

Science

SCOTLAND



*The Royal Society
of Edinburgh*

KNOWLEDGE MADE USEFUL

Issue 22 Summer 2018

Start-Ups: *Shaping Scotland's Future*



www.sciencescotland.org

Foreword

Investing in start-ups means much more than money



John Waddell FRSE

Scotland punches well above its weight in its support for early-stage businesses – and it shows. The excitement which surrounds the current generation of start-ups is something you can almost reach out and feel. And the privilege of helping to put together this edition of *Science Scotland* is a chance to share a little of that magic.

In the following pages, we focus on nine of the most promising young companies in Scotland, but there are many more stories to tell, so look out for future editions.

The nine companies featured have very different personalities, but they also have much in common. Whether they are focusing on healthcare or software, engineering or music, they have all identified a need in a particular market and developed innovative solutions by drawing on available resources – including technical as well as financial resources. They are not only good observers but are also proving good collaborators and entrepreneurs. And they also have global ambitions.

Scotland is a good incubator for start-ups. The business, academic and investment ecosystem in Scotland (both public and private) has created a spirit of interaction, openness and mutual support so that entrepreneurs do not operate in a vacuum. Investors do not only put in their money but also their experience and expertise. And to turn good opportunities into good outcomes, integrity can be just as important as intelligence, or even inspiration. Competition and collaboration need moral as well as financial support.

The diversity of sectors, business models, opportunities and players in Scotland is impressive for such a small country, where start-ups find it relatively easy to approach the right investors – people who will not just

share their vision for a potentially winning idea but can challenge them as well as cheer them on in the drive for success.

Success does not just benefit investors and the owners of the companies in which they invest – success is good for everyone. Equity-funded start-ups are key to creating high-quality jobs and stimulating the economy. This virtuous circle is given further impetus by Scottish universities' encouragement of spin-outs, as well as their world-class research and development standards – both of which attract potential business creators.

The angel investment community in Scotland also makes a major contribution and has greatly increased its influence over the last 25 years, substantially supported by Scottish Enterprise, which started co-investing in 2003 with a revolutionary and now much-copied model. This has enabled Scottish investors to make their money go further and has encouraged more people to enter the market in organised groups, rather than as individuals. Combined with EIS tax relief, this has fostered patience and a longer-term view, which gives young companies the time and space they need to flourish.

This positive investment environment is not only transforming business but also changing attitudes, and on Page 22 Dr Paul Hopkins exemplifies this by suggesting "acquisition can be good for you" – exploding a great business myth.

I hope this snapshot makes you think and also look forward to more insights into the start-up community – and more successes.

John Waddell is one of the most experienced early-stage investment managers in Scotland and was the CEO of Archangel Investors Ltd from 2005–2015.

Contents

Foreword	2
John Waddell FRSE	
James McIlroy – EnteroBiotix	4
Gut feeling proves right for EnteroBiotix	
Liita Cairney – Kalitasha	9
Making period poverty history	
Alasdair Mort – MIME Technologies	13
Rural solution goes global	
Corien Staels – Staels Design	18
Upwardly mobile mobility products	
Paul Hopkins – Opinion	22
Acquisition can be good for you	
Michael Tougher – Soundbops	24
In tune with music market	
Orfeas Boteas – Krotos	28
Sound investment pays off for Krotos	
Callum Murray – Amicus Resolution	31
If you can't beat the system...	
Manu Peleteiro – Inbest	35
More personal financial planning	
Steve Regis – ARX Maritime	39
Innovation versus the pirates	
Alisdair Gunn – Opinion	44
Innovators need to think global	

EDITORIAL TEAM:

Writer Peter Barr

Production Editor Jenny Liddell, The Royal Society of Edinburgh

Designer Emma Quinn

Printer Mackay & Inglis Ltd

www.rse.org.uk www.sciencescotland.org

ISSN 1743 – 6222 (Science Scotland Print) ISSN 1743 – 6230 (online)

If you would like more information, please contact: sciencescotland@theRSE.org.uk
The Royal Society of Edinburgh, 22–26 George Street, Edinburgh EH2 2PQ

ANY VIEWS EXPRESSED IN THIS PUBLICATION DO NOT NECESSARILY REPRESENT THOSE
OF THE ROYAL SOCIETY OF EDINBURGH, NOR ALL OF ITS FELLOWS.

The Royal Society of Edinburgh, Scotland's National Academy, is Scottish Charity No. SC000470



Gut feeling proves right for EnteroBiotix

Just over one year after setting up in Aberdeen, EnteroBiotix stands on the brink of a major advance in the pharmaceutical industry, establishing the business as a leading global player in a multi-billion-dollar market, thanks to recent breakthroughs in a new branch of medicine – using the microbial communities found in the gut to prevent and treat a wide range of infections and diseases. To make such an impact so quickly in such a competitive field is all the more remarkable because the Founder & CEO, James McIlroy, was until very recently a full-time medical student...

Late one night four years ago, soon after he had started a degree in physiology at the University of Edinburgh, James McIlroy was browsing through some medical journals when he came across an article which changed his life forever – and could also help to change the world of medicine. Researchers had transplanted faecal matter from a lean mouse to an obese mouse, and the obese mouse lost weight. “It seemed like an amazing idea,” says McIlroy, recalling the moment of truth. “I realised

that this could be the answer to all sorts of medical problems, but no-one was talking about it at medical school – the science was still very new.”

McIlroy then read another article describing how researchers in the Netherlands had done a stool transplant from one human into another, and the idea started gathering momentum. Surely, he wondered, there were other less invasive, more efficient ways to deliver the bacteria – for example, in a capsule that people can easily swallow? He also wondered if it would be possible one day to identify the “active ingredients” in the stool samples so these could be manufactured to get rid of the need for stool donations altogether.

Four years later, Dr McIlroy, now a qualified medical doctor, is CEO of EnteroBiotix, a company which raised £500,000 in funding within its first year and is on course to become a leading player in the pharmaceutical industry by developing new therapeutic products from the healthy bacteria which live in our gut – what scientists call the microbiome or microbiota. And the market for such products is expected to be worth over \$2.2 billion by 2025.



James McIlroy

Many infections or diseases are associated (causative or correlative) with imbalances of bacteria in the gut, and to restore the balance, doctors use antibiotics to reduce the bad bacteria or increase good bacteria with probiotics. In recent years, faecal microbiota transplantation (FMT) – transferring good bacteria from healthy people via rectal enema, colonoscopy, nasogastric tube or nasoduodenal tube – has proved to be particularly effective in the treatment of infections caused by *Clostroides difficile* (*C. diff*). And this is where EnteroBiotix is aiming to change things by developing a new kind of orally administered, patient-friendly product “with an increased product shelf-life”, which removes the need for invasive procedures while also “simplifying the design of placebo-controlled clinical trials.” And to bring this product into the healthcare system, EnteroBiotix has established an ISO-accredited controlled donation facility and manufacturing facility, with specialist technology– and specialist staff.

Inspiration

What inspires EnteroBiotix and McIlroy, who founded the company in 2017, is the potential of the gut or microbiome to prevent and cure a wide range of infections and diseases, by collecting faecal matter and delivering it as a treatment for patients, “making therapeutic products derived from healthy, tested and qualified donor microbiota that meet the requirements of competent authorities and guidance legislation in relation to medicinal products.”

This means taking stools from healthy, pre-screened human donors, then processing the good bacteria so they are easy and safe to transfer to a patient. Initially, the target for EnteroBiotix is infections caused by *C.diff*, but in the long term, this will be extended to more complex diseases, with an emphasis on inflammatory diseases and other infections.

The manufacturing challenge

To deliver safe, effective pharmaceutical solutions, companies such as EnteroBiotix have to meet the highest manufacturing standards. One basic problem is that the donated microbiota are exposed to the external environment, and this requires the use of strict aseptic techniques and specialist controlled environments such as biosafety cabinets and cleanrooms. Another challenge is that most microbiota are anaerobic bacteria (do not need oxygen to grow and may even die when exposed to the air), and traditional manufacturing methods involve open systems and aerobic environments which could compromise the viability of therapeutically-active anaerobic bacteria.

To solve these challenges, EnteroBiotix has developed a semi-automated ‘closed system’ that maintains the critical quality attributes of the microbiota – so the company in future will be able to enhance microbiota by adding and/or removing strains of bacteria in a more precise, and more controlled, manner.

“I realised that this could be the answer to all sorts of medical problems, but no-one was talking about it at medical school – the science was still very new.”

Even though bacteria do not present the same compatibility problems as blood and can be safely transplanted from one person to any other, the company is also working with a network of collaborators “to generate datasets from studies where the microbiome is being manipulated to identify useful associations between microbial signatures and clinical response.” In other words, they want to find out if the same bacteria produce positive responses in certain diseases.

Three steps forward

EnteroBiotix has conceived a three-pronged strategy to take it to the next stage of development. The first step is to bring its new medicinal products to market, using its new specialist equipment, including a cleanroom with isolator technology and dedicated quality control areas, based in the Rowett Institute for Nutrition and Health in Aberdeen.

The second step is to deliver its products for clinical trials, so researchers can identify and isolate the active ingredients to develop more targeted products by reverse-engineering individual components which mimic the effects of the bacteria. “This will play a pivotal role in the future,” says McIlroy, “by analysing how the gut reacts to therapy.”

The most exciting step, says McIlroy, is when EnteroBiotix will “super-charge” bacteria to target specific diseases. “This is where our impact will be greatest,” he explains, “by enhancing our products to optimise their therapeutic effects, by adding bacteria or specific microbial compounds. We want to be the very best in the world at augmenting human-derived donations for therapeutic application.”

In the early stages of developing new therapeutic solutions based on microbiota, it is hard to patent any of the products because they’re based on natural ingredients and hard to differentiate, but when the company begins to make its “super-charged” products,

that will change the game completely, as the know-how increases and the products are uniquely formulated – not just a full microbial community, but more defined “consortia” that deal with different medical problems affected by the balance of bacteria.

In years to come, according to many researchers, the microbiome could provide therapeutic solutions for everything from motor neurone disease to depression. Already, says McIlroy, studies of mice have revealed a connection between bacteria and Parkinson’s disease, and he is confident that many inflammatory diseases such as ulcerative colitis and Irritable Bowel Syndrome (IBS) may soon be treated using products based on good bacteria. Mental health may also be a target in future – the gut is known to have a big effect on the brain and is even described as “the second brain” by some researchers, part of what is called the “gut-brain axis.”

The other long-term aim, says McIlroy, is “to develop a fully integrated functional metagenomic platform for developing novel therapeutic candidates targeted at the microbiome,” as EnteroBiotix evolves into a microbiome pharmaceutical company, equipped with all the components it needs to become a world-class player in the industry, taking advantage of the latest advances in bioinformatics.

Ultimately, this may lead to future innovations which may eliminate the need for FMT altogether. “It may be that, for some diseases, a whole community approach is optimal. However, in others, it may be that the same or an improved effect could be achieved by defined ‘cocktails’ of bacteria or the molecules that they produce,” says McIlroy, adding: “reverse engineering will have a huge impact in future by developing novel solutions and we are uniquely placed with our integrated collection and manufacturing platform to partner with other companies with data science and sequencing capabilities”.

EnteroBiotix recently announced a major partnership with NHS Tayside during a visit from First Minister Nicola Sturgeon and Chief Medical Officer Dr Catherine Calderwood



Rapid progress

In its first year, EnteroBiotix won significant investment (oversubscribed) from a group led by Equity Gap, supported by the Scottish Investment Bank, the investment arm of Scottish Enterprise. The money (£500,000) has been used to “develop the first orally available products for FMT in Europe” as well as to expand the manufacturing and research team – the current staff of nine is expected to increase to over 20 people during the next 12 months.

Since setting up the company, McIlroy has also won a number of awards, including being named one of the Ten Outstanding Young People in Scotland by Junior Chamber International and Emerging Entrepreneur of the Year by Business Quarter, the *Herald Scotland* Global Game Changers award for ‘Young Pioneers’ and the Scottish Institute for Enterprise Young Innovators Challenge; while EnteroBiotix also came first in the 2017 Oxford Biostars biotechnology competition.

As the company prepares for its next round of investment, McIlroy knows there is still lots of work to be done. For someone who has just graduated from medical school – with distinction – after doing 12-hour shifts in hospitals and studying for his final exams at the same time as running his business, hard graft should not be a problem, however. McIlroy has an unwavering drive to succeed, but like so many other successful entrepreneurs, he also has a talent for attracting investors as well as the professionals he needs to turn his ideas into products – and profits.

McIlroy confesses that he has very limited experience in clinical medicine or working in laboratories, but he was also quick to recognise such talent would be critical to building his business and making his vision come true. One of the first professionals to join him was Nicolas Robinson, who has over 20 years of experience in cellular therapies and the manufacture of medicinal products and previously held a senior post in the Aberdeen Blood Transfusion Centre. Now Production Manager, Robinson had to be persuaded to cancel his plans for retirement to join EnteroBiotix. Among the other early recruits was Christopher Mosedale, the Research and Innovation Manager, a former medical student with a long-standing interest in the microbiome who also worked for EuroBiotix, McIlroy's initial venture into biotechnology, and Gregor Russell, the Chief Operating Officer, who previously worked with McIlroy as Director of Commercialisation at Innova Partnerships. McIlroy has also recently recruited Dr James Clark as the company's new CEO. Clark was formerly the CTO at Enterome, a Paris-based microbiome company that recently raised £30 million in funding. “With these skilled hands on deck I am confident that we will launch our rocket ship into orbit over the next few months,” says McIlroy.

The early days of EnteroBiotix were a “whirlwind of activity” for McIlroy, but he also recognised he needed solid industry know-how at the core of the new operation, and persuaded Colin Christopher Bennett to come aboard as Non-Executive Chairman, not just for his experience in the oil and gas sector but also as the Chief Executive of Benenden Health and his knowledge of governance issues.

“I’m passionate about translating ideas into products that will benefit society.”



Manufacturing requires controlled environments such as biosafety cabinets and cleanrooms.

