEMS

THE ROLE OF ENGINEERING TODAY		
1st	To **inspire** new innovations	59%
2nd	To **improve** the quality of people's lives	58%
3rd	To help the **economy grow**	57%
4th	To drive progress in society	55%
5th	To provide new job opportunities to my community	51%
6th	To **solve my country's** problems	44%
7th	To **solve the world's** problems	42%
8th	**To inspire today's youth**	58%
9th	To raise public awareness of challenges and progress	48%
10th	To inform public policy	40%
11th	To address social issues in society	39%

THE ROLE OF ENGINEERING IN THE NEXT 20 YEARS		
1st	To **solve the world's problems**	57%
2nd	To **inspire** new innovations	55%
3rd	To **improve** the quality of people's lives	55%
4th	To drive progress in society	54%
5th	To **solve my country's problems**	54%
6th	To help the **economy grow**	53%
7th	To provide new job opportunities to my community	49%
8th	To raise public awareness of challenges and progress	46%
9th	**To inspire today's youth**	45%
10th	To address social issues in society	41%
11th	To inform public policy	40%

Fig.2. In your opinion, which of the following describes the role of engineering within society today and in the future? // Base: All respondents – n=10,341

ENGINEERING IS SEEN TO HAVE A HAND IN SOLVING A RANGE OF GLOBAL CHALLENGES, WITH AN EMPHASIS ON ENVIRONMENTAL CHALLENGES

The sector is seen as a major contributor to all great global challenges, and a leading problem-solver for environmental and infrastructure issues

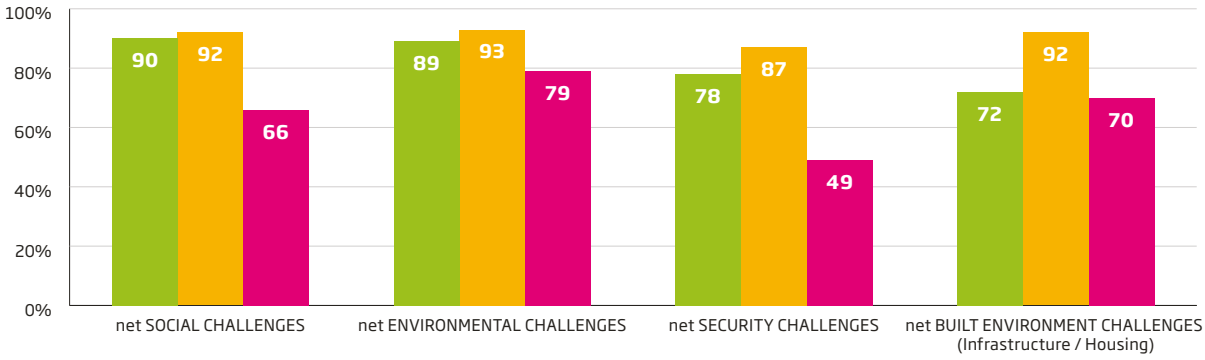


Fig.3. How important do you think the following global challenges are? Net: Very important / To what extent do you think engineering is helping provide solutions for each of the following global challenges? / And which, if any, of these challenges do you think engineering can solve? / And how much do you agree or disagree with the following statements about engineering's role in solving the major problems (eg environmental, economic, social issues) facing the world? // Base: All Respondents 10341 Net: Doing a little/ a lot

Professor Reinhard Huettl
President of Acatech (National Academy of Science and Engineering), Germany

Innovation is the key to sustainable value creation and employment. It is crucial for overcoming challenges such as demographic change, new mobility, digital transformation and the energy transition. Today, however, there is already a shortage of adequately qualified personnel in many innovative industries. As a result of high staff turnover and the anticipated future increase in recruitment levels, a growing deficit is becoming apparent.

The *QEPrize Create the Future Report* delivers an important international comparison. Motivations for choosing engineering as a career are changing rapidly. Young people in Germany and worldwide expect that engineering will focus on solving the world's problems. They are increasingly interested in contributing to society, although career opportunities remain a strong motivator. Future innovators want to be part of a sustainable society! We have to point out that science and engineering provide the means to reconcile responsibility with good career opportunities.

The QEPrize report corresponds perfectly to the results of our *German Barometer of Young Talent* in the STEM subjects. The report finds a moderate level of general interest in engineering in Germany, which contrasts to the high international reputation of our engineers. Moreover, there is a grave gender gap in interest in engineering in Germany – similar to the UK, Japan, and the US, but much wider than in emerging economies such as India or Brazil. Our German *STEM-Barometer* has also found that, for young people in Germany, the gender imbalance is a result of varying encouragement between boys and girls. We have to inspire the next generation of engineers. Challenges include the enhancement of interest in schools and minimizing dropout rates at universities. And we have to develop the literacy of our societies in science and engineering. The QEPrize report clearly shows similar challenges in countries such as Germany and the UK – we certainly can learn from one another.

'SOLVING THE WORLD'S PROBLEMS' TOPS FUTURE PRIORITIES FOR ENGINEERING IN 8 IN 10 MARKETS AND ALL GENERATIONS

What people want engineering to focus on in the future by market (ranked by highest scoring)

	UK	USA	GER	TURKEY	INDIA	CHINA	REP. OF KOREA	JAPAN	SOUTH AFRICA	BRAZIL
To solve the world's problems	**1st**	**1st**	**1st**	3rd	**1st**	**1st**	**1st**	3rd	**1st**	**1st**
To inspire new innovations	2nd	3rd	3rd	4th	3rd	3rd	4th	**1st**	7th	6th
To improve the quality of people's lives	3rd	2nd	2nd	**1st**	7th	6th	3rd	4th	5th	4th
To solve my country's problems	4th	4th	6th	6th	**2nd**	**2nd**	**2nd**	6th	**3rd**	**3rd**
To drive progress in society	5th	6th	4th	2nd	4th	4th	5th	2nd	4th	2nd
To help the economy grow	6th	7th	5th	5th	5th	5th	6th	5th	2nd	5th
To provide new job opportunities to my community	7th	5th	9th	7th	6th	8th	8th	10th	6th	7th
To raise public awareness of challenges and progress	8th	8th	8th	9th	8th	10th	7th	8th	8th	8th
To inspire today's youth	9th	9th	7th	8th	9th	7th	9th	9th	9th	10th
To inform public policy	10th	10th	10th	11th	11th	11th	10th	11th	11th	11th
To address social issues in society	11th	11th	11th	10th	10th	9th	11th	7th	10th	9th

Professor Frances Arnold
Professor of Chemical Engineering, Bioengineering and Biochemistry, Caltech, USA

Sustainable energy technology is the basis of a sustainable society. Meeting growing needs and expectations will require real engineering creativity. When I want to see creativity in action, I look to the biological world–the 'internet of living things' of which we are just a small part. Evolution innovates in wonderful ways and shows us how small steps can lead to big and often surprising changes in the machinery of life.

Even more exciting, we can use evolution as an algorithm for forward engineering, creating efficient biological solutions to pressing problems in energy and sustainability such as replacing fossil resources with renewable ones or replacing 'dirty' chemical processes with cleaner, biological ones.

What people want engineering to focus on in the future by generation (ranked by highest scoring)

	16 - 17	18 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65+
To solve the world's problems	**1st**	**1st**	**1st**	**1st**	**1st**	**1st**	**1st**
To improve the quality of people's lives	2nd	2nd	2nd	2nd	2nd	3rd	5th
To drive progress in society	3rd	4th	6th	4th	3rd	4th	2nd
To solve my country's problems	**4th**	**3rd**	**3rd**	5th	5th	5th	4th
To inspire new innovations	5th	6th	5th	**3rd**	**4th**	**2nd**	**3rd**
To help the economy grow	6th	5th	4th	6th	6th	6th	6th
To provide new job opportunities to my community	7th	7th	7th	7th	7th	7th	8th
To raise public awareness of challenges and progress	8th	8th	8th	8th	8th	8th	7th
To inspire today's youth	9th	9th	9th	9th	9th	9th	9th
To address social issues in society	10th	10th	10th	10th	11th	10th	11th
To inform public policy	11th	11th	11th	11th	10th	11th	10th

Fig.4. In your opinion, which of the following describes the role of engineering within society today and in the future? // Base: All respondents – n=10,341

Helge Lund
Chief Executive, BG Group

Engineers will build our future. This report recognises the great contribution engineering can play in solving some of the world's biggest issues particularly the environmental challenges. It highlights the expectations that society is placing on the shoulders of engineers. From climate change to supplying affordable and sustainable energy for all, we face problems that mean we must develop the best and brightest talent in engineering.

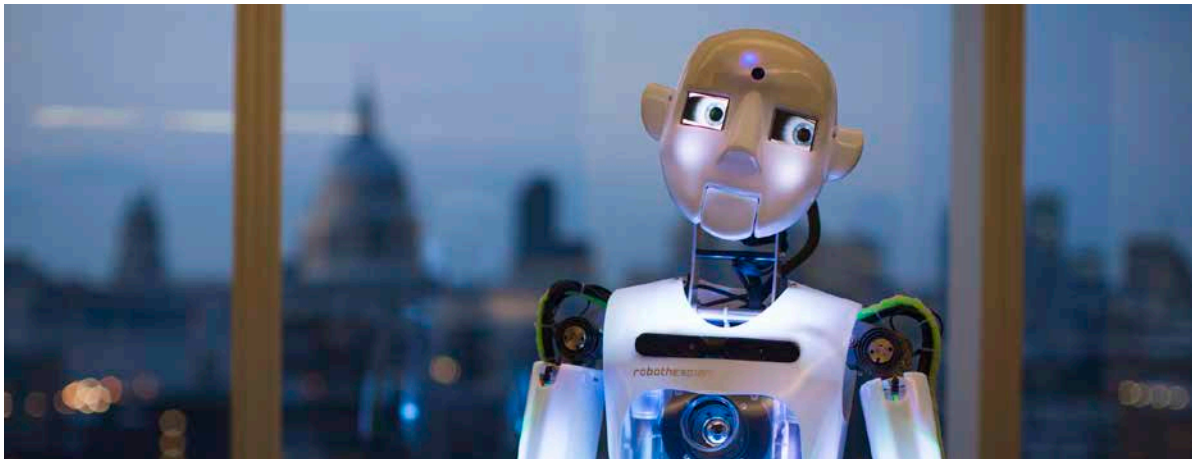
ADDRESSING ENERGY AND HEALTHCARE ISSUES TOPS THE LIST IN ALL MARKETS

	UK	USA	GER	TURKEY	INDIA	CHINA	REP. OF KOREA	JAPAN	SOUTH AFRICA	BRAZIL
Improve renewable energy (eg solar, wind, fusion)	55%	60%	68%	53%	48%	59%	58%	57%	71%	59%
Improve healthcare (eg medicines and treatment)	50%	50%	49%	49%	41%	61%	41%	32%	58%	48%

While all markets agree on the importance of addressing energy and healthcare challenges, when we look at the importance put on other issues, we see each individual country's local struggles and problems surface and take priority

Reduce unemployment	40%	36%	28%	41%	46%	40%	26%	17%	**66%**	46%
Address housing challenges	37%	30%	36%	40%	34%	**49%**	17%	11%	51%	48%
Address infrastructure challenges (eg roads, plumbing, cities)	**48%**	**52%**	**51%**	44%	44%	**53%**	23%	29%	**61%**	48%
Address water scarcity	44%	46%	54%	50%	40%	51%	31%	22%	**59%**	**54%**
Improve education (eg access, online learning, technology in schools)	34%	42%	35%	37%	44%	47%	17%	18%	**54%**	44%
Address social inequality (eg gender, wealth)	23%	23%	29%	29%	30%	**52%**	17%	15%	29%	32%

Fig.5. Thinking about the ideal future, which of the following would you like to see engineering to achieve within the next 20 years? // Base: All respondents - n=10,341 / And which of these do you think engineering will achieve within the next 20 years? // Base: All respondents - n=10,341



GLOBALLY, PEOPLE ARE INCREDIBLY OPTIMISTIC ABOUT WHAT THEY FEEL ENGINEERING CAN ACHIEVE IN THE NEXT 20 YEARS

% who think engineering will achieve...

