The Institution of Engineering and Technology

Bridging the innovation gaps

Growing UK businesses through better ecosystems and support

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CONTENTS

The Institution of Engineering and Technology

The Institution of Engineering and Technology (IET) is working to engineer a better world. We inspire, inform and influence the global engineering community, supporting technology innovation to meet the needs of society. The Institution of Engineering and Technology is registered as a Charity in England and Wales (no. 211014) and Scotland (no. SC038698).

1. EXECUTIVE SUMMARY

Innovation is one of the key pillars of the UK economy, bringing ideas to life and presenting new ways for products, services and processes to advance society. SMEs (companies with less than 250 employees and a turnover of no more than £50 million) are often at the forefront of innovative development and play a role in the innovation supply chain, with engineering and technology central to future success.

There are many government and business initiatives centred upon innovation within the SME community. However, funding and support is not always reaching the SMEs that have the best prospects for future growth; it has to be suitable for SMEs at different stages in their development.

Ambitious SMEs preparing for scale don't always know how much investment they're going to need and where they're going to get it. Despite the availability of funding from a variety of sources, there is a continuing decline in the number of SMEs seeking investment, with one survey released in March 2018 suggesting that just 22 per cent of SMEs were intending to pursue funding for business investment this year[1]. Without the right ecosystem in place, access to international markets, talent development, integrated business planning, customer research and extended product innovation can suffer.

As technology widens the growth gap between small SMEs and larger corporates[2], effective measures that bridge this gap, whether based on investment, training or risk-taking, will create a natural positive shift in the UK economy.

The Institution of Engineering and Technology (IET) has identified three challenges which are creating barriers to SME growth:

INVENTOR'S SYNDROME

No clear business pathway that transforms inventions (new processes or devices) into innovations (new processes or devices that add value)

THE SCALE-UP GAP

A lack of scale-ups and a decline in the percentage of companies seeking investment

THE FINANCIAL DISCONNECT

Barriers to communication between engineering, technology, commercial and financial sectors, compounded by the absence of a multi-sector support ecosystem

To address these challenges, they need to be considered as a single problem, as each challenge is interrelated. Many of the underlying causes are similar, so a holistic approach will accelerate awareness and action, reduce confusion and ensure clear communication pathways between all groups.

The solutions that the IET is proposing fall into two categories, namely ecosystems and support, which we'll be investigating thoroughly in this paper.

2. INTERPRETING INNOVATION

2.1 DEFINING INNOVATION

Innovation drives technological change and brings ideas to life, improving societies and helping people live the lives that they want to.

Innovation has many meanings. It's a term used by industry to describe a wide range of activities, and has a different nuance depending on the scale, stage and nature of a business. For the purposes of this report, innovation is defined as:

> "The process of transforming a new idea or invention into a product, service or process that addresses a specific challenge and generates sustainable financial value for an organisation in the context of its markets and customers."

Such innovation can include the work of universities, research institutes, entrepreneurs, SMEs and large corporates.

- **Universities and research institutes**

  Innovation can filter into industry through late-stage university R&D. In the UK, a significant amount of early stage industry research begins this way, spinning out of universities and research institutes as they seek to commercialise IP. New products and services can be developed through close knowledge exchange relationships between academia, industry and public sector bodies.

- **Entrepreneurship and SMEs**

  Entrepreneurs and SMEs are a key source of innovation in the UK. In a short time, entrepreneurs with innovative ideas can establish new and successful SME start-ups.

  These enterprises are responsible for the majority of new, marketable ideas and have created an innovation pipeline with the potential to drive strong economic expansion and create high-value employment. However, there may be a lack of adequate support for SMEs as they begin to reach scale-up stage.

- **Corporate R&D**

  Most large companies (more than 250 employees and a turnover in excess of £50 million) and multi-nationals have their own extensive R&D facilities and programmes. However, due to their size and governance structures, corporates can often suffer from constrained innovation and extended project lead times. Large companies are frequently at their most effective when they acquire innovations from SMEs, with corporate venture capital funds acting as a major driver of innovation. Another innovation route available to large companies is to spin out divisions into leaner, independent companies.

Innovation forms a pipeline that flows from various sources including universities, through industry and across national borders, impacting the economy positively at all levels. In the UK, innovation is strongest within the SME segment and that's where there are opportunities for economic growth. However, there remains a scale-up gap in the UK innovation ecosystem.

This occurs when start-ups enter a strong growth phase and evolve into larger organisations. They reach a certain size where growth can be limited by factors other than the choice of the directorship. Companies can be stuck in late-stage SME status due to a range of impediments that will be explored later in this report.

