Our Scottish Future

Playing to Win

The economic and social opportunity video games present for Scotland, and the need for an industrial plan to stay competitive in a global industry

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Ruairidh Macintosh

About the author

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Ruairidh is a gamer from Edinburgh, with a background in policy, business and communications. He currently works as a consultant in London, focusing on financial policy and climate change. His favourite games are Age of Empires 2 and Red Dead Redemption 2.

Executive Summary

Making video games is a Scottish success story.

We have a long history in a fast growing, high-tech entertainment industry that is bigger than film, tv and music combined. And video games are not just exciting and fun things to play, they are at the forefront of new technologies changing creative industries, medicine, and policy making.

The opportunity for Scotland is enormous. Not only to grow the size of our video games industry and create more well-paying jobs, but to continue our tradition as a home of scientific and technological breakthroughs.

But, in a global industry increasingly dominated by the largest international developers, and where games can be developed anywhere and sold everywhere, Scotland needs a plan to stay competitive. America, China and Japan all have large and established markets, and even smaller countries such as Finland have produced highly successful games companies. As a country, we have a strong heritage in gaming, but the games most famously made in Scotland were made a while ago; Lemmings was ground-breaking when it was released in 1991, and while the Grand Theft Auto series is one of the most successful entertainment products in history, the first game was released 25 years ago.

In short, Scotland needs a plan for video games or risks losing another industrial legacy.

We will need to overcome long-term challenges around access to the right kinds of skills and finance; compete on innovation rather than on scale or cost; and find areas of competitive advantage, especially where we can marry the skills and technology behind games with other sectors.

Many of the parts of such a plan are already in place. Successful and growing games studios are found across the country. We have a world-class set of academic institutions, especially with Abertay University. The Scottish government has commissioned – and accepted the recommendations of – an Independent Review into Scotland's Technology Ecosystem by Professor Mark Logan. And video games are recognised, if in passing, in Scotland's National Strategy for Economic Transformation.

However, in the face of such stiff global competition, the best plan would be one that seized the advantages Scotland's games industry gets from the social and economic connections of the

United Kingdom. From finance, skills, and connections with England's own world-class games industry as well as other leading high-tech creative industries such as film and TV, the UK offers opportunities to make the most of Scottish talent and creativity.

The challenge is that Scottish and UK expertise is spread out. Unlike in some other countries, the games industry is found in many towns and cities across the country. The effect is a national industry made up of regional pockets of expertise and capability. The risk is that historically successful clusters in Edinburgh and Dundee cannot keep up with ever stronger clusters in America, Japan, China and Europe. By combining Scottish imagination with the ideas, resources, and connections of the UK we have the best chance to stay competitive in the long-term. This is the role for an effective industrial strategy, making the connections that the market would not.

The opportunity is for Scottish and UK ministers to cooperate, creating a plan that connects the whole of the UK. The newly established 'Interministerial Group for Business and Industry' provides an effective forum to do so, and games should be on their next agenda.

This paper explores some of the components of what a plan could look like. Some parts are about building Scotland's long-term foundations, particularly around skills and access to finance. Others are about how the UK and Scotland can work together to find areas of competitive advantage, distinct combinations of industries and skills that other countries will find harder to replicate.

Today, Scotland is a power in the games industry. Making the most of the UK's strengths, we have a chance to become a superpower.

In Summary: The components of a plan and specific recommendations

Building long-term foundations

1. Broadening and deepening Scotland's skills base

The Scottish Government should:

Explicitly commit to making Computer Science a core part of the Scottish curriculum, giving it the same status and role in the timetable as the other sciences.

Increase funding for Scotland's universities to accept the intended growing number of Computer Science students.

Expand the funding available for the Tranzfuser competition, offering more Scottish graduates the chance to explore setting up their own games studio.

The Scottish and UK Governments should:

Create a UK-wide network for internships in the games industry, allowing Scottish students easier access to a wider range of experiences in the sector.

Building long-term foundations

2. Accessing finance to match the level of Scotland's ambition

The Scottish Government should:

Establish a Scottish Investment Office in London, to provide structured and systematic support for the most promising games companies to access Venture Capital funding.

The UK Government should:

Create a 'commissioning fund' to finance new, innovative, and indie games – building on the success of the similar model used by Channel 4 to fund independent film and TV studios.

In Summary: The components of a plan and specific recommendations

Using the UK's strengths to create a competitive advantage for Scotland

3. Connecting Scottish and UK games clusters and expertise

The UK and Scottish Governments should:

Work together to map the different geographic clusters of expertise in games, and ensure funding is available to facilitate connections across the whole country. This should be modelled on the Ecosystem Fund which does the same for Scotland only.

The Scottish Government should:

Support the Scottish Games Network to become an effective regional hub for the industry in Scotland, mirrored on Yorkshire's Games Republic.

Ensure that every 'Tech Scaler' established has a dedicated games champion, to maximise support for new start-ups.

Using the UK's strengths to create a competitive advantage for Scotland

4. Developing the crossover between games and other UK industries

The Scottish and UK Governments should:

Include adjacent industries in the creation of a UK-wide ecosystem fund, to enable more connections between games and other industries.

Create a 'Challenge Prize' fund which offers a reward for companies and universities which are able to apply games technology to societal challenges.

The Scottish Government should:

Designate the research and development centre, InGAME, at Abertay University a strategic national asset, providing it with secure long-term funding.

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Scotland's opportunity in the world's biggest entertainment industry

The biggest entertainment industry in the world isn't film, tv, or music. It's video games, with a global market worth over £200bn.

Born in the 1980s, games were once a single-player experience, played by 'gamers' who were usually young men and stereotypically playing in their bedrooms or dark arcades. Today, games are social, played with friends, on phones and in the living room. From simple puzzle games on smartphones to enormously visual and creative games on high-tech consoles, tens of millions of people across the UK play games. Collectively, the country spent a record £7.16bn on games in 2021.

Scotland's (semi) hidden secret is that we've been a major part of this industry since the beginning.

Grand Theft Auto, one of the most successful entertainment products in history, was born here. In Dundee a cluster of game developers has grown around Abertay University, the first institution in the world to offer a degree in game development. And major international developers - such as Epic Games, makers of the smash hit Fortnite - have established studios in Glasgow and Edinburgh alongside a new generation of Scottish start-ups making innovative and exciting games.

Scotland's roots in the industry can be traced back to 1982 and the decision to build the new Spectrum home computer at Dundee's Timex factory. With local parents working at Timex, Dundee kids got into gaming and a small computer-literate generation was born. Many went on to study computing at the Dundee Institute of Technology (the forerunner to Abertay University) and the University of Dundee. It was from this first generation that a group of students founded DMA Design in 1987, creating the best-selling game Lemmings in 1991 and later the Grand Theft Auto series.

In Scotland today, data from the trade body TIGA shows 147 active companies with the majority made up of game developers but also with supporting specialisms in animation, music and visual effects. In fact, Scotland has a disproportionate share of the UK-wide industry: home to some 8% of the UK's population, but a higher share of the workforce with some 6,400 jobs and 10.5% of the industry's Gross Value Add (GVA), a measure of economic value.

Scotland's opportunity in the world's biggest entertainment industry

Spotlight: Some of Scotland's games companies

Rockstar North and Rockstar Dundee: Formerly two ground-breaking companies - DMA Design and Ruffian Games - now subsidiaries of New York-based Rockstar Games.

Axis Studios: Visual effects specialists established in Glasgow, making content for global games, film and TV clients.

4J Studios – Dundee-based developer, whose hits include the console version of Minecraft (one of the best-selling video games of all time).

Tag Games – Mobile-focused developer in Dundee, specialising in both free-to-play and premium games.

The future is bright, with gaming growing rapidly in Scotland and internationally. The continued rise of mobile games, increasing numbers of women playing games, more sociable games drawing friends together, and breakthroughs in technologies such as 5G and cloud computing are all support trends. As a result, estimates suggest the global industry could grow by as much as 12.1% a year to reach $435bn by 2028. So, it is no surprise that Scottish companies are going from strength to strength, with the industry's GVA more than doubling between 2017-2019 to reach £343m.