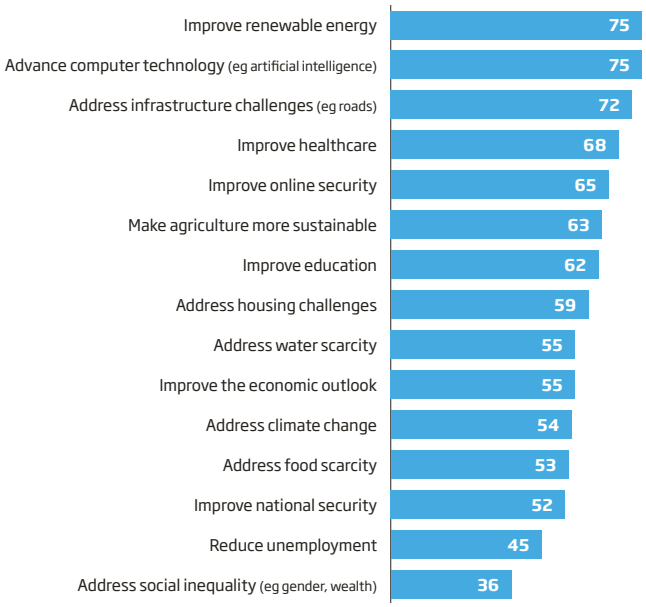


Fig.6. And which of these do you think engineering will achieve within the next 20 years? // Base: All respondents - n=10,341

Professor John Hennessy
President, Stanford University, USA

Engineers solve problems. They do so through the creation and deployment of new knowledge and technologies to create cost-effective solutions, often to the most demanding problems the world faces.

Among the most important of these technologies is information technology. Information technology has an almost unique role because of its universality: it can be deployed via software programming to overcome challenges in many different arenas. For example, creating a renewable energy system will depend on smart grids–powered by computation and communication technology–to manage intermittent energy sources. Using massive computational resources to analyse the relationship between the genome and human disease will be critical to creating new therapies for many chronic diseases. Computers are also being deployed to search for cost-effective medicines for diseases in the developing world.

The use of information technology for education has recently received great attention, and it is increasingly clear that online education can play a transformative role particularly in the developing world where educational institutions cannot meet the demand. The dramatic decreases in the cost of communication and computing technology have enabled these technologies to reach the developing world. For example, low-cost cell phones are helping communities with limited healthcare resources, providing diagnostic information to individuals, and allowing them to get help faster and more easily.

The first Queen Elizabeth Prize for Engineering celebrated what is arguably the most important creation of the past 50 years in information technology: the development of the internet and World Wide Web. The inventors that the prize recognized not only developed the fundamental principles that underlie the Internet but they were only instrumental in deploying the technology. Because the internet and World Wide Web are information technology platforms, the range of applications of this technology have far outstripped what the inventors could have imagined. Simply put, these engineers changed the world.

Queen Elizabeth Prize for Engineering Report

CHAPTER 2: RECOGNISING AND UNDERSTANDING ENGINEERING

People across the world believe engineering is undervalued

Compared to 12 other professions in each of the 10 countries surveyed – including business leader, lawyer, doctor and teacher – a career in engineering topped the list of jobs seen as vital to economic growth. It also ranked an impressive fourth for both prestige and accessibility.

Yet it is a profession that many feel is undervalued, with seven in ten people claiming that their country's engineers do not receive the recognition they deserve for their contribution to society. This may be causing interest levels among would-be recruits to lag behind the more general science roles of a STEM-based career.

While many of the myths and stereotypes surrounding engineering are dying out, the way people view the sector remains the subject of significant cultural variation.

In countries that have recently experienced rapid economic growth, such as India and China, interest in the profession is strong and spread relatively evenly across men and women. However, in more established economies, such as the USA and Germany, an engineering career appeals to fewer people, the vast majority of whom are male.

To truly harness the potential of the engineers of tomorrow, it is vital the sector finds ways to make it both desirable and accessible to all.

1

A career in engineering is well regarded. Among the careers measured, engineering is seen as **1st out of 13 as vital for economic growth, 4th for prestigious, and 4th for accessible.**

2

However, in certain markets it is seen as **undervalued** for its contribution to our present.

3

Engineering has **significantly different cultural interpretations**, as developed nations show a mediocre level of interest in the topic with a wide gender gap, while emerging economies show a significant interest in engineering with a more even gender spread.

I firmly believe that our continued success as a company – and as a society – depends on the bright, inquisitive minds of the engineers, scientists and technicians of tomorrow. This report shows that just 20% of 16 to 17 year-olds from the UK and 30% from the USA are interested in an engineering career compared to 80% in India. This is largely due to the outdated idea among students, parents and even teachers that jobs in these sectors are grubby, underpaid and "not for girls". We're working hard to shatter these stereotypes. That's why we are reaching out to young people of all ages to raise awareness of STEM career opportunities.

Steve Holliday
Chief Executive, National Grid

Paul Westbury CBE
Group Technical Director, Laing O'Rourke, UK

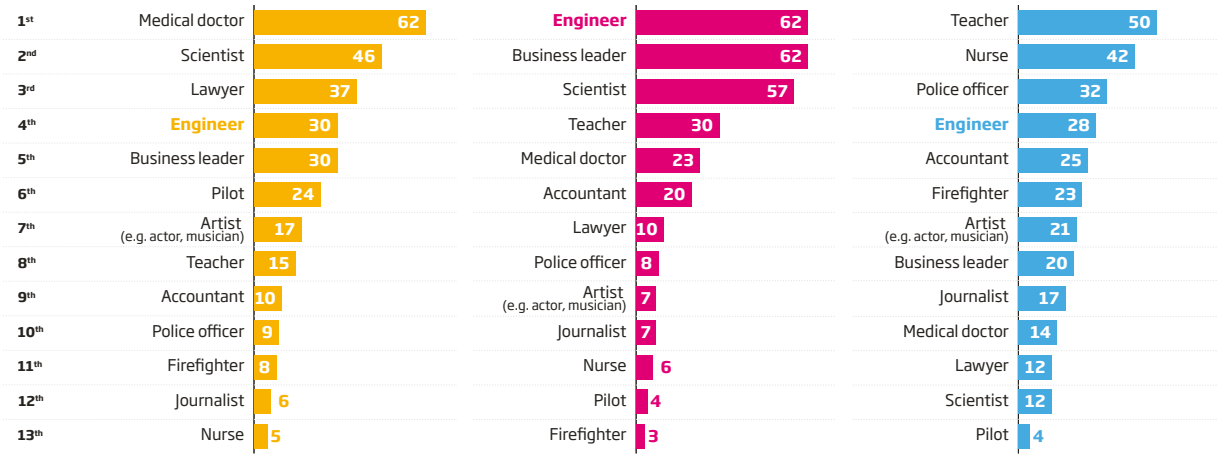
Engineers are increasingly seen as smart, creative and sociable people who are well connected to the world around them; a welcome shift from the dated stereotypes of the past! Engineering is not only seen as the number one profession that will solve the world's biggest problems, but it is also now regarded as the number one driver for future economic growth.

Businesses and governments have long understood that engineering makes a significant contribution to society and it is reassuring that public perceptions are increasingly aligning with this view. Public expectations around the positive future impact that the engineering profession must make have lifted, and a strongly performing engineering sector is increasingly seen as pivotal in securing a safe and secure future.

But there remain a number of significant challenges. The engineering profession still struggles to communicate the detail of what it does as broadly and as accessibly as it must and seems ill served by being badged as the "E" within STEM. Science, technology and mathematics are cornerstones to engineering, so with interest in STEM and science seen to be riding high it is noteworthy that this excitement doesn't always translate. Engineering takes science and develops technology solutions that make it directly applicable to the world around us. Engineering is the key bridge between science and society and as such is of profound importance to the actual delivery of solutions for people. More work is needed to communicate what we do; in the developed world to remind people of the huge future task at hand and to encourage more women into the profession, and in the developing world to encourage a sustainable balance between economic, social and environmental progress.

To attract and retain the best and most diverse global talent, our profession must stand on its own two feet and continue to ignite imagination, showcase innovation, and shout about the positive impact that engineering has, and must have, on the world around us.

ENGINEERING REMAINS AN ADMIRED AND ASPIRATIONAL PROFESSION



4th
out of 13 as a **prestigious** career

1st
out of 13 as a career **vital for economic growth**

4th
out of 13 as an **accessible** career

Fig.7. Please choose the three professions or careers which you see as the most prestigious / Please choose the three professions or careers which you see as the most vital for economic growth / Please choose the three professions or careers which you see as the most accessible (ie education and career opportunities are available for everyone) // Base: All Respondents 10341

ENGINEERING CONTRIBUTIONS TO SOCIETY ARE SEEN AS UNDERAPPRECIATED BY THE MAJORITY IN ALL COUNTRIES

Engineering's contribution is seen as undervalued by 7 in 10 people.

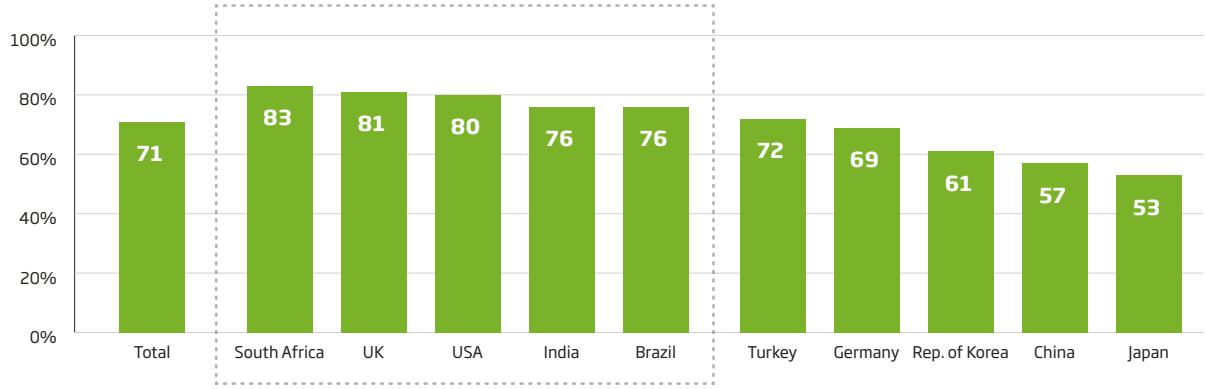


Fig.8. Below are some statements about engineering's contribution to society. Please indicate on the scale below how much you agree or disagree with the following // Base: All Respondents 10341 / Net: Doing a little/a lot Net: Somewhat /Strongly agree

Narayana Murthy
Founder, Infosys, India

Since its birth 30,000 years ago with the invention of the bow and arrow, engineering has been successfully driving progress in all aspects of our lives.