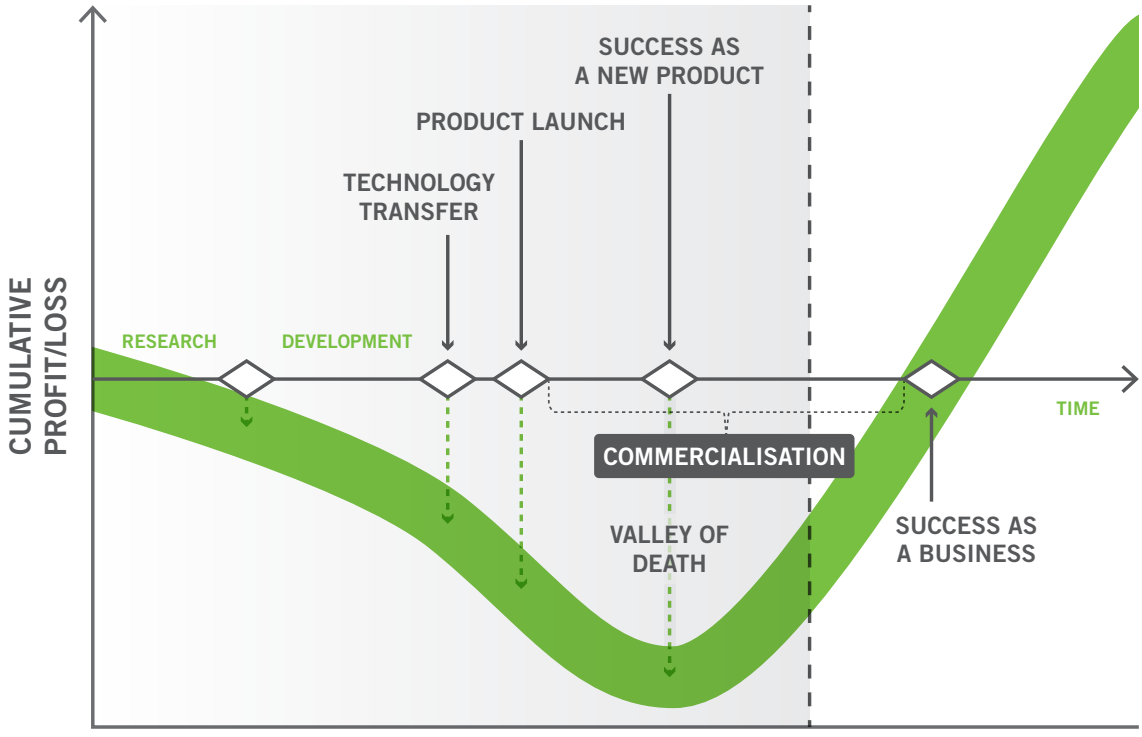
WHAT IS A SCALE-UP?

The Organisation for Economic Co-operation and Development (OECD) defines a scale-up as an enterprise with average annual growth in employees or turnover greater than 20 per cent per annum over a three year period, and with more than 10 employees at the beginning of the period.

Despite the scale-up gap being recognised by government – Iain Wright, former Chair of the Business, Energy and Industrial Strategy (BEIS) Committee commented in 2017 on how the UK is lagging behind international competitors in turning potential high-growth small businesses into larger businesses[3] – SMEs are still struggling to reach the scale-up stage in the business lifecycle (see 'Valley of Death' diagram). Moreover, when they get there, support continues to lag. According to a 2018 survey carried out by the ScaleUp Institute[4], nearly half of scale-up business leaders perceived that there was no relevant support available to help them grow. Two-thirds also want improved coordination of national services near to them.

The survey also found that scale-ups are twice as likely as other companies to innovate, and are actively seeking better access to funding and finance, along with access to a support ecosystem to underpin their innovation drive.

VALLEY OF DEATH DIAGRAM



(Source: Osawa and Miyazaki, 2006)

2.2 HOW MANY SCALE-UPS ARE THERE?

With 35,210 scale-ups in the UK in 2016[5], according to Office for National Statistics (ONS) figures, they account for less than 1% of the UK's 5.7 million businesses[6]. However, their combined turnover amounts to around £900 billion, according to the ScaleUp Institute's 2017 Survey. SMEs, on the other hand, make up over 99% of all UK businesses[6]. The vast majority of these, however, are micro businesses of less than 10 employees.

Providing more SMEs with the opportunities and ecosystem to grow into scale-ups could present a huge boost for the UK economy, with a sustained positive impact on jobs, local economies and skills development. In addition, launching more SMEs on the path to scale-up will create a knock-on positive effect for smaller companies striking out on the entrepreneurial journey.

2.3 THE IMPORTANCE OF ENGINEERING AND TECHNOLOGY

As we face the fourth industrial revolution, or Industry 4.0, engineering and technology are fundamental to growth, with scientists and engineers contributing to innovation across the breadth of the economy. This focus on innovation is intensified by the significant role that the engineering sector plays across the UK economy as a whole. Analysis carried out by the ONS shows that 5.66 million people were working in engineering businesses in 2016 (18.9% of the UK workforce), generating a turnover of £1.23 trillion, or 23.2% of the UK's total turnover from all registered enterprises[7].

