BRILLIANT BUILDINGS

EMPOWERING SCIENCE & TECHNOLOGY

Tomorrow's buildings

Willmott Dixon is at the forefront of creating the spaces and facilities that will enable the UK to excel as a world-leader in science and technology innovation.

Innovations in science and technology are driving our society forward. Willmott Dixon is helping to create the facilities to enable the next generation of ideas.

The world needs scientists to create sustainable energy sources, find cures that improve life chances and deliver care technology for our ageing population. The digital revolution is helping to tackle these challenges, yet the fact remains: humans are at the heart of any technological advance.

For ideas to thrive, people need the right space to work, think and communicate. Creating those spaces requires partnerships, knowledge, a broad range of experience and the ability to learn lessons so we keep improving.

The UK leads the world in many areas of science and research. Many projects we have worked on have helped achieve this: the Met Office's supercomputer in Exeter, completed in 2016, is a world leader for predicting weather patterns and events; the European Bioinformatics Institute in Cambridge shares its immense biological data freely with scientific communities around the world; and the Pears building in London will become home to the UCL Institute of Immunity and Transplantation to develop revolutionary treatments for leukaemia and diabetes.

When the government created UK Research and Innovation (UKRI) in 2018 to oversee the investment of some £6bn, it was an indication of how vital it believes the application and integration of research is to the country's success. In a post-Brexit economy, it will be more important than ever to create the environment for innovation and collaboration. That includes attracting and retaining the best people to our universities and our businesses, as well as developing relationships with the best institutions around the world and exporting technology and knowledge to those that need it.

In the following pages, we present ideas and learning to demonstrate how the UK can continue as a world leader in this dynamic sector.

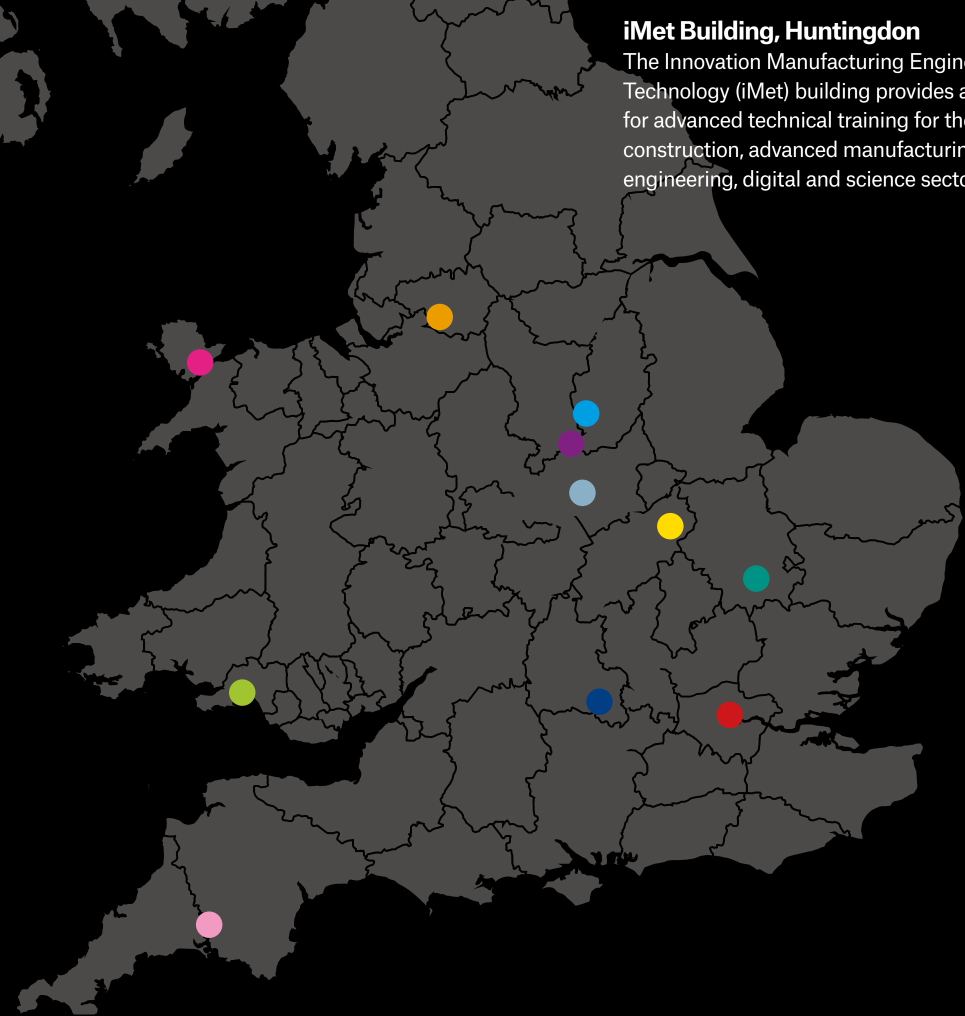
Rick Willmott, Group Chief Executive, Willmott Dixon

