

UK Photonics 2023: The Hidden Economic Engine



Acknowledgements:

The Photonics Leadership Group (PLG)

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Cover Art: The Future Photonics Hub



Executive summary

UK Photonics 2023: The Hidden Economic Engine

The UK photonics industry contributes £15.2bn to the economy per year and employs 80,000 people.

With a productivity of £89,400 per employee, photonics is one of the UK's most productive manufacturing sectors.

The Photonics industry is spread throughout the UK among 1,200 companies based in regions from the far South West, to Scotland and Northern Ireland. Internationally renowned, the majority of UK photonics companies export more than half of their output. A highly innovative sector: two thirds of companies make use of R&D tax credits and over half report investing more than 10% of their turnover into R&D. This innovation is built on collaboration, with 55% involved in collaborative R&D projects with a university and/or other industrial partner.

This innovative capacity is built on an internationally leading research base embedded in over 40 universities. Well connected to industry, four out of five photonic academics work with industry, with 40% of research groups receiving more than £1million in industrial funding annually.

UK photonics output has grown by more than 7% over the last two years despite the challenges of COVID-19. Based on comparison to Office of National Statistics data, photonics is one of the only UK manufacturing sectors to grow over this time. Photonics now employs as many people in the UK as automotive or aerospace production and more than three times the number employed in steel, chemical, or pharmaceutical manufacturing. Making a significant contribution to the economy, photonics output is now higher than chemical production and approaching that of aerospace and pharmaceutical manufacturing.

Globally, the photonics output was quantified at £575 billion in 2020 and is estimated to be >£650 billion today, with the European share ~16%. The

UK is the second largest manufacturer of photonics in Europe, after Germany, and the ninth largest in the world, according to independent analysis from Photonics21 and SPIE.

Photonics defined

All science and technology related to the generation, transmission, detection and manipulation of light is known as 'photonics'. Photonics technologies range from lenses and optical fibre, to lasers, semiconductors and LEDs, displays and cameras of all types, incorporated in products and high productivity manufacturing processes worldwide.

The UK has been innovating photonics for over four centuries and continues to deliver critical capability to society. Photonics is vital for modern communication, the internet, industry 5.0, autonomous vehicles, productive manufacturing, non-invasive healthcare and delivery of a sustainable economy. The UK Government's 2021 Innovation Strategy recognised the cross-cutting role of photonics and its societal impact. There is much more potential too, as the latest photonics innovations enable products in quantum 2.0, defence, advanced AI, autonomous transport, battery production and the hydrogen economy.

The challenge now is to capture more of the value delivered from photonics in the UK, support the industry to scale-up to meet increasing demand with talent and automation, and support underpinning innovation that benefits diverse applications across society.

Distribution of
UK photonics industry activity



Introduction

The UK photonics industry comprises a highly diverse range of organisations involved in developing, manufacturing and supporting products which use light-based technologies.

Photonics technologies are vital to most of the products and services used by virtually everyone in the UK on a daily basis. Laser light and optical fibre form the basis of the communication networks underpinning the internet and mobile networks. Displays are the heart of all digital entertainment, from televisions to smart phones and tablets. We capture, record and view the world through optical lenses. Manufacturers in industries from automotive to food production, rely on lasers to cut, texture, mark and measure. Optics, lasers and cameras are core to the precision defence systems of today and will be the eyes of tomorrow's driverless cars.

Society depends on photonics. We use light in a myriad of different ways every day, yet the seamless integration of photonics means it often works unseen inside everyday products. The same is true for the UK photonics industry, ubiquitous in enabling wide parts of the economy, yet hidden from view. Photonics is a major manufacturing and exporting sector built on four centuries of UK leadership, but few are aware of the scale of activity, or its impact. With companies distributed across the country, often of a small or medium-size, serving a huge range of very different applications, it is easy to see how people can remain unaware of the world-leading photonics manufacturer just around the corner.

This report provides the latest update on the size, scale and characteristics of the UK photonics industry. It is based on a robust, internationally proven methodology, designed to take into

account the dispersed and concealed nature of the industry. Consistently applied for over a decade this methodology enables robust reporting of long-term growth and is supplemented by a detailed industry survey.

The national distribution of the industry shows the regional strengths. Comparison of photonics to other high profile UK manufacturing sectors enables visualisation of the relative strength of the industry. The position of the UK relative to other global photonics markets provides international context.

Survey insights provide evidence for past and future growth, investment, exports and innovation. The unique perspective of the Future Photonics Leaders group provides an additional window on the motivation and vision of those that will take the industry forward.

The hugely diverse range of photonics applications means only the briefest description of a selection is included. An indication of how many of these applications are addressed by individual companies and researchers shows the diversity of engagement and loci of UK strengths.

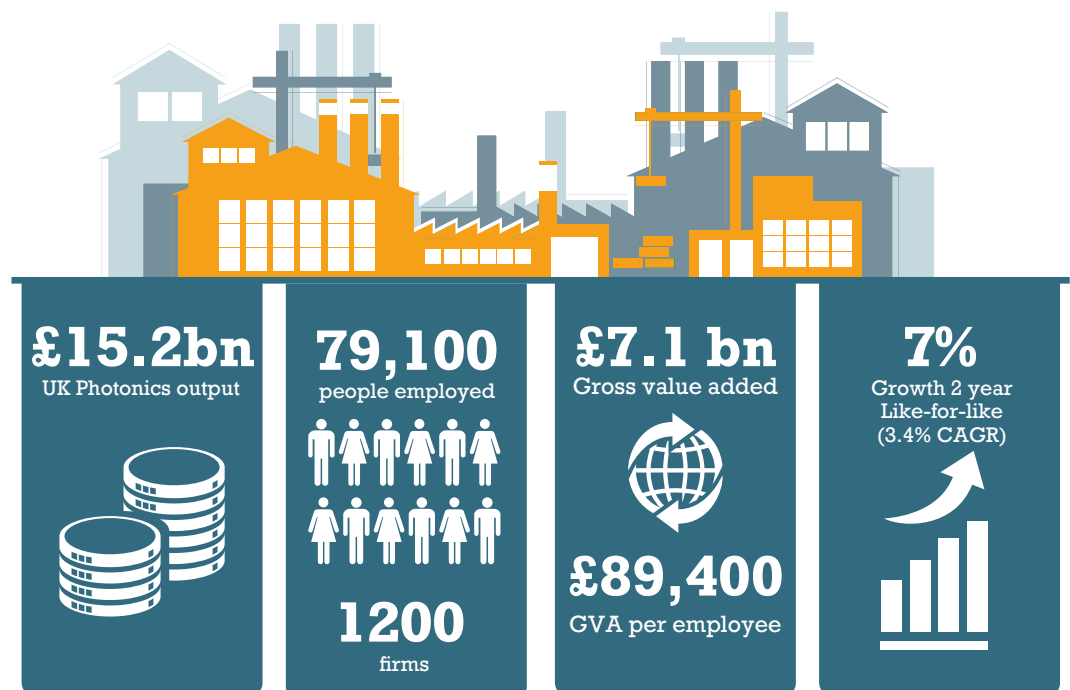
Views on the where the community see their future impact on the grand challenges faced by society illustrates the potential for the future and the risk of neglecting such a key sector.