When it comes to engineering scale-ups, Companies House data analysed by Beauhurst shows that manufacturing and engineering is the third largest scale-up sector, behind land development and distribution.

Additionally, the role of engineering and technology in the scale-up community is underlined by the 2018 ScaleUp Institute Survey[4], which interviewed 514 scale-up businesses, mostly engineering and technology firms, and found:

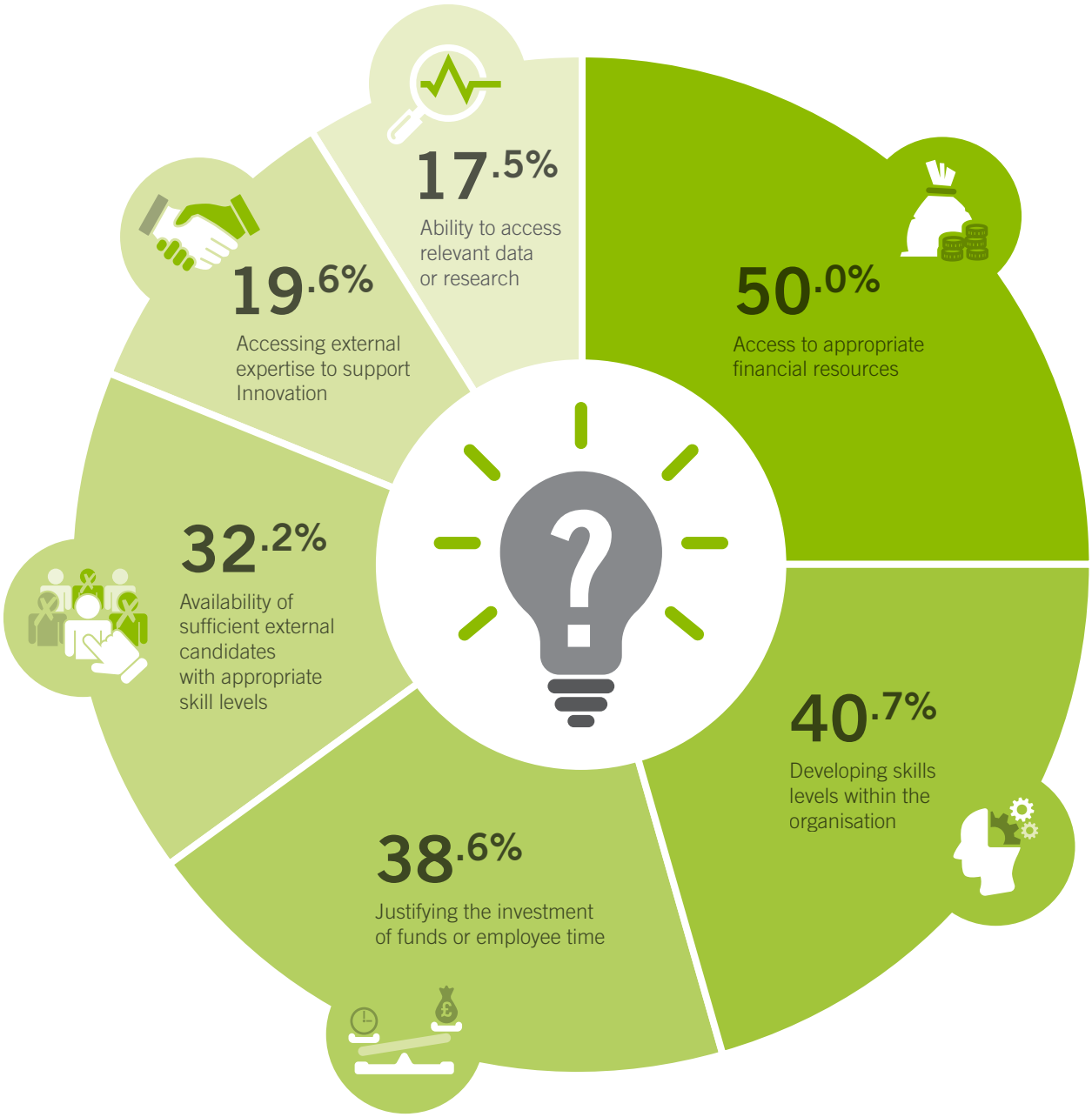
- **62%** are predicting turnover growth of at least 20% over the next year
- Scale-ups average around **£275,000 turnover per employee** - more than double the overall UK average
- **79%** have launched a new or improved product, service or process in the past three years

2.4 UNDERSTANDING INNOVATION IN ENGINEERING

Earlier in 2018, the IET carried out its own survey to better understand innovation within engineering SMEs. Of 333 people surveyed, 66.9% felt the SME they worked in innovated enough to meet strategic goals and retain a competitive edge.