Yet while 84% of people agree the sector is vital to enhancing innovation, improving lives and stimulating economic growth, just 55% express an interest in actually doing it as a job. This compares to 91% who say they would like to follow a STEM career.

So why is this?

One reason could be that US Ivy League colleges and UK Oxbridge universities have traditionally focused on the liberal arts. Students of these topics have therefore tended to hold society's most prestigious and well-paid jobs, making arts subjects more attractive to young people and limiting interest in areas like engineering.

Now, however, globalisation is changing things. While much of the developed world continues to experience moderate interest in engineering careers, emerging economies are providing a new breeding ground for engineers.

For example, in India, the software services industry alone recruits about 300,000 people every year. Meanwhile, over a third of the country's engineering students are women.

This boom is partly due to businesses wanting to make use of the comparatively cheap production and talent costs. Yet it is also helped by the fact most of the work modern engineers do involves design and programming, rather than hard physical labour. This is opening the door to more women and leading to a better gender balance.

In the future the Internet of Things will undoubtedly create more job opportunities across all branches of engineering. By developing strong skills in system design and computer programming, engineers can have an even greater impact on the world of tomorrow than they have had on the one of today. And that's true no matter what country they live in.

INTEREST IN ENGINEERING LAGS BEHIND STEM, WITH VARIATIONS BETWEEN COUNTRIES

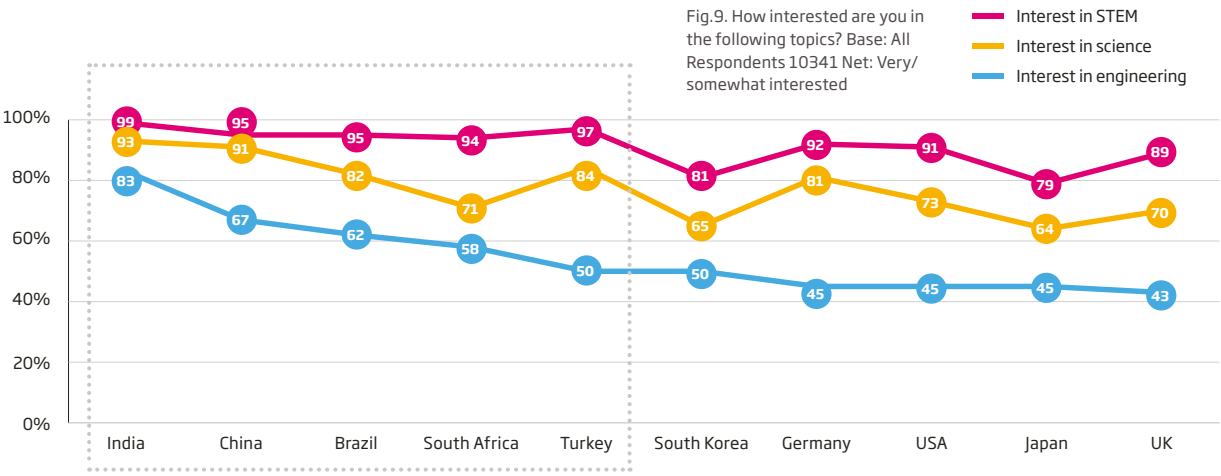


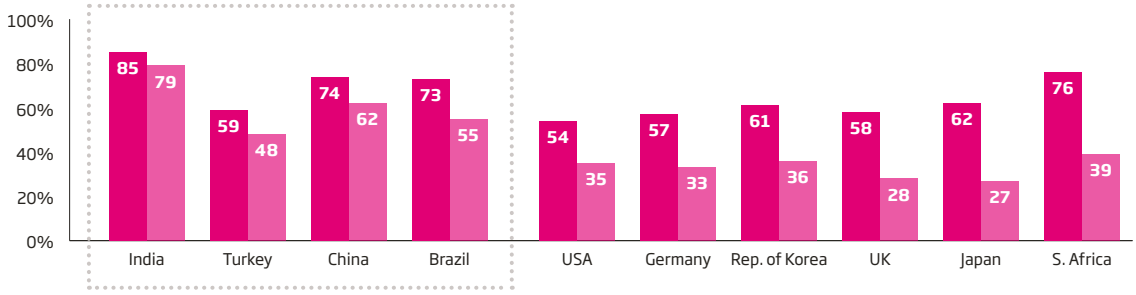
Fig.9. How interested are you in the following topics? Base: All Respondents 10341 Net: Very/ somewhat interested

91% Interest in STEM

77% Interest in science

55% Interest in engineering

EMERGING ECONOMIES, AHEAD OF DEVELOPED ECONOMIES, HAVE MOVED BEYOND ENGINEERING AS A MALE DOMINATED FIELD, AND INTEREST IS HIGH AMONG WOMEN



66% of men globally are interested in engineering

43% of women globally are interested in engineering

Interest in engineering: men

Interest in engineering: women

Fig.10. How interested are you in the following topics? Base: All Respondents 10341 Net: Very/ somewhat interested

Professor Dame Ann Dowling DBE
President, Royal Academy of Engineering, UK

Engineering is a rich, diverse career that allows people to make a real difference to society. Challenging perceptions that limit new entrants into engineering studies or the profession has long been an imperative for engineers and public engagement stakeholders in the sector and it is encouraging to see responses in the first *QEPrize Create the Future Report* that indicate a positive understanding of engineering and its potential.

Engineering has an enormous impact on societies, affecting everything from energy, water and transport, to the supply chain of every major global industry. The responses reflect a level of recognition of this - headway has been made in highlighting, for example, the link between engineering and economic growth, and the surveyed sample echoes this success. Promoting an understanding of the breadth of engineering careers on offer and of the vital role of engineering in solving global challenges is important in generating interest in the sector across diverse networks of individuals. Showcasing the creative, collaborative and team-based sides of engineering work and leveraging interest in other STEM fields, which often overlap, undermines dated stereotypes of what an engineer is.

Inexorably woven into the fabric of daily life, engineering is a thoroughly modern profession. However, myths and stereotypes are still the product of cultural variation and need to be discredited.

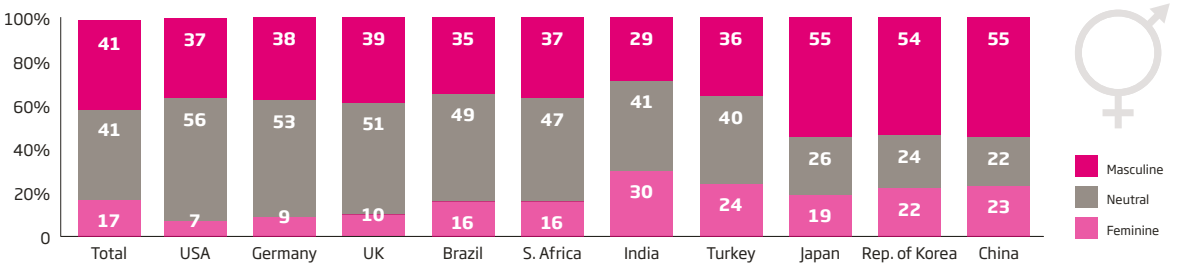
Much has been done over the last 30 years to increase gender diversity in engineering – although it is critical that we continue to address underrepresentation of women in the sector, as part of the effort to meet the need for an adequate skills pipeline. I have been fortunate to have been encouraged in and to have enjoyed a rewarding career in engineering, focusing primarily on aircraft noise, but exploring diverse related research areas – from clean combustion to energy-efficient cities. It's exciting for engineering students and engineers to see their work realised in an industry context and so much has been achieved by female engineers over the last 30 years. It is a responsibility for industry, engineers and educators to ensure that young people, regardless of gender, are exposed to the potential of a career in engineering.

The *QEPrize Create the Future Report* speaks to the international aspect of the Queen Elizabeth Prize for Engineering. In the same way that the QEPrize shares and celebrates international successes to inspire the next generation, markets can draw and apply lessons from their counterparts across the globe.

THERE ARE SIGNIFICANT CULTURAL DIFFERENCES BETWEEN PERCEPTIONS OF ENGINEERING

GENDER NEUTRALITY

Most markets, while acknowledging a skew towards masculinity, have a **fairly gender neutral view** of the profession.



PURPOSE VS. PROFIT

While engineers in emerged economies are more associated with purpose, **emerging markets view engineers as profit-driven**.

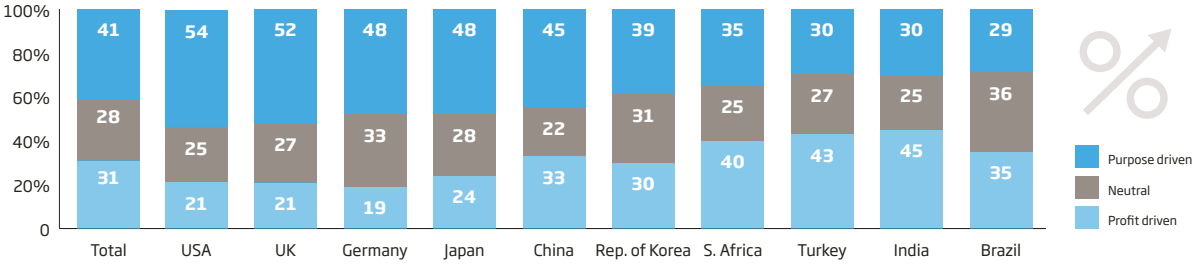


Fig.11. Now thinking about how you perceive an engineer, please indicate on the scales below where you think an engineer falls // Base: All Respondents 10341

Nigel Whitehead
Group Managing Director, BAE Systems

As an engineer myself I am passionate about the exciting possibilities presented by engineering, but I'm also aware that there remains a lack of knowledge about the breadth and range of career opportunities in engineering and science.

Our sector needs to work together to overcome some of the outdated stereotypes and old-fashioned notions that engineering isn't a career suitable for women. We must do more to show all young people, and their parents, that engineering is a great career choice and be bolder about the importance of STEM subjects.

A strong engineering sector is crucial to the UK economy and attracting more talent to this sector is a challenge that industry, government and academia must solve in partnership.

Professor Viola Vogel
Head of the Laboratory of Applied Mechanobiology, ETH Zurich, Switzerland

Emerging economies (India, Turkey, China, Brazil) have narrower gender gaps regarding the overall interest in engineering than the leading economies of the world. This is astounding since women have a far more equal access to education in the US, Germany, Japan and in S. Korea, compared to the emerging world, yet their aptitude to pursue engineering careers is less. In these same industrialized nations, more than 35% of the population consider engineering as a masculine domain. Access to education might thus not be the major driver for women to decide against engineering, but the overall societal perception of engineering as a discipline might be a key barrier.