The opportunity in front of Scotland is to become a powerhouse in this rapidly growing, high-value, high-tech industry. The huge demand for video games could be met with Scottish games, Scottish technology, and Scottish imagination. Alongside other parts of the UK, Scotland has the fundamentals to develop and grow a world-class cluster of game developers and the professions around them. And with platforms such as Valve's Steam or the Apple App Store making it easy to sell games anywhere, the opportunity is truly global.

Scotland's opportunity in the world's biggest entertainment industry

What games can give to Scotland

A successful games industry is an enormous opportunity for Scotland. It can be a source of new well-paying jobs across the country. Given the industry's productivity is nearly double the average for other sectors in the UK, it is structurally able to generate more well-paying jobs than other sectors. Not every role pays above average, but many do and the greatest opportunities are for graduates able to join the industry straight into developer roles. More broadly, games could also act as an anchor for developing Scotland's wider technology sector, a priority of the Scottish Government following Mark Logan's independent Review of Scotland's Technology Ecosystem in 2020.

But a significant opportunity lies in using games to spur innovation in other sectors, with the skills, technologies, and production methods behind games of value beyond the industry. From TV production to medicine, agriculture to public policy, games could help Scotland's other sectors compete and innovate (see box out). More than just fun things to play, games have the potential to be a transformative technology across large parts of the economy and society.

More and bigger games companies - with the ideas, talent, and imagination that come with them – could help build a more prosperous Scotland and continue our tradition as a home of scientific and industrial breakthroughs.

Scotland's opportunity in the world's biggest entertainment industry

The technology behind games can support other sectors

Film and TV production: Creating bestselling films and TV shows

Virtual production techniques are increasingly used in high-end films and TV series, drawing on the technology in game engines, such as Unreal and Unity. These techniques allow more digitally-advanced productions, such as incorporating computer graphics in real-time as the live-action shot is being filmed. The Batman and The Mandalorian are two examples of high-end productions which have made use of the technology.

Medicine: Developing new ways to test cancer drugs

Creating a model that interacts like a video game, scientists at Abertay and St Andrews universities developed a simulation tool to explore cancer treatments. The tool allows researchers to conduct virtual experiments with anti-cancer drugs, simplifying what were previously complicated computations. The aim is to help researchers in the design of combination therapies, an emerging form of personalised cancer treatment that offers a possible route to overcome anti-cancer drug resistance.

Scotland's opportunity in the world's biggest entertainment industry

The technology behind games can support other sectors (*continued*)

Agriculture: Improving animal welfare and productivity

Using technology from game engines, a new augmented reality tool can recognise a cow by its skin patterns and display health and productivity data on a headset. Developed in collaboration by the InGAME research and development centre, game studio Pocket Sized Hands, and an Edinburgh-based Agri-tech innovation centre, the tool aims to simplify the process for vets and farmers to decide what care or intervention an animal might.

Public Policy: Testing ideas on virtual citizens first to check they work

Virtual replicas of the real world can be built with computer game engines, opening the possibility of testing possible government policies before they are introduced. Two Dundee-based companies have recently been awarded grants to develop their ideas into playable proof-of-concept games. One of the companies, Konglomerate Games, proposed building an environment in which players can build a city and adjust the food environment by building or moving takeaways, supermarkets and restaurants with different health and affordability ratings, set how different citizens interact with the food outlets, and introduce health policies.

Making a plan to succeed in a competitive global industry

Making video games is competitive business. China, United States and Japan dominate the international market, home to the biggest and most established game developers, publishers, and the vast majority of revenue. Outside of the top 3 countries, the UK has one of the world's most successful industries, comparable to similar industries in Germany and South Korea. Some smaller countries with a population closer to Scotland's have also developed successful industries; Finland's Embrace Group is Europe's largest games company with a value of nearly $10bn.

A risk is that overtime Scotland is left behind.

One challenge comes from the major international game developers and publishers, such as Activision Blizzard, Take Two Interactive, Electronic Arts, and Ubisoft. These companies are behind the biggest, most complicated games – often for specific consoles such as PlayStation or Xbox. Some make all their own games in-house while hiring smaller studios to develop games, whole or in part. Fuelled by the massive expansion of the market in games, these companies are growing bigger and bigger, buying up smaller developers; Microsoft offered to purchase Activision Blizzard for $68.7bn in January 2022. These companies have the deepest pockets, the biggest teams, and will continue to produce a huge number of games.

10 Largest markets for games (2021)

Rank	Country	Value
1	China	$46.0 billion
2	United States	$40.5 billion
3	Japan	$22.1 billion
4	South Korea	$7.55 billion
5	Germany	$5.87 billion
6	United Kingdom	$5.3 billion
7	France	$4.13 billion
8	Canada	$3.69 billion
9	Italy	$3.28 billion
10	Spain	$2.33 billion

Making a plan to succeed in a competitive global industry

But at the same time, creative and innovative studios all over the world are producing games - especially as tools from Nvidia and Amazon Web Services have dramatically cut the costs involved. And mobile games – rather than console games – are where most money is made in the industry; these are substantially cheaper and easier to build, meaning even small studios can create highly successful games.

So, in a world where games can be made anywhere and sold everywhere, Scotland faces steep competition. There is a proud Scottish heritage in games, but it has been 31 years since Lemmings was released and 25 years since the first Grand Theft Auto game. We need a plan to stay competitive in the long-term, especially as new technologies continually change how games are made and consumed.

What success for Scotland could look like

Scotland and the UK is not the domestic home of any of the major international developers, although many have large operations across the country.

Raher, the vast majority of games companies in Scotland and the UK are small-or-micro businesses employing only a few people. Data from the trade body Ukie shows that 99.5% of all games companies in the UK employ fewer than 250 people, but the small number of very large companies which employee 250+ people are responsible for 26% of the workforce. In addition, the UK industry is fairly geographically disparate; rather than concentrated in one city, say London, data from Ukie shows 23 towns and cities with at least a small cluster of games companies.

There is still an enormous opportunity for Scotland and the UK in games, but the structure of the global industry has a few important implications:

Scottish games developers have room to grow but won't dislodge global titans

The rise of ever larger international developers and publishers, as well as the steep growth in budgets for games, means Scottish companies cannot rival the biggest players directly. Simply put, we can't re-create a multi-billion-dollar developer and publishing company overnight. Our success will come from making exciting and innovative games. We should aspire to grow both the number of studios in Scotland and the number that reach a significant size and publish multiple games.

Making a plan to succeed in a competitive global industry

Significant growth in the number of jobs will come from international developers

The largest companies are responsible for a disproportionate number of the jobs. This means that to significantly grow the number of people employed in the industry, Scotland will have to attract at least some of these companies to expand their presence.

Much of the value in gaming is in Intellectual Property, but challenges around financing mean that much of this ends up leaving Scotland and the UK

Some smaller studios make money through 'work-for-hire' tasks for major developers. Of those which make their own games, many are funded by a 'royalty advance' from a major publisher which takes a cut of the future profits – some estimates put the cut as high as 95%. This means that smaller developers miss out on the benefits if they develop a smash hit and the opportunity to grow.

Additionally, studios in the UK and Scotland are increasingly being bought by foreign investors rather than continuing to grow on their own. This means that that the value of their intellectual property (and the tax revenue associated with it) goes abroad.

Scotland and the UK's competitive advantage is in the cross-over with other high-tech industries, not costs.

Our success will come in part from creating world-class collaborations between these industries and video games, in ways that other countries will struggle to replicate. Scotland and the UK are home to world-class high-tech industries, including film and TV production and medical sciences, with increasing opportunities to drive innovation through applying games technologies to new challenges.

These implications help shape what success could look like for Scotland:

Making a plan to succeed in a competitive global industry

More Scottish games companies

Small-and-medium-sized games developers, as well as specialists for technology, audio, and graphic design.

