Photonics Scotland
THE SCOTTISH OPTOELECTRONICS ASSOCIATION

PHOTONICS IN SCOTLAND 2020 REPORT

A NETWORK OF technology SCOTLAND

CORPORATE SPONSORS

ENIGMA PEOPLE SOLUTIONS SCINTILLA

Foreword

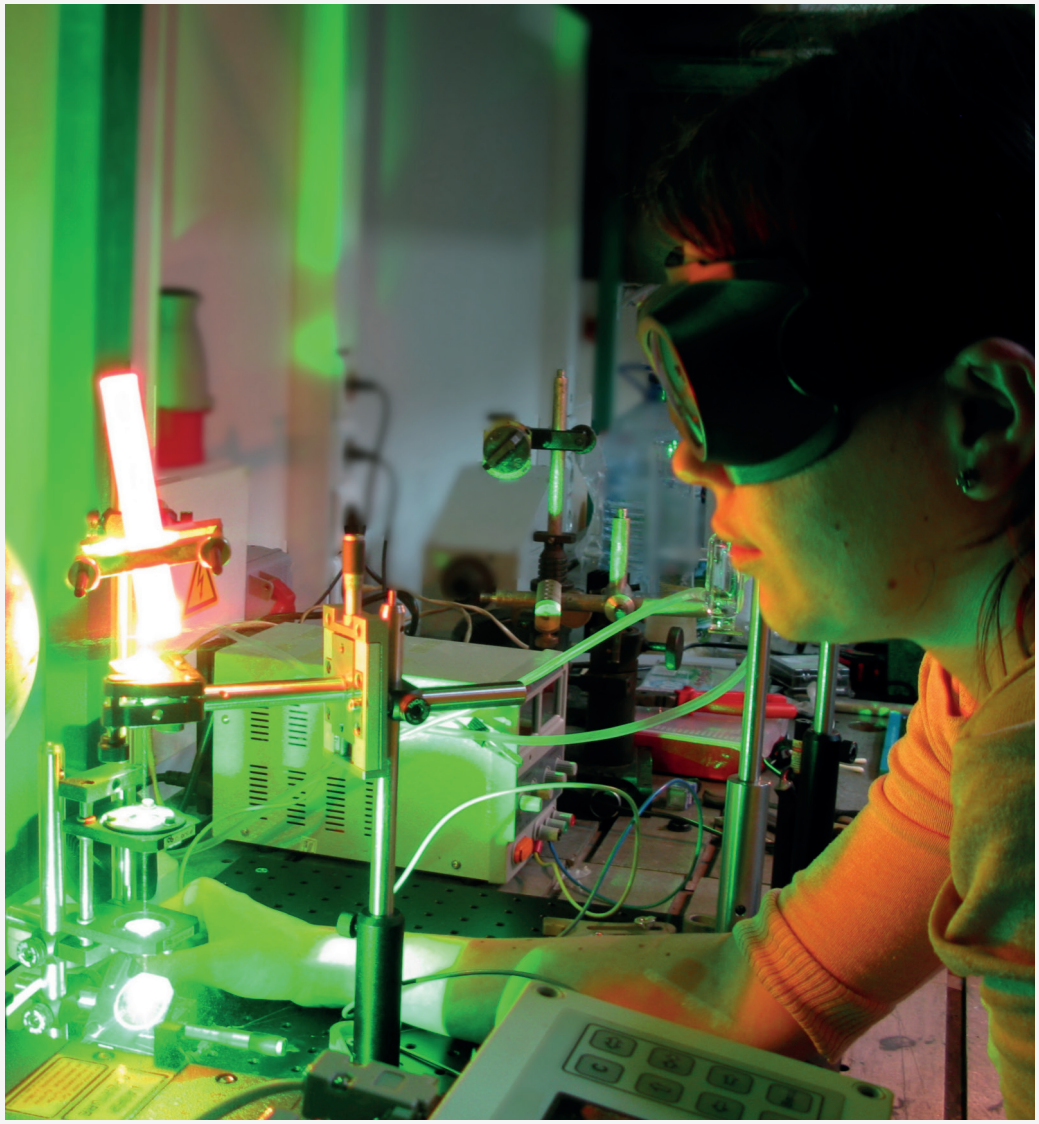
The global photonics market is estimated to be worth £540bn[1] and is set to grow rapidly over the next decade, accelerated by unprecedented demand for photonics enabled technologies across multiple sectors. Scotland is well positioned to capitalise on this rapid growth, with a long and distinguished history in this field, built on an internationally recognised academic base and a thriving industry cluster.

In 2019, Photonics Scotland published its vision to treble the size of Scotland's £1 billion photonics industry, detailing recommendations that will support this growth and maintain Scotland's respected position on the world stage.