The UK Photonics industry

The UK photonics industry produced goods and services worth £15.2 billion in 2022 growing 7% in two years

Behind this impressive output lies 1,200 companies based across the UK, from Cornwall to Aberdeen collectively employing 79,100 people. Each of those employees added £89,400 of gross value to the UK economy on average, giving a total Gross Value Added (GVA) of £7.1 billion per annum to the UK economy from photonics.

Underlying revenue growth over the last two years has been 7%*, equivalent to compound annual growth rate (CAGR) of 3.4%. Profit growth over the same time has been significantly higher at 9.2%, driving GVA growth of 6.9%. Employment growth has been lower at 3.2%, resulting a rise in productivity measured in GVA per employee growing by 3.6% over the last two years.



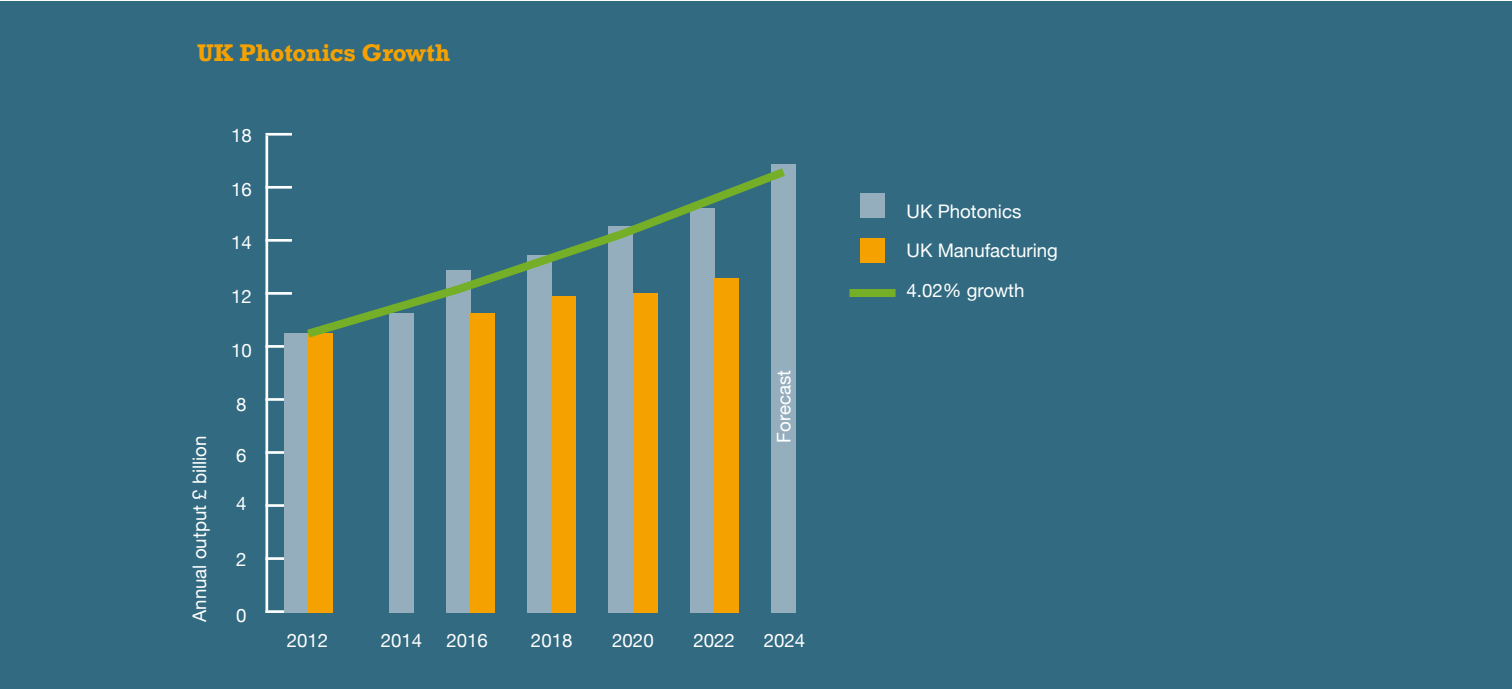
Source: Photonics Leadership Group (PLG), May 2023

The photonics industry size is based on taking a fraction of individual firms output, profit and employment relating to photonics activity for the last full financial year reported to Companies House (see methodology). The current estimate covers financial years ending in 2022 and growth the period from 2020 to 2022. Surveys during the COVID-19 pandemic showed most photonics businesses were able to adapt and remain operational during this time, reflected in the strong 2020-22 growth.

Over the last ten years the UK photonics industry has grown at an average annual growth rate of 4%, three times the average growth of the rest of UK manufacturing. Projecting this growth forward indicates UK photonics will grow to a £17 billion industry by 2024. Maintaining this growth rate to 2035 would create a UK photonics industry of £43 billion, in-line with the PLG's 2035 Vision for UK photonics.

Survey responses indicate the potential for significantly higher growth. Fully 70% of industrial respondents predict their companies will grow by more than 5% a year for the next two years, with 40% predicting growth of more than 10% per annum. This reflects the many opportunities and increased demand in the key application areas where the UK has strength including defence, digital economy, manufacturing and sustainability.

The average employee benefit paid in the photonics industry is taken from the Companies House returns for larger companies fully focused on the industry. The average benefit paid of £54,520 covers all seniority and experience levels from managing director to apprentice technician. Benefit growth was 1.6% from 2020 to 2022, predating the most recent 2023 inflationary pressures



* Underlying growth figures are based on direct comparison of the fiscal data for 924 companies present in both current and previous datasets where, turnover, profit and employee data were available in both years.

Impact

All major societal challenges and markets are being impacted by photonics creating unprecedented demand.

Addressing the challenges of today and tomorrow

The ubiquitous nature of photonics means it is critical for delivering solutions to the key challenges faced by society. Over 90% of the industry see photonics as critical or important for underpinning the UK's role as a leading scientific powerhouse and enabling broad economic growth. Photonics is seen as essential for quantum technologies and our national defence. Three quarters of the industry see photonics as playing a critical role in energy supply, the transition to a net zero economy, healthy living and the application of artificial intelligence.

The underpinning role of photonics has been recognised by its inclusion within the seven technologies families identified in the government's 2021 Innovation Strategy as key to the future of the UK. Photonics is also vital to deliver the five critical technologies identified in 2023 by the UK Science and Technology Framework.

Net Zero and Circular Economy

Photonics contributes to delivery of a Net Zero economy through advances in photovoltaic solar power generation and by reducing energy consumption with smart lighting, advanced data networking, vertical farming and laser-based manufacturing and 3D printing. By supporting material identification and high density marking, photonics has a key role in enabling an efficient circular economy.