It's difficult to know all the technical details of developing novel medicinal products as well as learning how to run a business, becoming a doctor and doing a degree in physiology during a so-called “year off” in Edinburgh, but McIlroy's job is not just to put in the hours in the lab and recruit experienced people but to articulate the corporate vision – “a patient-centred biotechnology company focused on developing first-in-class medicinal products for use in currently unmet clinical needs.”

McIlroy also believes that “the microbiome is the next big frontier of medicine,” and that EnteroBiotix and its partners “must work together to improve the lives of patients through sound science and pioneering medicines.” The company website also describes the need for close collaboration and innovation: “We know that in order to achieve our mission we must form alliances and create partnerships, and embrace innovation throughout our supply chain.” A recent agreement with NHS Tayside is one good example of how EnteroBiotix can partner with healthcare providers to demonstrate the benefits of innovative microbiome products, at the same time as “catalysing and accelerating product development.” The company has also signed agreements with the Scottish National Blood Transfusion Service and the Rowett Institute.

Social enterprise

When McIlroy was first inspired to set up a company to develop microbiome-based solutions, he thought the best approach would be to form a social enterprise, not just a company which aimed to make the world a better place but an organisation which did not pay a dividend to any investors – what he calls an “asset-locked” business. In November 2014, he set up a social enterprise called EuroBiotix CIC, “to expand safe access to FMT across the NHS.” As time went by, however,

he realised this model was not the best way to deliver results at the scale he desired to achieve. To create new medicinal products for large populations and major clients such as the NHS, he not only needed world-class technical help but also committed investors. Winning an RSE Enterprise Fellowship in September 2016 was another “pivotal moment” which helped McIlroy gain more perspective on business, as well as providing financial support. Having benefited from business training himself, McIlroy is also keen to help set up fellowships for medical students, to develop their entrepreneurial skills, and he was recently appointed Honorary Lecturer in Healthcare Innovation by the University of Aberdeen. “My plan is to leverage this appointment to forge new paths for entrepreneurial medics in partnership with existing resources at the University and beyond,” he explains.

“Big ideas need big money and big ambition behind them to succeed,” he says. “The most important thing is impact and the ethos of the organisation. The legal structure is a secondary issue. I’m passionate about translating ideas into products that will benefit society. EnteroBiotix embodies all the same values as a social enterprise, and we are still razor-focused on impact, both for the individual patient and healthcare providers in general. We want to help people get easier access to medical treatments, and that requires significant investment.”

McIlroy has always wanted to do “something big” with his life and make a contribution to society. When he is pitching to investors, he tells them he wants to do something that benefits people, but he also knows the company must be sustainable over the long term, as well as “putting patients at the heart of everything we do.” And if that means EnteroBiotix emerges as a world-class pharmaceutical company, creating all-round benefits for everyone, his stakeholders will not complain.

Making period poverty history



Liita Iyaloo Cairney has turned a social problem into a business by developing an innovative product for feminine hygiene, primarily aimed at developing countries. Her reusable solution, called Koree, is not just more affordable but ergonomically designed for better comfort and prevention of leakage – the most common complaint from consumers. So how did this Namibian biologist end up in Scotland attracting investment in a company whose mission is to do social good at the same time as providing a return for investors?

Young girls in a village in Namibia and businesswomen in a boardroom in Scotland may not seem to have much in common, but once a month they have to cope with periods and not feel restricted in their everyday lives by their menstrual cycle. There has been a lot of focus on “period poverty” in developing countries, most commonly its impact on young girls not going to school, but in wealthier countries like Scotland, there is not just an issue with the cost of the products but also a problem with the “shame and stigma” associated with menstruation that can affect women from all walks of life. And Liita Cairney, CEO and founder of Edinburgh-based Kalitasha, feels very strongly that women should always feel comfortable in their own bodies and have easy access to a wide choice of

affordable and well-designed feminine hygiene products whether they live in a small, remote village or run a big business.

According to a recent survey by a grassroots group called “Women for Independence,” almost one in five women in Scotland struggle to pay for basic sanitary products, using alternatives such as toilet roll, rags, socks and newspaper. Recent initiatives seek to address this by providing free sanitary products to low-income households, but Cairney has developed a novel solution – a reusable product called Koree, made from a silicon outer shell and a washable liner, which comes complete with bag for liners, so women can change them without needing access to bathrooms.

Some issues remain universal – in addition to health complications, most women express very similar feelings about the discomfort and leakage commonly experienced during menstruation – but period poverty tends to be a bigger problem in poorer countries, and has a much bigger impact on poor women's lives, wherever they live.

In the process of developing her revolutionary product, Cairney has also created a business which provides a return for investors as well as attempting to do social good. For Kalitasha, profit is what drives innovation and will make it sustainable over the long term – not a “dirty” word but the foundation of future success.



Liita Cairney (Photo by Karl Rabe)

“*Period poverty tends to be a bigger problem in poorer countries, and has a much bigger impact on poor women’s lives, wherever they live.*”

“When I registered the company,” Cairney explains, “I decided that the business model should not be a charity or social enterprise but a limited company, with shareholders like any other. This means there is greater scope for innovation and helps to bring in investors. Hector Cameron of Lancaster Capital was one of the early investors and he brought other members of his syndicate with him who also understood what I was aiming to do – they believed in me, simple as that.”

The journey begins...

Cairney’s “intellectual and spiritual journey” has not only taken her thousands of miles from Namibia to Scotland, but also from the world of academia to business. “Everything I struggled to do in my PhD (for instance, diligent planning and execution), I am good at in business,” she says, explaining that her academic skills are also something she’s been able to transfer to her work as an entrepreneur. She also thinks she got her ‘independent spirit’ from her native Namibia, which was under the rule of apartheid when she was born and only won its freedom from South Africa in 1990.

When she was a teenager, growing up in a small village, Cairney also experienced for herself what it was like to enter womanhood and deal with all the issues which are now the focus of her business. Unlike many other girls her own age, the young Liita understood the biological aspects of the menstrual cycle, but like most of her schoolmates, she also paid for all her own feminine hygiene products, out of the money she earned from various jobs, including

shop cashier and video shop rental assistant, and even a spell as a children’s television show presenter. “Most families simply don’t prioritise access to products,” says Cairney. “It’s such a critical, predictable event in women’s lives, but many people act as if it comes as a surprise. Most young women make do with what they can get, but this means they are often quite uncomfortable, and can lead to medical problems.”

What’s the problem?

Many social commentators argue about how much the menstrual cycle affects school attendance, but Cairney simply points out that the most important question is how much it inhibits women’s public engagement in general. School is only one of the problems.

Cairney welcomes efforts to address these issues in developing countries but is critical of “band-aid solutions” – for example, encouraging young girls to sew their own sanitary napkins. “Girls should not be defined by the limitations of their menstrual cycle,” she explains. “This is not addressing the heart of the problem, which has to include education.” In Cairney’s view, people in many societies “conflate menstruation with sexual issues,” thus complicating the way it’s discussed by introducing a religious and moral dimension, as well as myths and taboos. “Menstruation is not necessarily a sexual issue,” she explains, but if it’s not addressed head-on, a lack of knowledge can lead to problems with family planning, for instance.



Cairney feels very strongly the products must have consumer appeal.

Namibia to Scotland

After doing well in high school in Namibia, Cairney applied for university in the US, spending 18 months in New Jersey before enrolling at Bard College in New York, where she gained a BA in biology followed by an MSc in environmental policy, graduating in 2008. Initially, she left her options open, doing several courses other than science (including sculpture and the Alexander Technique), and as she approached graduation, she realised her future lay not in the lab but with people. “Coming from Namibia, I thought it was my personal duty to focus on science,” she says, “but that was not my calling. Science taught me discipline but I am more a people person, and environmental policy started to interest me more, looking at the environmental, legal and human aspects of science, including public health and international development.”

Two years working at the Population Council, an independent non-profit organisation which conducts research in public health and medicine, with an emphasis on poverty, gender and youth, persuaded Cairney that her future was “empowerment of adolescent girls,” and this encouraged her to do her PhD (in global public health) at the University of Edinburgh, to open more doors in her future career. While researching her thesis on HIV/Aids and the “ownership” of international development funding by recipient countries, Cairney went back to Namibia in 2012 to collect data, with assistance from the Ministry of Health and Social Services, and reached another turning point in her career. During her visit, she met the ex-Prime Minister, Nahas Angula, who inspired her to focus on a “simple solution” to poverty-related issues such as menstruation. “I wanted to come back and make an impact on people’s lives,” says Cairney, “and this opened my eyes to new possibilities.”

The next challenge for Cairney was to identify the issue which she cared about most and figure out how to address

it, and “period poverty” came top of the list, not just because of the economics involved and the public health implications but also because of the “fear and anxiety” felt by young girls when they reach puberty, lacking support from the people around them.

As an academic, Cairney didn’t know yet where her journey was heading, but a two-day workshop at the Centre for Career Development in Dundee, supported by the University of Edinburgh, helped her reflect on how best to re-channel her skills – and led to setting up her company in 2013. The idea of the workshop was to “look beyond research and explore the potential of entrepreneurship,” and Cairney was encouraged to think of her interest in the menstrual cycle as the launch-pad for a business. “They said, just run with it,” says Cairney. “And soon I realised I could do social good at the same time as developing a viable business and attracting investment – all in an environmental way.”

Initially, Cairney considered becoming a marketing agent for a silicon menstrual cup, developed by Ruby Cup and a few others, but after market research, she realised this was not the solution, partly because it required easy access to private washing facilities which are not widely available in rural areas. What Cairney needed was a totally new product, and that was when she started sketching out a few ideas.

Next, Cairney won a SMART:Scotland Grant from Scottish Enterprise to develop her product and a Royal Society of Edinburgh (RSE) Enterprise Fellowship (2014–2015) which provided business training, followed by a grant from the Scottish Institute for Enterprise (SIE) Patent Fund, which enabled her to design and develop her prototype. “At first, I thought the business would be something I did on the side, but it quickly took over my life,” she reveals. “I also learned that it is possible to learn how to be an entrepreneur – you don’t always need to have magical charm, but discipline definitely helps.”

Kalitasha's corporate mission: To bring dignity to women every day by applying common sense and ingenuity to the everyday problems associated with health and wellbeing.



“*Cairney’s personal mission is to make an impact on people’s lives.*”

One of the key people in Cairney's story is designer Helen Fisher from Edinburgh College of Art, who took Cairney's crude pencil sketches and transformed them into a blueprint for Koree, which was then taken forward by product design engineer, Scott Miller. Cairney explains: “A lot of thought went into the design, to get the ergonomics right and try out different combinations of materials, making sure it met the core requirements – anti-leakage, reusable and easy to wash. We also had to take account of the fact that inserting a product is taboo in many societies.”

The initial design was also discussed with a group of 50 women in Scotland, who were also surveyed to find out their main concerns about menstruation, which revealed that fear of leakage and checking for stains was the Number One issue, followed by physical and psychological security.

The first 1,000 Koree kits were ready for trials in Europe and Africa early last year, and the current First Lady of Namibia has also supported the project, which involved 300 adolescent girls in Namibia. The basic kits include a silicone case and a silicone shell, plus five reusable pads. Extras such as an inner pouch for storing used/soiled pads or extra pads, etc., can also be ordered, and the package is supported by educational materials to help young women learn about the menstrual cycle, available via www.firstperiod.org and www.kalitasha.com.

Cairney plans to develop more products based on the Koree design, and feels very strongly they must have consumer appeal: “The girls that buy them are like me. I was born and grew up in a village, and why shouldn't young women like me have a wide choice of products, like women in Scotland?”

Why don't the multinationals also compete in this market? “They could also develop reusable products, and have started to recognise period poverty as a real issue, but marketing disposables has been a great sales strategy for them, so why bother looking beyond?”

Cairney's personal mission is to make an impact on people's lives, and as she builds her team and looks for more investment, her company is also making waves in the commercial world, not just in terms of innovative product design but a new approach which turns a social problem into a sustainable and profitable business.

In April this year, Cairney returned to Bard College to deliver a speech, reflecting on her entrepreneurial journey. For her, it was a special trip that brought back lots of memories, but Cairney is more interested in looking ahead to the future than back to the past, as the struggle continues to make period poverty history.



It started as a high-tech solution to improve first response in medical emergencies in remote areas of Scotland, but now MIMÉ® is on the verge of taking flight in one of the world's biggest markets – civil aviation.

Early one morning, on a visit to Silicon Valley in November 2017, Dr Alasdair Mort and his co-founder Anne Roberts were out for a run, in a bid to recover from jet lag. And as they jogged along under the flight path near San Francisco Airport, they saw the future of their company take off in front of their eyes. As Roberts later described it, “This was the pivotal moment when we realised just how scalable the opportunity was for our product in the international aviation industry.”

Less than one year later, MIMÉ Pro is now getting ready to launch, and MIMÉ Technologies is focusing on aviation as its initial target market, recognising that success in this rapidly growing sector could be a launch-pad into other major sectors. With four billion passengers currently flying per annum, a figure expected to increase to over eight billion within the next two decades, any new technology that makes flying safer and

more cost-efficient is welcome – and that includes first-response medical software like MIMÉ Pro. Medical incidents can affect one in every 200 flights per month, and airlines do not only have a duty of care to everyone on board but also face significant costs and “an increase in the complexity of operations” when flights are diverted because of an emergency. So if you can improve in-flight medical care and reduce liability, you would not only help to save lives but also save money.

The team at MIMÉ Technologies has spent years researching and developing its product, supported by specialists in natural language generation (NLG) who turn the physiological data from vital signs sensors into readable reports, specifically designed for handing over to emergency services. During this period, Mort also spent a lot of time up in the mountains of Scotland and in the back of ambulances on the road and in the air to understand first-hand the problems faced by medical response teams in remote environments. When MIMÉ Pro is released, he will probably spend more time flying around the world, but when it comes to planning the company's future, his feet are firmly planted on the ground.



Co-founders Alasdair Mort (CEO) and Anne Roberts (Director of Customer Development) with Ian Stephens (Chairman).