To further inform these recommendations, Photonics Scotland recently conducted a baseline survey of the sector, the results of which are presented in this report. Now, more than ever, it is important to understand as much as we can about our sector and the information collated here will be of huge importance as Scottish Government and its Enterprise Agencies seek to support companies through these unprecedented times.

The survey, conducted between March – May 2020, received a fantastic response from our industry partners with around 75% of Scottish photonics companies submitting completed surveys. This represents the most detailed analysis of the sector in over a decade.

However, it is also important to note that the data reported here was gathered just as the full extent of the coronavirus pandemic was becoming apparent and broadly reflects the position of the sector in a pre-covid world. Photonics stands to play a significant role in Scotland's post-pandemic economic recovery and it will be hugely important to monitor this impact, something that Photonics Scotland is committed to doing over the coming months and years.



1. Europe's Age of Light, European Technology Platform Photonics21, 2017

Sponsor statements

ENIGMA
PEOPLE SOLUTIONS

Ben Hanley
Founder and Director
Enigma People Solutions

What excites Enigma People Solutions so much about the photonics industry in Scotland is that we can see significant investment and innovation happening in the space. We believe this is happening because photonics underpins so many modern and emerging technologies but also because, in Scotland, we have a growing group of really interesting and excellent companies that are growing as they develop a wide variety of products and solutions. The candidates we speak with are fascinated and amazed by the strength of the photonics market in Scotland and one even stated "I had this impression that the whole economy is built around the photonics industry ... I think that's the future and I see it's developing quite rapidly."

There is clear growth potential in the market in Scotland and we are highly enthused by the variety of companies that continue to grow and develop in the sector. To grow, aside from funding, one of the key challenges companies face is recruiting the right talent. The industry in Scotland needs access to the best candidates not just in the UK but internationally as well. That is why Enigma is proud to be represented on the steering board for the EPSRC & SFI CDT in Photonic Integration & Advanced Data Storage working to help develop the next generation of talent coming through.

Enigma is immensely proud to be a valuable partner to the photonics sector in Scotland not least through our continued sponsorship of Technology Scotland and Photonics Scotland. One of our missions is to use our national and international reach to help the industry in Scotland to attract new talent. One recent example is a senior laser engineer from Sweden who started with one of our clients just before lockdown hit. We have also, in the past year, worked with candidates from France, Germany, Lithuania, Netherlands, Singapore, Hong Kong and USA. We are able to introduce candidates to our clients that they may never have come across otherwise.

SCINTILLA

Peter McBride
Founder and Patent Attorney
Scintlla IP

We at Scintilla are proud to renew and affirm our ongoing commitment to Technology Scotland and to the community that it so passionately supports. These are unprecedented times for the economy, but the enabling technology sectors, and the photonics sector in particular have been resilient and innovative, showing great ingenuity to work around the various logistical problems that have been caused by the ongoing restrictions.

Now more than ever an effective intellectual property strategy is crucial for long term growth and sustainability. Start-ups and SMEs with patents and other registered IP rights consistently raise higher investment rounds and larger corporations can "spend smart" to leverage intelligence from IP data and to make sure that their IP budget is tightly aligned with commercial objectives. The number of patent applications in the photonics sector has been growing constantly in the last ten years with patent applications related to lasers up over 16% from 2016 to 2018.