To the contrary, in India where women of the emerging middle class are increasingly fighting for equal rights, only 29% of the population consider engineering as masculine, while an amazing 30% consider it as feminine. This is the second most surprising finding, since India therefore has by far the most gender-balanced view towards the attractiveness of engineering in comparison to all of the other countries.

What goes wrong in our industrialised nations? Can it be that the peer pressure on young women to choose something else, but engineering, is actually higher in the industrialised nations than in India? Perhaps the last graphic gives some insights. India ranks highest in the perception that engineers are profit-driven. Perhaps society, or the young women themselves, consider engineering as an attractive choice since it is a profession that promises their fiscal independence? Is the drive to gain fiscal independence for women less pronounced in the industrialised world, thereby motivating them to make alternate choices?

This might shed light into a puzzle that is troubling all of us engaged as academicians in engineering outreach programmes aimed at increasing the percentage of female students in engineering over the last decades. Yet, these programs had far less success than initially hoped. In this context, it is troubling that 57% of all responders associate some negative trades in the social skill sets of engineers. Perhaps we need to focus all our attention on these negative perceptions in order to get them debunked.

SEVERAL MYTHS AND STEREOTYPES ABOUT ENGINEERS ARE BEING ERODED

93%
agree that engineering has one of these **positive traits**

+

85%
agree most engineers are **intelligent**

86%
agree engineers are **logical and fact-based people**

86%
agree engineers are **good at maths**

84%
agree engineers are **creative people**

ONLY
57%
agree that engineering has one of these **negative traits**

−

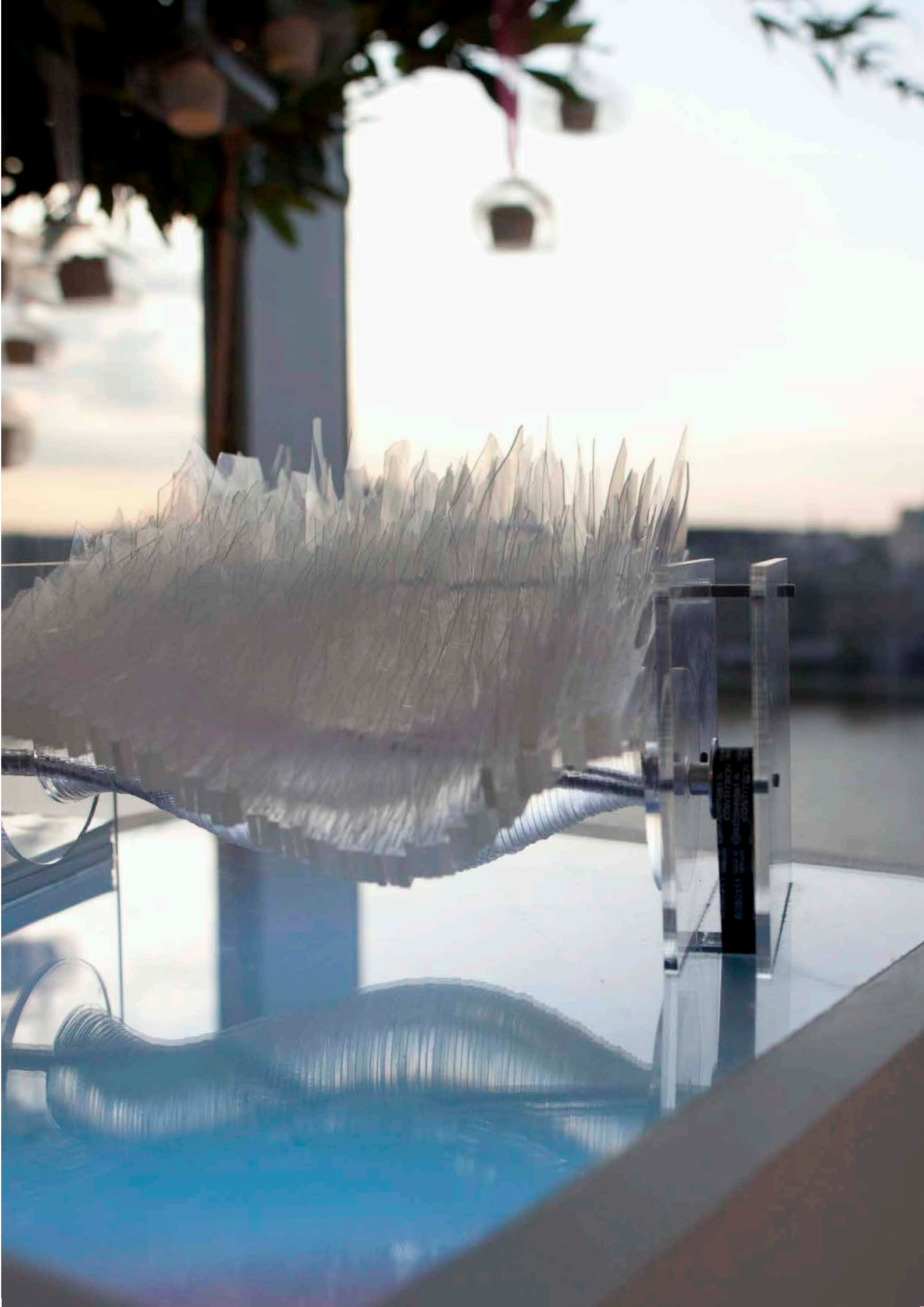
A MINORITY OF PEOPLE HOLD OUTDATED VIEWS

35%
think engineers are **detached from the world around them**

39%
think engineers are **not social**

42%
think engineers are **not good at public speaking**

Fig.12. How well do each of the following statements describe the way you would describe an engineer?// Base: All Respondents 10341



Queen Elizabeth
Prize for
Engineering
Report

CHAPTER 3: INSPIRING THE NEXT GENERATION

The engineers of tomorrow want to contribute to society

Respect for engineering's contribution to society is almost universal, meaning the future of the sector looks bright. However, exactly how bright depends on perspective.

In countries that have recently experienced economic growth, the profession holds huge attraction for the next generation. For example, in both India and Turkey, around 80 per cent of 16 to 17-year-olds say they are interested in engineering.

However, that figure drops to just 20 per cent in the UK, where interest is greatest among those aged 45 and over. This trend is replicated across other, more established economies, such as Japan and the USA. It also endures despite the overall appeal of STEM-based careers remaining high.

In order to turn respect into action, the sector must find a way to motivate the engineers of tomorrow. With young people claiming to be driven not by money or prestige but by a wish to contribute to society and build a long-term career, this means demonstrating how an engineering career can match their ambitions and desires – at both a global and local level.

Equally key will be continuing to challenge the common misconception that engineering degrees are too expensive or too difficult to complete.

1

A **localised** approach is essential to engage the next generation, as we see younger generations in emerging economies are more interested in engineering than their older counterparts while the reverse is true for developed markets.

2

Cultural differences on perception of engineering as a career are even greater when we analyse the main motives for pursuing the profession – with **younger generations** being either more driven by **contribution to society or career opportunity** depending on the market.

3

While engineering is perceived as vital for economic growth, **perceived accessibility differs by market, with major barriers including resources and training for young people**.

I passionately believe that engineering holds the key to a better tomorrow. To see people's faith in innovation and engineering as the future number one driver to solving the world's problems is inspiring and also challenging. It lays down the gauntlet to us as leaders in the engineering industry to make this happen.

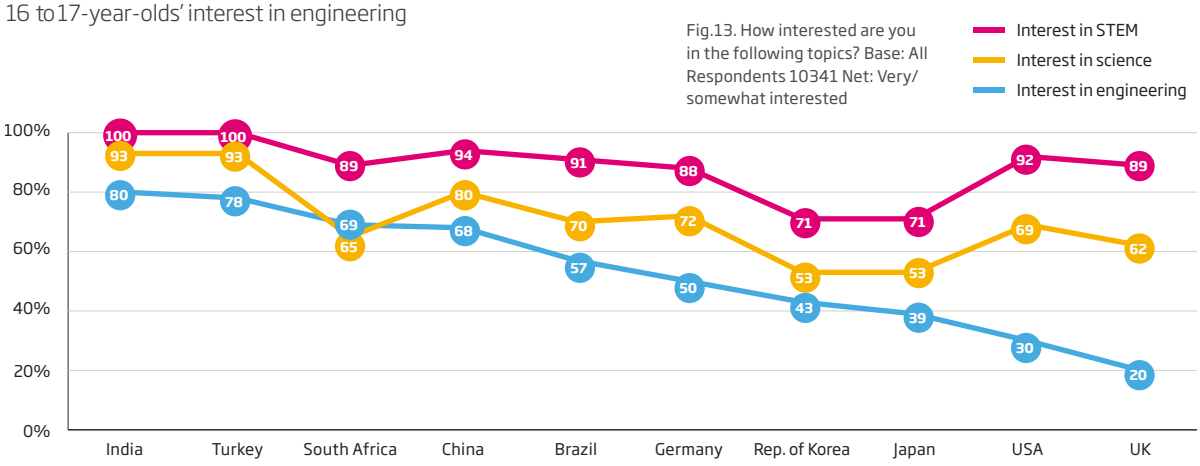
It is worrying to me that fewer 16-17 year olds in Britain declare a strong interest in engineering compared to other countries and compared to fellow Brits with an interest in STEM. There is an important role here for our industry and for our education system to better explain what engineering is about and the benefits it brings to our society.

Professor Juergen Maier
Chief Executive, Siemens Plc

16 TO 17-YEAR-OLDS IN EMERGING ECONOMIES HAVE HIGHER INTEREST IN ENGINEERING

16 to17-year-olds' interest in engineering

Fig.13. How interested are you in the following topics? Base: All Respondents 10341 Net: Very/ somewhat interested



GLOBAL AND TOTAL

91% Interest in STEM

77% Interest in science

55% Interest in engineering

Professor Lynn Gladden
Shell Professor of Chemical Engineering,
University of Cambridge, UK

Understanding that young people's attitudes towards engineering differ around the world is hugely important in communicating career opportunities in engineering.

The survey shows interest in engineering among 16 to 17-year-olds in recently fast growing economies is significantly greater than elsewhere across the globe which is striking. For example, in South Africa the interest in engineering surpasses that of mainstream science.

Why is this? Maybe the 'difference that engineering makes' is much more obvious first hand in the emerging economies. Combine this with the more balanced drivers of societal benefit and career opportunity in influencing the career selection of these young people, and you will see some of the brightest minds taking up careers in engineering. These young engineers, unhindered by traditional discipline boundaries, can be expected to produce new technologies which will leap-frog existing engineering solutions to seize the initiative in solving some of the world's major problems.