More international studios with a presence in Scotland

Game developers and publishers such as Ubisoft or Activision Blizzard, with more studio and employees in Scotland.

More Intellectual Property staying in Scotland

Scottish companies able to grow and retain the value of their innovations, rather than being acquired by foreign companies or selling their Intellectual Property.

More video games expertise used in other sectors

A broader and deeper talent pool of developers and programmers able to create innovation in other sectors.

Towards an industrial strategy for games

In short, there is a clear need for an industrial strategy to support the games sector.

This is not about government's 'picking winners and losers', but rather about how the right supportive policies can enable an industry to compete. This kind of approach is well-established for many other industries, but games has historically been under-appreciated and under-valued by policy makers.

Importantly, there is already the precursor a games-specific plan in place: the recommendations of Mark Logan's Review of Scotland's Technology Ecosystem. The report's conclusion was that "Scotland cannot yet boast a world-class tech ecosystem" and that we remain "pre-tipping point", the stage where virtuous effects kick in and sustain and grow a sector. The skills, ideas, networks and connections for one high-tech industry cannot be built in isolation, and many of Mark Logan's recommendations will support the games industry.

Making a plan to succeed in a competitive global industry

But to thrive, the games industry needs a dedicated plan. And crucially, the opportunity is to create a plan that connects the Scottish and UK industries.

Unlike many sectors, the games industry is spread right across the whole of the country. This has many benefits, but a significant drawback is that that the total effect of the industry risks being less than the sum of its parts; if the same sized industry was concentrated in one city, then the effects of agglomeration would kick-in and help create a stronger, more dynamic industry. Given the level of global competition, it is vital that the pockets of industry, academic insights, skills provision, and financial resources are connected. Alone, the risk is that historically successful clusters in Edinburgh and Dundee cannot keep up with ever stronger clusters in America, Japan, China and Europe. By combining Scottish imagination with the ideas, resources, and connections of the UK we have the best chance to stay competitive in the long-term. (And Scottish imagination and expertise will also benefit companies across the UK).

This is the role for an effective industrial strategy; making the connections that the market would not, so that Scottish (and British) games companies can put their best foot forward internationally.

In the UK, cooperation between devolved administrations and Westminster – especially on devolved issues like much economic policy – has often lacked a formal mechanism. This was the idea behind establishing the new 'Interministerial Group for Business and Industry', bringing together the relevant ministers from each of the four administrations.

To develop an effective plan, ministers should place the games industry on their next agenda – and ask officials to work together to create a coherent strategy.

The following chapters looks at some of the key areas that would inform such a strategy, including where there is opportunity for greater cooperation across the UK:

Making a plan to succeed in a competitive global industry

Building long-term foundations

1. Broadening and deepening Scotland's skills base
2. Accessing finance to match the level of Scotland's ambition

Using the UK's strengths to create a competitive advantage for Scotland

1. Connecting Scottish and UK games clusters and expertise
2. Developing the crossover between games and other UK industries

A quick aside: The idea of economic clusters

One really useful idea for understanding how to support Scotland's video games industry is 'economic clusters'.

In summary, the idea is that there are regional concentrations of related firms and organisations which benefit from having similar economic activity concentrated in a physical area. Think of technology companies in Silicon Valley in the United States, or life-sciences companies in Oxford or Cambridge in the UK. By bringing together connected companies, institutions, talented individuals, academic institutions, the right infrastructure, the right networks, some regions or cities are able to create and maintain distinct economic advantages.

As a result, many policy makers have been attracted by the idea of how to grow – or create – clusters.

This isn't about governments 'picking winners or losers', or overly directive industrial strategies. Rather, the opportunity is for policy makers to help support the conditions needed for success. A useful guide is David Sainsbury's 'Windows of Opportunity', which highlights three aspects to support already established clusters:

Skills: What economists call a 'thick labour market', which simply means that there is a substantial volume of employers looking for similar skills, matched by a similar volume of potential employees with those skills. This creates a virtuous cycle, where prospective employers and employees both look to a certain area to make it easier to hire the right skills for a role.

Making a plan to succeed in a competitive global industry

A quick aside: The idea of economic clusters (*continued*)

Associated services: For innovative firms, the presence of the right technical, legal, advertising, and

other professional services can make a significant difference in their ability to grow. A concentration of these firms can support a group of innovative firms to grow quickly.

Knowledge spill-overs: New ideas are rarely born in a vacuum, and ideas, creativity, and invention in one setting or industry can often spark developments in other areas. Bringing together many related companies can maximise the opportunity for cross-over and innovation.

It would be a mistake to think these factors alone could create a cluster. Clusters are born from the combination of these core capabilities, and the technology and market opportunities which they are able to take advantage of. 'Adding a university, venture capital, and stirring' won't create a new Silicon Valley.

The good news is that Scotland has strong foundations in clusters around games and technology in Dundee and Edinburgh, and the opportunity is how to grow them.
And governments have an important role in helping to grow and sustain successful clusters, by encouraging the development of the right skills, supporting the development of a 'critical mass' of innovative companies, and creating the right conditions for

Making a plan to succeed in a competitive global industry

1. Broadening and deepening Scotland's skills base

The central feature of developing video games is integrating cutting-edge technology and artistic content. This is where "technology meets creative prowess" in the words of Sir Ian Livingstone, a veteran of the UK industry.

Gone are the days of the solo developer, today it takes a team with a wide range of skills to make a game: experience in programming and software, expertise in digital animation and visual effects, creativity to write the script and music score, testing and quality assurance, and eventually sales and marketing.

But the golden thread is programming skills. This is the reason why a majority of those working in the industry today have degrees in computer science or other STEM subjects. Without this core skill, any games company would struggle to take a game from idea to reality.

The good news is that Scotland has an established and talented industry, and many of the fundamentals needed to grow a strong pipeline of new talent.

An enormous asset is Abertay University, ranked as one of the top institutions in the world to study game design and the best in the UK for teaching quality. Not only is the university home to the UK's first Centre for Excellence in Computer Games Education, it has also expanded into related courses such as game production and the fast-growing field of Esports. And the world-famous Glasgow School of Art now offers courses in 'Games and Virtual Reality' which combine design and software development. More broadly, 16 of Scotland's 19 universities offer more than 175 computer science and gaming-related courses. And as a country, we produce 21,000 university graduates in IT, engineering, maths and science.

A skills shortage

But for at least the last decade, the games industry has consistently warned that a skills gap is holding it back. The two established trade bodies, Ukie and TIGA, have both raised this as a key issue; back in 2011 an independent review by Sir Ian Livingstone raised the alarm about a "skills shortage" across the UK; MPs on the House of Commons' Scottish Affairs Committee came to the same conclusion

Making a plan to succeed in a competitive global industry

1. Broadening and deepening Scotland's skills base

in their own inquiry.

More recently, Mark Logan argued that lacking the right pipeline of skills and education "probably more than any other factor, undermines Scotland's capability to produce a steady flow of world-class scaled-up technology businesses." Without broadening and deepening Scotland's skills base, we will struggle to produce more games companies, grow the ones we already have, or attract major international developers to expand their presence here.

So, expanding the base of software programming skills in Scotland is essential to the long-term competitiveness of our games industry. And in games, like the tech sector more generally, this will have to include overcoming a persistent gender gap; data from Ukie shows that men make up 67% of those working in the industry. Scotland will compete with one arm tied behind if we are only able to effectively draw the next generation of games leaders from one half of the population.

Both Mark Logan and Sir Ian Livingstone's reviews contained detailed recommendations on building the skills needed for a successful tech and games sector. This paper focuses on two particular bottlenecks in the talent pipeline for Scotland:

1. School: building the foundational enthusiasm and skills
2. Early career: Developing the core technical and business skills

Strengthening the pipeline in these areas will have a disproportionate benefit.