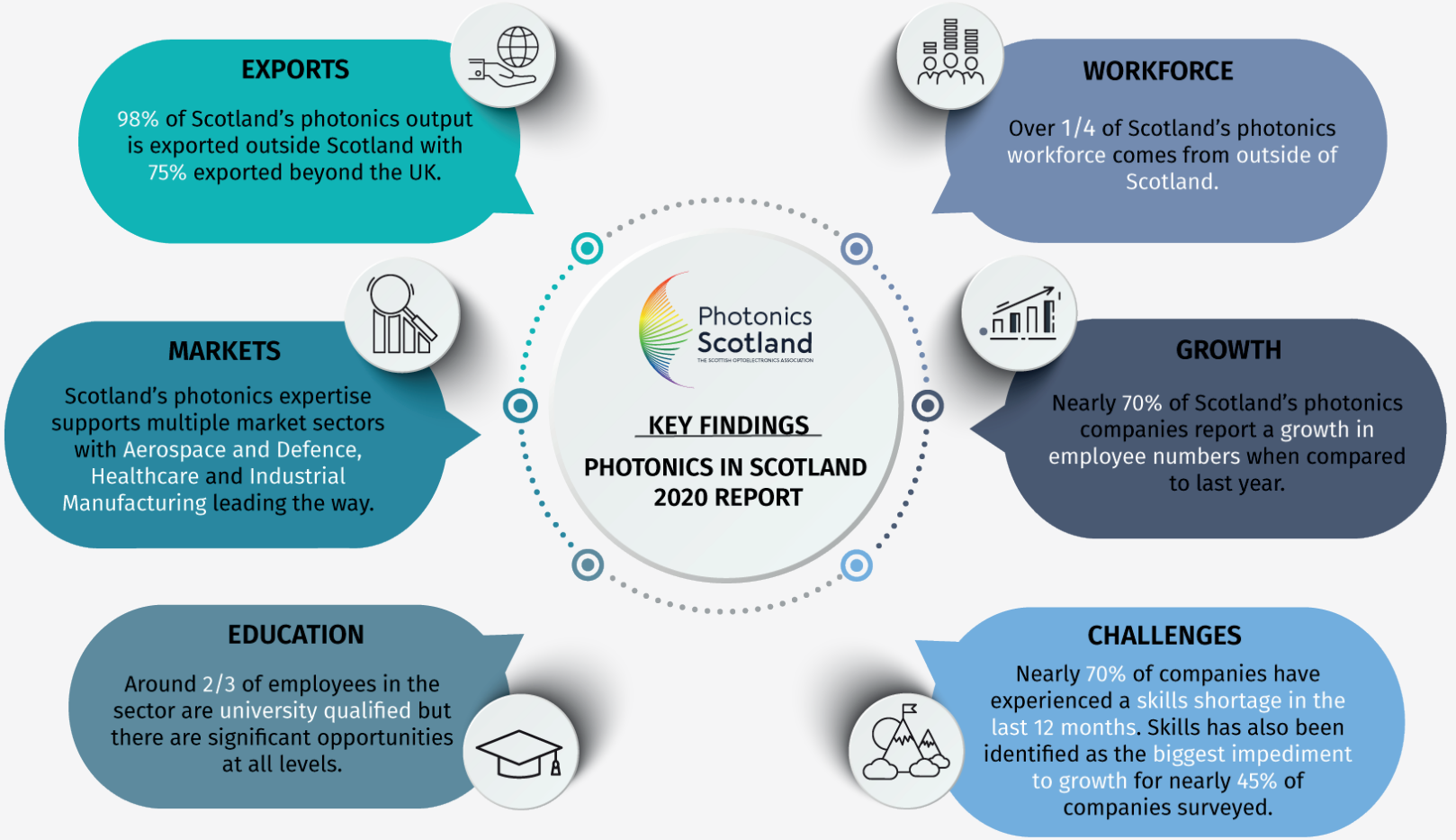
Scintilla work with companies to develop and implement an effective IP strategy with respect to their business objectives. This may include advising on IP registrations for inventions, brands and designs, general landscaping, as well as innovation analysis, trademarks and/or design registrations. We add value by closely aligning any filings or registrations with the company commercial goals so that they are best placed to get the most from their intellectual property. Other recent highlights have included expanding our office premises to a larger footprint and also retaining our listing in the IAM 1000, a global directory of the top patent professionals.

We are proud to support the community and our experience of working with innovators across various sectors makes us optimistic that Scotland will be well placed to "bounce back" and continue its leadership in the knowledge economy.

Executive summary

It is hugely encouraging to report that around 7 in every 10 Scottish photonics companies highlighted a year on year increase in employee numbers. It is clear that photonics continues to be an area of growth in Scotland, supported by a company base dominated by innovative small and medium sized enterprises (SMEs). Indeed, 94% of companies in the sector are currently classified as SMEs. These companies offer huge growth opportunity but only if this potential is recognised by Scottish Government and its Enterprise Agencies and the necessary investment and support infrastructure are cultivated.

Scottish photonics continues to capitalise on a truly global market with 98% of output exported beyond Scotland, and 75% beyond the rest of the UK. Acceleration in the demand for Scottish photonics products and services is fuelled by a diverse range of application areas with Aerospace and Defence, Healthcare and Industrial Manufacturing leading the way, all traditional areas of strength for the sector in Scotland. However, there is also increasing potential in areas such as Energy, Transport, Quantum and Communications, driven by an increasingly connected world and pressures to achieve clean economic growth through sustainable methods.



Executive summary

Scottish photonics companies have significant experience operating on the world stage, something that is often necessary even for those in early stages of development. However, as the demand for photonics grows, so too does the competitive landscape in which Scotland finds itself. Investment to maintain Scotland's hard earned reputation will be crucial, marketing Scotland's expertise globally and ensuring that the support networks are in place to exploit new and growing international markets.

Scotland's photonics workforce is a highly skilled one with the majority of employees boasting university undergraduate or postgraduate qualifications (66%). However, there are opportunities at all education levels and it is important to note that nearly a third of Scotland's photonics employees have entered the sector with college qualifications or no formal qualifications at all.

Challenges relating to gender balance remain with female representation in the workforce at just 27%. While this compares favourably with international comparators it is clear that more work must be done to develop this relatively untapped talent pool to support future growth.