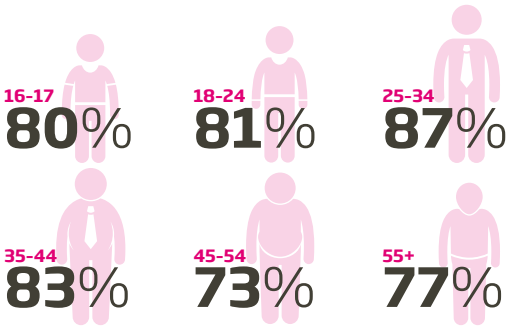
So why does engineering appear to be less attractive to those living within the mature economies? In the UK, there still remains a lack of understanding of what engineering is and how it can transform lives. There is a huge opportunity to re-energise the current generation of young people in our schools, so that they see and relate to the excitement and opportunities which a career in engineering can bring. In this context, the award of the QEPrize to Dr Robert Langer, who works at the cutting edge of science and chemical engineering, will act as a catalyst for changing perceptions of engineering. National academies and business need to do their part in inspiring the next generation of engineers, but the role of educators in delivering this goal cannot be underestimated.

INSPIRING THE NEXT GENERATION OF ENGINEERS REQUIRES A LOCALISED APPROACH, AS LEVELS OF MARKET DEVELOPMENT AFFECT PEAK AGES OF INTEREST IN ENGINEERING

Fig.14. How interested are you in the following topics? Base: All Respondents 10341 Net: Very/somewhat interested

India

Interest in engineering is currently peaking in India, with those of working age more interested in the industry than those still in education. This peaks with 87% of 25 to 34-year-olds interested in STEM.



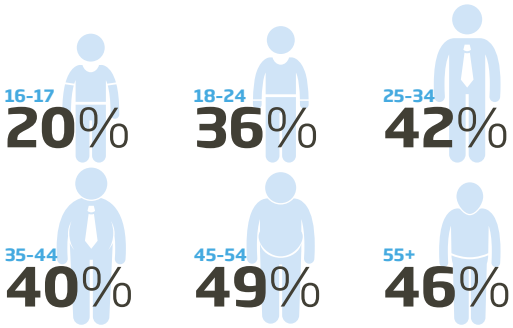
99% Interest in STEM

93% Interest in science

83% Interest in engineering

UK

Interest in engineering has peaked in the UK, as those of working age and retirement age have a greater interest in the industry than those still in education. 55+ is the age group with the greatest interest in engineering at 49%.



89% Interest in STEM

70% Interest in science

43% Interest in engineering

Erik Bonino
Chairman, Shell UK

Engineers have revolutionised our world. They've cured diseases, transformed communications and sent mankind to the depths of the oceans and into space. Engineers are also the lifeblood of our company. Their ingenuity and innovation enables us to undertake incredibly complex projects across the world. One of the biggest challenges, for both society and companies like Shell, is how to provide much more energy and much less CO_2.

Solving challenges like this relies on the talent and skills of engineers. Shell is proud to be a founding donor of The Queen Elizabeth Prize for Engineering and its work to inspire the next generation of engineers.

THE SOCIETAL BENEFITS OF ENGINEERING CAREERS ARE MORE IMPORTANT FOR YOUNGER GENERATIONS

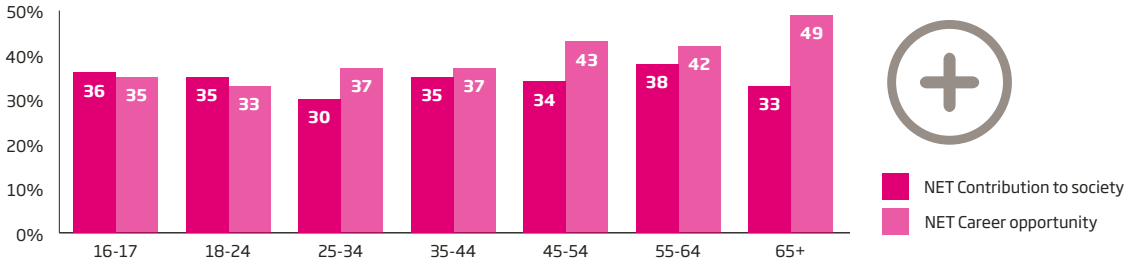


Fig.15. Which of the following do you feel are benefits of choosing engineering as a career path? / Which of the following do you feel is the main benefit of choosing engineering as a career path? // Base: All Respondents 10341

Dr Robert Langer
Winner of the Queen Elizabeth Prize for Engineering and the David H. Koch Institute Professor at MIT, USA

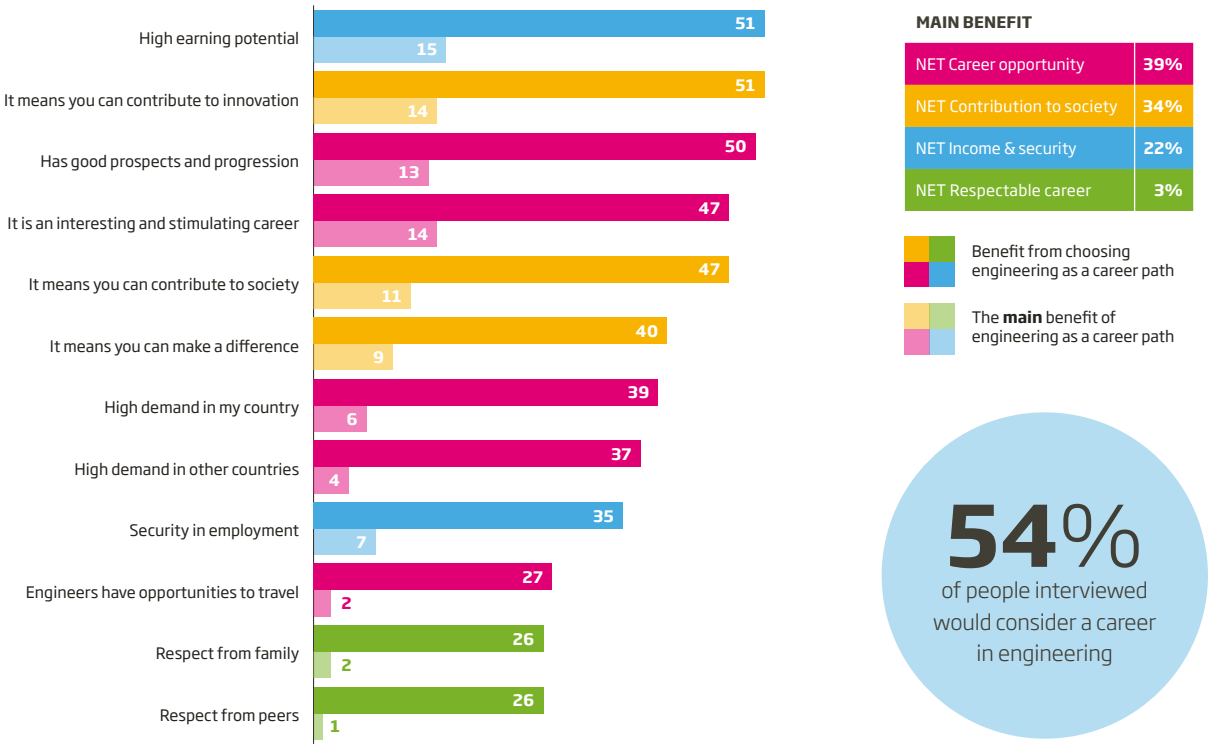
I think engineering is such a wonderful way to contribute to society. The two things that give me the greatest satisfaction are discovering principles or making inventions that enable people to have happier and healthier lives, and seeing the people who train in our lab do well and get jobs where they become leaders in engineering themselves.

In the first case, our lab has created new principles for treating cancer, new microspheres and nanospheres for treating different diseases, new materials, and even someday new ways of creating new tissues and organs.

It's a thrill for me to see what we do to help people to have happier and healthier lives. In the second case, I've witnessed hundreds of students and fellows who have trained in our lab get great jobs at universities where they train future engineers or get jobs in industry where they use their engineering training to improve the world. I think the people who come to our lab do so, because they share the same mission I do - which is to create engineering principles that can make the world a better place. I also view the people who train in our lab as an extended family and it's a wonderful feeling to see them so happy when they get great job offers or achieve an important milestone in what they do.

CAREER OPPORTUNITY AND CONTRIBUTION TO SOCIETY MOTIVATE PEOPLE TO BECOME ENGINEERS

Current perceived benefits of becoming an engineer (general vs. main benefit)



MAIN BENEFIT

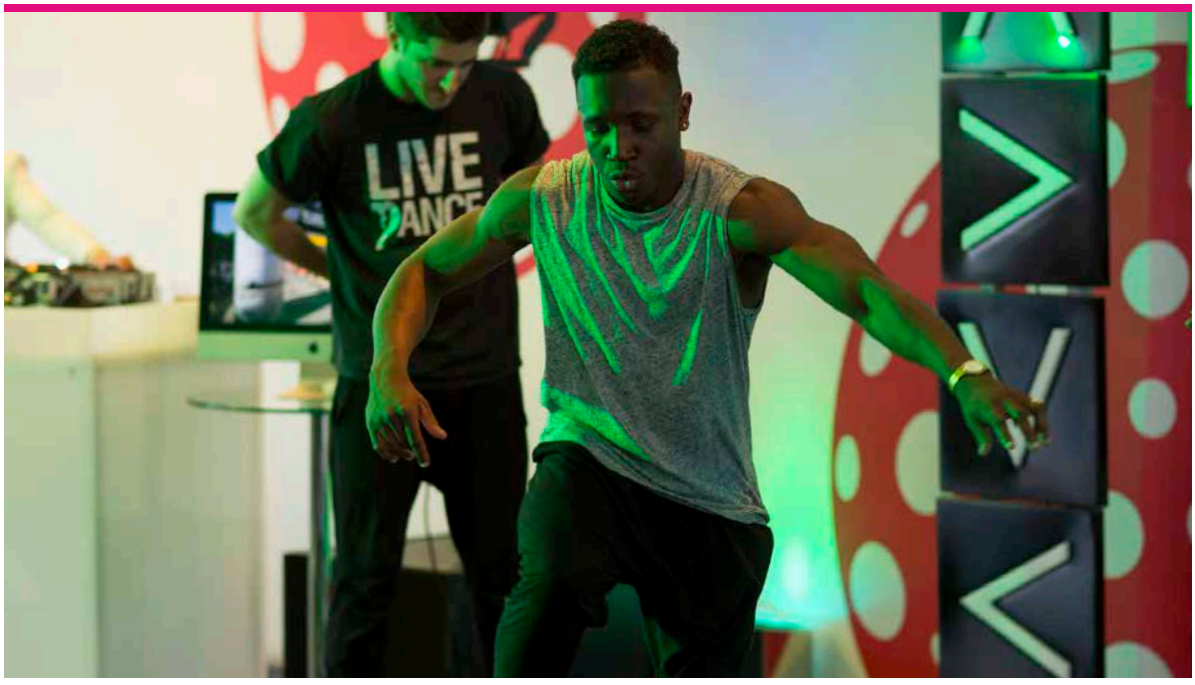
NET Career opportunity	39%
NET Contribution to society	34%
NET Income & security	22%
NET Respectable career	3%

Benefit from choosing engineering as a career path

The **main** benefit of engineering as a career path

54%
of people interviewed would consider a career in engineering

Fig.16. Which of the following do you feel are benefits of choosing engineering as a career path? / Which of the following do you feel is the main benefit of choosing engineering as a career path? / NET Summary: Somewhat /Strongly agree: Below are some statements about your perceptions of engineering as a career. Please indicate on the scale below how much you agree or disagree with the following / NET Summary: Somewhat /Strongly agree: Below are some statements about choosing engineering as a career. Please indicate on the scale below how much you agree or disagree with the following // Base: All Respondents 10341