Building the team

Before the launch, a key part of the strategy is getting the right people on board, including Clinical Advisor Dr Tim Stevenson. Stevenson has over 30 years' experience in medicine and was previously Head of Health Services for Virgin Atlantic, as well as being an approved medical examiner for aviation and diving, and an approved doctor with the Maritime and Coastguard Agency (MCA). Co-founder and CEO Mort has a PhD in public health from the University of Aberdeen's Centre for Rural Health (Inverness), a Masters degree in Human and Applied Physiology from King's College London, and a BSc in Physiology and Sports Science from the University of Glasgow. He also has extensive industry experience, evaluating life-support technologies for air, land and sea, including aircrew protection, for QinetiQ (previously the MOD's Defence Evaluation Research Agency). Co-founder Anne Roberts, the Director of Customer Development, is a specialist in the application of new technologies for pre-hospital care settings, including emergency response, voluntary first aid and remote care. She has a BA (hons) in Psychology & Sociology from the University of Strathclyde and has honorary research status at the University of Aberdeen's Institute of Applied Health Sciences. Roberts has also held positions at the Centre for Rural Health, the University of Aberdeen's Digital Economy Hub, and worked in a research capacity for NHS Information Services Division and the Scottish Government. When you add to them the recent appointment of Chairman Ian Stephens, the CEO of

Biofilm, whose previous roles include senior positions with Optos, Touch Bionics and Mpathy Medical, the team has significant strength in the Med-Tech business – and great ambition.

Market opportunity

Mort is an inventive person who spotted a gap in the market and was curious why nobody else was developing a first-response solution. Working at the Centre for Rural Health, he could see the potential of the telehealth market, but he set his sights on something much more technologically advanced – and also more down to earth. “Ironically, although MIME Pro is designed to connect to ground services via WiFi, the beauty of the core software is that it ultimately does not rely on connectivity and operates as a standalone system.”

Early on in his career, Mort developed an interest in monitoring physiological functions at extremes, including altitude and depth as well as temperature, and this has served him well in the development of MIME, along with his personal interest in outdoor sports such as mountain biking and hill walking. His PhD combined these interests, exploring the potential for novel types of medical sensors to monitor casualties during search and rescue, when conditions can be so bad that the first responders have to make very rapid decisions about whether to deal with the medical needs on the spot or get the person out of there as soon as they can – the so-called “stay and play” or “bag and drag” options.



“Extremes like remoteness and rurality always interested me, and if you can develop a solution for extremes, it will work almost anywhere.”

You can monitor vital functions such as temperature and heart rate, simply by applying wireless sensors, much like sticking on a plaster, but with MIME Pro, these sensors connect to the software so that when you arrive at the hospital, doctors can instantly see how the patient is doing by viewing a clear, concise handover report. “The rescuers have to consider their own safety first as well as look after the patient,” says Mort, “but the ability to monitor and record medical data is not only crucial for patient outcomes but also because it allows first responders to adhere to governance and audit their actions, in case there’s a call for a later inquiry.”

The breakthrough came in 2010, when his PhD supervisor at the Centre for Rural Health won RCUK funding of £12 million to research and develop technology for rural areas, and MIME became the first project under the programme, with an emphasis on rural ‘Community First Responders.’

“Extremes like remoteness and rurality always interested me,” Mort explains, “and if you can develop a solution for extremes, it will work almost anywhere.”

During his research, seeing emergency conditions for himself, Mort saw the need to ask “all the hard questions,” and gradually his vision for a first-response solution for remote care began to evolve. The first prototype was developed in 2015, the year before the company spun out of the University of Aberdeen, then sales and marketing gathered momentum. “At first, we took a varied approach to customer discovery, which enabled us to determine exactly where the commercial opportunities would be,” says Mort. Initially, Mort sounded out various potential clients, including UK fire brigades and ambulance services, but the “blue-light” market can take a long time to reach a decision, and that made the company change its direction. In Mort’s opinion, the public and private sectors are also motivated very differently, and aviation has emerged as the primary target, “because it is a scalable and repeatable market.”

As the technology evolves, so does the marketing strategy: “The ethos is the same,” says Mort, “to support people with limited first-aid training, in difficult conditions. But the mindset has changed, and we’re now 100 per cent commercial.”

MIME Pro is innovative software which supports the provision of effective care in medical emergencies, in any location remote from professional medical assistance. It is designed to help the first responder at the scene with simple medical guidance, to ensure a consistent standard of care.

The technology integrates with Bluetooth® wireless sensors to monitor vital signs in real time, so cabin crew can not only manage the patient (e.g., react to early warning signs) but also capture, report and audit medical details during on-scene incidents – improving care and making patient handover easier and more efficient. The software also complies with Medical Device Directive (93/42/EEC) & EN62304.



The team at MIME knew it was important to develop “a high-quality product in terms of both its functionality and its aesthetics.”

Not for nothing

When Mort became an RSE Enterprise Fellow in October 2015, a short time after entering Converge Challenge (Scotland's largest entrepreneurial training programme and competition with prize funds of £150,000 per year), he quickly learned a marketing lesson he will never forget. “Early on, I was told not to undersell what we were doing,” he reveals. “So, we decided not to give it away, even though it was tempting to do a free trial with a client who'd give us free feedback and maybe go on to place orders.”

For Mort, the Fellowship was also an experience which opened his mind to the world beyond academia. “I wasn't interested in constantly publishing academic papers,” he says. “I enjoyed research but wanted to explore commercial impact and be at the front end – selling our vision.”

Mort says it took time to convert from academia to business, but he relished the challenge. He also says: “I don't like the word entrepreneur – for me, it's just business.” And for now, he is focused on building his company and starting to generate profits.

In addition to the RSE Enterprise Fellowship, MIME Technologies has benefited from the Highlands & Islands Enterprise (HIE) Pathfinder Accelerator Programme (2015), at that time supported by BioCity Group, as well as winning a total of £90,000 of funding from Scottish EDGE. “Until now, we've been well funded every step of the way,” Mort explains. “We've also had the benefit of having steady jobs as researchers, before going full-time at MIME.” Roberts was the first to go full-time at MIME, quickly followed by Mort, and even though he is the CEO, they are both equally committed to the business.



*“ I don’t like the word entrepreneur.
For me, it’s just business. ”*

First-round investment

As Mort and Roberts seek first-round investment, aiming to raise up to £500,000, the technical priority is to ensure that the software is completely market ready and meets all the regulatory requirements for aviation. The money raised will help to fund final product enhancements, including hiring new developers to supplement the technical team. Mort is keen to create new jobs in the Highlands, adding to the four employees already on board. “At first, we ran the operation lean but now we need a bigger team,” says Mort. “We also must be sure that we are capable of meeting growing customer demand.”

The groundwork has already been done, including the marketing strategy and new company branding, supported by Gregor McNeish of Tide Graphic Design Consultants, also based in Inverness. Chairman Ian Stevens quickly identified the market potential of MIME and knows it's important to deliver “a high-quality product in terms of both its functionality and its aesthetics,” drawing on his personal experience at Touch Bionics and Optos, and Mort is keen to learn from this experience.

Mort is full of new ideas, including future applications which would take advantage of the latest innovations in Artificial Intelligence and Augmented Reality. This would help address the major problem of reviewing or recording information at the same time as physically helping a patient – bridging the “large disconnect” between the medical equipment and the data. Another new project is a multi-patient version of the technology, which the team are exploring with help from a SMART Scotland feasibility award.

Looking forward, Mort would also like to help humanitarian organisations and “make a positive social impact,” but for now the focus will remain on aviation. And if MIME Technologies comes close to matching the meteoric success of Touch Bionics and Optos in the medical market, the sky is the limit for Mort and his team.

Upwardly mobile mobility products



She has survived the heat of Dragon's Den and is ready to conquer the world with her innovative cooling solution for wheelchairs, now being made in Dunfermline. Entrepreneur Corien Staels may already be turning her mind to the next generation of mobility and disability products, but first she means business – getting wheelAIR to market.

“One of the most important things I've learned since getting involved in the disability market,” says Corien Staels, the CEO of Staels Design, “is just how inaccessible so many things are, and just how easy it would be to make them more accessible – including homes and offices as well as simple everyday items like clothing.”

Such words suggest that Staels has many more bright ideas for products to come, but first she has to focus all her energies on sending the first wave of her innovative wheelchair solution to distributors around the world,

and winning market confidence. Her first product breakthrough is wheelAIR, a cooling backrest cushion which makes life much more comfortable for wheelchair users by regulating body temperature. For Staels this also means that customers have greater control and can “live life on their own terms,” staying cooler for longer.

One of the biggest challenges for disabled people, says Staels, is inclusion, and wheelAIR is a perfect example of a product which can make a critical difference in everyday life if you spend most of your time in a wheelchair. Most people can sit in an armchair for hours without any problem, but if you're in a wheelchair, “sometimes certain neurological conditions or spinal cord injuries mean that you can easily get over-heated and/or start sweating a lot – or not at all,” she explains. Another nasty side-effect of heatstroke is nausea, but the over-riding complaint is what Staels calls “frustration with a lack of solutions.”



“Michael Kerr:
When I first learnt
about the benefits
it could have for a
huge number of
chair users and
especially for those
with spinal cord
injuries, I just had
to get involved.”

If you're competing in the Paralympics, over-heating could even mean the difference between winning and losing a medal. Michael Kerr, the former captain of the GB wheelchair rugby team, who recently became a brand ambassador for wheelAIR, confirms this: "When I first learnt about the benefits it could have for a huge number of chair users, and especially for those with spinal cord injuries, I just had to get involved."

The battery-powered wheelAIR has in-built fan technology with four different settings, not just to cool the user's back but also to reduce the body's "core temperature" by taking away excess heat and moisture – increasing comfort and reducing the risk of hyperthermia. By using high-quality fabrics and foam for the cushion, it also offers extra support.

Staels first came up with the idea while at college in the Netherlands, writing a research paper on "the development of a cooling wheelchair cover and T-shirt to cool down the body temperature of wheelchair sports competitors with a spinal cord injury, in particular handbike athletes."

At that time, no-one talked about developing the concept and starting a business to market the product, but when she came to the University of Glasgow to do her MSc in International Business and Entrepreneurship in 2015, the idea quickly gathered momentum and Staels Design was founded the following year, inspired by the mission to "meet unmet needs in the market." She also had the drive to be an

entrepreneur, and her studies in Glasgow confirmed this and sharpened her skills.

Before she came to Scotland, Staels had done a lot of research, interviewing wheelchair users, Paralympic athletes and retailers. "I threw myself into the disability community," she says. And because her thesis supervisor at the Amsterdam Fashion Institute was a wheelchair user, she also had plenty of expert advice close to hand.

So where did the original idea come from and what drove her on? In a recent interview, Staels explained her motivation: "I'd heard so many stories about wheelchair users cooling themselves down with water hoses and sprays, and disabled athletes wearing ice vests. I thought it was ridiculous that people with a disability still have to use such methods, so having thought of a solution, I thought I needed to bring this to market."

While in the Netherlands, Staels built a basic prototype from off-the-shelf components, but development took off in earnest in Glasgow, including sourcing better foam and fabrics and improving the fan and the power supply. Staels knew a lot about textiles but not about injection moulding, complex electronics, foam or rubber, so she had to learn as she progressed, but her experience in fashion management meant she was used to working with creative designers. "The electronics was the most difficult aspect," she says, but thanks to engineering ingenuity, wheelAIR now features four levels of airflow to meet special needs.

*Appearing on the BBC TV show *Dragons' Den* in 2017 gave Stael's mass-market exposure – but in the end she turned down the offer from Peter Jones and Deborah Meaden.*



As the product took shape, Stael's used a focus group to gather user feedback and fine-tune the design, making it lighter in weight and more power-efficient. Her initial operational expenses were covered by Enterprise Campus (an organisation funded by the Scottish Funding Council which helped postgraduates from Scottish universities to set up and grow their own business, and "realise their entrepreneurial potential"), and more awards soon followed, including £10,000 from Scottish EDGE which allowed Stael's to hire a design team. This was soon followed by a further £100,000 from Scottish EDGE and £31,000 from Converge Challenge, which enabled Stael's to move into production, plus £100,000 from private investors which helped her to expand her team and take her product to market.

Dragons' Den

Appearing on the BBC TV show *Dragons' Den* in 2017 gave Stael's mass-market exposure, but in the end she turned down the offer from Peter Jones and Deborah Meaden (£75,000 between them for 30% of the business, dropping to 20% once the Dragons got their money back) and went it alone, having raised enough cash (including the money from Scottish EDGE) since the TV show to start producing wheelAIR in Dunfermline. "At first I wasn't keen to appear on the show, but it would have been great to be mentored by Peter and Deborah."

During filming, Stael's had an experience she'll never forget. The pitch was going well when Peter Jones began interrogating Stael's about her numbers, and she suddenly

started to feel very faint – she had not eaten anything all day before her appearance and the heat of the studio lights pushed her over the edge. The next thing she knew, Stael's was in a wheelchair, being cooled down thanks to wheelAIR, but eating lots of biscuits helped her back onto her feet to complete her otherwise "pitch-perfect" presentation – and find herself having to choose different offers from four of the Dragons before she eventually opted for Meaden and Jones.

"The BBC crew must have been seeing gold when they wheeled me out of the Den, eating a banana," wrote Stael's in a blog, but her embarrassment was worth it in the end when the show made her famous – and won nationwide recognition for wheelAIR.

The only negative discussion in the Den was to do with the pricing, says Stael's. At £650 per unit, the retail price may seem quite high for "a cushion," but this needs to be put into perspective. Some basic backrest cushions cost £200, while similar products for wheelchairs are priced significantly higher than wheelAIR, without the same degree of functionality (the only design of its type with four levels of airflow) or quality materials, including replaceable parts. Add to this the margins of retailers and distributors, and £650 may start to look like a bargain if it does what the company claims – improving people's posture, taking away heat and moisture, speeding up rehabilitation and preventing heatstroke. "It would be nice to sell the product for a few pounds," says Stael's, "but we could not sustain that."



“
Now we are one step closer to achieving our aim of being the centre of expertise in cooling and heating solutions for the mobility industry.”