Cultivating and growing the talent pool will be crucial in supporting future growth. Skills are identified as the single biggest impediment to growth with nearly 70% of companies reporting at least one vacancy due to a skills shortage in the last 12 months. It is clear, therefore, that we must invest in our future talent pool to support the predicted growth in the sector. Across all education levels it will be crucial to develop our workforce through continual training and upskilling opportunities and we must invest more in encouraging the next generation of photonics employees. While engagement at university level is high, there is more work to be done to raise awareness of the sector at earlier stages in the education pipeline

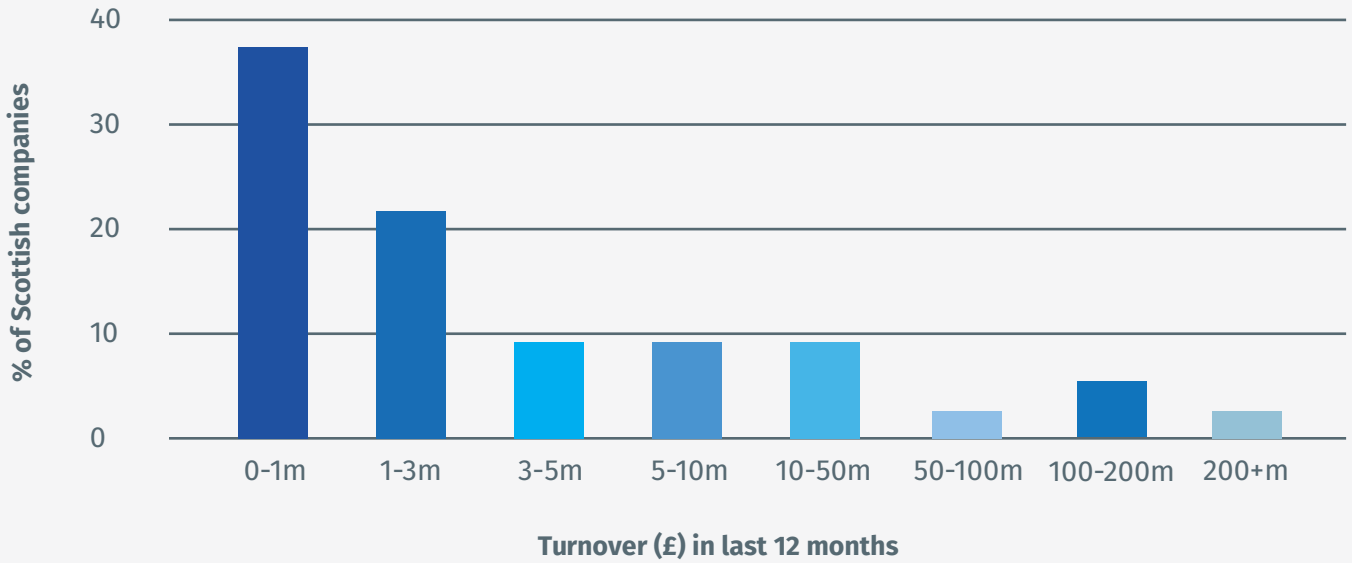
The sector also continues to rely on the import of talent with around a quarter of the workforce originating outside of Scotland. This input is warmly welcomed and as the sector continues to grow so too will the demand for international skills and expertise to augment our home grown talent.

Against this backdrop, and impending political uncertainties, it will be absolutely crucial to maintain access to this talent and encourage international skills to Scotland.

Finally, innovation will continue to be key in maximising the opportunities available through a range of high growth, dynamic applications. It is encouraging to note then that the innovation landscape in Scotland appears to be buoyant. Scottish photonics companies can boast a hugely impressive success rate in winning available funding with 95% of applicants securing funding through the major UK and European routes. Relationships between industry and our academic base are clearly strong with 90% of companies reporting university collaborations in the last three years. However, further opportunity is available through increasing engagement with Scotland's enviable array of translational assets with visibility and awareness key.