Environment

Light can provide accurate, non-invasive and real-time data on the environmental parameters, from temperature, to bioactivity and CO2 levels critical to informing intervention decisions and understanding human impact. Photonic sensors are central to satellite Earth observation, agricultural crop inspection and biodiversity monitoring.

Healthcare and Healthy Living

From pathology microscopes and cell counters to X-rays and fluorescent based diagnostics, photonics-based tools are everywhere in our hospitals and operating theatres. The use of laser surgery and photodynamic therapies continue to rise. Drug discovery depends on photonics tools to understand molecules, screen drug candidates, ensure quality and identify fakes. Light is central to wearable health/ lifestyle trackers and the correct lighting vital for alertness and stress reduction.

Digital Economy

The digital economy is synonymous with the movement of data. Fibre optic based communications is the only viable solution to move high volumes of data nationally and internationally. As data volumes continue to grow, optical networking has become standard in the world's data centres and widely deployed in the latest arrays of low Earth orbit satellites.

Defence and Security

By capturing information remotely, light is essential for situational awareness, surveillance, communications and reconnaissance. Advanced cameras and sensors are the essential data feeds for informed decision making. Lasers provide precision targeting, countermeasures against incoming threats and, with the latest high power laser directed energy systems, an alternative to kinetic interventions.

Efficient Flexible Manufacturing and Industry 5.0

Digital laser processing is used to cut, mark, join, clean and texture materials in car plants to food production. Machine vision is a vital part of process control. Few factories can be found without one photonic based laser or camera- most would be far more efficient if they deployed more. Metal 3D printing relies on lasers. Battery, semiconductor and consumer electronics manufacturing depends on lasers, including those made in the UK.

Space

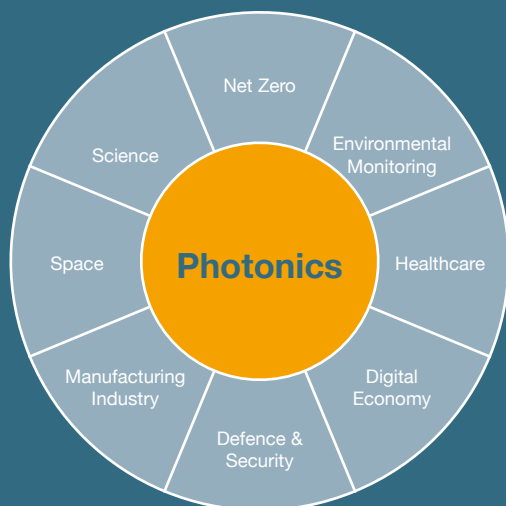
Photonics is key to gathering data in space, to relaying that data to Earth and operating space craft. High resolution cameras and active LiDAR systems are the core of earth observation. Photonics is used to move data between satellites and in the future to beam data to earth. Active laser measurement systems are vital to docking space craft and even igniting rocket engines.

Science and Technology

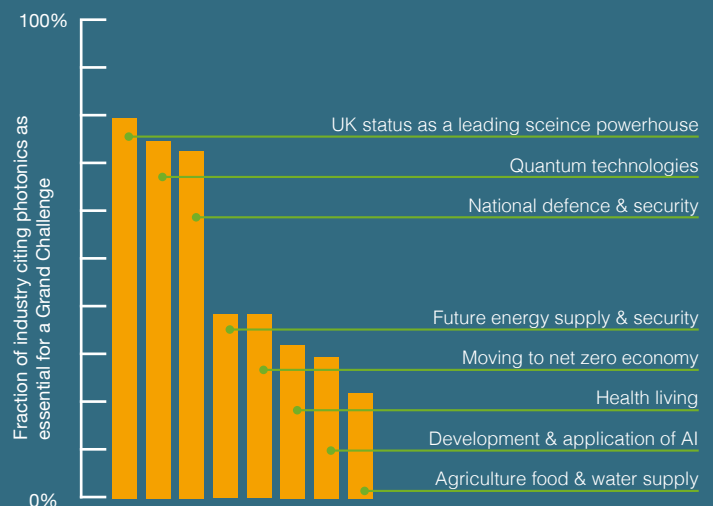
The UK is an internationally recognised centre for the design and build of optical and infra-red astronomical instrumentation, including for the James Webb Space Telescope and the European Extremely Large Telescope.

Extreme light sources are at the heart of much of the world's large-scale science and technology infrastructure, able to create extreme conditions and break matter into its constituent parts on demand to advance the frontiers of scientific and technical knowledge.

Photonics impact is everywhere



Importance of Photonics to Societal Grand Challenges



Market Focus and structure

Photonics companies focus on multiple markets critical to the UK.