Highlights so far

So how is Staels enjoying the experience? “It’s been a roller-coaster of emotions,” she says.

On the plus side, she loves learning and doing so many different things at the same time – it stops her getting bored. She also loves to see ideas becoming a reality, including all the steps involved in building her business: “It’s been super-exciting to set up the company, but the highest high is seeing people using the product – that’s a great outcome. Running a business isn’t about money for me – it is about the thrill of being able to change people’s lives for the better.”

Staels always had ambitions to start her own business, but since she ticked that box, she’s also started learning “what they didn’t teach me at university,” and her experience as an RSE Enterprise Fellow provided her with in-depth business training as well as mentoring and one year’s salary, from October 2016 to September last year. “I think that you can learn to be an entrepreneur but you have to be born with the passion and drive,” she says. “You also have to be resilient and willing to work 24/7.”

What next?

Staels is now busy building her team and setting up an international distributor network. “We are ready to take the market by storm, both nationally and internationally,” Staels recently wrote on her website. “Now we are one step closer to achieving our aim of being the centre of expertise in cooling and heating solutions for the mobility industry.”

Manufacturing is now going full-steam ahead, and doing this in Dunfermline means Staels has much greater control and can deal with issues faster because she is closer at hand.

Today, the main priority is sales, but Staels also has her eyes set on the future and bringing new products to market, retaining the focus on heating and cooling. Exploring new markets will also require more attention.

More challenges ahead

Staels enjoys the challenge of the disability market and has worked with a wide range of organisations as well as wheelchair users to develop her current design, and this experience has opened her eyes to other possibilities in the disability market beyond wheelchair comfort. For example, she points out that wheelchair users often require different zippers and buttons, and clothes which hang unlike most regular off-the-peg items. Speciality fashion is part of the answer, but instead of having separate outlets, Staels believes these different styles of clothing should be in mainstream shops to make the retail experience much more inclusive – just as disabled athletes now compete in the Commonwealth Games just like everyone else.

This inclusive approach is reflected in wheelAIR – Staels identified a problem and discovered a new way to solve it by asking: “Why not?” Why shouldn’t wheelchair users feel more comfortable? Why shouldn’t society be more inclusive?

“I want to create more awareness of issues like this,” says Staels, “and designing more inclusive solutions like wheelAIR is part of that process. There are so many things to improve.”

Next up in the Staels Design portfolio is a range of related new products for heating and cooling. But because she also has a background in the fashion industry and has started to research the disability market in much greater depth, who knows what may be next?



Acquisition can be good for you

The word “acquisition” conjures up images of the latest great hope being hoovered up by a ruthless and predatory international competitor, depriving the Scottish economy of the spoils from the (always guaranteed) Next Big Thing.

Inward acquisitions (where an indigenous business is acquired from outside Scotland) are often assumed to lead to closure, a transfer of higher-value functions out of Scotland, asset stripping, a ‘branch plant economy’ and a loss of economic activity, signifying a lack of ambition.

But is this borne out by the evidence? The answer, based on the latest analysis run by Scottish Enterprise, suggests not.

In Scotland, acquisition is a strategy used by higher and faster-growth companies, particularly younger ones, to realise their growth ambitions; it is used to secure investment and ensure access to markets, clients and customers at a pace that many companies simply are not able to achieve on their own. It is not something that simply happens to Scottish companies, and occurs in every economy, often at a higher rate elsewhere. It is

a challenging and high-risk approach, with many pitfalls, but one that can and has proven successful.

Whatever the outcome, acquisition enriches those entrepreneurs who take the risk and put the time in to grow a company. Our research found that ambition amongst many Scottish companies is high. We also found that many companies use acquisition to vault to the next level and achieve wider economic benefits, with the impact on staff and leaving a legacy high on their wish-list.

In 2015, we tried to ‘follow the money’ post-acquisition. We ended up following the individuals who exited following an acquisition, and found that their impact, knowledge and experience, skills and investment are spread more widely than when working in only one company. It is rare they simply stop being economically active, and the challenge comes in trying to help these individuals find the companies in Scotland which can benefit from their expertise and advice, as well as investment, since we also found that money follows talent – a clue perhaps for future policy initiatives. An acquisition also provides a return on investment for investors.

“The research presents a strong case for widening the understanding amongst companies, entrepreneurs and stakeholders of the role and benefits of acquisition.”

So, the evidence challenges the assumption that acquisition limits economic growth in Scotland.

Firstly, only a very small group of companies acquire and/or get acquired, and Scotland sees less overall activity than many similar-sized European nations. Other nations and regions of the UK see more inward acquisitions yet have a greater number of growth companies, which suggests that the issue for Scotland is not about the level of acquisition but the number of companies able, willing and ready to consider it as an avenue.

This is not to say there are no examples where companies have been acquired and there has been no benefit to the economy. This is unquestionably true, but Scotland has the best rate of those inward-acquired companies remaining active and remaining based in Scotland, demonstrating the positive impact of policy initiatives to anchor companies here. This ensures more benefits from an acquisition remain in Scotland than elsewhere – challenging the idea of a vulnerability specific to Scotland.

The acquisitions data (corroborated by other evidence developed by Scottish Enterprise) suggests that the challenge for Scotland relates to growth rather than acquisitions. This may in part explain the concern over acquisition. When the pool of growth companies is small, a lower number of acquisitions can cause a greater level of anxiety than if the pool was larger.

Indeed, this nervousness may be a consequence of the ‘gap’ between the rate of being acquired and making acquisitions being greatest in Scotland, not because of a high inward rate (which is mid-ranking) but because of the low acquiring rate.

Therefore, the question is whether to focus on increasing the number of growth companies or on limiting the number of acquisitions. Limiting acquisition (regardless of how this could be implemented) may lead to less access to skilled individuals as well as to less investment for new, emerging companies to tap into – including companies which may have the potential to be the next Skyscanner.

Limiting acquisition would also create a cycle which further limits entrepreneurial and business growth, leading to a deterioration in Scotland’s reputation as a place where high-quality, dynamic businesses emerge, grow and thrive. One notable comment put to me during an interview was: “If no one wants to buy any companies here, we’ve got a huge problem.”

Perhaps the most realistic approach is, therefore, to focus on stimulating more growth companies. In that regard, the focus of the new Strategic Board on scale-ups is most welcome and one of the ways – currently under-utilised – in which more Scottish companies could achieve and sustain growth is, when appropriate, through acquisition. Given a greater percentage of acquisition activity (but not total numbers) in Scotland involves young companies, consideration could be paid to supporting more established companies which perhaps have plateaued after an initial growth episode.

The research presents a strong case for widening the understanding amongst companies, entrepreneurs and stakeholders of the role and benefits of acquisition. It highlights the fact that there are some strong fundamentals on which to build but, perhaps most importantly, challenges the idea that acquisition is a thorn in the side of Scotland realising its ambitions for sustainable, inclusive growth.

A copy of the report is available online at www.evaluationsonline.org.uk

Dr Paul Hopkins,
Scottish Enterprise Economic Research Team

In tune with music market



Most music teachers recognise that all of us have musical potential and should start learning when we are young – ideally between three and six years of age when our hearing develops most quickly. It's also widely recognised that learning should be fun, and Michael Tougher, CEO of Soundbops, has come up with a clever technological solution that could create the next generation of Mozarts, Madonnas and Mobys...

As an inventor and designer, what gives Michael Tougher the most satisfaction is seeing his ideas becoming real products, and this year his innovative educational music technology will go into production after three years of development – ready to capture a share of a fast-growing market (STEAM (Science, Technology, Engineering, Arts & Maths) toys) worth an estimated \$30 billion by 2019. As an “engineering entrepreneur,” what also gets Tougher excited is the fact his working prototype has already established a fan base of 400 paying customers in ten

different countries and generated pre-orders worth over £50,000, suggesting that Soundbops has global potential even before it is officially launched.

The interest so far goes beyond a healthy-looking order book, according to Tougher. In fact, he says, his early adopters not only provide him with valuable technical feedback but also send him ideas and samples of music which he's able to include in educational materials. “Together, all this validates our product and what we are doing,” says Tougher, “and gives us lots of confidence moving ahead.” Combined with the support of its crowdfunding partners, this also means that Soundbops has an international customer community to join it on its journey as it seeks to research and develop new products – “brand evangelists” who believe in the product and recommend it to others. “You can do lots of marketing surveys,” says Tougher, “but when people share credit-card details, you believe what they say.”



Michael Tougher

“Having seen young children struggle to play the keyboard, only hitting the white keys and playing one note at a time, it was great to see them engaging with my product and really learning to enjoy making music.”

Tougher is enjoying the challenge of building his business and speaks like an experienced entrepreneur, but it's only three years since he set up his company, straight after finishing college. After graduating with a first-class honours degree in product design engineering from the University of Glasgow, including courses in mechanical engineering at Glasgow as well as a design course at the Glasgow School of Art, Tougher could have gone on like some of his colleagues to work for a large multinational firm; but he had a different idea – an idea that grew into Soundbops.

The big idea

Tougher says he always knew he wanted to be an inventor, and his interest in music dates back to his childhood, learning guitar from his father. These interests came together in the early design of his musical toy, first conceived while still at university, an experience which Tougher says provided him with “a fantastic basis for learning how to transform an idea into a real prototype that works and can be used.”

After testing his idea, Tougher knew he was onto a winner: “Having seen young children struggle to play the keyboard, only hitting the white keys and playing one note at a time, it was great to see them engaging with my product and really learning to enjoy making music.”

Soundbops looks like many other colourful toys aimed at very young children, but it packs a lot of power and intelligence. In simple terms, it consists of a plastic

control panel (in effect the blank page for the musical score or notation) where children place small colour-coded buttons, marked A, B, C, D and E, etc., to represent all the basic musical notes, enabling them to compose their own music without traditional instruments.

The key to its success is flexibility – it doesn't have fixed keys, like a traditional keyboard. When you press a button in any location, it plays the note displayed by the letter, and if you stack the buttons, you can also play chords (A Minor, E Major, etc.). By arranging the buttons in a particular sequence, you therefore create your own tune, and can experiment with different combinations simply by changing or rearranging the buttons.

Most people have what's known as “muscle memory” when they play music, but Soundbops means that children learn the building blocks of music right from the very beginning. “Notes are the foundation of music,” Tougher says on his website. “Having a thorough understanding is key to playing any instrument, and with Soundbops your kids gain a comprehensive understanding without even noticing it.”

According to surveys, 96% of parents want their kids to learn music, but very young children can struggle with keyboards, for example, and may be discouraged because they don't experience instant results. Soundbops is designed to address all these issues, so lack of dexterity is not an issue and the children have fun from the start.



According to surveys, 96% of parents want their kids to learn music

“Most parents tell me their children love music,” says Tougher, “but the worry is that this initial interest will evaporate. Not everyone can be a virtuoso, but we can all enjoy music, whether it’s playing an instrument or simply listening, and that is where Soundbops can help – not just with creativity but also concentration.”

The challenge

Connectivity to tablet computers and existing music apps such as GarageBand is also an integral part of the design, making it easy for users to connect and collaborate via the Internet – so they can form an online orchestra or pop group. Tougher also plans to create special apps and develop new products for older children, making sure the new designs provide continuity with the original Soundbops, including the same colour coding.

In terms of the technology, the biggest challenge was stacking the notes to make chords. Tougher knew the buttons had to be reliable but also affordable, and this has taken up a lot of Tougher’s time during the initial design stage, when trial and error also made a major contribution. “It’s important to keep prices down at the same time as making the product robust,” he explains, “especially when we are talking to schools, who want products to last.” Another major challenge is design for manufacturing, and Tougher has called on the talents of other designers to help him on that score.

“My priority right now is building the brand,” says Tougher. The only real competitors are apps, he believes, but they do not provide the same degree of interaction or learning value, while conventional keyboards also have their limitations.

For the time being, Soundbops will focus on products for very young children, but Tougher also has ideas for mass-market products in future, including electronic products aimed at older age groups, building on the success of his existing technology. Other possibilities include the creation of cartoon characters linked to the brand.

Seeking investment

Even though production started in summer 2018, Soundbops is still at an early stage in its development and Tougher is actively seeking investors, including recent crowdfunding initiatives via Kickstarter. In the first round of investment, Tougher aims to raise about £300,000 by the end of the year which, added to the £50,000 already in the bank, will help him build his team and develop new products. “It will be a big step to become an employer,” says Tougher. “At the moment, my job involves a lot of plate-spinning, so I need help with lots of things like social media, to strengthen our relationship with early adopters, so I can focus more on getting the product to market and building the brand, as well as speaking to investors.”



The brightly coloured building blocks of Soundbops have been described as “the Lego equivalent of music.”

“It’s a very exciting, exponentially growing market, and we’re ready to capture a large market share.”

It may be early days in the company’s history, but Tougher also has his eyes on future expansion. “In the educational/musical market, acquisitions are common,” says Tougher, “and if we meet our revenue targets of £10–15 million by the end of Year Five, our investors would see very healthy returns. It’s a very exciting, exponentially growing market, and we’re ready to capture a large market share.”

Recognition

Now a member of the Royal Academy of Engineering’s Enterprise Hub, Tougher has a solid background in engineering and has sharpened his business skills since university, thanks to a series of mentors. Various jobs as an intern, working with names such as Hasbro, Bayer, Sony, Loewe, Asus, Intel and Sonos, as well as retail experience with Channel Assist and John Lewis, have also helped him learn about the importance of branding and customer service.

Tougher has also won a string of awards, both as a student and as CEO of Soundbops. For example, he was named the “brightest young engineering entrepreneur”

last year in the Royal Academy of Engineering’s Launchpad Competition, and has also won the Young Edge Award, the William Ross Prize, the Deutsche Bank Creative Enterprise Award for Design, the Hammermen Award, the PDE Trust Award for Excellence and Innovation and the James Dyson Foundation Award. He also came first in the Design Innovation Plastics Competition in 2014 and won the SIE Young Innovators Challenge, and was a finalist in the Young Innovators Challenge in 2015. He was also the first person from Glasgow School of Art to become an RSE Enterprise Fellow in 2016. This year, he is also a finalist in Scottish EDGE, competing for a top prize of £100,000.