CAREER OPPORTUNITIES MOTIVATE THE MAJORITY OF COUNTRIES, YET SOME ARE MORE MOTIVATED BY CONTRIBUTION TO SOCIETY

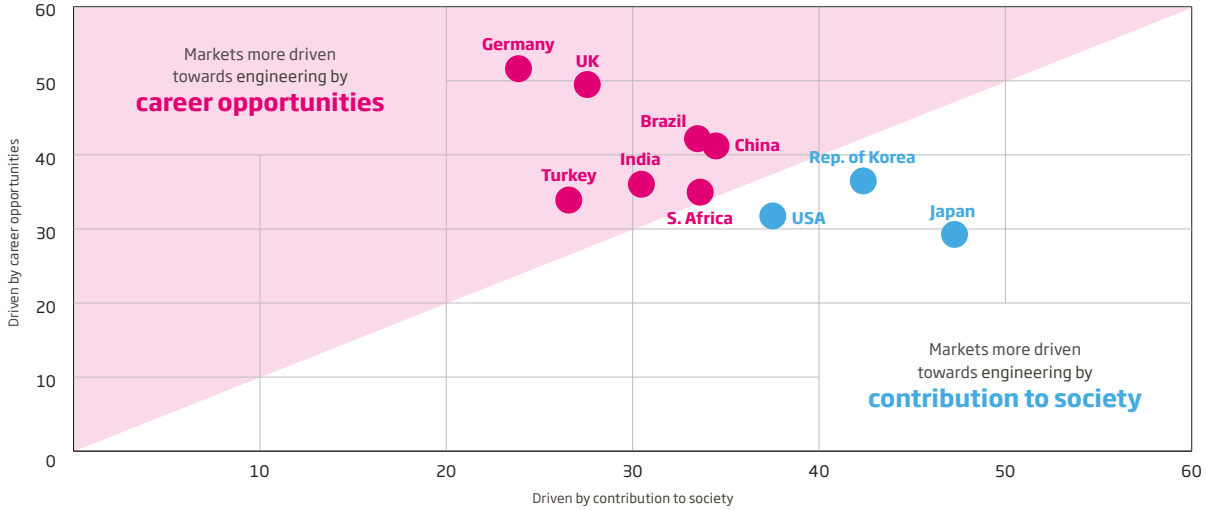


Fig.17. Which of the following do you feel are benefits of choosing engineering as a career path? / Which of the following do you feel is the main benefit of choosing engineering as a career path? // Base: All Respondents 10341

THE APPEAL OF CONTRIBUTING TO SOCIETY FURTHER INCREASES AMONG YOUNG ADULTS, DEMONSTRATING THE NEED FOR AN APPROACH WHICH TAKES AGE AS WELL AS COUNTRY INTO ACCOUNT

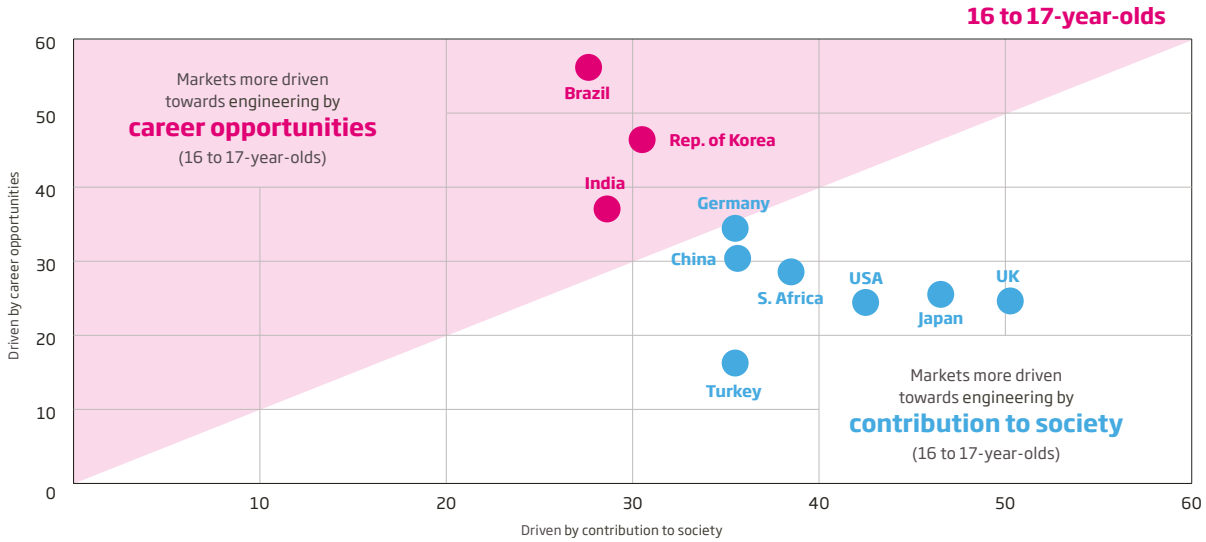


Fig.18. Which of the following do you feel are benefits of choosing engineering as a career path? / Which of the following do you feel is the main benefit of choosing engineering as a career path? // Base: 16-17 year olds n=351

Professor Hiroshi Komiyama
President, Engineering Academy, Japan

Generally, the industrial structure of developed countries sees more people engaged in the services industry than the manufacturing industry. It is for this reason that, as an economy matures, more people lose interest in engineering. In Japan especially, engineering as an occupation is losing popularity. While there is a strong recognition that engineering is a key element of economic growth in the country, engineering has failed to achieve a high recognition as an occupation within Japanese society. This is underpinned by growing uncertainties about the future, caused mainly by intensifying international competition and the hollowing out of Japan's industry.

As a "problem-saddled developed country," Japan has experienced a number of challenges currently being faced around the world, including saturation of material affluence and an ageing society, ahead of the other countries. The country is now being urged to shift its focus from the quantity of goods to the quality of life. This shift is a theme for future development of society, as well as a key to open a frontier in a new type of economic growth. For example, to achieve increased quality of life, we will seek a longevity society; a society in which all citizens can live with dignity and participate in social activities, a society free from concerns about energy and other resources, and a society where people live in harmony with nature. To achieve this vision, we need to make a wide variety of renovations in our systems and technologies. In this respect, engineering will play a significant role in creating a new society not only by helping increase qualities of goods but also by focusing on solving social problems.

It is to be noted that, in Japan, young generations recognize the value of engineering in contributing to society. This recognition is important in our effort to promote the understanding of engineering widely, and it is seen as a hope for the future development of human resources.

Queen Elizabeth Prize for Engineering Report

CHAPTER 4: CREATING OPPORTUNITY

Engineering is seen to have a positive role in creating new job opportunities in communities around the world.

Across the board, people recognise engineering's positive role in creating new job opportunities in their community.

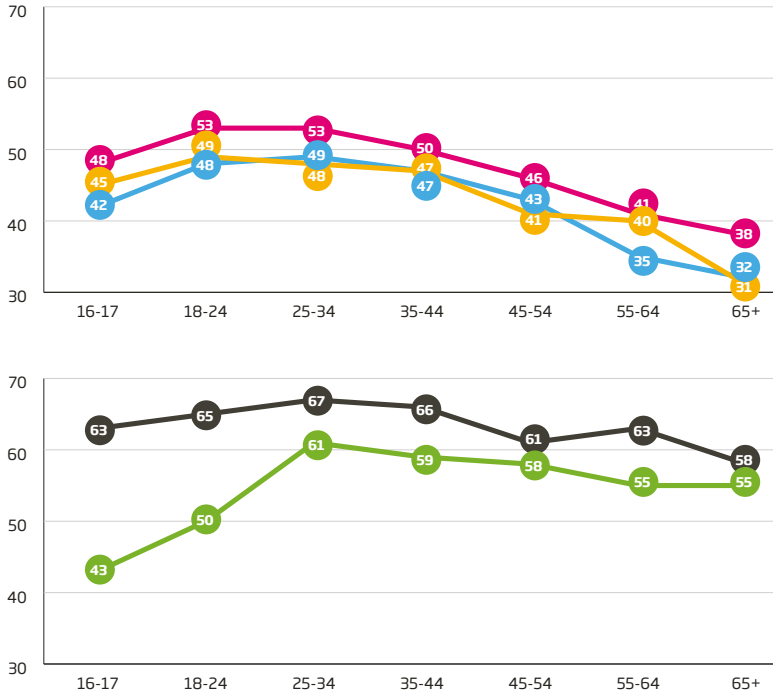
However, in seven of the 10 countries surveyed, there is a perceived lack of resources to help young people get started in the profession. This perception is particularly prevalent in Brazil and South Africa, especially among older generations.

Many 18–35 year olds, the principal age for career decision-making, also consider the cost and difficulty of becoming an engineer to be major barriers to entry.

Yet encouragingly, 16-17 year olds rank engineering as the world's third most accessible career. This represents a fantastic opportunity for the whole industry: a chance to harness the next generation's respect and enthusiasm for the sector, and nurture them to become the game-changing engineers of tomorrow.

Building this bright future requires a level playing field. Currently, the opportunities for aspiring engineers in countries such as the US, India and Germany far outstrip those in China, South Korea and even the UK.

For the engineering sector to continue to have a positive and lasting impact on the world around us, everyone must be given an equal chance to become part of it.



Perceived barriers

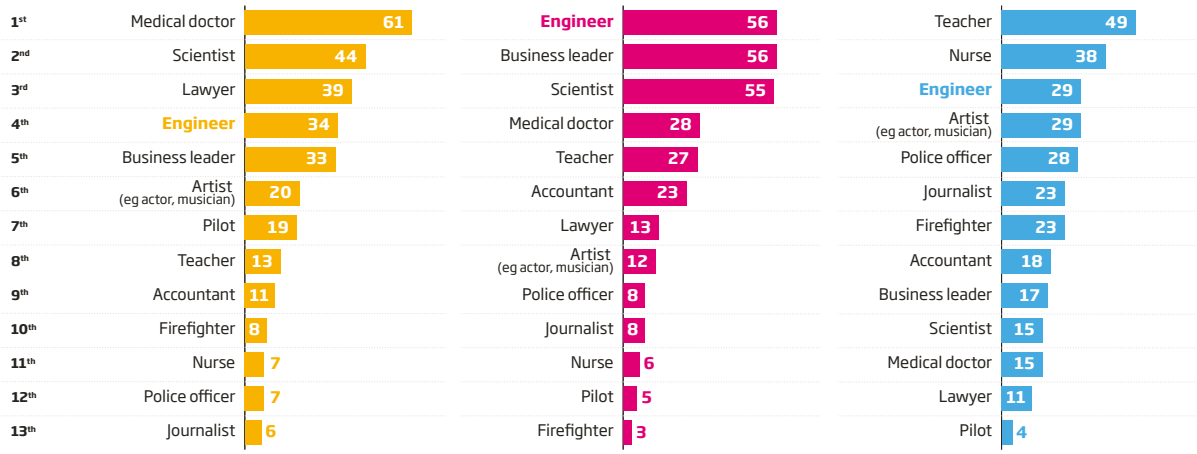
Many of those at the principal age of career decision feel an engineering degree is **too hard** or challenging, **too expensive**, and that it is **too difficult for them to get started** in that career anyways