Sector landscape

COMPANY SIZE - TURNOVER

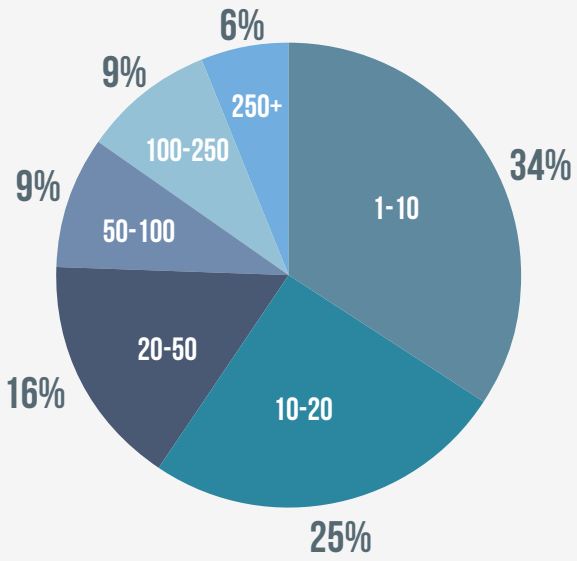


SCOTLAND'S PHOTONICS SECTOR

- £1.2bn in revenue
- 60 companies
- + 5,700 employees

COMPANY SIZE - NUMBER OF EMPLOYEES

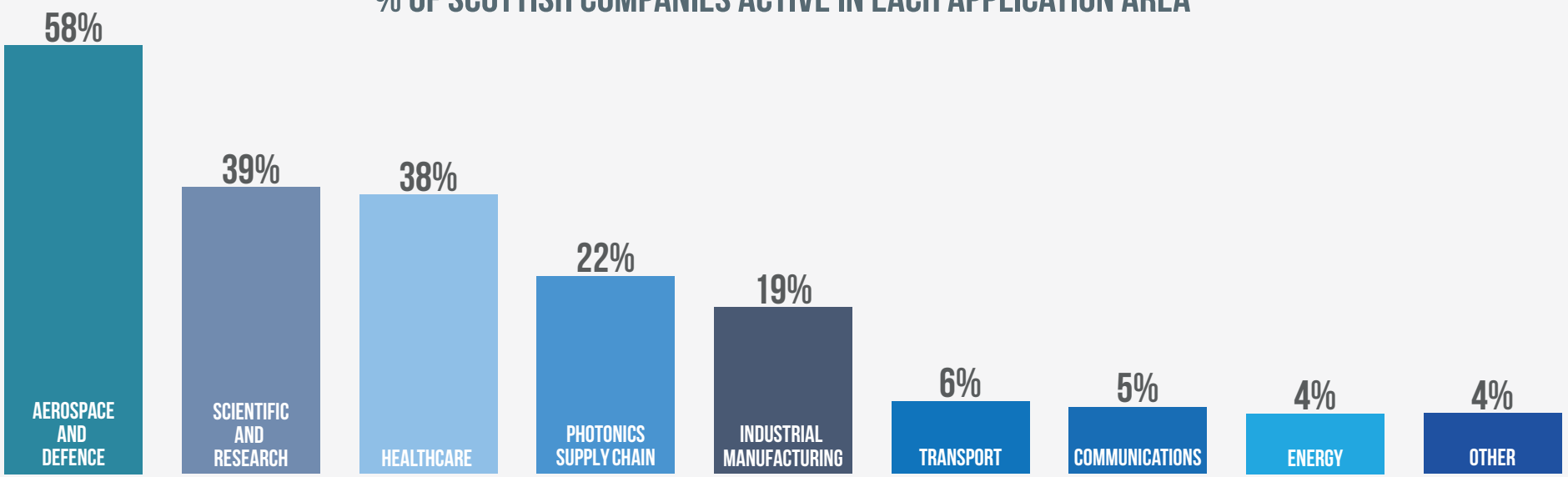
94% OF COMPANIES ARE SMES



Small and medium sized enterprises dominate Scotland's photonics landscape. These companies offer huge potential for growth but must be supported through a scale up of Scotland's investment and support infrastructure.

OPPORTUNITY

Application focus



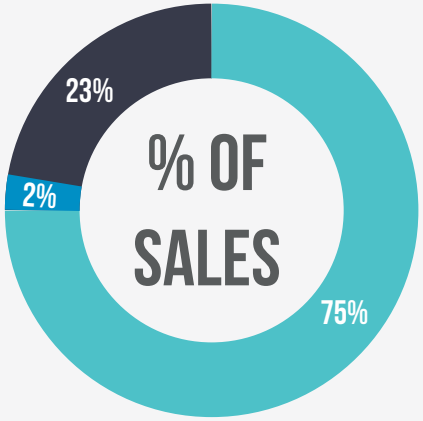
Scotland's photonics sector supports a diverse range of application areas, many of which are poised to enjoy significant growth over the next decade. Investment in innovation will be key if Scotland is to capitalise on these dynamic, high growth markets.

OPPORTUNITY

A QUANTUM FUTURE

Quantum technologies are enjoying an ever increasing profile of late, with endless possibilities in areas such as Computing, Communications, Advanced Manufacturing and Health. These technologies rely heavily on photonics with some estimates suggesting that up to 80% of all quantum technology is dependent on lasers and advanced optics Therefore implementation of quantum technologies, along with early product delivery, will only be realised by applying photonics technologies and expertise, both of which are readily available in Scotland.