Tougher himself describes the brightly coloured building blocks of Soundbops as “the Lego equivalent of music,” and if he comes even close to the achievements of the Danish toy industry giant, he will be a major player in one of the world’s most competitive markets. “A lot of people want to be part of the journey,” says Tougher, “and our ambition is to be a global brand.”



Sound investment pays off for Krotos

When he was a sound engineer, Orfeas Boteas got frustrated with the poor choice of software for creating special sound effects, including animal voices, so he decided to develop a solution of his own. His first product, called Dehumaniser, quickly got the entertainment industry talking, and now his company has branched out into other sound solutions for consumers and professionals in countries all over the world, backed by some of Scotland's best-known investors...

One night after coming home late from the office, Orfeas Boteas sits down to watch the latest episode of *Game of Thrones*, and as the programme starts, he notices that one of his company's audio tools has been used to create one of the sound effects – making Viserion the Ice Dragon come to life on the screen in the season finale.

For Boteas, the CEO of Edinburgh-based Krotos, it is not unusual to notice his sound-effects software in use without knowing about it until he himself sees the final result – whether it's a popular TV show, a blockbuster movie or a computer game. The simple fact is that his software is now being so widely used in the entertainment industry, he has lost count of the number of times it is called into action. In the science-fiction horror series *Stranger Things 2*, for example, Emmy-award-winning sound wizards Brad North and Craig Henighan have used Dehumaniser for their weird creations, Pollywogs and Demodogs. Other recent hit productions that have used the Krotos software include *The Avengers*, *Jungle Book* and *Sleepy Hollow*, as well as games including *Doom* and *Far Cry 4*.

“Nowadays, whenever you hear a scary monster voice in a film or a computer game, there’s a good chance that Dehumaniser software has been used to create it.”

Nowadays, whenever you hear a scary monster voice in a film or a computer game, there’s a good chance that Dehumaniser software has been used to create it. And last year, as Krotos continued to make lots of noise in the industry, making sales to major studios including Warner Brothers and Disney, it secured a six-figure investment from “one of the most influential figures in gaming,” the award-winning video game producer and designer, Leslie Benzies, in a major deal co-funded by Old College Capital, the venture investment arm of the University of Edinburgh, where Boteas recently studied.

As part of the deal, Benzies (former President of games creator Rockstar North) joined the board at Krotos, which already included Matthew Smith (the former Audio Director of Rockstar North), IT entrepreneur Ian Ritchie and “financial expert” Colin Grant. “Orfeas understands the potential of bringing technology and creativity together, and his vision for the future of audio tools resonated with me. I look forward to working with such a talented and driven team,” said Benzies, one of the team who created the best-selling computer game, *Grand Theft Auto*.

According to Boteas, this latest investment “enabled the company to double its headcount and accelerate development of its professional audio software.” And this explosion of interest comes only a few years since Boteas first came to Scotland, never thinking for a moment that his future was to set up a software development business and make waves in the entertainment industry in countries all over the world...

Legendary origins

Born in Athens, Orfeas Boteas is lucky to have one of the most “classical” names in the audio industry – his first name is the modern form of Orpheus, the legendary figure who could charm all living things with his music. While still at school, the young man loved to mess around with music and computers, so it made sense to go on to study Music Technology and Acoustics at the Technological Educational Institute of Crete in 2004.

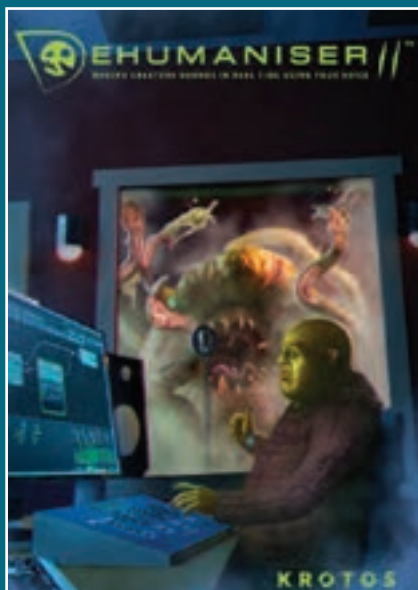
After a spell as a sound engineer, doing post-production for TV shows, commercials and documentaries in Greece, Boteas moved to Scotland to do an MSc in sound design at the University of Edinburgh (UoE), followed by an “internship” as part of the Santander Breakthrough Programme, including business funding and support. From 2013 to 2014, he was an RSE Enterprise Fellow, learning more about business as he set up his company, Krotos, in September 2013. Boteas has also received funding from the Higgs EDGE Award and Scottish Enterprise's SMART: Scotland Award.

As well as being interested in sound design and music, Boteas had tried a lot of different digital solutions to create special sonic effects, using his own voice and various plug-ins, and thought he could develop something better – for example, to simulate animal voices. In the past, this kind of special effect was usually created during post-production, but he wanted to do it in real time and make it technically simpler.

Boteas began developing Dehumaniser in 2012 as part of his MSc project, and after lots of hard work, he released the software free to download on the Internet, supported by a website to showcase his portfolio, including a demo of the prototype product in action. Like many other software developers trying to market the fruits of their labour, he gave it away, but as so often happens, this built awareness – and created demand.

So many individual sound designers and established companies downloaded this early version and provided such positive feedback that Boteas was able to develop a professional version, and add new features, with some help from Nick Konstantakopoulos, a programmer friend based in Greece. One of Boteas's business advisors at UoE, Paul Devlin, then suggested asking users for donations, and Boteas began to make some money from his product, which he used to fund work on an upgrade.

Soon afterwards, a big production studio bought the professional version, and several industry veterans started sending him suggestions – some of them with 25 years of experience working in special effects. And as the software evolved, Boteas was able to monetise the product and gradually expand his staff, recruiting a high-level programming team to improve the original standalone solution, including plug-in versions.



Krotos sound-design software

Dehumaniser: Sound-design software that makes it possible to produce imaginary voices (e.g., robots and monsters) in real-time, “dramatically speeding up a process that previously took up to eight hours to complete,” by transforming your voice using preset special effects – including state of health and age, etc. Priced from about £35-£335 per desktop.

Weaponiser: An “all-in-one” solution for real-time weapon sound design, including a library of hundreds of professionally recorded weapons.

Reformer: Enables artists to perform pre-made sound libraries using any audio input and “sculpt effects in real-time.” Reformer Pro enables real-time sound creation using your own sounds.

During his time as an RSE Enterprise Fellow, Boteas discovered he was feeling the same growing pains as most other people enrolled in the programme, but unlike most of them, he was already earning money from his business, and very quickly had a team of ten developers to manage, plus a sales and marketing department and a board of non-executive directors to deal with. But when investors started knocking on his door, Boteas was not concerned about losing control: “The investors do not micro-manage,” he says. “They also understand the industry and see its potential.”

Legendary future?

Boteas has overseen the company’s organic growth, and sees his strength as knowing what the industry wants. He loves technology and also understands how his own business works, because he’s been involved in every aspect of operations, including sales and marketing, building the website and basic development work. “I am passionate about the company and passionate about innovation,” he says, “and I want to make everyone else involved share that excitement.”

Boteas’s long-term ambition is to be an innovator in the audio industry, which he sees as having enormous potential, in terms of total revenues and innovation. And to be successful, he believes the company has to continue to grow – it has already changed his life but there is much more to come. Dealing with the biggest games studios in the world, and seeing his products used in major productions such as *Jungle Book* and *Game of Thrones*, has been an exciting experience for Boteas. Sometimes, it has been a roller-coaster of emotions, but he relishes the challenge of managing people and solving problems, whether they are technical or commercial.

Apart from building a successful business, what pleases Boteas most is the joy of observing his product enabling performers and artists to express themselves by capturing emotion – improving how they work with sound and getting results without all the “boring stuff” getting in the way of creativity. “Dehumaniser started as a niche product,” he explains, “but we have steadily expanded our portfolio, including Weaponiser and Reformer, adding multi-layered textures to music and special effects, to broaden the spectrum of sound.”

Boteas has thought about establishing an office in Greece, but the United States is where the action is at the moment and where it would be logical to make his next move. In terms of new technology, the sky is the limit for Krotos, as more and more new media take centre stage, including Virtual Reality, Augmented Reality and Mixed Reality, while other new developments emerge from the latest advances in Artificial Intelligence (AI), including the ability to compose “original” music. But no matter how clever these learning machines may become in the future, there will always be a place for human beings, says Boteas – even a solution like Dehumaniser needs people to make it perform.

“Krotos is an exciting new company with potential to grow rapidly and deliver real economic impact in Edinburgh. This deal highlights the potential of student-led enterprise and it is great that the University, through Old College Capital, is able to take a stake in the company and share in its future success.” ANDREA YOUNG, FUND MANAGER OF OLD COLLEGE CAPITAL



If you can't beat the system...

At first glance, interior décor may not have much in common with an online solution for handling anti-money-laundering compliance, but Callum Murray may never have set up his award-winning software business without the problems he experienced in dealing with the civil justice system when his first business got into trouble...

For every small company, fighting for business is tough, but if like Callum Murray you have practiced Thai boxing since secondary school, you know how to take a few punches – and bounce back after a knock-down.

Three years ago, Murray (now chief executive of Edinburgh-based Amicus Resolution) was convinced that his company had a new product that would transform how individuals and small companies engaged with civil disputes – an automated online tool to help predict the outcome of legal disputes, so cases could be settled without necessarily going to court. Developed

by Murray and a few of his friends with support from The Data Lab (one of Scotland's innovation centres), the clever software analysed case histories and court information so everyone involved could make informed decisions over how to proceed – potentially saving significant money, time and court expenses.

The problem, says Murray, is that when he presented the software to law firms, they told him they liked it but said they had other more pressing concerns, and asked him if he could develop a system for checking their clients to make sure they complied with the new regulations related to identity fraud and money laundering – something that would save more time and money than anything else.

Instead of throwing in the towel when their software didn't catch on as expected, Murray and his team began developing exactly what the legal eagles told him they wanted, and Amicus ID was born.

Compliance solution

Amicus ID is an online, encrypted solution which provides secure compliance checks for clients and staff within regulated companies such as law firms, independent financial advisors, accountants and estate agents – all of whom are now exposed to greater risk and penalties if they fail to meet their legal obligations.

The software runs on any smart device and makes it simple to capture and analyse information in real time within a few minutes, including details such as identity documentation, business ownership and shareholdings, as well as flagging adverse media content. The software trawls data from 130 countries, including banks and government records, and also makes it easy to keep files updated. The checks can be done based on general information including name and date of birth, address and telephone number, as well as photographs and documents such as utility bills. It can be scaled to any size of company and is constantly updated in line with the latest regulatory changes such as data privacy standards.

The benefits for regulated professionals are obvious, but the software also makes it easier for everyone to undergo the checks required when seeking advice – in line with the company's mission "to make civil justice available for everyone," based on Murray's personal experience both as a litigant and a business owner.



Callum Murray

Adventure

This was not the first time that Murray had learned from a setback in business, or tried something new. He has always had a sense of adventure, and took a year off from his studies at the University of Stirling to travel the world, working for a cruise line in Europe, handling customs and immigration paperwork, driving across the US and spending three months in rural Thailand, training six days a week at a Muay Thai Boxing camp, a combat sport he'd first been exposed to at school in Bo'ness. After graduating in 2007 with an honours degree in Business and Entrepreneurship, he started working in the construction industry and, after spotting a gap in the market, he set up Fresh Interior Solutions, a refurbishment and finishing trades service for high-end residential and commercial clients. With help from the Prince's Trust, he was able to expand the operation, building a team of ten people over the first eighteen months, but when the financial crash started to bite, the company encountered cash flow issues and Murray had to lay off his employees – despite being owed £50,000 for work already completed – when his bank pulled the plug on his overdraft facility. After a spell working six days a week with only one apprentice to help him, Murray sold his order book to one of his competitors for 10% of value, frustrated that attempts to claim his money back from debtors had hit a brick wall.

After dealing with several claims via law firms, Murray realised that he was not the only small business to suffer in this way. "If it had happened to me," he explains, "there must have been thousands of others." He also saw that there were other ways to settle disputes without going to court, including mediation.

Even when there was a court judgement in somebody's favour, payment did not necessarily follow. The whole process was slow, complex and hard to navigate. "One million legal cases in the UK go unresolved every year," it says on the Amicus website. In addition, one in three people can't find or afford legal expertise when they need it, and four out of five small businesses can't afford legal help.

“We were already making good progress, but all of us still had a lot more to learn, and these awards were vital to the company’s growth.”

Mediation

Having used mediation himself and seen the all-round benefits of settling claims without litigation, Murray enrolled at the Chartered Institute for Arbitration to learn how it worked, and became a mediator. He then set up his own consultancy – Murray & Duncan – and became the co-chair of the Young Mediators' Group in 2013. He also volunteered for the Citizens' Advice Bureau as an in-court advisor in Edinburgh Sheriff Court. “I understood the pain points,” he explains, including simple issues such as defendants not appearing when summoned to court for procedural hearings.

Mediation isn't always the answer, however. “People should be able to make informed decisions and the advice from a trusted legal advisor can of course be vital, but there’s no silver bullet,” says Murray. “Awareness around the effectiveness of mediation is increasing but there’s a way to go before it’s broadly in use across the UK.”

Game-changing product

Murray still believed that mediation was a good approach to settling disputes, but started to think that there must be a better solution – a game-changing product. “If you can't beat the system, then change it,” was how Murray saw it. And that was when he started building his software development team, “one friend after another,” to build a solution to take the pain out of disputes. Murray knew the civil justice process from both sides of the fence, and had spotted a gap in the market, so he paired up with experts in other fields to fill that space. His first co-founder was an experienced product designer who had been an early employee of Freeagent, an Edinburgh-based software success story which last year floated on AIM and more recently was acquired by RBS group. In turn, he introduced a server-side systems architect, who had experience in both government and banking security teams. This architect then introduced a friend who had experience in engineering volume software products. After adding more friends of friends, including a front-end designer and a long-standing chartered accountant, the team was ready for business. A shareholding structure was put in place for the team, including an agreement that external investment would be sought in due course to accelerate growth. The team may not have been financial experts, but their mission was clear: Let's get a product to market and start to earn money.