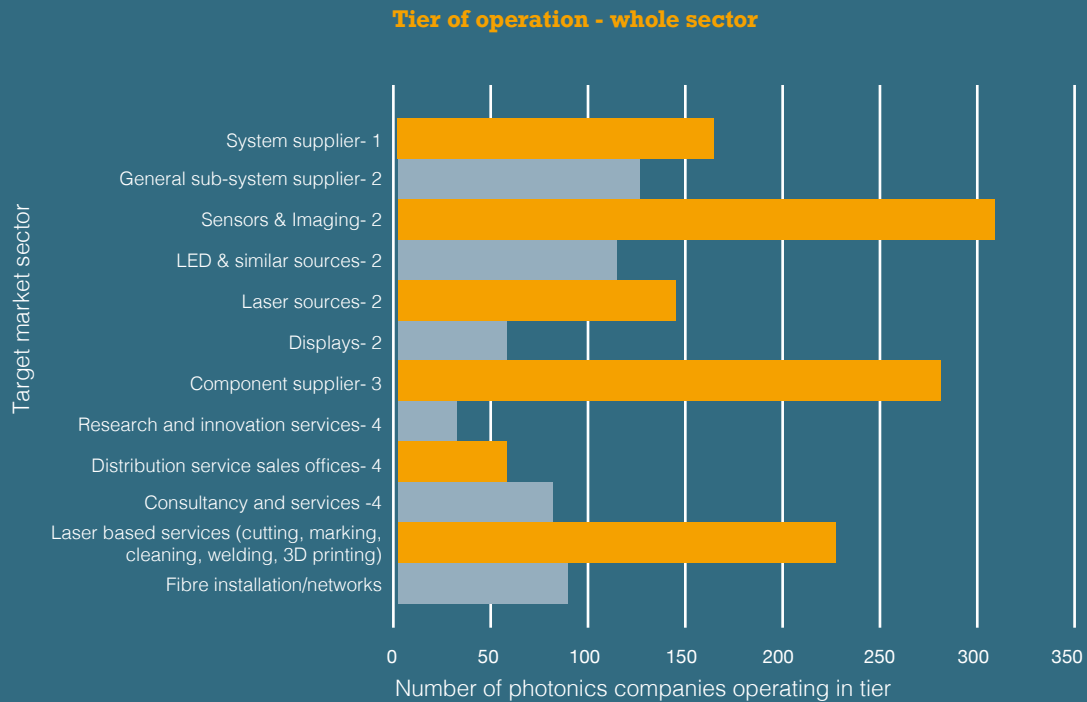
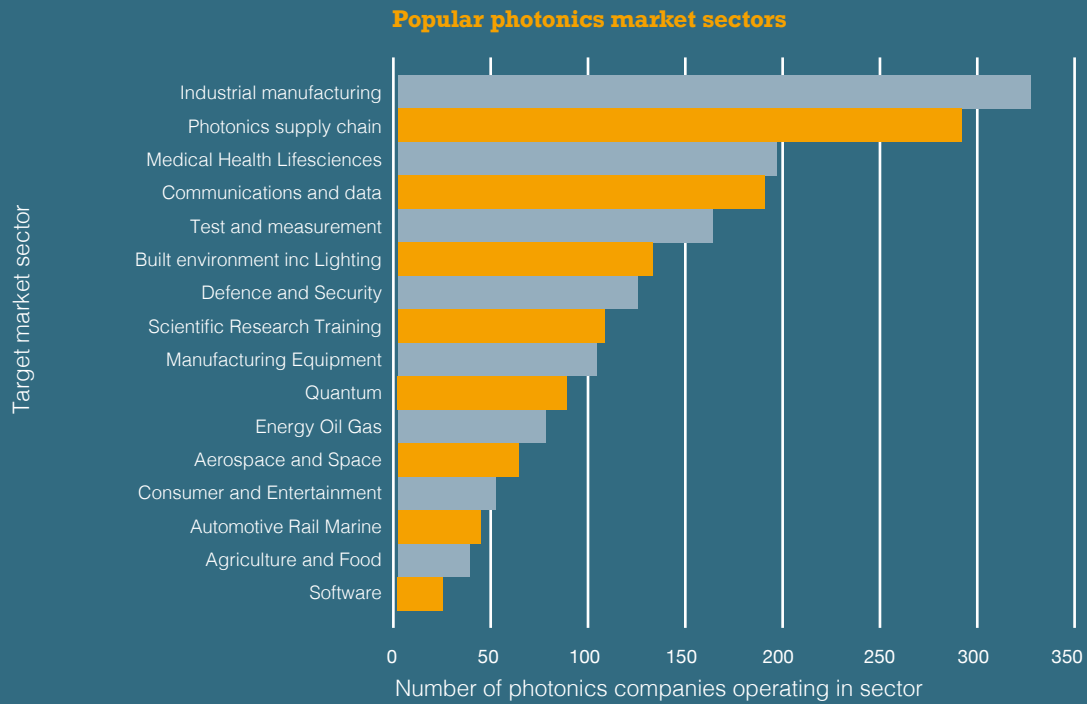
As an underpinning enabling technology, photonics companies address a large range of markets. On average each photonics company addresses between two and five distinct markets. Even small SMEs often address multiple markets: a reflection of the cross-cutting nature of photonics.

Industrial manufacturing is the most frequently targeted sector. This is driven by the large number of companies providing laser materials processing, a reflection of the key role this specialism has across much of UK manufacturing. A significant number of UK companies also supply components into the photonics supply chain. This strong photonics supply chain engagement is a reflection of UK expertise in manufacturing the quality critical components for use in higher level systems, but also a reflection of structural weakness in capturing the value of higher level system integration in the UK.

The structural strengths and weakness are further reflected in the supply chain tiers within which UK photonics companies operate. The majority of companies are component, sub-systems suppliers or laser processing service companies. Full system suppliers are in the minority, except in the defence sector where the UK has notable strengths e.g., Leonardo, Thales, MBDA, BAE Systems, etc. Although many full system integrators are not captured in this analysis as they are considered photonic users rather than direct photonic manufacturers.

In addition to the sectors captured in the PLG taxonomy, more than one third of the industry cite involvement with the semiconductor industry and space and satellite markets. A growing number also report increasing engagement with environment, weather and climate related markets.

These market foci are highly aligned to the UK Government's 2023 science and technology council priorities in AI, engineering biology, telecommunications, semiconductors and quantum technologies. UK firms are developing optical tensor chips to form the basis of rapid AI machine learning; single photon emitters and detectors for quantum; optical semiconductors and novel optical fibres for future of telecommunications; and photonics diagnostics chips for healthcare, to identify just a few



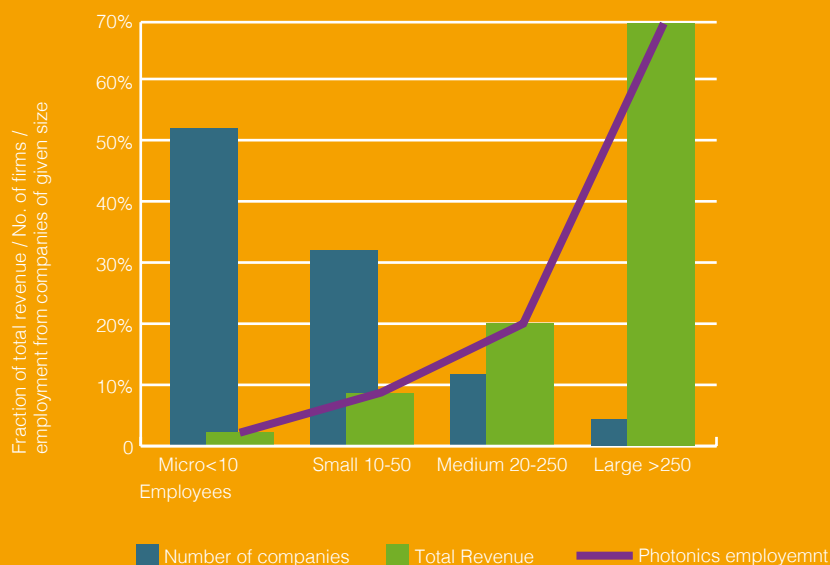
Industry profile

UK Photonics is highly experienced featuring a healthy cross-section of mature companies, young start-ups and SMEs.

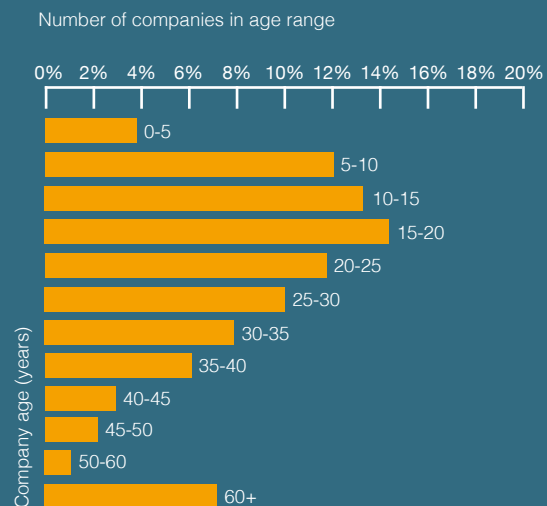
The UK has been at the forefront of photonics innovation since James Clark Maxwell's 1865 Theory of Electromagnetism. The photonics industry therefore features companies of all ages, from the 20% founded in the last 10 years, to the more than 10% which are over 50 years old. This creates a UK photonics ecosystem with considerable experience in developing and commercialising technology that has navigated multiple technology cycles, from the invention of the semiconductor laser and optical fibre through to the latest quantum innovations.