WILLMOTT DIXON
SINCE 1852

For further information on our range of science and technology projects please visit our website: **www.willmottdixon.co.uk**

Creating the spaces for next-generation ideas to thrive

Many projects we have worked on recently have helped the UK to lead in science and technology innovation internationally. Here are some of them.



BioCity Discovery, Nottingham
BioCity Discovery is one of Nottingham's most significant developments over the past decade, with a vision to support more than 700 new bioscience roles and act as a catalyst for life sciences employers in the region.

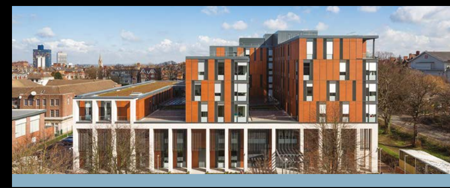
Menai Science Park, Wales
M-SParc is Wales' first dedicated science park. Operated by Bangor University, it provides facilities for tech firms to develop knowledge-based science, with an early focus on low-carbon energy, the environment and ICT.

Schuster Annexe, Manchester
We have extended the Schuster Building for the University of Manchester's School of Physics and Astronomy. This allows students and academics to collaborate better and improves the student experience.

Met Office Supercomputer, Exeter
We provided a home for one of the world's most powerful computers, 13 times more powerful than the previous system, performing more than 16,000 trillion calculations per second.

Computational Foundry, Swansea University
This world-class computational and mathematical sciences facility is a beacon for transformative research collaborations, attracting leading academics to Wales.

RAL Space Integration and Test Facility Centre, Harwell
The facility enables the development, assembly and testing of space-bound hardware, housing Europe's most sophisticated space design, production and research facilities.



George Davies Centre, University of Leicester
Focusing on patients rather than diseases or protocols, this is the UK's largest non-residential property to achieve the ultra-low energy consumption Passivhaus standard.

iMet Building, Huntingdon
The Innovation Manufacturing Engineering Technology (iMet) building provides a hub for advanced technical training for the construction, advanced manufacturing, engineering, digital and science sectors.

Department of Material Science and Metallurgy, University of Cambridge
We accommodated a broad range of research fields to deliver enhanced materials performance while addressing sustainability and scarcity of resources.

Pears Building, UCL, Islington, London
The Royal Free Charity is working with us to build a world-leading research centre that co-locates NHS care and university research.

STEM Building, University of Derby
This building enhances real-world learning, and is designed to meet specific engineering and computing-studies needs; for example an accessible roof for teaching sustainable engineering and technology communications.

1. Preparing for tomorrow's world

According to the World Economic Forum, 65 percent of today's children will be doing jobs that haven't been invented yet. How then do governments, universities and companies plan for the next two decades? The answer is creating collaborative environments in which micro-businesses flourish, entrepreneurs develop ideas, and individuals, public research facilities and the private sector create tomorrow's economy.

Delivering science outcomes that have a societal benefit requires investment. Historically, the focus has been on the 'golden triangle' between London, Oxford and Cambridge to produce the best graduates and R&D collaboration. Now other cities are catching up, pushing to create their own clusters of excellence.