In the meantime, Murray was accepted into the RSE Enterprise Fellowship programme, and the company won additional support from Scottish Enterprise, Business Gateway and Scottish EDGE, which helped get the software from concept to product. “We were already making good progress,” says Murray, “but all of us still had a lot more to learn, and these awards were vital to the company’s growth.”

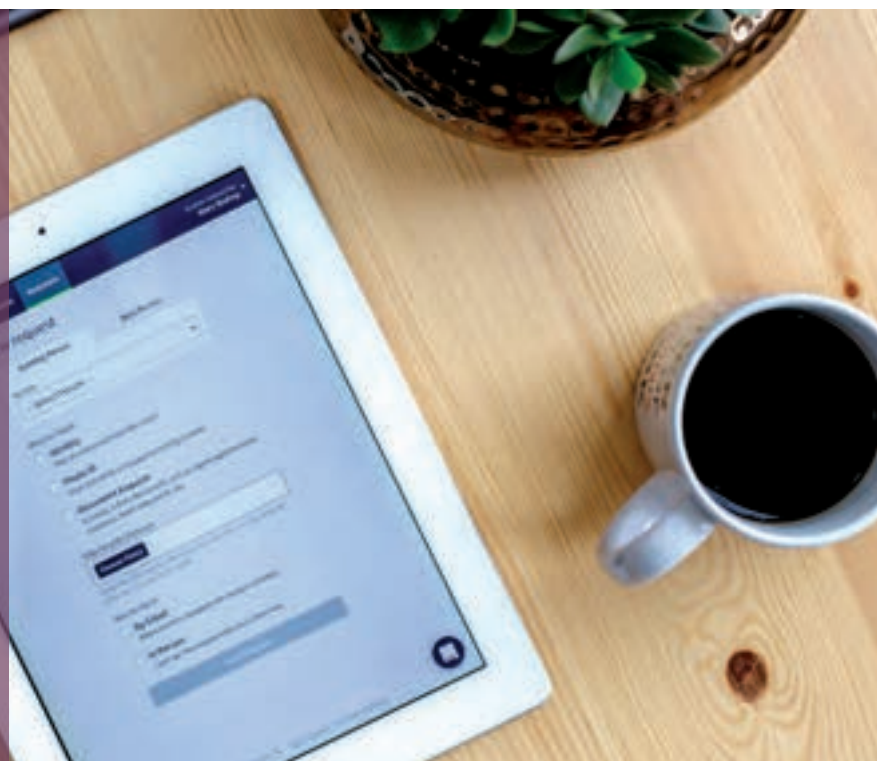
Murray was surprised when he sat down in front of a “jury” of 12 people to apply for the RSE Enterprise Fellowship programme in 2016. While most other applicants came from “deep academia” and primarily wanted to learn how to manage a business, Murray already had some business knowledge and had different targets in mind. He also thought that his idea – an online system to assess the chance of legal success – was not the kind of ground-breaking, “high-tech” solution that the RSE wanted to fund. When the programme started, however, Murray and the other young entrepreneurs learned from each other, as well as being taught the ropes in other business areas, including sales and marketing, fundraising and IP strategy, travelling all over the UK as part of the programme. “Perhaps the major benefit was the value of the peer-support network,” says Murray, “sharing our experience, despite the fact we come from different industry sectors.”

False start?

Back in the office, Amicus got on with building its prototype product, developing a special algorithm to analyse cases. And everything was going well until Murray proudly presented the software to the legal profession and discovered a much bigger gap in the market – compliance.

It must have been a difficult decision, but Murray and his colleagues parked their wider ambitions “to focus on the compliance and initial engagement challenges faced by regulated professionals.” Their compliance solution, Amicus ID, is already generating revenue, doubling sales from month to month and winning market and investor confidence. And, staying true to their mission, Murray and his team still have plans to further develop their original dispute resolution platform, which they refer to as “Big Amicus,” once Amicus ID meets its initial targets, allowing further investment into additional products.

Through the EDGE Pledge, Amiquis has committed to donate 1% of any exit gain to give other start-ups the same opportunities it has enjoyed from public funds. The company is also part of The FutureX Mettā Network, an international community of entrepreneurial change makers and pioneers which aims to “build a better world through business.”



Winning investment

Initially, to get the business off the ground, Murray raised £75,000 from people he knew, then increased this to £450,000, by leveraging what he had from private investors to win public funding, without diluting equity. “We raised our profile, then we quietly approached the investors who fitted our values,” says Murray. “The outcome matters more than the investment.”

Since then, several well-known investors have engaged with Amiquis, including Sir Sandy Crombie, the former Chief Executive of Standard Life. Crombie chairs the Board and is also “preparing the ground for an eventual float on the Alternative Investment Market (AIM).” Other investors include San Francisco-based Fifth Era Capital (who will support a planned expansion into the US), Kevan McDonald, Chris Van Der Kyle, Paddy Burns, Gavin Dutch and several other high-net-worth angel investors.

“When Sir Sandy joined, it raised a few eyebrows,” says Murray, “but his presence helped initial introductions and stimulated interest. Once clients sign up, they like what they see.” Murray also recalls how Crombie asked about the capital requirements going forward, including rent for office space. When Murray mentioned a figure of £150 per month, Crombie asked if this was per square foot, but Murray quickly told him it was actually per desk. “For Sandy, Amiquis compared to Standard Life means there aren’t quite so many zeros involved,” says Murray.

So far, the company has raised a total of £450,000 through investment, but even though this helps, the aim is to start making profits as soon as it possibly can. “Because

we are already generating revenue, investors want to get involved,” says Murray, “but drawing on experience and expertise is just as important as money – there are lots of people out there who want to invest, but we have chosen people who add value in other ways.”

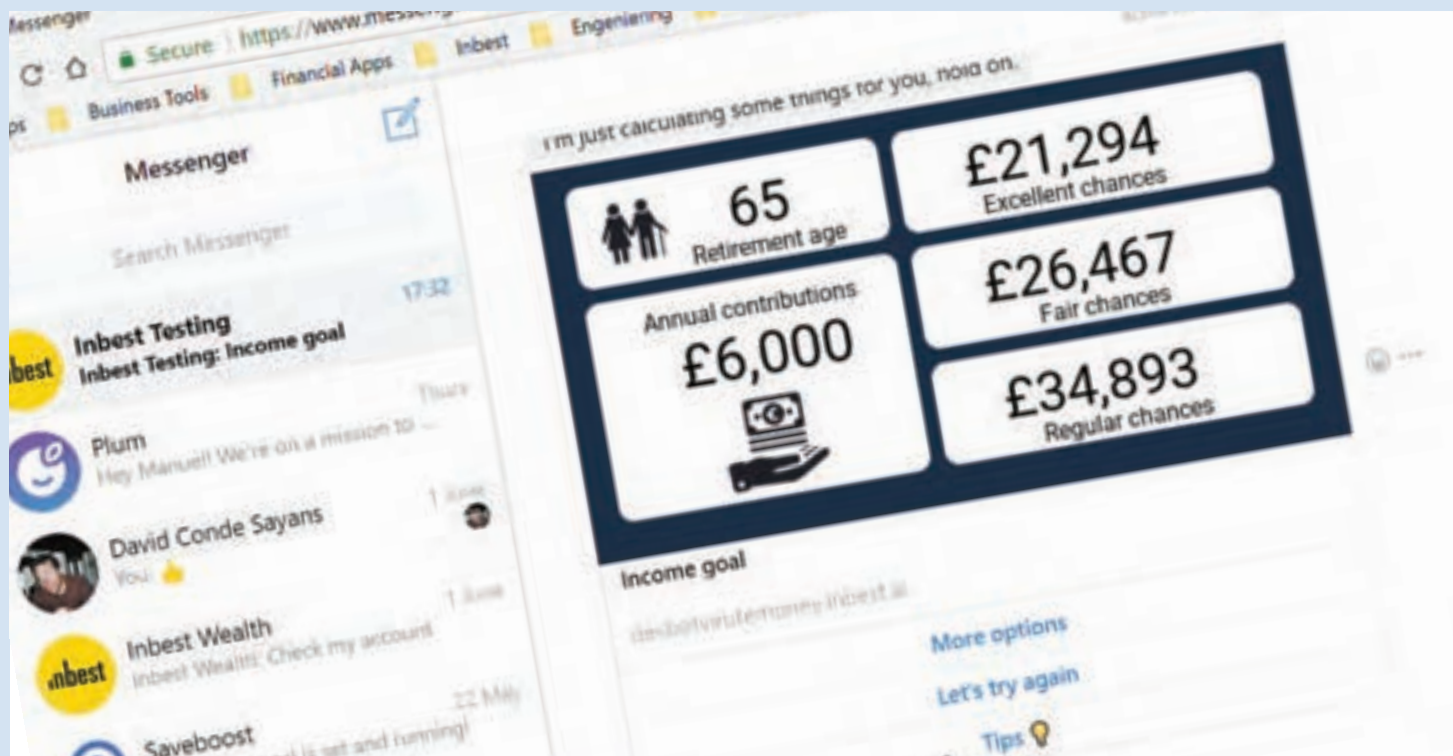
Gathering momentum

Within a very short time, Amiquis has taken its product from beta testing to market, doubled head count and gone through two rounds of investment. “We’ve kept our promises,” says Murray, “by validating not just the technology but also the team. The software has to be robust and more more than 99.5% uptime plus 100% client retention speaks for itself.”

Since its release, Amiquis ID has spread into new market sectors, first gaining trust with legal firms then moving on to real estate, recruitment and finance, winning business from regulated professionals across the UK. Customers pay based on usage, and this ensures a steady flow of revenues. Access to the product is based on a recurring monthly agreement, so customers are not tied to the software for lengthy periods, like some rival products, and this, combined with greater functionality, has made it possible to win a lot of business from competitors, says Murray.

“In the long term,” says Murray, “we’re building multiple products to provide open access to legal expertise and information for small companies and individuals.”

The company now employs 22 people and has offices in Edinburgh, Cambridge and London, but the overriding aim is sustainable growth – global domination can wait.



More personal financial planning

Open Banking will transform financial planning, allowing consumers to access their own banking data so they can understand the state of their current finances and manage their money all the way into retirement. Manu Peleteiro, CEO of Inbest, has developed a digital platform which enables financial advisors to automate the complicated, time-consuming business of gathering and analysing all of this financial data – saving everyone money and making his business a promising prospect for future investors...

When someone says they have developed a new kind of platform to automate a complicated process in business, the first reaction often is that this will put machines in charge and make human beings redundant. But Manu Peleteiro has a radical solution for financial planning which automates the “boring bits” and could make financial advisors more human, allowing them to focus on the personal long-term requirements of clients, while the “robots” crunch the numbers.

According to Peleteiro, it can take three to five hours to aggregate and analyse an individual’s “big” financial data, and this makes it much more expensive to offer advice to a client with relatively limited assets. With wealthier clients, the data may be bigger and more complex, but the value add will also be significantly greater. Because it cuts the costs for everyone by automating all the time-consuming processes, Peleteiro describes his solution as the “democratisation” of financial management, using a digital platform called Inbest.ai which takes advantage of the latest advances in data analytics “to provide a holistic, personal and realistic financial planning service.”

Peleteiro also thinks the benefits of Inbest.ai are a win-win situation for consumers and professionals: “Inbest helps customers feel confident about their financial decisions and helps their financial advisors build stronger customer relationships by focusing on the emotional aspects of financial planning, at the same time as delivering a premium service.” Intelligent technology will always be important in providing financial advice, but psychology and social science also play a major role, along with professional training – in other words, we still need human beings on the job.

What is Inbest.ai?

Inbest is a data analytics platform designed to “democratise” access to financial management by automating the financial planning process – gathering and analysing customer data so financial advisors can provide “more personal and realistic financial advice.”

The platform offers solutions for each stage of the customer lifecycle, including savings, retirement planning and pensions, plus an API for financial service providers to build their own custom solutions and workflows. It aggregates banking, investment and pension accounts, then categorises the data and analyses the financial status quo, keeping in mind lifestyle and investment goals, including the affordability of financial products.

There are three different modules, packaged for professionals and enterprise users, focusing on:

- **financial situation**
- **financial planning**
- **tax planning**



Time off for Manu Peleteiro (centre).

Open Banking

Apart from its intelligent technology, the key to the success of Peleteiro's new product is the recent change in banking regulations which gives consumers access to their own financial data – what is called Open Banking. This “disruptive” regulation also allows you to give your financial advisor or service provider permission to access your data – as long as they are regulated by the relevant government organisation, which in the UK is the FCA (Financial Conduct Authority) and meet the relevant security requirements. Unrestricted access to all your “big data” makes it easier to understand your situation better and help you reach your long-term goals in tune with your personal needs and desires, including attitude to risk. “Open banking will be a major force improving financial health,” says Peleteiro, who also believes it's important to deliver the financial data in a simple, friendly and jargon-free format. Similarly, giving permission to access your personal data will also have an impact on the future of healthcare, enabling anonymised medical records to be used in research.

In simple terms, if you use Internet banking, you can provide a link to any trusted organisation, so they can look at all your transactions and balances, pension funds and investments, etc. This makes your financial situation transparent to any advisor, making it easier to manage and plan your finances, based on your actual behaviour and real facts and figures – rather than what you declare. For example, you may be repaying a loan, saving for a holiday or buying a pension. When you fill in a form, you may forget these individual transactions, but Inbest misses none of this detail, so outside advisors can see the whole picture.

“Scotland is a centre of excellence in Open Banking, and we want to export that excellence to other countries in Europe.”

“Our experience with Open Banking gives the UK and Scotland the edge,” Peleteiro believes. “We are probably two years ahead of the rest of the world, and our financial culture and regulatory framework are also big advantages – especially the emphasis on defending the rights of consumers.”