(1) Schools: Commit to making computer science a core part of the curriculum

If Scotland wants a competitive games industry, and a successful technology industry more broadly, it needs to be put Computer Science at the heart of the curriculum. This was the conclusion of Mark Logan in 2020 and Sir Ian Livingstone more than 10 years ago in his own review for the UK's Department for Culture, Media and Sport.

Making a plan to succeed in a competitive global industry

1. Broadening and deepening Scotland's skills base

Scotland's games and technology industries cannot grow much larger than the number of software programmers with the enthusiasm and technical skills to enter the industry. So, to be globally competitive, Scotland needs as broad a base as possible of students who could chose to go on to pursue further study or a career in technology and games. And this means starting in schools.

In simple terms, Computer Science needs to be elevated to parity with other sciences such as Physics and Chemistry, meaning it is taught by subject-specific teachers and all S1 and S2 students are required to take the subject. While today at least 90% of Scottish secondary schools have some form of Computer Science programme, it often given only a fraction of time on the timetable as the other sciences. And the vast majority of teachers do not have a specific background in the subject.

Reversing the decline in Computer Science education

After accepting Mark Logan's recommendations, the Scottish Government has introduced additional support for Computer Science education. These are welcome steps, including £1.3m in funding to improve computer facilities, with schools able to bid for grants of £3,000 to purchase additional computing science equipment, devices, software or teaching resources. A new teacher-led organisation to collect and promote best practice in in the classroom has also been set up.

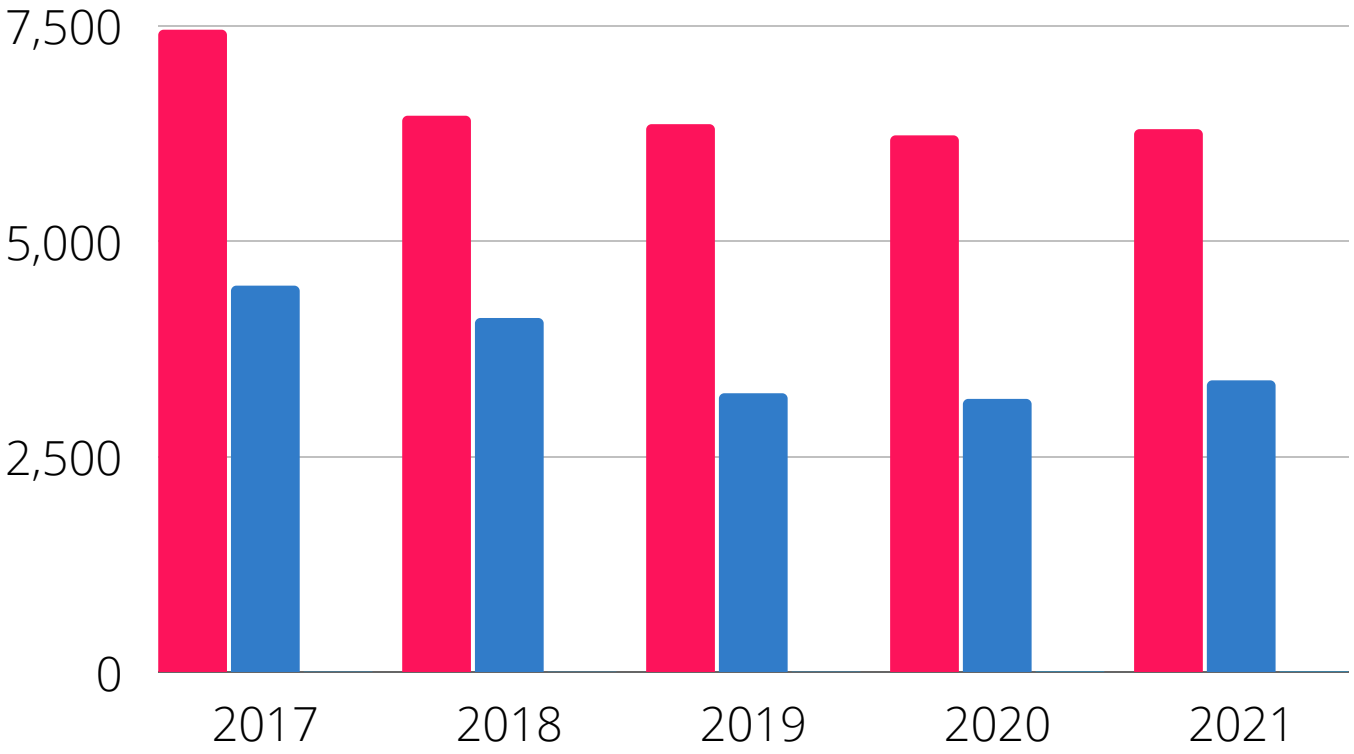
But the backdrop is that Computer Science is declining, not growing, in Scotland.

The number of students taking the subject, as well as the number of subject-specific teachers teaching it, has fallen substantially over the past 5 years.