International markets



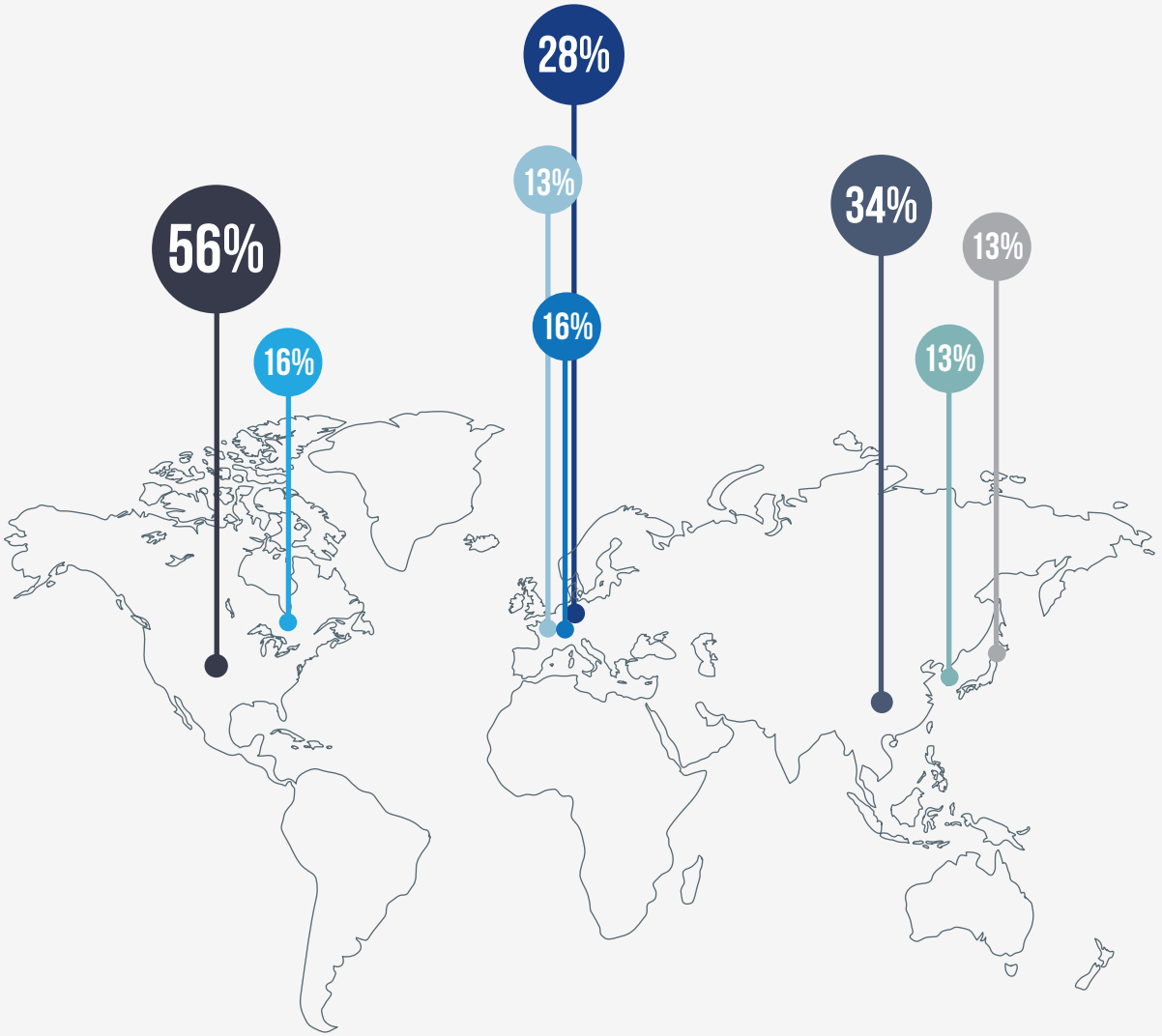
Scotland Rest of UK International

98% OF OUTPUT EXPORTED OUTSIDE OF SCOTLAND

Photonics is set to be a trillion dollar global market by the end of the decade[2]. This huge opportunity is reflected in Scotland's focus on international exports but the sector must be supported to expand its internationalisation efforts and promote Scottish products and expertise globally.