Inbest aims to build on this strategic advantage: “Scotland is a centre of excellence in Open Banking,” Peleteiro explains, “and we want to export that excellence to other countries in Europe.”

The road to Scotland

Peleteiro came to Scotland in 2012 when he was offered a job in Edinburgh by Moody's Analytics, a New York-based consultancy which provides economic research, focusing on risk, performance and financial modelling. Among his clients then were RBS and Scottish Widows, and when he decided to “emancipate” himself from the world of employment and start his own business, they hired him as a consultant. Peleteiro also studied at the Institute and Faculty of Actuaries in Edinburgh from 2013 to 2015.

Prior to this, Peleteiro was a quant analyst at Accenture, based in Madrid, and an equity analyst for BPI, based in Spain and Portugal, after gaining a BSc in economics and finance, followed by an MSc in financial mathematics, at the Esade Business School in Barcelona, where he studied from 2003 to 2008.

Inbest was founded in 2014, with a mission to develop a digital platform to help consumers understand their own finances so they could make better financial decisions. Right from the beginning, Peleteiro also wanted to collaborate with academic researchers interested in data analytics and user interface design.

Two years later, Interface (a networking organisation which connects academic researchers with business), introduced Peleteiro to Edinburgh Napier University, who helped him apply for an RSE Enterprise Fellowship, so he could focus on developing his business while receiving one year's salary plus mentorship and monthly training. Working with Dr Roberto Rossi, Director of Post Graduate Programmes at the University of Edinburgh Business School, and his colleague, Dr Raffaella Calabrese, Peleteiro also studied models which incorporate socio-economic indicators to analyse people's financial wellbeing, then later won funding from The Data Lab to look in greater depth at banking data, to develop a system to offer financial advice, including taking account of people's “rainy day” savings and spending, automatically able to adapt to changes in market or user conditions. Another project studied the anonymised data of 200,000 customers, seeking to extract any relevant trends – the kind of work which large employers could do for their staff. Inbest has also won support from Scottish Enterprise and Scottish Development International, who recognise the company's export potential and value what it offers to researchers.

Collaboration is a cornerstone of Peleteiro's business philosophy: “I am delighted to collaborate with world-class academics in behavioural finance, financial mathematics and machine learning to alleviate a problem faced by consumers all over the world. We need to collaborate to develop content, product and services that make personal finances simpler and more accessible.”

Millions of people in the UK have problems with debt, and many of them say that they are too ashamed to ask for any help. According to a recent survey, one in three middle-class adults say they would need to borrow money to pay an unexpected £500 bill, while half of British workers can't afford to retire.

“From buying our first car or home to saving for retirement, the financial decisions we make play a major role in shaping our lives. Yet the majority of people still find it difficult to access the right knowledge to help them make the best choices, which in too many cases can lead to debt and poor financial wellbeing. Working in partnership with Inbest, we hope to change this, by finding a new way to help people find the right advice about how to manage their money. We’re especially pleased to be working with a company which focuses not only on finance but people.”

DR RAFFAELLA CALABRESE (ASSOCIATE PROFESSOR AT THE UNIVERSITY OF EDINBURGH BUSINESS SCHOOL), WHO HAS WORKED WITH MANU PELETEIRO ON RESEARCH INTO MEASURING PEOPLE'S FINANCIAL WELLBEING.

Raising investment

Peleteiro aims to raise investment for Inbest by the end of the year to fund his expansion in Edinburgh, London and Madrid – strengthening his sales team and hiring more developers in Scotland and Spain. His current team consists of two developers and a data scientist, based in Edinburgh, and a sales director based in Madrid, and salaries account for the majority of costs – especially in Scotland where there's fierce competition for talent.

Investment will be welcome, but is not yet a priority for Peleteiro. “First, we have to ship the product,” he explains, “and demonstrate its value. We are currently working with two major banks, and this will be key to our future success.”

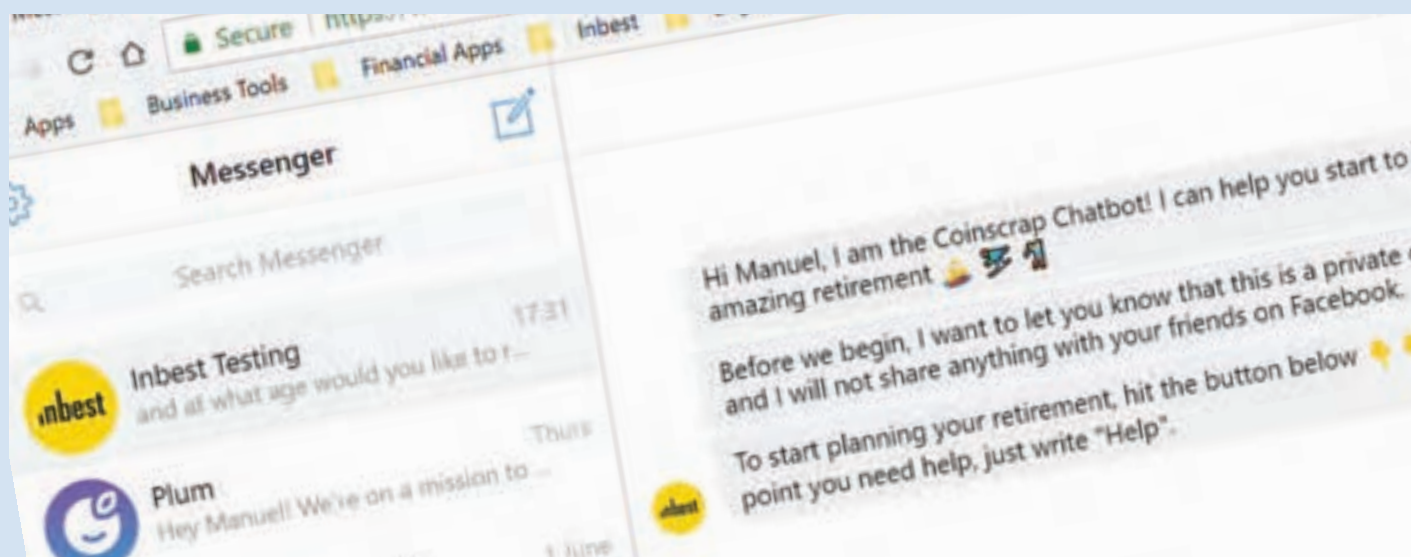
Banks do not tend to make decisions very quickly when it comes to implementing new technology. Inbest has to join the “product queue” with many other companies and win support from many different stakeholders before any project can even begin. But Peleteiro is confident both projects will deliver on schedule, and that the product will scale. Then investors will hopefully follow...

Lessons

So what has Peleteiro learned since setting up his business? “I’ve learned a lot about myself,” he answers, “including the fact I can be very stubborn.” Apart from putting in long hours, he's also learned he needs to be more flexible with working arrangements, dividing his time between Scotland and Spain, and anticipates this will continue to be the case over the next few years.

As well as learning how to run a business, Peleteiro also thinks that everyone needs to be taught more about money matters, starting in primary school, through adolescence, early adulthood, midlife and onto retirement – talking more openly and ending the “taboo” about personal finance. “Schools, universities, companies and local communities should also encourage financial education,” he adds.

Peleteiro has described himself as “a Fintech entrepreneur on a mission to democratise access to wealth management;” but for now, he is focused on proving the value of Inbest and looking after clients in the UK and Spain, so Inbest can become the go-to company for financial planning technology – and attract investment – by delivering concrete results.






Innovation versus the pirates

Piracy costs the shipping industry \$2.6 billion per annum – and the losses are increasing every year. Add to this the cost of other incidents at sea, including damaged cargo, stowaways and crew overboard, and you have a major problem which, in turn, presents a major opportunity for Edinburgh-based ARX Maritime – a company which offers security services for international shipping, including everything from innovative anti-pirate barriers to risk assessment systems powered by Big Data and Artificial Intelligence...

In films and novels, pirates are often portrayed as romantic adventurers, but in the real world they are nasty, violent criminals who steal things and also destroy human lives. To stop them we need more than bullets, however, and ARX Maritime is developing a package of novel solutions which combines the best of physical and digital designs, including barriers and personal alarms as well as the latest Artificial Intelligence tools.

The company's Chief Operating Officer, Steve Regis, may not be your average entrepreneur, but when it comes to maritime security, he is someone you would want to have aboard – he has come face to face with the pirates himself and his company now protects over US\$10 billion of maritime assets for 500 clients. An ex-marine who served in Iraq and Afghanistan, Regis also worked as an armed guard on ships in the Indian Ocean. Most people would regard this as a highly dangerous job, but for Regis it was relatively easy compared to a war zone: “After nine years in the forces,” he explains, “I thought it was time to reduce my personal level of risk – I had used up a few of my nine lives already.”

In his new role on containerships and tankers, Regis focused on training the crew and advising how to “harden” the vessel, as well as providing protection. And as he sailed around the ocean with his finger on the trigger, scanning the horizon for pirates, Regis also analysed the “architecture” of the vessels he worked on and started to come up with some ideas of his own.



“The idea in my head was now coming aboard.”

A better solution?

Barbed wire or razor wire is one of the most basic standard defences recommended by maritime security consultants, but Regis questioned this because it seemed “completely ineffective.” Not only did it fail to stop determined pirates getting aboard but it soon began to crumble after being exposed to the weather and was hard to install. “Razor wire just doesn’t work,” says Regis, “so I started to think that there must be a better solution, and that’s when the idea for ARX ABaC was born.”

Back on dry land in 2014, Regis started doing research and refining his initial design – an innovative barrier system which “deflects ladders, grappling hooks and climbing poles to stop intruders boarding the vessel.” At this time, Regis had no experience of running a business or product design, but he did have a very clear vision of what was required and a trip to Hobbycraft (an arts and crafts supply shop) enabled him to bring his new idea to life. Armed with advice from Business Gateway, Regis then approached a number of design firms and showed them his sketches – and a balsa-wood model. Some designers didn’t seem to understand the concept but Cramasie (a product design and development company based in Edinburgh) “got it straight away” and the product began to take shape, funded by a private investor and matched public funding – £5,000 for a feasibility study and £37,500 for research and development.

Looking at his original sketches, Regis says the final product looks “remarkably similar” in terms of basic shape and features. Cramasie helped to visualise the final design and the next stage in the process was to research the materials needed to make sure the design would survive extreme conditions – including temperatures of minus 20 to 50 degrees centigrade. The design brief stipulated that the barrier had to be robust enough to withstand attack as well as the weather, but also light and easy to install, and with help from another Edinburgh-based company, naval architects QED Naval, who focus on renewables, a prototype was built and Regis started sounding out the market.

Before it went into production, however, Regis started testing the product – with a little help from climbers at Alien Rock, an indoor climbing centre based near his office in Leith. The climbers actually got over the prototype barrier with relative ease, so Regis asked them for advice. “A lot of nuances in the design came out of those discussions with the climbers,” he explains. Then Regis asked some friends of his, all of them former commandos, to “test it to destruction,” and the barrier was ready for production.



Steve Regis in action.

Sales drive begins

Research and development took roughly 18 months from sketch to final product, then the sales drive began. “We knew we needed early adopters,” says Regis, and the first client – BP – signed up in summer 2016. To clinch the deal, Regis drove to Rotterdam with two sample units in the back of his van and delivered them to BP’s chief security officer. “Our USP (unique selling point),” says Regis, “is that our solution is incredibly easy to install, so we just handed over the products and manual, and let them get on with the job.” The manual is “IKEA style,” with very simple graphics on a single A4 page, and BP’s team managed to follow instructions and install the first barrier in a couple of minutes.

With orders worth \$250,000 now in place, ARX needed more funding to start full production, and raised \$1 million, thanks to the support of Bermuda-based investors Entrepreneur Dreamlab, who “identify, invest in, nurture and grow outstanding businesses from the early inception stage of an idea to the mature stage of being prepared for international growth or an exit.” Other syndicates were keen to invest but the new backers also provided a chairman – Stephen Castree, the founder and director of Entrepreneur Dreamlab, who is also the director of a hedge fund with over \$20 billion in assets.

Pirate attacks on the increase

The number of pirate attacks in the first three months of 2018 was higher than it has been for over five years, according to the ICC International Maritime Bureau – a total of 66 around the world. “Not only does piracy seem to be rising,” says ARX Chief Operating Officer Steve Regis, “but the type of attack is also worsening, including 100 people held hostage – more than three times up on last year.”

The Gulf of Guinea is the hotspot for hostage takings, particularly vessels carrying gas and oil, and one explanation could be the release of a large number of Somali pirates from prison.

“The social and economic conditions that gave rise to the first wave of Somali piracy still remain the same,” adds Regis, “so this is an area that is likely to see an upsurge in pirate activity.”

Currently, however, Nigeria ranks Number One in the table, with the number of armed attacks steadily rising, and evidence of more sophisticated equipment used during attacks. Another trend is an increase in terrorist-related attacks.



Barbed wire is “completely ineffective,” says Regis.

The next big moment came when Regis watched 70 units craned onto a ship docked in Muscat. “The idea in my head was now coming aboard,” he recalls.

The final design is 700mm wide and 1,300mm tall, with an overhang of 700mm, and a typical installation would require about 100 barriers, fixed to the most vulnerable part of the ship (e.g. the sunken poop deck), at a cost of about \$150 per unit. According to Regis, the barriers should pay for themselves within about three years – unlike other measures such as razor wire which need constant replacement.

“Security is all about layers,” says Regis, “and what we offer is a more effective and sustainable alternative, with professional consultancy part of the service provided.”

More products in pipeline

With the anti-boarding barrier now well established, ARX is busy developing a number of other maritime security products, aimed at dealing with everything from stowaways and crew overboard to container security – all of which can cost a lot of money.

Stowaways can be a major drain on resources – about £35,000 per incident – and ARX is in the final stages of developing what it describes as “the first maritime movement alert and detection system on the market.”

Attached to mooring ropes, doorways, anchor chains and rudders, where the crew cannot always keep watch, the ARX Mlarm senses movement and alerts the crew, making it much harder for intruders to board.