Making a plan to succeed in a competitive global industry

1. Broadening and deepening Scotland's skills base

Declining number of students taking Computer Science



National 5: -15% since 2017
Higher: -25% since 2017

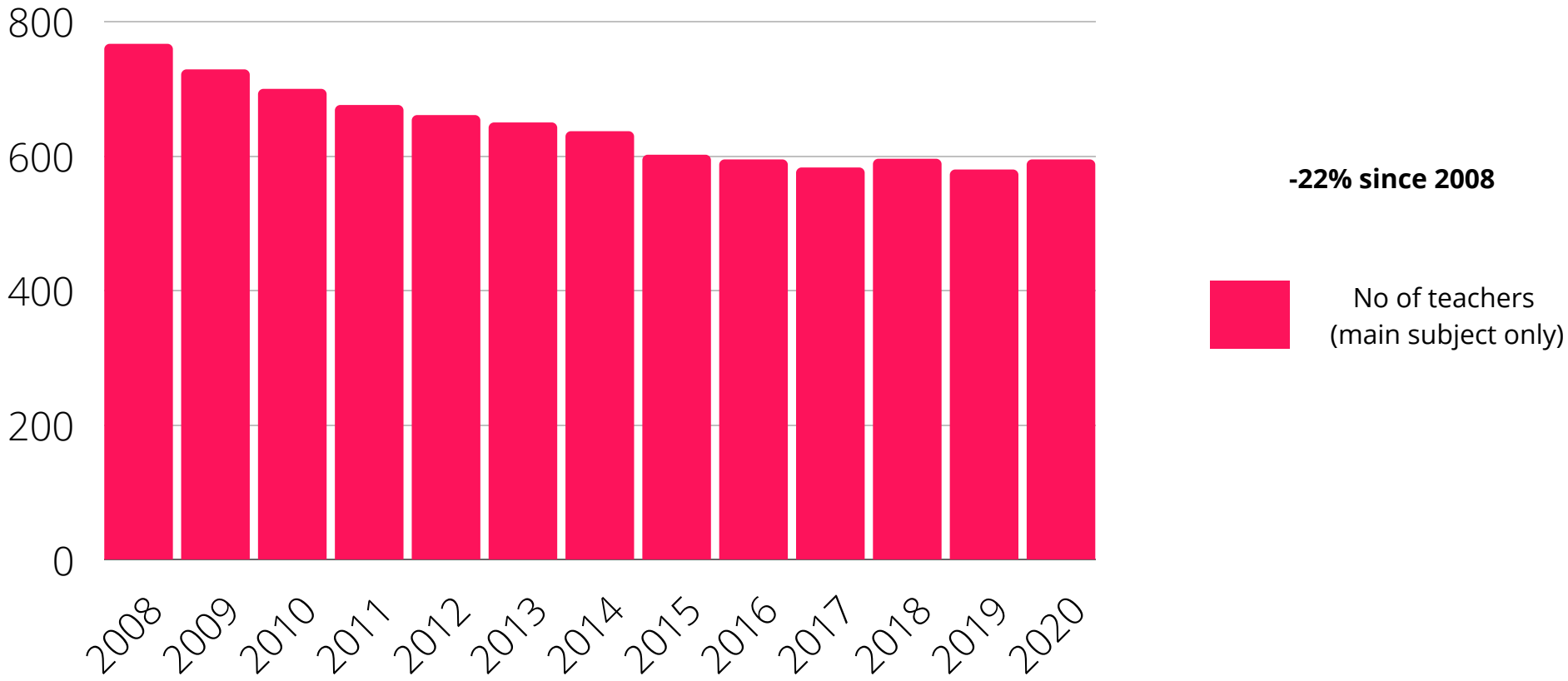
National 5

Highers

Making a plan to succeed in a competitive global industry

1. Broadening and deepening Scotland's skills base

Declining number of teachers whose main subject is Computer Science

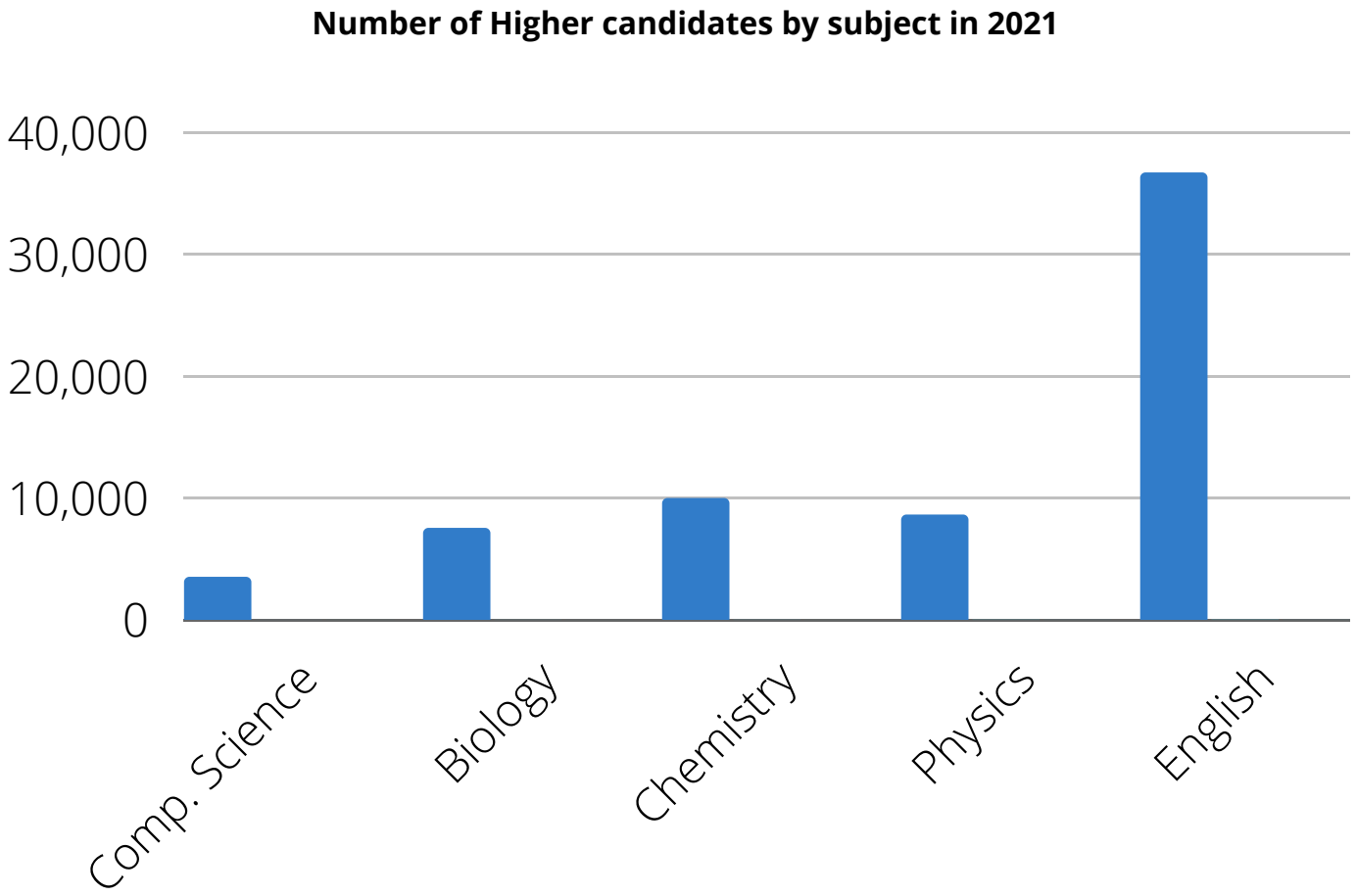


Making a plan to succeed in a competitive global industry

1. Broadening and deepening Scotland's skills base

There is also a significant and persistent gender gap, with boys making up 80% or more of the candidates at both National 5 and Higher. If girls studied the subject at the same rate as boys, we would have a further 2,200 candidates at Higher every year.

Set against the number of students taking other STEM subjects – let the most popular subject, English – it is clear that Scotland today produces a pretty small number of students equipped to explore a career in technology or games.



Making a plan to succeed in a competitive global industry

1. Broadening and deepening Scotland's skills base

In simple terms, Scotland does not produce enough of a flow of young people with the skills and interests in computer programming to remain competitive in the long run. Especially as other similarly sized countries, such as Finland, race ahead. Ensuring every student has a broad grounding in Computer Science is the only way to sufficiently grow the number of potential future programmers who will drive the games industry.

In order to achieve the scale of change required and ensure a broad enough pipeline of talent to support a growing and competitive games industry, the Scottish government needs to commit to the overarching aim of putting Computer Science on the same footing as the other sciences in the early years of secondary school.

In addition to simply increasing the number of students who would be interested and able to the subject at National 5 level and beyond, elevating the role of Computer Science in schools would:

Allow the subject to be more interesting: With only 17% of computer science teachers having a background in the subject, the curriculum is limited to what can be taught by non-specialists. The result is that the curriculum is "boring."

Make it easier to recruit more subject-specific teachers: In evidence to a Holyrood Committee in December last year, Mark Logan argued that the status of Computer Science as a "third-rate" subject and the poor cousin of the other sciences made it harder to recruit teachers.

Now is the moment to commit

A window of opportunity to act is approaching. The Scottish Government has committed to major reforms of the SQA and Education Scotland, scrapping and replacing both by the summer of 2024. The Education Secretary is due to update Holyrood in June

Making a plan to succeed in a competitive global industry

1. Broadening and deepening Scotland's skills base

2022 on the government's plans, which would be a natural moment to explicitly commit to elevating the role of Computer Science in Scottish education, in addition to the specific areas of support introduced to date.

Some might argue this would be 'too much change, too soon'. But the bigger risk is that after substantial non-curriculum change, the appetite for further change to elevate the role of Computer Science is put on the back burner for a few years and Scotland delays building the foundations we need to compete.

(2) Early career: Developing core technical and business skills

The next stage of the pipeline is to equip interested and able students with the core technical skills needed to enter the games industry. This includes an understanding of the production processes, programming languages, and software applications the industry uses.

The most established route is as a graduate with a degree in computer science, game design, or a STEM subject. Drawing on the recommendations of Mark Logan and Sir Ian Livingstone, as well as suggestions and ideas from industry, there are a number of interventions that could help. Some involve additional funding from the Scottish government, but many involve making the most of the UK's connections.

Increased funding for Scottish universities to support greater no. of students

Growing Scotland's pipeline of graduates with strong software skills will require at least some additional funding for universities.

Some of this is needed to expand the number of potential Scottish computer science students that universities are willing to take. It would be counterproductive to have taught a new generation of potential game developers in school if universities are not financially incentivised to accept them. In practice, this may require

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1. Broadening and deepening Scotland's skills base

paying an additional premium for universities to accept Scottish computer science undergraduates, instead of offering space on courses to international students who pay vastly greater fees.