By far the majority of photonics revenues come from the few large UK photonics companies who also employ the largest share of the photonics workforce. The large number of micro and SMEs sized organisations make a significant contribution in driving innovation forward and are notably as equally export focused as the larger firms. These distributions have changed by less than one percentage point in any category in the last four years and are similar to those observed in other enabling technology sectors such as acoustics and fluid dynamics, and the photonics industry globally.

Revenue/employment by size of operation



Company age profile



Regional distribution

The photonics industry is distributed across all regions of the UK, from Northern Ireland, Scotland and Wales to the North East and South West of England.

Regions with more than £1billion of photonics output include Scotland, the East and West Midlands, the East, South West and South East of England. Employment is even more uniformly spread with only two regions with more than 7,500 photonics employees and only two with less than 4,500. Productivity is above £90,000 GVA per employee in 8 out of 12 regions.

Over 1,410 operating sites are recorded in the UK for photonics companies, 20% higher than the total number of photonics companies reflecting the number that have multiple operating locations.

Significant clusters of photonics activity exist in North and South Wales, the central belt of Scotland, the South Coast, Torbay, Durham, the Greater Manchester and Cambridge areas and across Northern Ireland and the Midlands. These have often built up around academic centres of excellence and developed into ecosystems around specific technologies, such as optical fibres or lasers.

Regional distribution of estimated UK photonics output, photonic jobs & GVA per job



Region	Output	Photonic Jobs	GVA per job
Scotland	£1,283m	7,020	£87,000
Northern Ireland	£437m	2,760	£114,000
North East	£558m	3,400	£94,000
North West	£995m	4,740	£100,000
Yorkshire and the Humber	£867m	4,360	£98,000
East Midlands	£1,152m	5,600	£82,000
West Midlands	£1,052m	5,250	£96,000
Wales	£758m	4,490	£92,000
East of England	£1,865m	8,630	£87,000
Greater London	£891m	4,610	£123,000
South East	£4,262m	21,100	£75,000
South West	£1,058m	7,050	£93,000
Total	£15,200m	79,100	£89,400

Innovation Focused

Over half of UK photonics companies invest more than 10% of their turnover into R&D.

Photonics is a highly innovation focused industry. Over the last 20 years, over 480 distinct UK photonics companies have been involved in at least one of over 3,100 different Innovate projects in 900 different Innovate UK programmes. Two out of five UK photonics firms have participated in at least one Innovate UK project as some point, with the average company engaging in more than six Innovate projects. This includes all types of project, not just those involving photonics, and is an overall indication of the level of innovation engagement of companies, rather than specific investment in photonics.

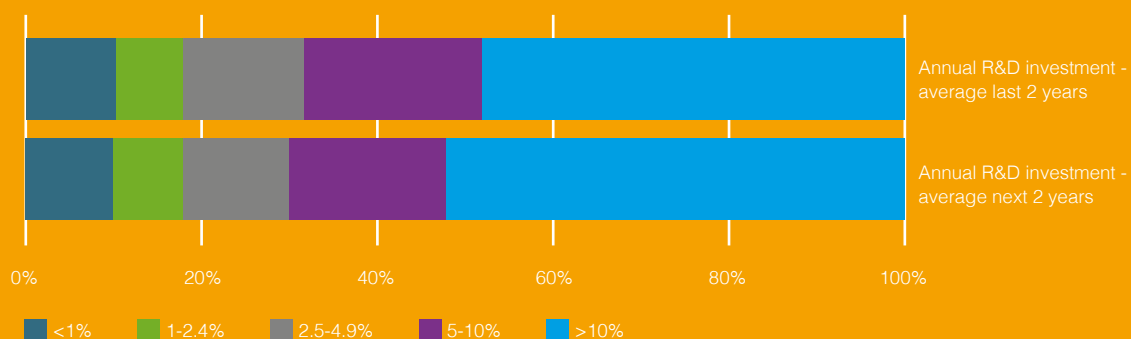
This level of innovation engagement is an incredible achievement considering there have been no dedicated Innovate UK photonics calls for over 15 years. Indeed, over 55% of photonics companies report being a collaboration partner on a publicly funded research project in the last two years. Given

the highly competitive environment for UK funding this level of engagement is testimony to the diversity of applications and challenges to which photonics innovation is seen as critical by end users.

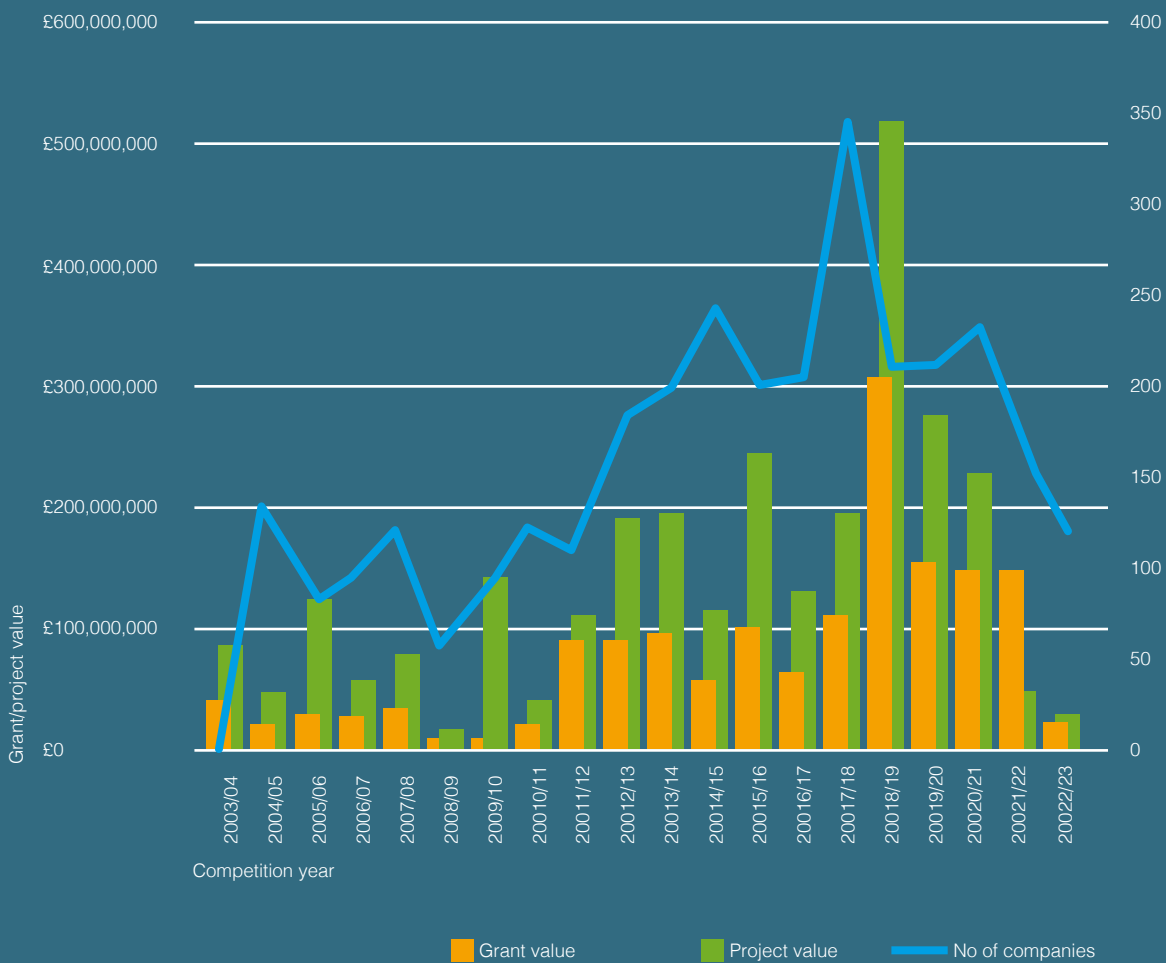
The R&D intensity is further reflected in industrial investment. Over 50% of companies indicate they invest more than 10% of their turnover into R&D. Over 80% invest more than the 2.5% overall - the UK government target for R&D investment. The number of firms investing at the highest level is forecast to increase in the next 2 years, further reflecting the many significant opportunities and growing demand for photonics.