When asked about the biggest challenges faced by SMEs when innovating, access to appropriate financial resources was the most popular response, at 50%, followed by being able to develop skill levels within the organisation and justifying the investment of funds or employee time (40.7% and 38.6% respectively). The following infographic shows the most popular responses.

Q: WHAT DO YOU THINK ARE THE BIGGEST CHALLENGES THAT SMES FACE WHEN INNOVATING?



3. CHALLENGES TO INNOVATION AND GROWTH

Innovation is crucial to the engineering and technology sector, the wider business community and the UK economy as a whole. SMEs have become the central driver of innovation in the UK. As smaller enterprises, they do need to take calculated risks, but they are often able to operate with more agility than their large company counterparts, which may have processes in place that mitigate risk and could stifle innovation.

Through market analysis, surveys, focus groups and roundtables conducted with senior financial executives, academics and SME managers in 2018, the IET has set out to understand the challenges surrounding innovation and SME expansion. The research did not show a significant difference in the needs of engineering and technology SMEs, with similar themes coming through from both industry sectors.

As a result of these initiatives, the IET has identified three challenges which are creating barriers to SME growth:

3.1 CHALLENGE 1: INVENTOR'S SYNDROME

There is no shortage of ideas and inventions among engineers and entrepreneurs working within UK SMEs, but success isn't all about the science. Inventor's syndrome manifests itself as the belief that when a technology is explored, developed and perfected it will automatically find a market and become a commercial success - the "build it and they will come" mentality.

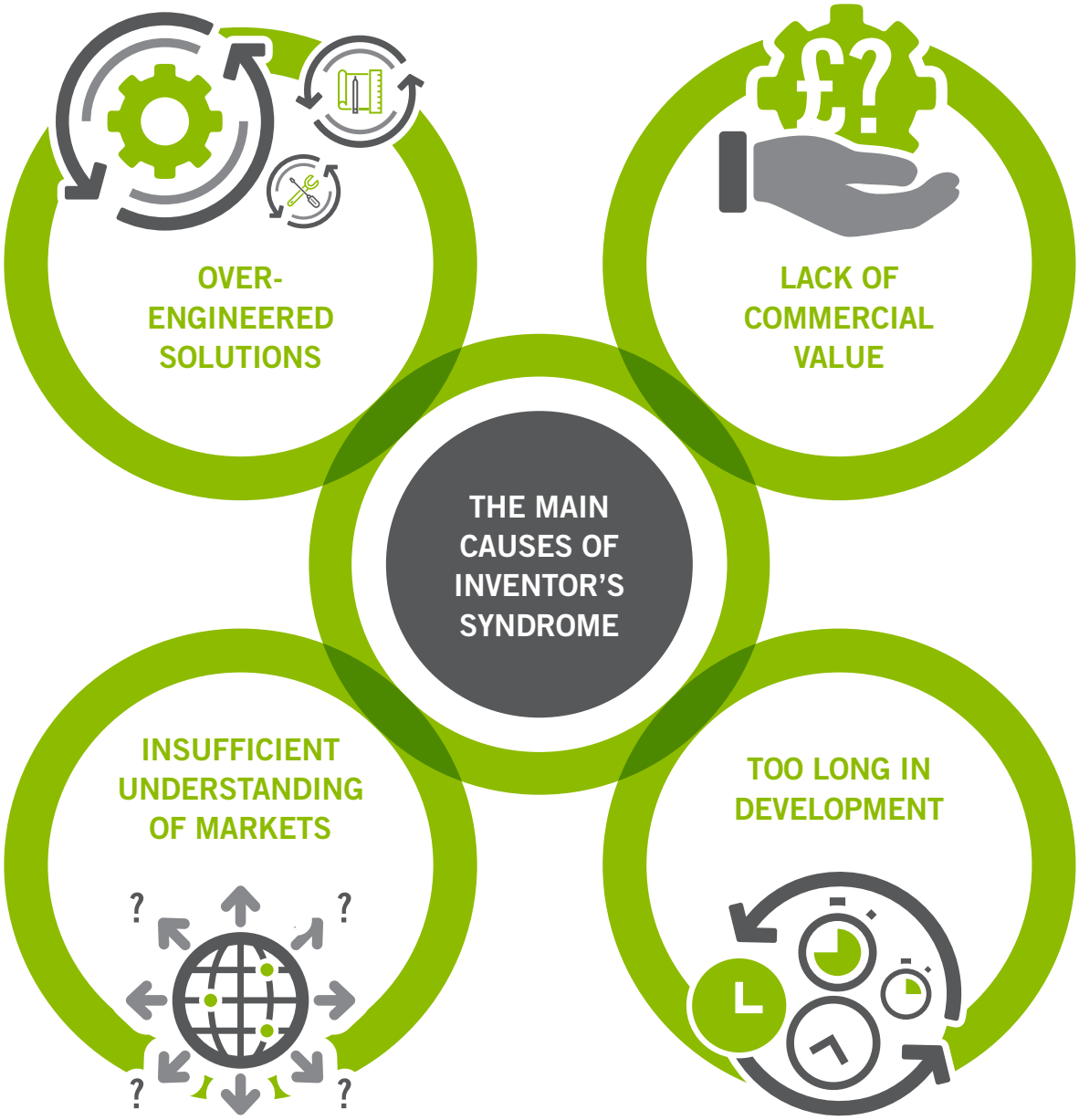
Inventors may become so fixated on bringing an idea to life that they begin to disconnect from the commercial realities. They equate the investment they've made in developing the invention with real-world value, believing that its sophistication alone will make widespread adoption inevitable.