Crew overboard is also a problem for shipping, and ARX is currently developing a new solution called ARX MOB (Man Overboard), a device worn by everyone on board the ship, with a distress beacon which activates as soon as it contacts the water then tracks the position of the person overboard, making rescue easier and faster. ARX TempTrack is another new product in the pipeline, designed to monitor refrigerated containers to make sure the cargo is not getting spoiled. And as part of its offer to clients, ARX is also part of the Octopus network, which provides armed protection to vessels.

Intelligent systems

As well as developing physical barriers, alarms and detection systems, ARX takes advantage of the latest advances in Artificial Intelligence (AI) to power its maritime intelligence system, including maps which highlight risks in real time and reports which use the latest Big Data techniques to filter news of incidents at sea and forecast future risks so clients can avoid the high-risk areas.

ARX Maritime in brief:

- More than 500 clients
- US\$10 billion of assets protected
- 32,488 products delivered



Marketed by ARX in partnership with Sicyon, OpenBridge “identifies, manages and mitigates risks by recommending best management practices and how best to prepare for and navigate through high-risk areas,” based on geo-referenced data from a number of sources, including insurers and banks as well as “military-grade intelligence” first developed for NATO.

The OpenBridge service is provided free of charge to subscribers and ARX also offers bespoke reports based on individual customer requirements, including size and speed of vessel.

Human versus machine?

As a decision-making tool, AI will increasingly take over some operations at sea, threatening some people’s jobs, but human experience will always be needed. In a recent blog, the CEO of ARX, Josh Hutchinson (another ex-marine who has been with the company right from the start), posed the question: “Will artificial intelligence one day take over from human intelligence?” AI is very good at gathering and processing data, he wrote, and will help to reduce costs and improve efficiency in many critical tasks, but it is “a great assistant and nothing more – our ability to use it is not advanced enough to overtake the skill of human intelligence and judgement.” For example, he added, computers may be good at detecting mechanical problems but are not so good at fixing things such as engines. And ARX exemplifies this dual approach to maritime issues – combining human know-how and intelligent technology.

Business ecosystem

The company has also taken full advantage of the business ecosystem in Scotland: “Scotland is a hot-bed of entrepreneurship, and we’ve been blown away by the level of support here,” says Regis. ARX is also part of a recent initiative launched by the RSE this year called “Unlocking Ambition,” which plans to invest £4 million in up to 20 “high-potential entrepreneurs with innovative projects.”

Meanwhile, ARX is gearing up for future expansion, and seeking new investment – up to \$15 million to scale up production and develop its portfolio of products. Sales this year will be about £3 million for barriers, says Regis, with annual growth expected to be about 30%. ARX will use a different model for sales of its various products, including subscription, and will gradually phase in new products, with ARX Mlarm available next year and ARX MOB on sale the following year. And as this innovation continues to gather momentum, the pirates do not stand a chance.



Innovators need to think global

Some may say that one of Scotland's best exports is talent. Others talk about the innovations we have produced through the years. And wherever you travel, you will probably meet someone who has been educated at one of Scotland's leading higher education institutions.

But instead of looking back at our historical achievements and patting ourselves on the back, let's focus on the new generation of entrepreneurs.

The scientists, technologists and business leaders featured in this issue of *Science Scotland* are not just talented and innovative people, but entrepreneurs seeking to transform their expertise into global businesses.

The new generation also seek to follow in the footsteps of previous entrepreneurs by facing up to many of the challenging issues affecting modern society. For this, they need patience, perseverance and vision, but they also need to be creative and risk-tolerant, adaptable and confident. Today they also need to be more collaborative than ever before.

Entrepreneurs also need expertise in their domain, but as Steve Blank recently discussed in his *Berkley Blog*¹, being a domain expert doesn't make you competent in commerce – he observes it's rare for the smartest technical innovators to also be the most successful entrepreneurs.

¹ Steve Blank Berkley Blog – *Innovators and Entrepreneurs: What's the difference?* <http://bit.ly/2A23jBZ>

“ *The overlap between an innovator and an entrepreneur is the ability to develop an idea which creates change.* ”

Whether you are making a breakthrough in science or developing a new technological gizmo, the overlap between an Innovator and an entrepreneur is the ability to develop an idea which creates change.

What distinguishes the most successful entrepreneurs is that they can take a great idea, service, process, product or invention and turn it into a successful business opportunity.

The new economy

In *Wealth of Nations*, published in 1776, Adam Smith proposed that wealth should be measured by its total production and commerce. Today we have entered a new economic era where commerce is shaped by technologies. It is also an era which the analysts McKinsey & Company describe as “distributive” – where different rules apply.

Increasingly, the engine of our economy is transforming from a people-driven economy towards a domain that’s influenced through digital technologies – most notably, Artificial Intelligence, Machine Learning, Natural Language Processing, Blockchain, the Internet of Things and Industry 4.0.

Investment in these shiny new technologies increases productivity – the linchpin of economic growth which leads to improved living standards.

With Scotland’s digital technology sector forecast² to grow twice as fast as the Scottish economy overall in the years to 2024, our newest Scottish technology businesses are building some of the best design teams in the world, designing great products as well as innovating transformative services for the global digital economies.

Although some industries are receiving the “tech treatment,” most organisations are having to deliver more, with less. As a result, many private and public organisations are taking an “agile” approach to developing their business, an approach which PA Consulting³ emphasises can help organisations be responsive to change, allowing them to pivot their focus on priorities and value.

Solving some of the greatest client challenges in financial services is one of the key challenges for the Edinburgh-based business, Float. Tapping into the power of cloud technologies, the Float team designed their cash-flow forecasting platform to be accessible to small business owners, helping them to optimise their productivity.

Identifying new market opportunities is one of Scotland’s best characteristics, especially when you look at the recent growth of Scotland’s space industry. Driven by a global industry with an ambition to produce reusable rockets and reach towards manned missions to Mars, Morgan Stanley⁴ predict revenues generated by the global space industry will increase to US\$1.1 trillion or more by 2040, up from \$350 billion today.

Nestled alongside established Glasgow-based satellite and data development businesses such as Clyde Space and Spire, the emergence of pocketcube developer Alba Orbital and satellite data services business Bird.i has helped Scotland’s Space industry account⁵ for 18% of all jobs in the UK Space industry, which is now the largest sector amongst Scotland’s rapidly growing Aerospace, Defence and Space Industry, adding an estimated annual turnover of £2.5 billion⁶ to the Scottish economy.

² BBC: Digital technology ‘is Scotland’s fast-growing sector’ – <http://bbc.in/2oXezKo>

³ PA Consulting: Experience Agile – Agile Transformation and Delivery – <http://bit.ly/2Dfq3fg>

⁴ Morgan Stanley: Space – Investing in the Final Frontier – <http://mgstn.ly/2B0vyNG>

⁵ BBC: Scottish space industry soaring high – <http://bbc.in/2qqHwLO>

⁶ ADS: Scotland’s space sector ^e <http://bit.ly/2kKJep2>



Alisdair Gunn

Central to the transformation of global industries is data – the “electricity of growth” – which is redefining service design. Ever since Google was founded 20 years ago, data has dominated service design. With businesses developing new services and society becoming increasingly dependent on data, new risks have emerged which threaten the integrity of data – e.g., cyber threats.⁷

Having just completed its first year in business, Wallet.Services recognised the burst of innovation around securing data and discovered the transformative security qualities of distributed ledger technologies such as Blockchain. In response, the team created a platform called Siccar, a solution which applies blockchain, allowing citizens, businesses and government to share information securely. Built in close collaboration with the Scottish Government, Siccar has the potential to create paperless, digital-first public services, an area which McKinsey⁸ recognises can protect trusted records and interactions with citizens.

With PWC reporting global entertainment and media revenues to hit \$2.4 trillion in 2022⁹, creating new experiences which transport a customer to a never-before-seen world is something that Glasgow-based Axis Animation aims to produce through its bold, hyper-real cinematic stories. The team have created some highly original content and have already secured an impressive showreel of global clients, including the BBC, Universal, Activision and Microsoft.

Like many people living and working in Scotland, I celebrate what we achieved in the past, but what is happening right now is even more exciting. The global economy is rapidly changing. Technology and markets are rapidly changing. And the new generation of start-ups in Scotland is not just responding, but driving the changes, using Scotland as a platform for their global ambitions.

Alisdair Gunn is Director of Framewire,[®] an advisory practice which works with corporates, tech start-ups, government, universities and the public sector to deliver growth through service transformation, market engagement, international development, innovation, business strategy, partnering, digital technology and equity investment. Alisdair is also a board member of BIMA's Scotland Council, the British trade association driving innovation and excellence across the digital industries, providing independent expertise on service transformation and delivery of growth. He is also a strategic advisor to tech businesses Amicus and Very Connect as well as tech accelerator Seed Haus.

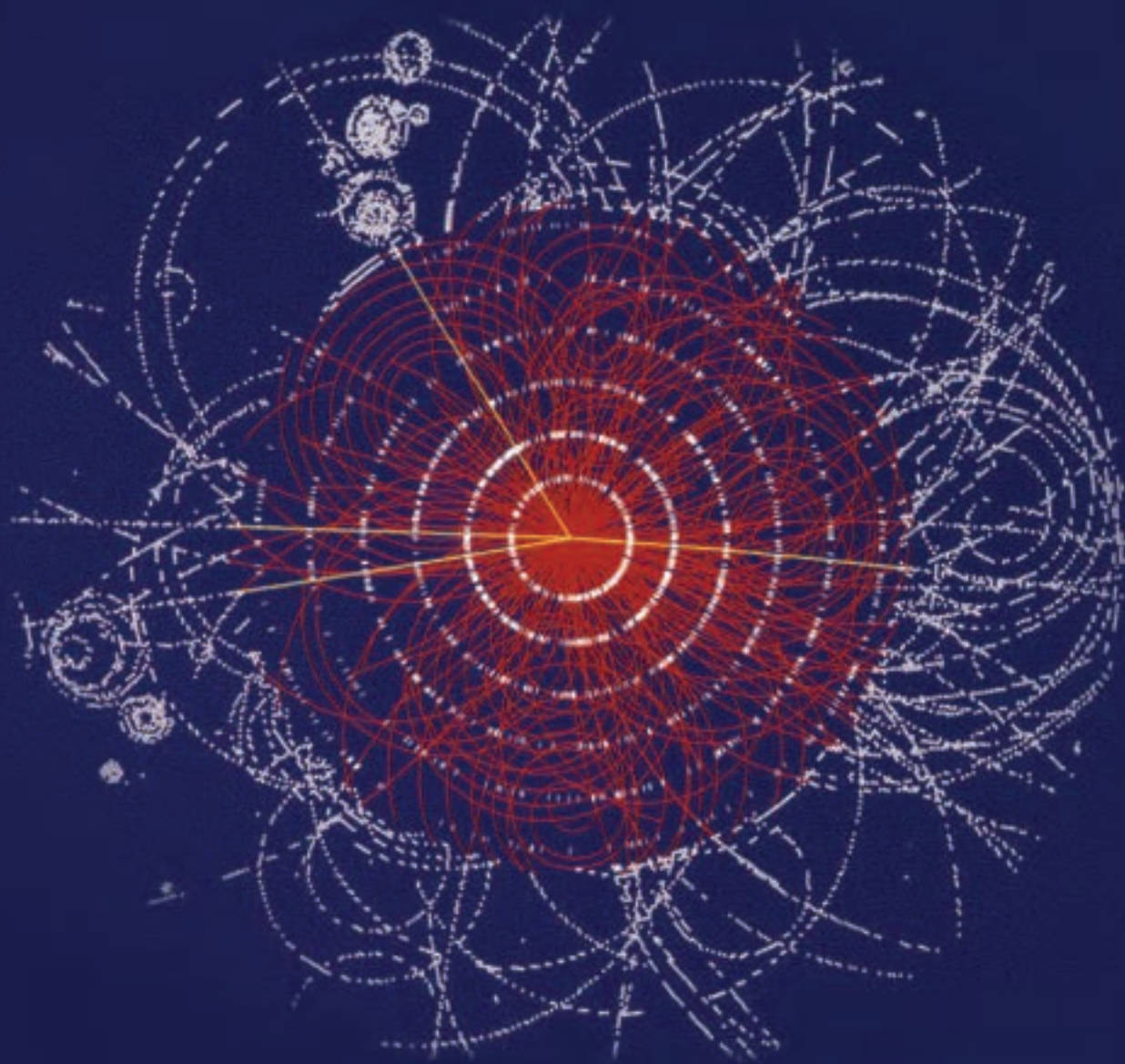
Email: alisdair@framewire.co

Web: www.framewire.co

⁷ PWC: The Global State of Information Security Survey 2018 – <https://pwc.to/2yYuK9W>

⁸ McKinsey: Using Blockchain to improve data management in the public sector – <http://bit.ly/2BxYvBr>

⁹ P9PWC report: Global entertainment and media revenues to hit \$2.4tn in 2022 – <https://pwc.to/2NGeS3T>





www.sciencescotland.org

Science
SCOTLAND



Scottish Government
Riaghaltas na h-Alba
gov.scot



*The Royal Society
of Edinburgh*

KNOWLEDGE MADE USEFUL

Science Scotland – bringing you the best of Science and Technology from Scotland – is published by The Royal Society of Edinburgh, with support from:

The Scottish Government is responsible for most of the issues of day-to-day concern to the people of Scotland, including health, education, justice, rural affairs and transport.

The Royal Society of Edinburgh, Scotland's National Academy, was founded in 1783 and the Fellowship today includes some of the best intellectual talent in academia, the professions and business. The RSE facilitates public debate, research programmes, educational projects and strategy formulations. Its strength is its diversity and impartiality. The Society's unique multi-disciplinary approach enables it to draw from and link with a broad spectrum of expertise to enhance the understanding of globally-important issues. In fulfilling its Royal Charter for the 'advancement of learning and useful knowledge', the RSE seeks to contribute to the social, cultural and economic wellbeing of Scotland.

To view Science Scotland online, please go to:
www.sciencescotland.org

For more information, please contact:
sciencescotland@theRSE.org.uk