In a further reflection of their level of innovation engagement, 80% of photonics companies make use of, or have applied for R&D tax credits. These are frequently cited as a major motivation for bringing inward investment in photonics to the UK.

**Corporate R&D investment as fraction of turnover
(photonic and non-photonic investments)**



Innovate funding to companies engaged in photonics*



* includes both photonic and non photonic projects

Knowledge base

200 years of expanding the boundaries of photonics knowledge.

There are over 40 universities actively engaged in photonics research and development across the UK. These are complemented by at least 18 partly or fully publicly funded RTOs with varying degrees of photonics focus including the Fraunhofer Centre for Applied Photonics, TWI, the Centre for Healthcare Photonics and the Compound Semiconductor Applications Catapult.

The focus and facilities within these institutes cover the full range of photonics research topics from advanced materials, including semiconductors and metamaterials, to optical fibres and bulk optics and coatings to lasers and LEDs. The UK is privileged to host multiple world-leading photonics researchers in numerous groups and makes an outsized contribution to the advancement of photonics knowledge globally.

Industrial funding is significant for all photonics research groups, with international industry support widely leveraged alongside UK industrial support. One in ten research groups indicate they have received over £50m in funding from industry in the last two years, and two in five have received over £1m. Only 10% of researchers indicate they have received no industrial funding, pointing to an excellent engagement of the UK photonics research community with the UK and global industry.

Challenges with securing funding, recruiting and retaining researchers are cited as the main barriers to advancing research. Lack of industrial awareness of their research potential, or lack of commercialisation opportunities, were among the least cited barriers to research progress, reinforcing the strong interaction between the photonics research and industrial communities. Although, identification of this as a barrier, even by a minority of academics, indicates there is still more to be done to bring the communities together.

In 2020 the PLG gathered many of the UK's leading photonics researchers to ask what they would be researching in ten years. The resulting 'Future Horizons for Photonics Research 2030 and Beyond' report identified 72 distinct research topics grouped into four broad categories: materials, optical and physical phenomena, manufacturing processes and devices, and systems. Supporting research in these areas is vital for underpinning the UK's position as a research and scientific powerhouse in photonics against increasing competition for talent and funding from Asia, China, USA and Europe.

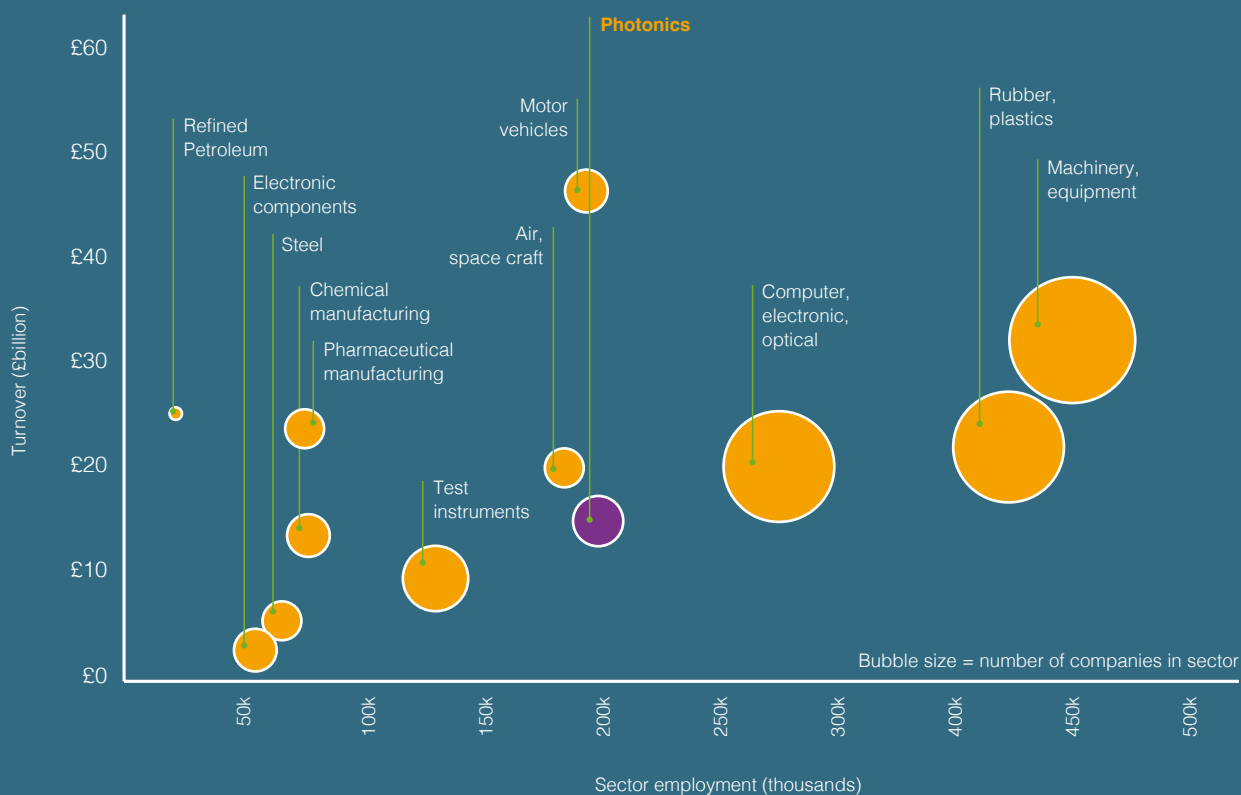


Centres of photonics knowledge generation in UK Universities and RTOs

- Academic / University centres
- Research and Training organisations

National Comparisons

Employment & turnover of key UK manufacturing sectors



Source for manufacturing sectors other than Photonics: Office for National Statistics (ONS), 2022

UK photonics is one of the most productive manufacturing sectors in the UK.