Generating a good idea, developing a proof of concept and successfully taking it to market is a huge undertaking and requires as much financial, business and marketing acumen as it does engineering prowess. However, there is often no clear business pathway to transform inventions into innovative products and services that create demand.

Entrepreneurs and start-ups need to be tough, stubborn and resourceful to survive the early stages. They need to be self-reliant, and sometimes this can lead to a blinkered view of an invention and cause them to lose focus of the wider context. Another critical factor is getting the innovation to market at the right time, as timing has been shown to be one of the biggest differentiators between success and failure.

Results from the IET roundtable sessions chaired in April and May 2018 identified market analysis as a weakness for many small businesses. These enterprises are not always able to fully understand how trends change markets. Therefore, they may not be able to identify opportunities, the best timing or know where to invest their time and resources. Invariably while owner-managers have the necessary technical engineering skills, they don't necessarily have the commercial knowledge and insight needed to grow a business sustainably.

There are many reasons why good ideas fail, even when the market is ready and the need is there. Spending too much time in development can result in an obsolete innovation; a simple prototype may turn into an over-engineered solution. If there is insufficient market research, or the wrong demographic is selected for focus groups, results may be misleading and funding diverted to develop unnecessary products. Many of the reasons behind product failure are linked to inventor's syndrome.



3.2 CHALLENGE 2: THE SCALE-UP GAP

Scale-up businesses drive significant economic growth. They generate twice the turnover per head compared to the UK average[8], and the UK has one of the highest rates of business start-ups in the world - nearly 660,000 companies were established in 2016 according to the Centre for Entrepreneurs[9]. However, this groundswell of start-ups is not translating into scale-ups. According to the OECD, the UK ranks 3rd in the national league table for producing start-ups, but only 13th on the list for number of successful scale-ups.

Ambitious SMEs preparing for scale don't always know how much investment they're going to need and where they're going to get it. Without such investment, access to international markets, talent development, integrated business planning, customer research and extended product innovation can suffer. Many SMEs attempt to address one or more of these issues, but to achieve scale-up status a company needs to be working successfully towards all those goals.

3.3 CHALLENGE 3: THE FINANCIAL DISCONNECT

Within the UK, there is a disconnect between engineering, manufacturing and technology companies that are looking to scale-up and the financial sector that has the funding and commercial expertise to assist them. The key elements are already in place: the UK has a strong financial sector and ranks highly in early stage technology development. The funding is available, but connecting it to investment-ready opportunities is a difficult task.

Cultural differences between the finance and engineering sectors can prevent them from working together effectively. For example, the two sectors may have different views of the timescales required to obtain a return on investment (ROI). The financial sector needs to better understand the long-term commitment required to move from innovation to sellable product, whereas the engineering sector ought to be more aware of the need for constant, clear and transparent communication with the investment community.

In its Innovation Roundtable with Enterprise and Academic Partners held in April 2018, the IET identified a lack of understanding in the wider business community about the people trying to deliver innovation and the amount of time and effort required to progress from a working concept to first sale.

As innovations are created more through experience and attitude than through teaching – it is possible to teach business management and skills, for example, but innovation success is more likely with the support of people that have 'been there and done it' – it can sometimes be challenging to create a supportive environment for innovation. Culture, networking and engagement are often overlooked in favour of a high-profile focus on the need for engineering skills and the core aspects of engineering, design and technology.