OPPORTUNITY

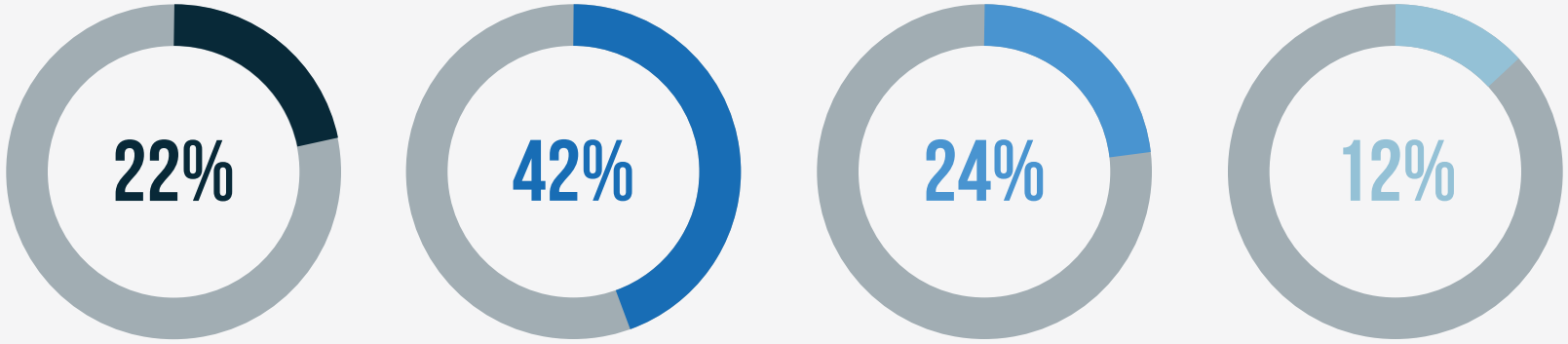
TOP EXPORT MARKETS



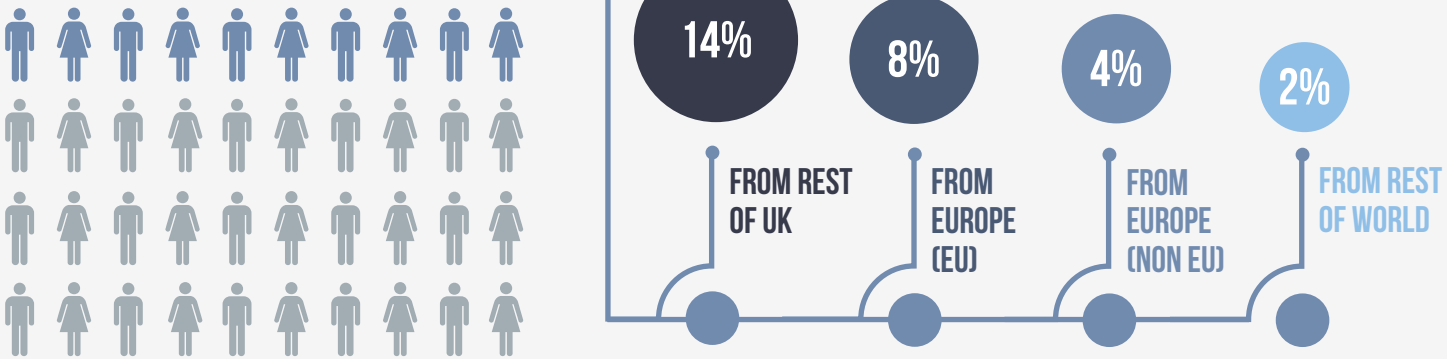
2. P&S Market Research, Market Analysis – Photonics Market, 2020.

Workforce

QUALIFICATION LEVEL OF SCOTLAND'S PHOTONICS EMPLOYEES



OVER 1/4 of Scotland's workforce come from outside of Scotland



While the sector will always require a core of highly skilled engineers and scientists, there are opportunities for those at all education levels. A greater focus on vocational training and apprenticeships will help to support the ongoing skills need.

OPPORTUNITY

Gender balance

THE GLOBAL GENDER SPLIT IN PHOTONICS IS 80% MALE AND 20% FEMALE[3]

OPENING UP PHOTONICS

As well as unlocking the well documented commercial and cultural benefits of a more gender diverse workforce, addressing the gender gap will be vital in securing the necessary number of skilled workers to support future growth. In order to achieve this, initiatives such as 'Opening Up Photonics' will work with both industry and academia to identify the barriers to female engagement in the sector, putting recommendations and processes in place that will provide employers and educators with the necessary tools to encourage more women into photonics careers.

Scottish photonics can claim to perform above the global average when it comes to female participation in the sector. However, there remains a huge opportunity to develop a relatively untapped talent pool to support future growth.