UK photonics employs similar numbers of people to the automotive and aerospace manufacturing sectors and three times more than employed in iron and steel, chemical, electronics components or pharmaceutical manufacturing. As a total industry photonics is one of the largest manufacturing focused employers in the UK.

The continued growth of photonics in the UK means the industry now has a higher turnover than chemical manufacturing, or the test and measurement instrument sectors, and output is three times that of UK steel and iron production. Total photonics revenues are now approaching those from air and space craft manufacturing, refined petroleum and pharmaceutical manufacturing.

Photonics has also continued to grow through the 2020-2022 period when analysis of ONS data shows most other UK manufacturing sectors have declined. The ability of photonics to grow whilst experiencing the same headwinds underscores the resilience of the industry.

The diversified and distributed nature of UK photonics industry also means that it supports many more companies than other sectors with similar total revenue or employment. There are 25% more firms in the UK photonics sector than involved in manufacture of motor vehicles, ten times more than engaged in petroleum product manufacture and 50-70% more firms than involved in either aircraft manufacture, pharmaceutical manufacturing, iron and steel production or chemical production. This breadth is related to the diversity of photonics and its applications and provides resilience against challenges in any individual market, enabling consistent long term growth in the sector.

Given there are no SIC codes that exclusively capture photonics activity, the economic comparison is based on comparing the data generated on the sector by the PLG with sector data from the Office of National Statistics based on SIC codes. Some SIC codes incorporate optical products (e.g., division 26), but there are many photonics companies who report activity under different SIC codes, often 'Other manufacturing'. This is a common challenge for all enabling technology sectors and has resulted in the application of the industry sizing techniques deployed here also being applied to fluid dynamics and acoustics in the UK and internationally.

Methodology

An international established process for quantifying photonics and enabling technology industries.

The photonics industry does not have a dedicated Standard Industrial Classification (SIC) code. This is a challenge that has long hindered efforts to accurately quantify the size of the industry and other enabling technology sectors around the globe. In addition, many companies producing photonics products do so alongside producing non-light based products.

The methodology for this report was developed to meet these challenges and provides a valid, representative estimate of the UK photonics industry size, without the need to resort to confidential data. Consistent biennial application for over a decade enables accurate reporting of the underlying growth rate of the industry and comparison to other sectors which increasingly use the same process.

Step 1: Compile a comprehensive list of companies engaged with photonics. A comprehensive list has been compiled over ten years and made available online at <https://photonicsuk.org/directory> where additions are invited. This list is filtered to remove publicly funded research organisations (e.g., universities), holding companies and those that use photonics products, but do not add value with internal photonics expertise.

Step 2: UK output (turnover), profit and employment figures are sourced from Dun and Bradstreet, based on matching the company name, number and postcode. Where global figures are returned for international business, a fraction of activity is attributed to the UK based on local employment, unless otherwise known.

Step 3: For larger, diversified companies producing both photonics and other products: the proportion of total company output categorised as specifically photonics was estimated by an expert panel. This apportionment fraction was applied to revenue, profit and employment.

Step 4: The average benefit paid per employee was estimated from the total reported benefits paid and employee numbers for a sample of companies reporting such figures and fully focused on photonics. Gross value added (GVA) was calculated from total profit and total employee benefits paid using this average.

Step 5: Operational address for all companies are recorded and assigned to NUTS regions via postcode. Fiscal figures are distributed between sites based on industry input, or uniform distribution between sites where not otherwise known.

Step 6: Additional forward-looking data was gathered through a survey conducted in March 2023. Responses included forecast growth, investment, exports, target markets, impact and innovation engagement. Over 100 survey responses were received.

This methodology was designed to enable the inclusion of highly diversified companies, without over-attributing the value of their output to photonics. The methodology is the gold standard for quantifying the size of enabling technology and has been applied to Acoustics and Fluid Mechanics in the UK; Fluid Mechanics in the Netherlands, Australia and New Zealand, and Photonics in Australia, New Zealand and globally by SPIE and Thematys.

Within the latest 2023 update the total of number of companies included in the analysis has declined by 3% since the previous 2021 update.

Fiscal data is based on that reported to Companies House and captured by Dun and Bradstreet by May 2023. It therefore features a range of year end dates within 2022. The same capture date is used biennially to enable accurate growth comparisons.

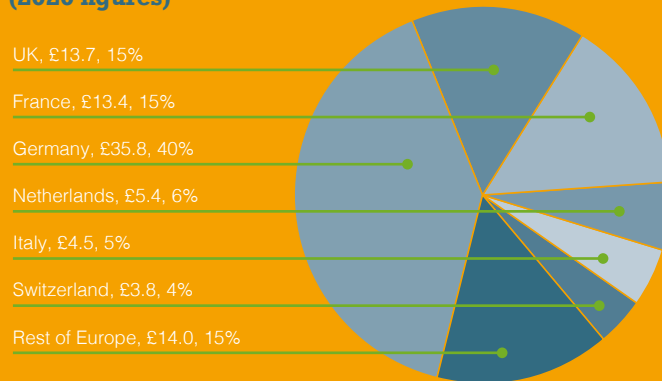
Methodology for estimating UK photonics industry size



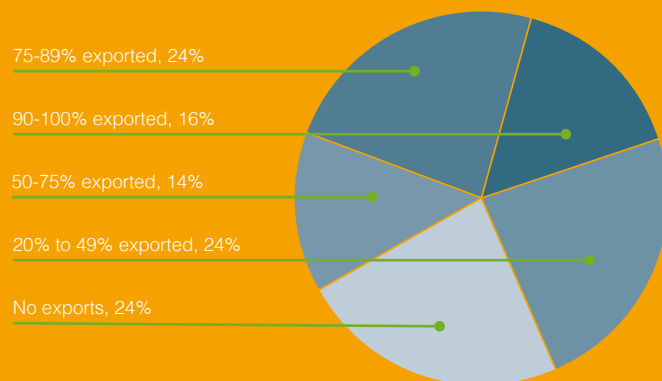
UK Photonics in the World

The global photonics industry is worth >£650 billion.