Regret levels

As a result, interest, inspiration, and consideration towards engineering spikes within the 25 to 44-year-olds, along with **regret for not pursuing the career**

Fig.19. NET Summary: Somewhat /Strongly agree : Below are some statements about your perceptions of engineering as a career. Please indicate on the scale below how much you agree or disagree with the following:// Base: All Respondents 10341 / Net: Doing a little /a lot Net: Somewhat / Strongly agree

16 TO 17-YEAR-OLDS SEE ENGINEERING AS MORE ACCESSIBLE THAN THE REST OF THE PUBLI(



4th
out of 13 as a
prestigious career

1st
out of 13 as a career
vital for economic growth

3rd
out of 13 as an
accessible career (4th globally)

Fig.22. Please choose the three professions or careers which you see as the most prestigious / Please choose the three professions or careers which you see as the most vital for economic growth / Please choose the three professions or careers which you see as the most accessible (ie education and career opportunities are available for everyone) // Base: All Respondents 10341

Professor Sir Christopher Snowden
Vice-Chancellor, University of Southampton, UK

The perception of engineering in the UK follows a pattern typical of westernised developed nations; there is the view that job opportunities are not as prominent as in the strongly developing economies. Engineering in the UK is still seen by nearly two-thirds of respondents as providing new job opportunities; however, this opinion leads to the UK occupying only an average position in terms of leading engineering countries. The UK still retains the perception of leading in engineering over countries such as Brazil and South Korea despite the view that there are fewer job opportunities than in these countries. A similar pattern emerges for funding for training the engineering workforce and in terms of difficulty for young people to get started in an engineering career. The UK occupies a mid-position among the ten countries in terms of its index for understanding the opportunities for engineering, while still being perceived as being in a group with good opportunities for aspiring engineers.

In some respects, the UK's perceived positioning reflects an economy which has moved from, historically, a dependency on manufacturing to services and higher-added value technology. Nevertheless, respondents clearly felt that there were still opportunities for engineers and that the main barrier to careers in engineering was a shortage of funding for training. Interestingly, while the positive views of engineering were similar to those in the USA, often felt to be the leading engineering nation, the constraints on engineering careers are perceived to be fewer in the USA than in the UK, leading to the view that the USA retains the highest opportunities for those aspiring to be engineers.

The UK could take steps to improving its ranking in the index by investing further in engineering education and training and creating visible opportunities for engineering careers. This would certainly require increasing the awareness of engineering and careers in schools and colleges and continuing to win the support of business and industry to promote engineering.

ALL COUNTRIES FEEL THAT ENGINEERING PROVIDES NEW JOB OPPORTUNITIES IN THEIR COMMUNITY, BUT NOT ALL FEEL PROUD OF THEIR COUNTRY'S ENGINEERING SECTORS

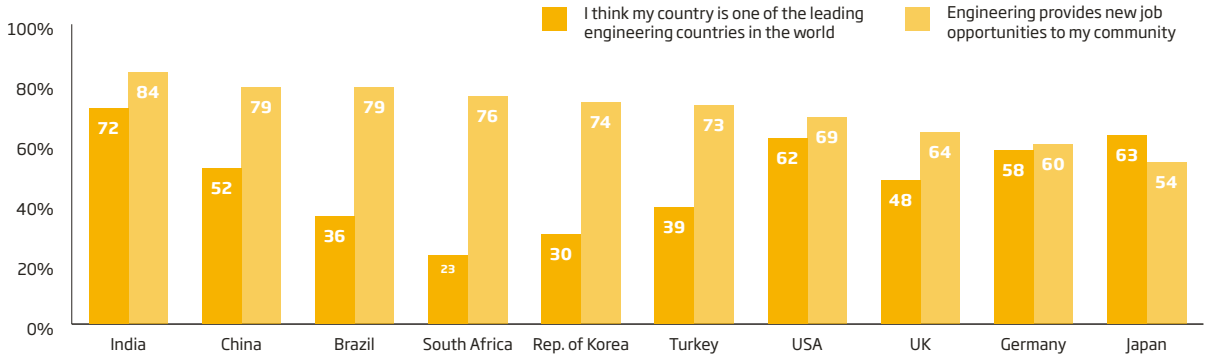


Fig.20. Below are some statements about your perceptions of engineering as a career. Please indicate on the scale below how much you agree or disagree with the following / Below are some statements about engineering's contribution to society. Please indicate on the scale below how much you agree or disagree with the following // Base: All Respondents 10341 Net: Somewhat /Strongly agree

AND RESOURCES TO GET STARTED IN ENGINEERING ARE FOUND TO BE LACKING IN 7 OUT OF 10 COUNTRIES

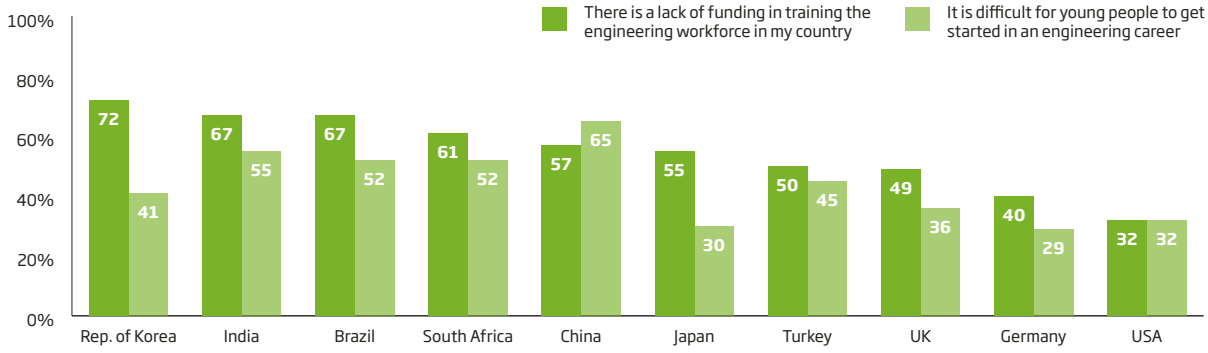
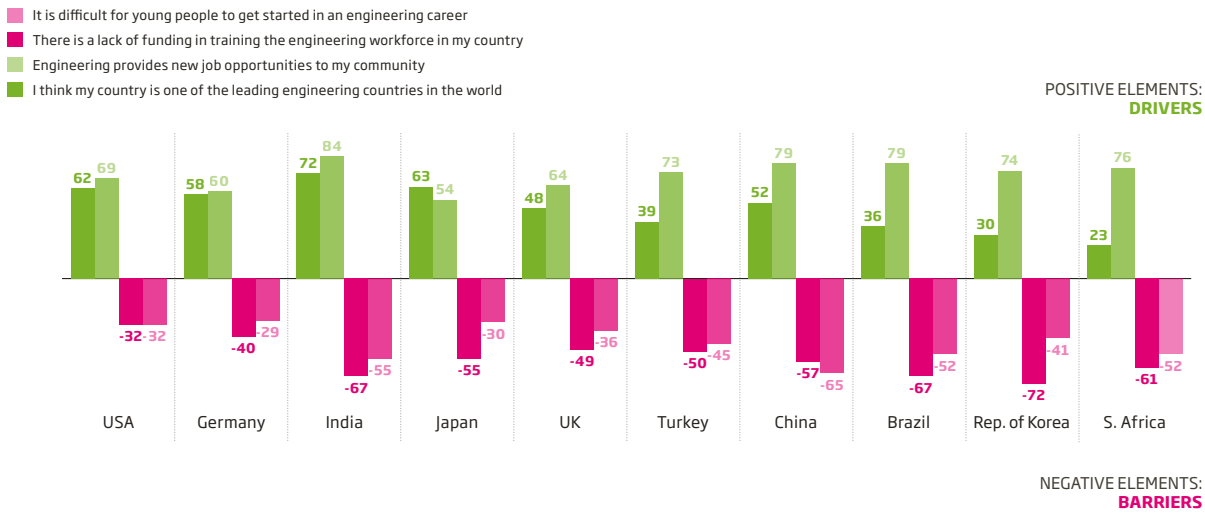


Fig.21. Below are some statements about your perceptions of engineering as a career. Please indicate on the scale below how much you agree or disagree with the following // Base: All Respondents 10341 Net: Somewhat /Strongly agree

UNDERSTANDING THE OPPORTUNITY TOWARDS ENGINEERING



CREATING A HOLISTIC VIEW OF THE OPPORTUNITY TOWARDS ENGINEERING

Fig.23. Below are some statements about your perceptions of engineering as a career. // Base: All Respondents 10341 Net: Somewhat / Strongly agree

Dr Dan Mote
President, National Academy of Engineering, USA

The *Create the Future Report* shows how important it is to highlight the tremendous opportunities existing in engineering careers to attract the next generation. The Queen Elizabeth Prize for Engineering celebrates world-changing engineering innovations and brings public recognition to those engineers who were primarily responsible for them. It is important for our society, and especially for our young people, to understand how greatly our future, just like our past, depends on engineering achievements. There is no plan B.

THE US, GERMANY, AND INDIA ENJOY HIGH OPPORTUNITY INDICATORS FOR THOSE ASPIRING TO BE ENGINEERS

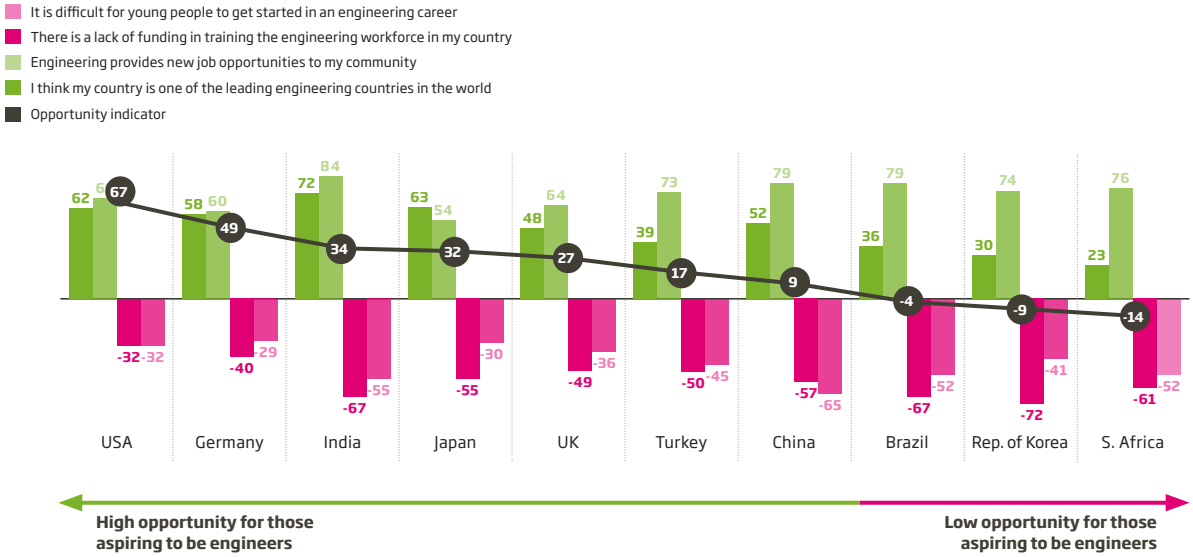


Fig.24. Below are some statements about your perceptions of engineering as a career. // Base: All Respondents 10341 Net: Somewhat / Strongly agree