Mark Logan also recommended additional funding for universities to support activities such as 'start-up schools' and tech incubators to equip students with additional business and leadership skills that would support them in a career in tech. The current funding settlement for computer science does not take these kinds of practical skills costs into account, in contrast to, for example, medicine where student's laboratory costs are included.

Tranzfuser: a UK-wide competition for graduate games

Encouraging graduates to explore what it would take to start their own games company, and supporting the best to do so, is an important part of developing a thriving Scottish games industry. Tranzfuser, a UK-wider summer competition for graduate developer teams aiming to start their own studio, is an established and successful programme that does exactly that.

Set up in 2016, the competition provides each team with £6,000 to develop their idea as well as support from a network of local hubs, which in Scotland includes Abertay and Glasgow Caledonian universities. Teams also receive coaching and practice in pitching their idea, with the most successful receiving further financial support and advice to start their own studio.

The practical experience and industry connections teams can build in the competition is valuable. In just over 5 years, more than 20 teams have gone on to form their own companies and many individual team members have taken jobs with major international developers.

The competition is a practical example of how the Scottish games industry can benefit from the connections of the rest of the UK. Tranzfuser is funded by the UK government but run by a team in Dundee, giving the city's games cluster a UK-wide role. And in competing, Scottish teams are able to benefit from the ideas, imagination and experience of the wider UK industry.

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In February, the UK Government committed to an additional £8m in funding the non-profit delivery body behind the competition, UK Games Talent & Finance, although much of this was to support the body's other role in providing seed funding grants to start-ups. Given the competition's role in encouraging new start-ups, the UK government should expand the funding available for the competition specifically to allow more teams from each of the constituent regions to participate.

Creating a UK-wide network to provide internships for graduates

Another route for graduates interested in joining the industry, or starting their own company, is to pick up experience of working in the industry through internships. In his review, Mark Logan recommended providing a wider range of opportunities – both in Scotland and abroad – for students interested in tech or start-ups. This would build on the support that individual universities provide to students as well efforts such as Entrepreneurial Scotland's Saltire Scholars Programme which places students aboard. For Logan, a key benefit was increasing Scotland's exposure to international best practice in tech companies, especially in Silicon Valley.

If Scotland wants to create a successful games industry, it should build on these recommendations and help create a UK-wide internship programme. The rest of the UK has a large and established games industry, with many leading companies. If an aim is to attract students to the industry by showing what a career in games could entail, or expose them to innovative thinking and ideas, then we should maximise the opportunity for Scottish students gain this experience domestically. There will always be value in internships further afield, but no matter the amount of funding it will always be easier to place (and potentially fund) internships within the UK – and so offer a greater number of students such an opportunity.

In practical terms, the Scottish and UK Governments should support a nation-wide 'internship jobs board' - potentially in collaboration with the trade body Ukie – to make it easier to match opportunities and interested students. Working with universities, there should be appropriate funding to cover student's costs, such as travel and accommodation, in order to allow Scottish students to take up opportunities in other parts of the country.

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2. Accessing finance to match the level of Scotland's ambition

A longstanding concern of the UK games industry has been access to finance. Ukie, TIGA and industry veterans have all regularly cited this as a priority issue for the last decade. Without the right type and volume of finance, Scotland will struggle to produce – or grow – as many games companies as it has the potential to do.

There is also increasing concern that a lack of funding is leading to the UK's most promising companies being bought out by foreign investors rather than continuing to grow on their own. And with foreign ownership, the UK loses the valuable intellectual property in those companies and the tax revenues with it. In Scotland, both Dundee's Ruffian Games and Edinburgh's Cloudgine have been bought by American firms in the last 5 years. And on the back of a recent surge in foreign acquisitions, totalling £3.8bn between 2017 and 2020 alone, Sir Ian Livingstone warned this year that many companies have just sold out earlier than they should have done."

A key challenge is that banks are often unwilling to lend significant sums to games companies, seeing them – like other creative or high-tech businesses – as too risky. This means that the industry is more reliant on other forms of external funding. As a company becomes more successful, it will find it easier to attract funding, but for start-ups and companies at an earlier stage it can be a real challenge.

A long-established source of external finance for game developers is game publishers, exchanging a share of the future royalties for an initial advance to fund the games' development. On the plus side, this provides a reliable and certain source of funding – and remains the dominant funding model for the industry, according to Ukie. The downside is that the terms often mean that developers who make a smash hit rarely see the full reward, and so lack the funds to accelerate their growth afterwards.

So, for Scotland's games industry the challenge is to increase the volume and accessibility of funding – especially for early-stage companies or companies needing funding for growth. And to do so in a way that allow more games companies to hold on to the value of their intellectual property.

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2. Accessing finance to match the level of Scotland's ambition

Funding for the highest potential companies

Scotland boasts real strengths in providing finance to companies and start-ups. In the words of Mark Logan, our "angel investor networks and syndicates rank amongst the world's most developed." And there are established public sector vehicles which offer similar levels of financial support, such as the Scottish Investment Bank and TechStart.

The challenge, however, is that the scale of these sources tends to be limited. Angel investors, for example, are usually unable to fund the later stages of growth for a successful start-up. The risk is they are overtaken by competitors or that a buy-out from a (usually) foreign investor becomes more attractive. This is especially the case when Scotland – like most countries – lacks a deep venture capital market where the scale of funds could be found.

While there are deep financial markets in New York, Frankfurt or Paris, the closest source of this kind of funding is at the other end of the East Coast Mainline: London. Here, there is an established and world-class venture capital market, where VC funds raised a record amount of capital in 2021 amounting to 35% of all funds raised in Europe last year. There is also a network of VC funds with experience of investing in games companies, including those headquartered in London such as Northzone, London Venture Partners and RLC, and those based in the US but with London offices such as Accel and Index Ventures.

For the most ambitious and successful Scottish games companies, London offers a clear route to the funding they need.

The problem is that potential is not being realised today. A common observation of the games industry is that there is not currently a high level of investment scouting from London VCs in Scotland. Many of the reasons are practical: a VC fund can visit several high-quality prospects in a day on the tube, which makes the prospect of a trip to Scotland to visit one or maybe two companies less attractive. And a Scottish games company, working on limited funds, can rarely afford the repeated trips to London needed to build relationships with VC funds that may or may not result in an investment.

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In response, Scotland should establish an investment office in London to provided structure and sustained supported for Scottish companies to raise funds from London VCs. The office could act as an outpost to educate the market on the opportunities in Scotland and improve the discoverability of the most promising investment prospects. And the office should be funded to cover the cost of travel for companies and include support and advice for pitching to investors. Collectively, this could help ensure that the highest potential games companies have easier access to the scale and type of funding they need to grow.

Funding to encourage more early-stage companies

For games companies earlier in their development, the key need is often the initial round of cash to get a team going and develop a prototype which could attract further funding. Often this kind of funding is met by savings, or loans from friends and family. But there is an important role for public grants to ensure opportunity is available to everyone with an idea no matter their background.

The UK Games Fund in an anchor source of early-stage funding for the games industry. A community interest company founded in 2015, funded by the UK government and based in Dundee, the Fund provides grants of up to £25,000 to early-stage companies. In the past 6 years, the Fund has provided £5.7m of funding to more than 170 projects across the UK, such as Lowtek Games based in Dundee, and many have gone on to grow significantly. In February 2022, the UK Government announced a significant increase of support for the Fund of an additional £8m over three years.

Importantly, the Fund is able to gain a broader degree of experience working across the UK that it can then offer to Scottish companies. The greater number of companies and applications for funding means that the fund has grown its understanding of the kind and structure of support companies need and adapted its funding rounds overtime. While it originally started out providing direct grant funding of £25,000, it has evolved its support to offer different tiers of support so that more companies at an earlier stage are able to benefit. The Fund also offers support for companies to refine their business proposal to access future funding from other sources.

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The quickest and most effective way to help more Scottish early-stage games companies access funding is to increase the support offered through the Fund.