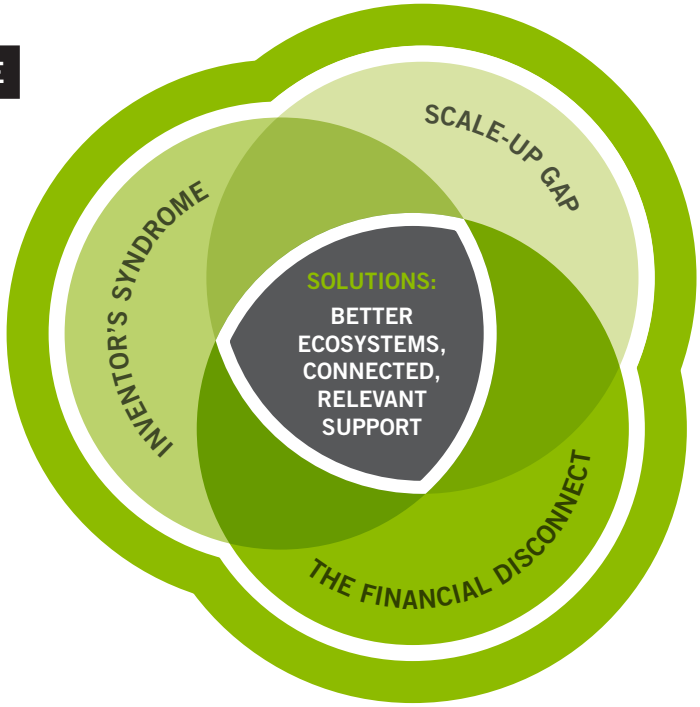
The IET roundtable sessions highlighted that there are many initiatives, programmes and mentoring schemes already in place. The challenge, though, is that they often operate in a detached manner from one another, or they're too clustered together, too focused on just start-ups or not looking closely enough at new technology. Linking relevant offerings together in an agile way and improving how they are communicated both cross-governmentally and externally will help simplify and clarify the system, which is needed[10].

With so many different initiatives, delivered by different agencies or consortia, the funding landscape for SMEs can seem confusing and time-consuming, causing many not to seek assistance at all.

3.4 EVALUATING THE CHALLENGE

Many of the underlying causes behind the three challenges to SME growth are the same.

Addressing these underlying causes as a unified whole is the most effective way to release the downward pressure and allow more SMEs to reach scale-up status.

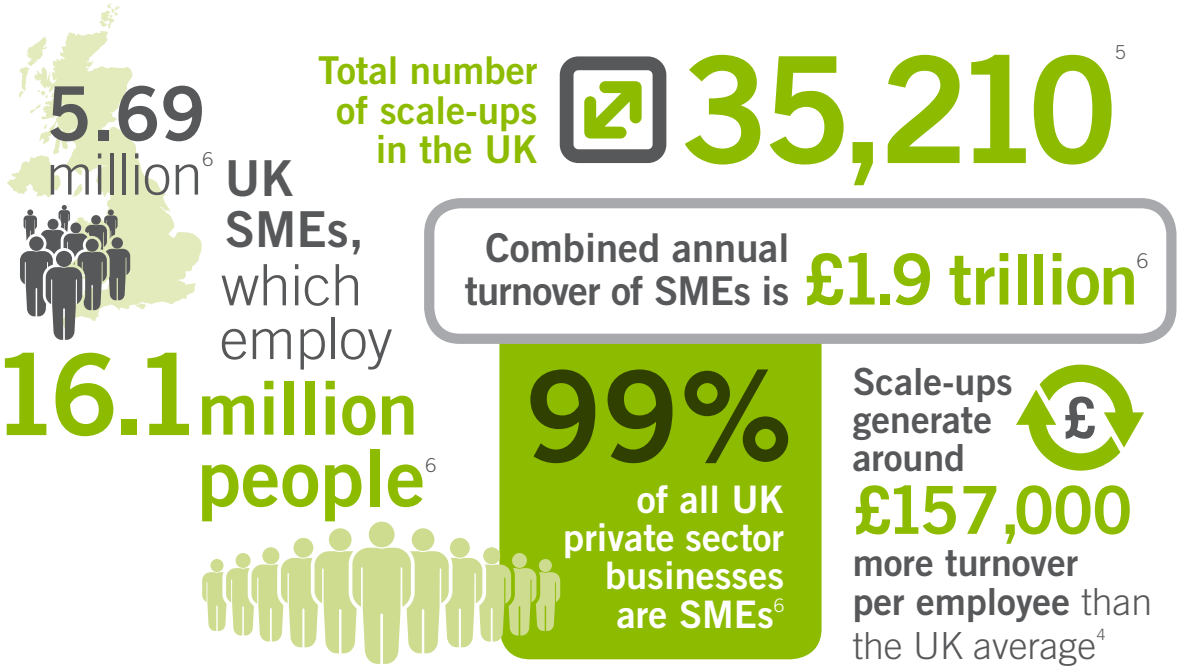


4. THE SCALE OF THE OPPORTUNITY

Building a cohesive infrastructure that enables even just a small proportion of SMEs to overcome the barriers of scaling-up will result in a swift and measurable positive impact on the UK economy.