WHILE THE US, GERMANY, AND INDIA ENJOY HIGH OPPORTUNITY FOR THOSE ASPIRING TO BE ENGINEERS, BRAZIL, SOUTH KOREA, AND SOUTH AFRICA ARE STRUGGLING IN THIS RESPECT

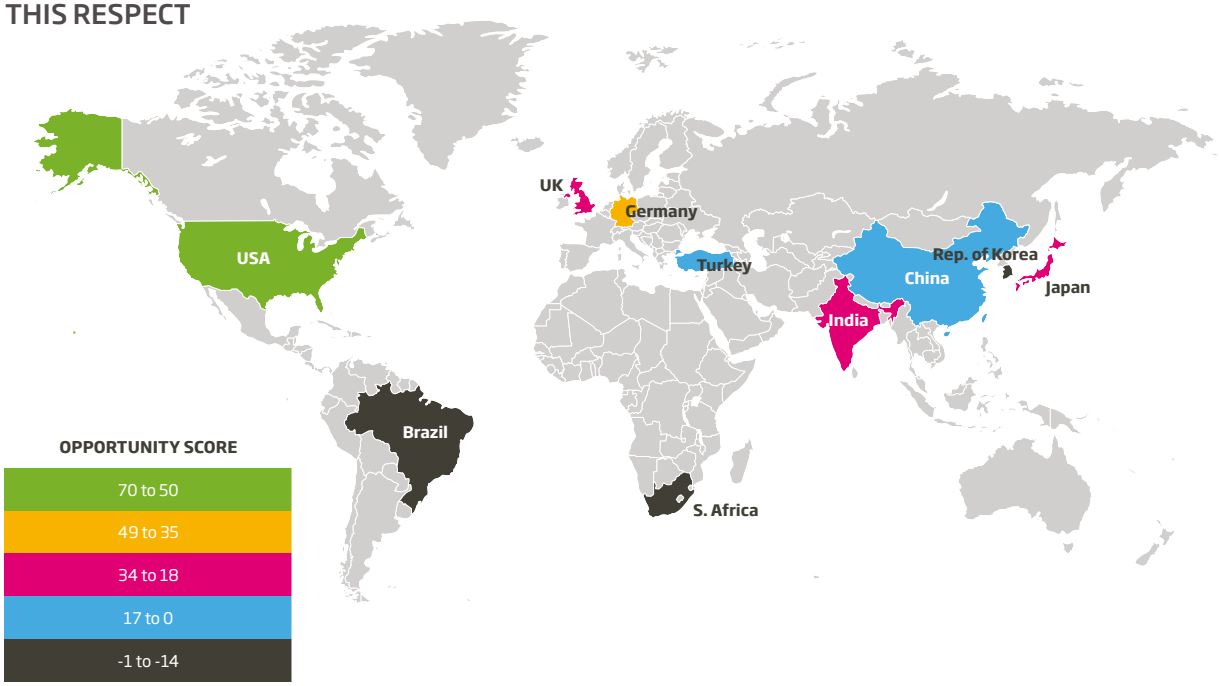
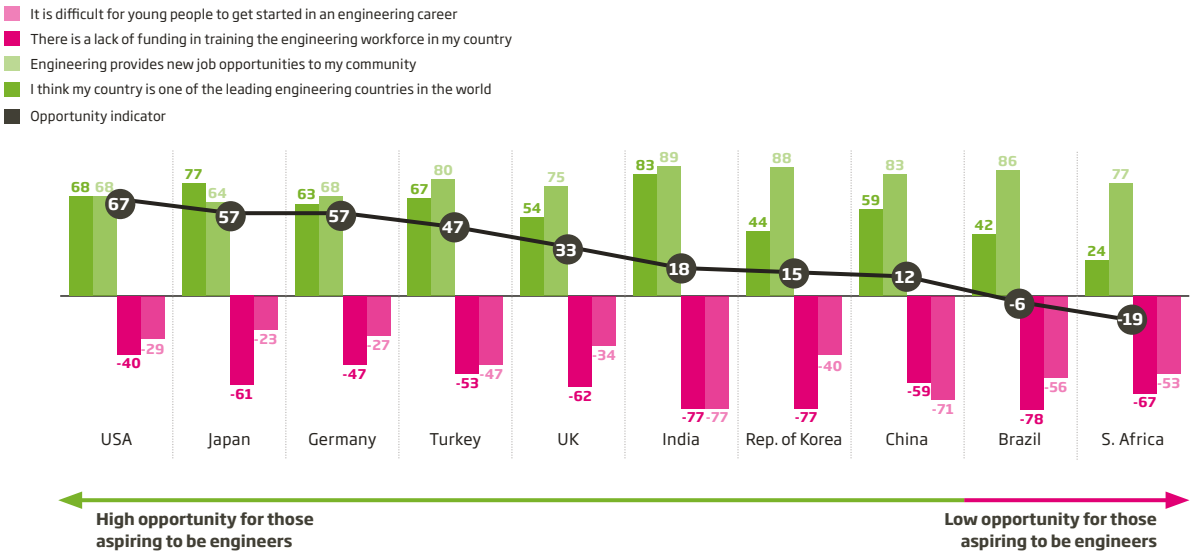
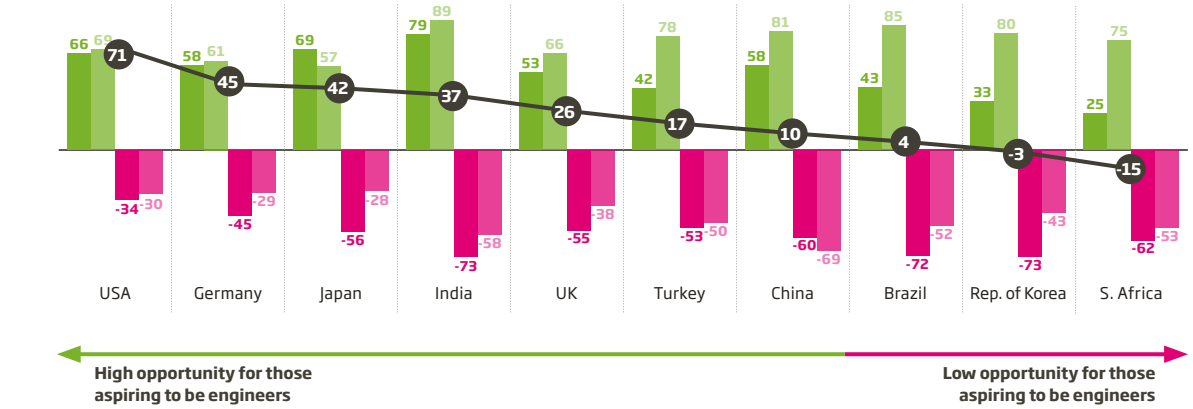


Fig.25. Below are some statements about your perceptions of engineering as a career. // Base: All Respondents 10341 Net: Somewhat / Strongly agree

GRANDPARENTS' VIEW OF OPPORTUNITY



PARENTS' VIEW OF OPPORTUNITY



16 TO 25-YEAR-OLDS' VIEW OF OPPORTUNITY

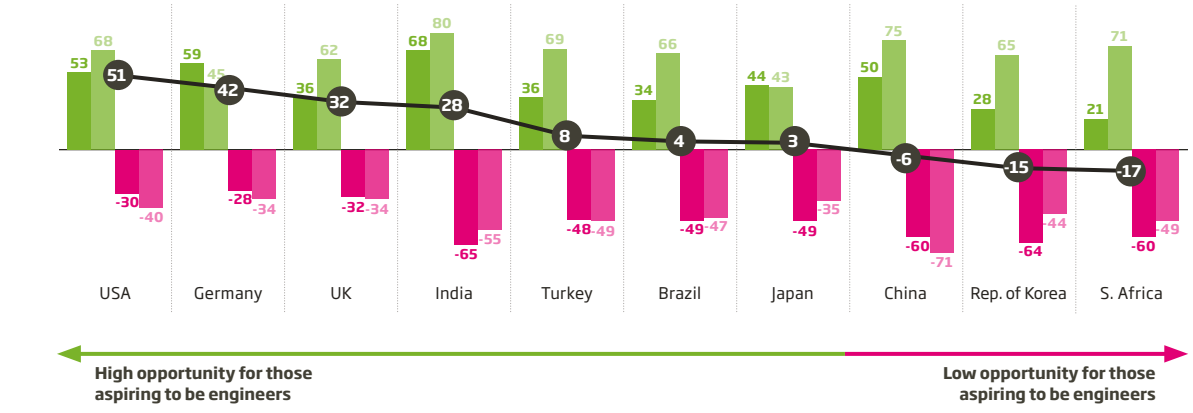


Fig.26, 27, 28. Below are some statements about your perceptions of engineering as a career. // Base: All Respondents 10341 Net: Somewhat / Strongly agree

Queen Elizabeth
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METHODOLOGY

The online survey was in field in May 2015 (UK) and June to July 2015 (rest of markets).

In order to target the population according to our purpose, the study was conducted using an online panel of people willing to participate in surveys. This interviewing method provides both accessibility (through either desktop, laptop, or tablet), flexibility, and privacy for the participants, enabling higher quality findings through more honest responses.

Ensuring samples are representative of the countries surveyed: Respondents were selected to form a representative sample of the general public in the 10 markets interviewed through their distribution of age, gender, and region according to national statistic figures. Social grade was monitored.

Ensuring consistent answers: The flow and order of the questionnaire was optimized to ensure consistency. Additionally, questions were written by expert Market Research Society certified research practitioners to ensure neutrality and protect the results from bias.

Ensuring accuracy and protecting results from bias: The data was captured by a team which verified the quality and accuracy of the responses to prevent 'flat-liners' and 'speeders' (respondents who just click through the survey without reading the text).

Margin of error: circa 3% on a 95% confidence interval

The Queen Elizabeth Prize for Engineering is a global £1 million prize that celebrates a ground-breaking innovation in engineering. The prize rewards an individual or team of engineers whose work has had a major impact on humanity.

While doing so, the QEPrize also celebrates engineering as a discipline and career choice, shining light on the excitement and importance of engineering and inspiring young people to get involved in the subject.

The fruits of engineering range from nano-scale devices that get medicines to where they are needed in the body to the world's biggest – and greenest – buildings; from the pinpoint accuracy of robots that perform heart surgery to the proliferation of ever-faster multiplatform broadband applications; from hi-tech fabrics to make the smart clothes of the future to new, clean and green sources of energy to power the world.

The QEPrize celebrate stories of these engineering successes, raising the international public profile of engineering and inspiring new generations of engineers to take up the challenges of the future.

The Queen Elizabeth Prize for Engineering is funded by donations from the following international companies:

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