New funding for more innovative and exciting games

One of the reasons that the UK has such an established and culturally rich film and TV industry is because the industry is supported by public funds which encourage the development of a wide range of programmes beyond just those which would be funded by the market. Channel 4 has a key role; instead of producing its own shows it has a mandate to reinvest its commercial profits in a wide range of new and innovative content. There is a specific fund for smaller indie producers and a commitment to commission content from studios across the UK. There is a chance to do something similar with games.

The Scottish and UK governments should consider how it could design a 'commissioning fund', which could provide funding for new and exciting games from studios across the country. This could support and encourage a wide range of new games and encourage Scottish companies to create more novel and ground-breaking kinds of content. And in a context where external funding is so hard to come by, and publishers are likely to fund the types of games with proven demand, such a fund would broaden the out the types of games which are made. And it could offer a new route for games companies to seek funding outside the publisher model.

Keeping cash in the business in the business to grow

Introduced in 2014, the Video Games Tax Relief has become a significant feature of the UK industry. The aim is to encourage innovation and overcome the "substantial barriers" the industry faced in benefitting from the more general Research and Development tax relief.

The relief works by refunding companies up to 25% of their investment in game development either by deducting the costs from taxable income or, in the case of loss-making companies, through a cash rebate. This is a generous relief which can be applied to up to 80% of a company's core costs involved in designing, producing and testing a game.

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Both industry trade bodies, Ukie and TIGA, have heavily championed the relief. For its proponents, the relief is a key incentive to encourage new investment in an uncertain and risky industry. And research on the economic impact suggests that some 28% of all spending on game development in the UK is supported by the relief – accounting for £860.4m in 2019, the most recent year figures are available for. Analysis by TIGA shows that 242 video games received final certification for the relief in 2021, with the majority being small budget projects.

For small and early-stage studios, the relief has a particular benefit of allowing them to keep more cash within the business – either by minimising tax liabilities on profits, or offsetting losses. This is a significant advantage that allows a company to continue bringing a game to market or to invest in future growth. And as Ukie note, in some circumstances the relief can help secure bank loans for additional funding.

Ensuring Scottish games companies are aware of the relief, and understand how to claim it, will support the industry's growth.

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3. Connecting Scottish and UK games clusters and expertise

For economists, 'agglomeration' is a magic word. It describes the reinforcing positive cycle where companies and industries gain advantages from being physically close to each other, attracting more firms and new people. It is part of the idea behind 'economic clusters', where concentrations industries and associated skills and infrastructure come together and create distinct advantages. Some of the most famous examples are of technology companies in Silicon Valley in the United States or life-sciences companies Oxford and Cambridge in the UK.

It is this economic effect which has helped create two strong centres for Scottish games in Dundee and Edinburgh, bringing together connected companies, institutions, talented individuals, academic institutions, the right infrastructure, and the right networks.

But the same idea is behind the long-term risk to the Scottish games industry. Not only do Scottish games companies face a range of competitors – from the mega international developers to the new and creative start-ups – many of those competitors are found in large clusters benefitting from their own agglomeration effects.

That is, every new games company in New York and Los Angeles, and every new clever young graduate moving to the city to work, is making those clusters stronger.

The challenge for the UK is both that our clusters are smaller than the world's biggest ones and that ours are spread out; data from Ukie shows that 55% of game developer roles in the country are outside London and the South East, and that 23 towns and cities have at least a small concentration of companies. Major clusters like Edinburgh, Dundee, Sheffield, Brighton and Leamington Spa are physically far apart – as are academic expertise, industry networks, and access to funding. Overall, this is likely a net benefit because it means the industry can more easily access the talents of the whole country. But a significant risk is that each cluster stands and falls individually, out competed by larger and more significant clusters internationally.

So, there is a clear role for an industrial strategy to create more connections between each of the UK's clusters and areas of expertise.

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3. Connecting Scottish and UK games clusters and expertise

Creating stronger connections within Scotland

Today in Scotland, the games industry is thriving but lacks a strong collective presence. There is little in the way of the social infrastructure that could bring together different companies and make it easier to discover new opportunities and make connections. At a very practical level, this means that the connections between companies which might lead to new bits of work or the sharing of ideas are typically through close physical proximity or personal connection. And there is not a simple way for the Scottish industry to 'dock-in' to other parts of the UK or with other industries.

There is no clear equivalent in Scotland of, for example, Yorkshire's industry-led network Games Republic, an industry-led group creating a focal point for the region. The closest we have is the Scottish Games Network which is a source of journalism for the industry as providing other resources such as a 'company directory' and jobs board. It is not yet the heart of a cluster across Scotland.

Encouragingly, there are steps in this direction. The Scottish Games Network has received funding from Scotland's new 'Ecosystem Fund', a pot of money established on the recommendation of Mark Logan to support activities that facilitate the community around Scotland's wider technology ecosystem. The financing means the Network will host the first 'Scottish Games Week' this autumn, to promote the best work, build connections, and attract leading international industry experts.

Yet in comparison to the attention, funding, and support provided to other industries this is fairly minimal support. In contrast, Scotland's Data Lab which acts as a hub for companies working on data and artificial intelligence is backed by millions of pounds of funding and has four city hubs across the country.

A plan to maximise the competitiveness of Scotland's games industry should include support to create and sustain a central 'hub', which could act as a bridge between different companies and between the industry and other sectors. With minimal funding, it could be supported to house expertise to support companies with commercialisation of games as well as skills and policy. The most obvious candidate is the existing Scottish Games Network. The Scottish Government should explore how the Network could be incorporated into existing economic programmes to provide it with

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long-term financial support.

This could be supported by integrating a 'games champion' into each of the newly announced 'Tech Scalers' across Scotland, intended to provide mentorship and commercial education to entrepreneurs and provide co-working spaces for start-ups. The national infrastructure recommended by Mark Logan will make a significant difference to connecting the wider technology sector, but to maximise the opportunity to create and grow more start-ups focused on games there should be dedicated support.

Creating stronger connections across the UK

The next step should be to deepen the connections with the wider UK's games industry, which as an established and growing industry is also a source of insights and ideas for Scotland's companies.

Today, many leading businesses are hundreds of miles apart, like Edinburgh's Rockstar North and Sheffield's Sumo Digital. So too are the established academic experts, such as Abertay University and Bournemouth's National Centre for Computer Animation. And as are the established government-backed research and development centres such as InGAME hosted in Dundee. The collective effect is to create pockets of expertise, connected by personal relationships and happenstance rather than design.

The opportunity is to make visible the UK's pockets of expertise and facilitate the connections between them that industry want to make. There is no point in trying to force a games studio in Dundee to travel to Bournemouth, but there are likely many companies across the UK who might if they knew the research teams existed and were able to travel.

Some of these connections exist today. The trade body Ukie does an excellent job in hosting events across the UK, acting as a UK-wide ambassador for the sector, and there are a variety of industry conferences and events. And related groups such as Immerse UK act as focal points for the members, drawing together companies working on games and other immersive technologies from across the UK.

But overall, there is still a missed opportunity. We lack the funding, or even the awareness, to be able to make the most of the pools of talent and expertise across the UK. An intentionally connected

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games industry would be one where up and coming studios in Edinburgh and Dundee are aware of the pockets of research excellence in England and are able to easily access them, or to make connections with established companies working on something more similar to them than the studios physically near them. As it is today, those connections are by luck rather than design. And there is no joined up approach; Ukie runs an accelerator programme with Creative England, but the funding structure means that Scottish companies have to secure separate financial support to join.

The UK and Scottish Governments need to go beyond simply recognising games as a high- potential sector and explicitly aim to create an interconnected UK games industry.

The good news is that the early stages of this are already in place: the UK Games Fund has a national role, there is an active trade body in Ukie, and there are many well-established regional networks such as Games Republic.

Building on this to create a national map of the sector and crucially making the pockets of industry expertise discoverable and then accessible is the next step, including a specific pot of funding to build inter-UK connections modelled on Scotland's Ecosystem Fund.