The measures that will transform SMEs into scale-ups can also be used to launch existing scale-ups into the next stages of success.

SMES AND SCALE-UPS: THE FIGURES



5. SOLUTIONS FOR SUCCESS

The three key challenges (inventor's syndrome, the scale-up gap and the financial disconnect) need to be considered in combination, as all three are interrelated. Many of the underlying causes are similar, so a holistic approach will accelerate awareness and action, reduce confusion and ensure clear communication pathways between all groups involved.

The recommendations that the IET is proposing fall into two categories, namely ecosystems and support.

5.1 SOLUTION 1: BUILDING BETTER ECOSYSTEMS

Peer-to-peer mentoring, local networking and showcasing innovation can all lead to strengthened partnerships across all sectors of the UK economy. The key is to ensure that activities are embedded into a coherent ecosystem.

Across the UK, in the digital age a more joined-up approach can be made by addressing training, knowledge, mentoring schemes, organisational relationships and showcasing initiatives. This requires support from both government and NGOs across all areas to ensure a coherent message reaches the intended recipients.

RECRUITMENT

Engineering SMEs often cannot find the talent they need from within the UK. They find the Home Office process of obtaining Tier 2 visas for overseas candidates daunting and burdensome, and as a result many SMEs exclude themselves from the wider global talent pool. This situation may be further exacerbated by recent political changes.

Support for managing Tier 2 visa applications as well as advertising to raise awareness of opportunities at UK SMEs globally would be welcome from both the government and the IET. Countries such as India, Russia and Turkey produce very talented engineers who could bring large benefits to the UK economy, and would be much more attracted to UK SMEs and scale-ups.

TRAINING AND KNOWLEDGE

Running a successful business requires training and knowledge that extends beyond the technical. Entrepreneurs need to be able to identify markets, make sales pitches and manage finances. Scale-ups and potential scale-ups need specialist managerial, sectoral and technical skills and knowledge, but this needs to be applied within a larger business knowledge framework and combined with a much deeper and better understanding of client challenges and issues. In addition, sometimes the problem is that entrepreneurs and managers don't recognise that they need training.

Leveraging organisational relationships across the innovation ecosystem, with universities, large corporations, government bodies, investment organisations and SMEs should also be a route to consider and implement.

More students are also needed in STEM subjects, both academic and vocational, to be retained in the country and encouraged to continue to develop skills. Moreover, skills need to be encouraged and made available on an interim basis from outside the UK in a manner which reacts promptly to SME needs.

MENTORING

Access to good mentors, with in-depth knowledge of business environments across a range of sectors, is critical for any innovative SME. Although mentoring may have negative connotations, due to associations with poor value consultancy, SME managers are eager to hear from people who have recently overcome similar challenges in their sectors. Equally, many successful business people want to pass on their knowledge to others.

Mentoring schemes need to be carefully managed and assessed to ensure consistency, but they could go a long way towards achieving the aforementioned boost to the economy. Key considerations include:

- Identifying the right people who are active in the industry and possess both the knowledge and experience to guide SMEs
- Gaining support from trusted advisors for inventors or senior financial managers in start-ups to develop sensible, flexible business and strategic plans
- Ensuring mentoring is easy to access and either free or delivered at a minimal cost
- Identifying specific guidance on areas such as the protection of IP, company registration, tax and the impact of GDPR regulation when discussing with potential clients or partners
- Providing SMEs with general business and marketing advice

INNOVATION NETWORKING

There is huge value to be derived from developing local networks of like-minded SMEs with similar technologies or supply chains to build links between businesses, as well as supporting the sharing of knowledge and expertise. Beyond this, it is vital for SMEs with innovative products to network with the wider industry, larger companies, academia, government and venture capitalists.

Cross-discipline networking opportunities to encourage the sharing of expertise between sectors should also be considered – the IET could play a role in facilitating this.

CASE STUDIES AND SHOWCASING

IET research shows that many SMEs see value in inspirational case studies and the showcasing of best practice. Case studies need to go into granular depth so that participants gain real value and insight from the activity.

Telling the stories of companies that have sought answers to issues and problems and addressed them by adopting innovation creates a clear pathway for others to adopt a similar approach. They are an invaluable tool in helping to encourage SMEs to engage, explore, participate and grow.

5.2 SOLUTION 2: SUPPORT THAT DELIVERS

Beyond building the necessary ecosystems, the requirement for another tier of support exists, where finance is provided, public innovation funding is made available and partnerships between SMEs and academia are developed with long-term goals. This should be combined with a much deeper and better understanding of client challenges and issues, ideally through cultivating an environment where clients, supply, SME, large organisations and universities can work together on significant problems.