European photonics output £billion (2020 figures)



Export fraction



The global photonics industry output in 2020 was estimated to be £575 billion (€654 bn) by Tematys in a study for Photonics21. Application of the 6.5% global compound annual growth rate, puts the global photonics industry output at ~£650 billion in 2022. The Europe share of this was ~16% (£90 billion, €103bn in 2020).

The UK is the second largest photonics producer in Europe after Germany, with French output close to UK photonics, the Netherlands one half of UK output, and Italy and Switzerland having a photonics industry one third of that of the UK.

Of the global industry, the UK share is estimated to be 2.4% according to analysis from SPIE focused solely on photonics components. Japan, USA, China, S. Korea and Germany make up the top 5 global photonics component producers with the UK 9th overall.

Compiled independently from the PLG, the 2020 Tematys study estimates for the UK agree almost exactly with the PLG's and other global estimates for the same period, supporting the broader conclusion presented here.

Due to its reputation for innovation, talent and business friendly environment, UK photonics firms attract significant foreign direct investment. Many global industry leaders have acquired and expanded operations in the UK including Coherent, Trumpf, Microsoft, TÜV Nord, Lumentum, Huber+Suhner and Excelitas.

UK firms are heavily globally focused with the majority exporting over half of their output. And four out of ten firms exporting more than 75% of their output. Fully one in six firms are so internationally focused they export over 90% of their output.



Future Leaders

FPL

The view from the next generation



Kayleigh Thomson
Co-chair (Industry)
G&H Photonics



Rand Ismaeel
Co-chair (Research)
University of Southampton/
National Oceanography centre



Callum Stirling
Secretariat (Communications)
University of Southampton



Jake Biele
Secretariat (Meetings & Events)
Light Trace Photonics



David Coathup
Joint Finance Officer
Wrexham Glyndwr University



Cameron McEleny
Joint Finance Officer University
of Glasgow/Queen's University
Belfast



Zeki Shaw
Joint Finance Officer
University of Glasgow

The Future Photonics Leaders (FPL) group is a new committee within the UK's Photonics Leadership Group.

The Future Photonics Leaders group represents the inclusive voice of early-career photonics professionals in the UK across both academia and industry while advocating for photonics within wider society and government. Established in December 2022, the committee were elected from across the UK photonics ecosystem following a community-led sandpit.

Considering the vision for the Future Photonics Leaders and its potential impact, Dr Kayleigh Thomson, Co-Chair (Industry) and Optical Engineer at G&H Photonics, says:

“Photonics is fast becoming an integral part of everyday life, from handheld devices such as mobile phones to large-scale aerospace and defence applications involving satellites and armoured vehicles.

The skills required to engineer and produce such equipment are often a fine art that is not taught unless you already know someone in the sector, even though these products are used by nearly every member of today's society. Helping to encourage new professionals or people wishing to change their careers to photonics is essential for the development of this technology. As such, the Future Photonics Leaders will look how best to bridge the gaps between education and career to help achieve this”

Dr Jake Biele, Secretariat (Meetings & Events) and Co-Founder of start-up Light Trace Photonics, adds:

“The potential of photonics to deliver a positive, long-lasting impact on society is perhaps most evident when attempting to list the broad range of technologies that it already enables. We know that we are only just scratching the surface of what is scientifically possible, and the key challenge lies in helping the industry scale.

I'm confident that attracting talent into the industry will help tackle this challenge and that's why I joined the Future Photonics Leaders committee. It's my hope that by giving the next generation a seat at the table, to voice concerns, and lead discussions, the FPL will not only help the industry grow but we will also help enable future generations to pursue opportunity-filled careers in photonics.”

Dr Callum Stirling, Secretariat (Communications) and Research Fellow at the University of Southampton, comments:

“As an enabling technology, photonics is driving innovation across a wide variety of sectors, such as telecommunications, healthcare and sustainable manufacturing. From a research viewpoint, we hope and expect to propel photonics even further to provide tangible solutions in our increasingly challenging world. These ideas might yet be imagined, or have just begun to coalesce in the margins of a researcher's laboratory notebook.

It's therefore critical that we provide the space and opportunity for our early-career community to shape photonics for the future. The problems facing today's leaders aren't necessarily the problems of tomorrow; the FPL will empower our community to offer a different perspective and will provide ownership over the future of our field.”

Summary

UK photonics is a major UK industry with a vital role in delivering future economic growth and meeting the society challenges of today and tomorrow.

The ubiquitous nature of light means all the major challenges facing society are connected to photonics, from energy security to healthy living. The diversity of the photonics impact is illustrated by the breadth of the markets UK photonics companies address. UK photonics companies operate at every tier in the supply chain, from complex full systems suppliers, e.g. in defence photonics, where the UK has a particular strength, to component suppliers. Most are heavily engaged in innovation, with >40% having been partners in at least one Innovate UK project. More than half invest over 10% of their turnover back into R&D annually, and four out of five exceed the government target of 2.5% R&D investment.

The high level of innovation is supported by a globally renowned research base distributed among 58 world-class universities and RTOs. University photonics research groups are heavily engaged with industry, with 40% receiving more than £1 million in industrial funding annually.

This diverse innovation-focused industry has seen revenue, growth of 7% in the last two years continuing productivity improvements mean this growth has been delivered with workforce growth of only 3.2% and generated profit growth of over 9%. The result is a photonics industry which generated £15.2bn in UK revenues in 2022, employs 79,100

people in 1,200 firms and adds a gross value of £7.1 billion to the UK economy each year. The UK has the second-largest photonics industry in Europe after Germany and the ninth largest globally. With a GVA per employee of £89,400, photonics is one of the UK's most productive manufacturing-focused sectors and the only one to have grown throughout the COVID-19 pandemic from 2020-2022.

The UK has strength and depth in many areas of photonics, with the industry focusing not just on high-value niches, but also on supporting volume production through semiconductor fabrication and machine tools and instrumentation supporting volume manufacturing in a wide range of industries.

To build on these strengths, support is needed in five critical areas to protect against global competition and capture even more value to the UK economy. Without support the UK's leadership in photonics and the ability to attract and retain international business in the UK is under threat. And without UK photonics capability and support for scale-up, all of the current emerging industries that depend on photonics to keep them competitive will be subject to vulnerability and vagaries of global supply chains and importing the most critical enabling and underpinning photonics solutions.

Actions

Foster higher level system engineering beyond aerospace and defence

Support volume scale-up and automation in UK photonics production

Enhance UK resilience by supporting UK photonics components in challenge focused programs

Empower photonics to innovate solutions to the applications with greatest market pull

Expand and accelerate the supply of next generation photonics skills and talent in pace with industry growth

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Supporters



Association of Industrial Lasers Users, Bay Photonics, Chromacity, Compound Semiconductor Centre, Edmund Optics, Fibercore, Heriot-Watt University, Optica (OSA), Science and Technology Facilities Council, Thales, University of Aston



If you are interested in learning more about UK Photonics:
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