OPPORTUNITY

3. SPIE Global Salary Report 2019.

Growth

69%

of companies **increased** their workforce over the last 12 months

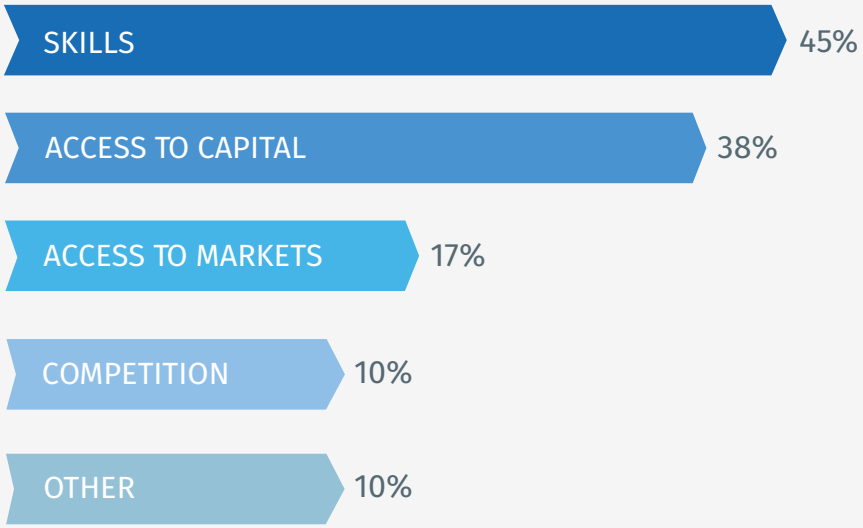
28%

of companies saw **no change** to their workforce over the last 12 months

3%

of companies **decreased** their workforce over the last 12 months

BIGGEST IMPEDIMENT TO GROWTH



Nearly 7 in every 10 photonics companies reported growth in employee numbers over the last 12 months. This is hugely encouraging but continued focus on skills and investment will be required to maintain this positive trend.

OPPORTUNITY

Skills and training

68% of companies have experienced a skills shortage over the last 12 months

69%
Currently engage with Scottish universities and colleges

55%
Currently engage with schools or science festivals to promote photonics

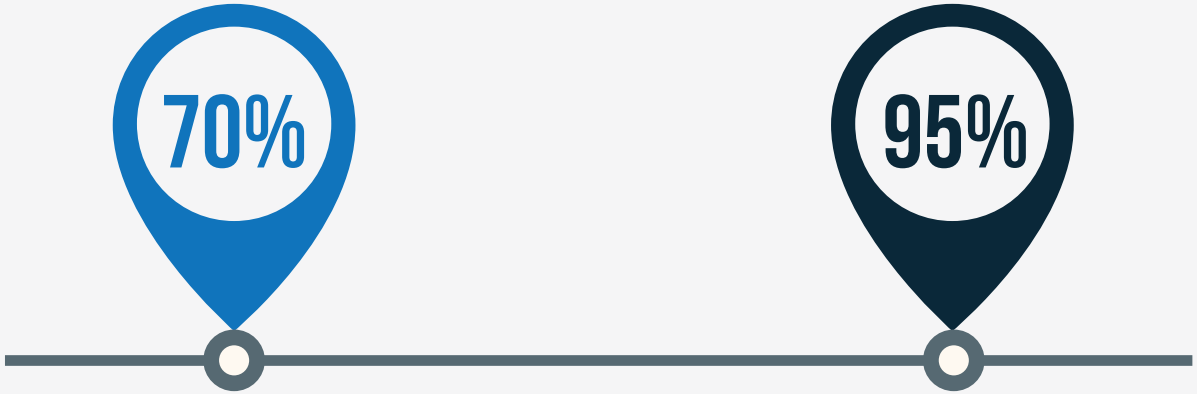
59%
Seek external technical/commercial training

38%
Operate a graduate or continuous training programme

While the sector continues to enjoy good engagement with universities, more could be done to inspire the next generation of photonics professionals through building greater visibility earlier in the education pathway. This should be supported through a coordinated National Photonics Initiative.

OPPORTUNITY

Innovation and research



have **applied for grants** from the EU, SE or UKRI in the past 3 years

have been **successful** in their grant applications

65% of companies have engaged with at least one other innovation asset within Scotland in the last 3 years

90% of companies have engaged with one of Scotland's universities in the last 3 years

The sector continues to be hugely successful in securing innovation funding. Close ties to Scotland's universities remain but further benefit could be extracted through increasing engagement with Scotland's enviable array of translational assets.

OPPORTUNITY

Community comments

WHAT ONE THING SHOULD THE GOVERNMENT AND ITS ENTERPRISE AGENCIES PRIORITISE TO SUPPORT SCOTTISH PHOTONICS?

"Support sales and marketing costs."

"Marketing the excellent Scottish companies internationally to enable an increase in exporting and collaboration."

"Address skills gap."

"Spinouts from University groups can access Scottish Enterprise High-Growth Spinout funding. There should be an equivalent programme for startups not derived from a University group."

"Better qualified and more ambitious investment community with scale."

"Investment in growing established companies to scale and industrialise innovative technologies."

"Even greater encouragement in schools and in steering students into Engineering faculties and apprenticeships."

"Tax benefits for innovative companies."

"Promote our capabilities and lobby more on our behalf at home and abroad."

"Support pipeline of Physics, Maths and Engineering graduates with significant alignment with optical applications."

"Support and encourage stable SME photonics companies that employ people long term instead of throwing resources at "high growth", here today, gone tomorrow companies."

"Ensuring that individual companies do not impose onerous restrictions on their employees' ability to leave and be employed in the same sector."

"Increase support and funding for Scottish SMEs."

"Invest heavily in all aspects of the industry."

"Support local supplier incentives."

"Early-career enterpreneurship training."

"SIB / SNIB focus on investment in sector."

"Bring proper credible technical and commercial rigor to evaluating potential projects to support."

"Ability to fund Scottish part of large organisations as if they were SMEs."