FINANCIAL SUPPORT

The recent IET 'Innovation Opportunities and Challenges for SMEs' Survey showed that the primary reason for SMEs not innovating was a shortage of appropriate financial support and a lack of engineering understanding among many investors.

From the investor perspective, the view is that businesses are often not investment-ready, but by demonstrating stronger business capabilities and more robust strategic plans, the likelihood of securing financial support would be increased. Support also has to be available when it is needed; government initiatives that follow fixed timeframes and/or guidelines may limit their own effectiveness.

It is vital that entrepreneurs in start-ups and scale-ups are teamed with the investors, technical advisors and broader representatives that they need to be successful. As well as accelerating innovation, this is also likely to reduce the risks associated with early-stage investments and could include assisting corporates in the deployment of investment funds.

INCUBATORS AND ACCELERATORS

The most recent official figures show that there are 205 incubators and 163 accelerators currently active in the UK, spanning commercial, not-for-profit and government bodies[11]. However, many provide little more than office space for start-ups and lack prototyping facilities, access to finance and mentoring.

There is an opportunity to bridge the gap between start-up and scale-up by extending these incubators and accelerators into the next phase of SME growth, creating a joined-up approach.

ANGEL / INVESTMENT CLUBS

Bringing together the finance community, together with those seeking investment in a neutral environment where both sides are equally valued, could unlock significant funds for SME growth.

GOVERNMENT SCHEMES

Government-backed schemes include UKRI (incorporating Innovate UK), Nesta, British Business Bank, StartUp Britain, StartUp Loans, Defence and Security Accelerator alongside numerous specialist industry specific schemes, networks and regional initiatives.

Government innovation funding needs to be strategically targeted towards growth companies, companies, to enhance the potential for economic prosperity.

A REGIONAL OUTLOOK

It is also important not to neglect the importance of key regional disparities. For example, it is generally much harder to find investment in most places outside London and the surrounding areas.

Far more is spent on R&D in the South East and East of England than anywhere else in the UK. In 2016, these regions combined accounted for 37% of total UK R&D spend, amounting to £12.3 billion[12].

According to British Business Bank, 57% of business angels are based in London and the South East as well, with 43% of business angel investments made in this part of the country[13].

Productivity is a problem too, with one think-tank suggesting that if all UK cities were as productive as those in London and the South East (e.g. Slough, Reading and Milton Keynes), the UK economy would be more than £200 billion larger than it currently is[14].

By using some of the additional R&D spending that the Government has pledged and spreading it more evenly across the country, focusing on tackling skills gaps and improving infrastructure in low-productivity cities and developing new clusters of business angels away from the South East, there could be big benefits for the country as a whole.

5.3 THE ROUTE FORWARD

Despite this wide variety of supportive organisations, there is a gap in the UK ecosystem of organisations that seek to join up all the elements required for successful businesses to grow, particularly for SMEs that are in the process of scaling up.

The UK is a world-leader in many aspects of engineering, with the individual elements already in place to ensure success for a large number of engineering SMEs. Building and nurturing a wider support framework will lead to tangible benefits for engineering and a positive impact on the UK economy.

There have been many government and business initiatives centred upon innovation within business, perhaps too many. Creating a framework that embraces ecosystems and financial support networks will help boost the outlook of SMEs in the UK and increase the number of scale-ups that contribute to the economy.

6. CONCLUSION

The UK is among the top performing countries for creating start-ups, but struggles to turn them into larger commercial successes. This is a problem that urgently needs to be addressed.

The road from invention to innovation is a long and frequently complex one. At present, too much attention is often paid to the invention; by looking at the longer term we will stand a better chance of boosting the economy and raising ailing productivity levels. The invention cannot do that on its own.

Supporting infrastructures need to be expanded and connected together, drawing on all sections of the economy: academia, industry and government. This will facilitate the development and commercial growth of small business in particular, allowing them to respond in a more agile way.

Policymakers and those who support businesses need to focus on the whole ecosystem and bridge the gaps that many companies face on their journeys to commercial success.

Systemic scale-up support that follows the solutions laid out in this report will lead to more jobs and improved growth, greater economic prosperity, a sustained competitive advantage and benefits to businesses and society across the country.

7. METHODOLOGY AND REFERENCES

7.1 METHODOLOGY

Background material for this paper was obtained in two ways:

- A review of relevant reports on the current innovation landscape in the UK
- Findings taken from a survey of IET members and non-members on the topic of innovation, as well as four roundtable workshops with IET Enterprise and Academic Partners, finance groups and angels, technology SMEs and manufacturing SMEs – all carried out earlier in 2018.

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Michael Faraday House
Six Hills Way
Stevenage
SG1 2AY

T: 01438 313311
E: sep@theiet.org
Twitter: @TheIET