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4. Developing the crossover between games and other UK industries

Games have the potential to be a transformative technology, supporting innovation in a wide range of sectors beyond just entertainment. For Scotland and the UK, this offers an enormous opportunity – it raises the prospect of being able to combine an expertise in games with strengths in other established industries to create the kinds of competitive advantages that other countries will struggle to replicate.

So, any plan for games should consider the cross-over with other sectors, both in Scotland and across the UK. Not only can this offer new routes for games companies to gain new work, but it can spur innovation and Scotland's wider economic competitiveness.

Virtual production: The confluence of games, visual effects, and film

The most established crossover between games and another industry is with film and TV production, where advances in technology and production processes are increasingly blurring the traditional distinctions.

Virtual production techniques, increasingly used by producers in high-end productions to create visual effects and computer graphic technologies in real time, are based off games engines such as Unreal. The effect is to allow producers to combine live action footage with computer graphics as it is being filmed, as was done in the recent UK production of The Batman.

At the same time, there has been a rise in 'interactive shows', where users are able to make active choices while watching a film or TV show similar to how players would make choices in a game. Netflix's Black Mirror: Bandersnatch in 2018 was a major hit, where seemingly trivial choices a viewer made during the film – such as which cereal the character should have for breakfast at the start – had knock-on effects. Netflix has also started buying games studios outright, with an intention to incorporate games into its subscription bundle.

As the lines between games, film, and TV blur, there is an opportunity to marry the skills of Scotland's video games industry with the world-class production industry across the UK. Huge numbers of major international films and TV shows are made in the UK, including the Star Wars and James Bond series (at Pinewood

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Studios in England), Netflix's Sex Education (in Wales) or HBO's Game of Thrones (in Northern Ireland). And Soho in London is an internationally recognised as a leading home for visual effects specialists.

One Scottish company succeeding at the intersection of these industries is Axis Studios. Founded in Glasgow, but now with a presence in Bristol and London, the studio specialises in visual effects and animation for games and films, working on popular products such as the animation for the trailer for the Halo Infinite game and the visual effects for Sky's new series of Discovery of Witches.

While the cross-over between these different industries is still emerging, and may not provide immediate opportunities for individual games companies, there is a clear long-term advantage for encouraging closer collaboration across the UK. In the medium-term, there is greater opportunity for the animators, designers, and programmers behind games to cross-over into other immersive entertainment industries or for Scottish games studios to attract work from film and TV production companies.

And the relationship can go the other way, with innovation in TV and film inspiring new ways of making games. One example is the work of the StoryFutures Academy, the UK's National Centre for Immersive Storytelling, which is funded by UK Research and Innovation and led by the National Film and Television School and Royal Holloway, University of London. The centre focuses on the use of 'extended reality' technology, and it aims to offer cutting edge training in immersive technology and immersive storytelling to 'traditional' film or games makers. An opportunity for Scottish game companies, to enable them to stay at the forefront of innovation in the industry, would be to connect them with the UK's deep expertise in film and TV production and the advances in storytelling. Across the UK, from London to Belfast, there are deep expertise of creative technology and storytelling. Many of these are supported by UK Research and Innovation's 'Creative Industries Clusters Programme'. The opportunity would be to strengthen the connections between these clusters – for example the StoryFutures Academy in London and Future Screens NI in Belfast. In bringing these expertise and connections together, the UK – and Scotland's games industry within in – could create a real source of competitive advantage.

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Supporting advances in other sectors, from medicine to agriculture

The growing category of 'applied games' takes the ideas, design concepts, and technology behind games primarily designed for entertainment and 'applies' them to design problems in different industries or societal challenges.

Abertay University is home to two world-class assets in applied games:

1. Abertay Games Lab, a practice-based research group made up of staff from the University.
2. InGAME, a research & development centre for the video games industry, hosted by the University, and funded by both the Scottish and UK governments.

The Abertay Games Lab works with businesses, as well as public sector and charitable organisations, to explore applied games. In partnership with Dundee and St Andrews universities, the group has developed new ways to explain key medical concepts (see box out). Set alongside other innovations, such as the recent developer of a game-based simulation tool developed by between Abertay and St Andrews universities to explore cancer treatments, there is an exciting pattern of innovation at the intersection of games and medicine on Scotland's East Coast.

Games to explain medical concepts

Sanatorium (with St Andrews University)
A prototype that utilised game design techniques and technology to demystify and educate players about the diagnosis and treatment of Tuberculous.

The Enemy Within (with Dundee University)
An educational strategy game designed to inform teenagers about the genesis, evolution and progression of cancer.

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The research & development centre InGAME, in addition to helping games studios find new ways to develop fun games, has also been a source of innovation for real-world challenges. Recent examples include supporting collaboration between a Dundee-based studio and an agri-tech business from Edinburgh, funded by a £250,000 grant by UK Research and Innovation. The projected created an augmented reality tool that identifies individual cows based on their markings and provides detailed information to vets and farmers on site, increasing their productivity.

InGAME: Innovation for Games and Media Enterprise

> *"Games studios are often small, and it can be hard for them to lift their head above the parapet of day-to-day game creation. But we can introduce them to the wider opportunities that are available, for applying their creativity and expertise outside of game-making."*
>
> Dr Lowthorpe Head of Collaborative R&D at InGAME

More recently, the centre has launched a series of 'applied games catalysers': challenging others to apply videogame tools and ideas to real-world problems. The first is in partnership with the innovation agency Nesta, and aims to help people lead longer, more healthy lives, in particular through efforts to reduce obesity. One of the initial companies awarded a grant, Dundee-based Konglomerate Games, proposed building an environment in which players can build a city and adjust the food environment by building or moving takeaways, supermarkets and restaurants with different health and affordability ratings, set how different citizens interact with the food outlets, and introduce health policies.

Yet, despite its significant importance, InGAME's funding ends in the summer of 2023 meaning the programme is due to close in its current form. To make the most of its potential, the Scottish and UK Governments should treat the programme as a strategic national asset and provide long-term funding.

More widely, there is an opportunity to expand the potential of games to tackle social problems. "Challenge prizes" are an established mechanism to do so, where a public competition offers

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a reward to whoever can first or most effectively meet a specific challenge. The idea would be for the Scottish Government to set up a challenge prize for a rolling-series of public challenges, focused on the games industry. This would allow the full talent and ideas of studios across Scotland – and teams in universities beyond Abertay – to contribute. Such a programme could be hosted by the innovation think thank Nesta, whose 'Nesta Challenges' is a hub of expertise on how to use prizes effectively to address social challenges.

Conclusion

Scotland can – and should - be proud of its role in the world's largest entertainment industry. We've created some of the bestselling and most innovative games of all time. Today, we're home to major developers, a range of popular and growing indie studios, and world-class universities and researchers. And the industry is growing a pace.

But, as the games industry becomes more competitive and increasingly dominated by the biggest developers, Scotland needs a plan. Done right, we can stay at the front of innovation in the industry, creating new and exciting games, launching new studios, and applying the ideas and technologies of gaming to other industries. Done badly, we risk losing another industrial legacy.

Many of the interventions needed – from tackling longstanding challenges around access to skills and finance, to encouraging innovation – are in our grasp. Although the Scottish Government has a wide range of opportunities to act, the fastest and most significant opportunity is to improve the cooperation and connection between Scotland and the rest of the UK. Building bridges to create a more connected UK games industry could spark new ideas and innovative games; combining expertise in games, film, tv and virtual production could open new opportunities; innovations in Scotland – from medicine to Agri-tech – have the potential to be adopted all over the country. In short, together, Scotland and the UK have many of the fundamentals to create something more than the sum of its parts. And in so doing, realise greater opportunities for Scotland.

Long gone are the days when games were merely things played by nerdy teenagers in bedrooms. The opportunity now is to create exciting new games and well-paying jobs, drive a new generation of technological breakthroughs, and contribute to a more prosperous and successful Scotland. And it's ours for the taking.

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Our Scottish Future believes that good governance in Scotland and across the United Kingdom has to be based on the values of cooperation, empathy, solidarity and reciprocity.

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