One example is Nottingham, where the city council took the bold step of investing in the speculative BioCity Discovery building because it recognised the economic importance of retaining bioscience businesses in the city.

This paid off when Sygnature Discovery took a large proportion of the building to create an innovation and incubation centre.

Universities are a common factor in many Willmott Dixon projects, whether they are situated on a university campus, a research facility shared between academia and industry or part of a university town. The battle for talent is fierce, with buildings and the behaviours they foster an increasing factor when it comes to attracting the best people and funding.

Manchester is another city aiming to be a centre for world science. "We are developing people for a different kind of society. We are trying to make them more entrepreneurial," says Professor Stephen Watts, head of the School of Physics and Astronomy at Manchester University, who led the extension to the Schuster Building that Willmott Dixon built. "Our buildings prepare students for the outside world, while attracting the funding and people to invent and develop tomorrow's technology."

Below: Making Nottingham a centre for bio-tech companies; BioCity Discovery Building. **Opposite:** M-SParc, Wales' first science park.

Nottingham's Discovery Building
Key facts

A beacon for the biosciences sector in Nottingham.

Illuminated sculpture reflects the activity of the sun, communicated by NASA satellites.

Created space for Nottingham-born Sygnature Discovery, which has grown from four people to 180 in 14 years with a turnover of £13m.

Sygnature works on drugs at the very earliest stages, aiming to cure diseases such as Alzeimer's and Parkinson's, and collaborating with companies around the world.

"WHEN WE DESIGN SPACES, WE SHOULD ALWAYS REMEMBER THEY WILL BE POPULATED BY HUMANS, NOT ROBOTS"
PROFESSOR STEPHEN WATTS, UNIVERSITY OF MANCHESTER

M-SParc in Anglesey
Key facts

Wales' first science and technology park, the project is already ahead of its occupancy targets.

Innovative use of Corian cladding creates a 'wow' factor.

Communal space, the Battery, is open to everyone to encourage community involvement and collaboration.

Tenants' activities include developing software for automation, prosthetics for children, apps and high-precision manufacturing.

2. Sharing accelerates the learning

Laboratories are just one factor of R&D. Truly understanding diverse user needs and creating spaces for interaction and collaboration is regarded as vital.

"When we design spaces, we should always remember they will be populated by humans, not robots," says Professor Stephen Watts, who led the extension to the Schuster Building.

One outcome of extending Manchester University's Schuster Annex is that it has changed student behaviour: they work together more often in their own study time. The crux of this is the ground-floor 'Ideas Mill', a flexible, multi-purpose space with large tables for students to congregate, study and collaborate.

The space has even attracted students from outside the faculty, which Professor Watts welcomes – though some of his colleagues discouraged it at first. Inter-disciplinary collaboration has been identified as increasing innovation in the future.

Shared areas are a common theme for other science and technology buildings, too. Users at Nottingham's Discovery Building enjoy free yoga classes and regular talks provided by landlord BioCity.

"It's nice to bring everybody together as a working community," says Sygnature Discovery's facilities manager Tracey Allford. "It works really well."

Creating the science 'wow' factor for wider engagement

At M-SParc in Anglesey, Wales' first science park, a break-out and café area called The Battery attracts people from inside and outside the building. M-SParc managing director Pryderi ap Rhisiart says: "The idea is people collaborate, hold impromptu meetings and discussions and become virtual or physical tenants in the building." Rhisiart and the designers looked at similar spaces from around the world to decide on the size and form of the Battery.

M-SParc – as well as BioCity and the Schuster Annex – have another ingredient in common: the 'wow' factor.

For M-SParc, the first and biggest 'wow' is the Corian ribbon that clads the front of the building. Biocity has a sculpture by local artist Wolfgang Buttress that reflects the activity of the sun. The Schuster Annex extension has a distinctive diagram, produced by researchers at the university, fitted into its huge glass façade.

"THE IDEA IS THAT PEOPLE COLLABORATE AND HOLD IMPROMPTU MEETINGS"
PRYDERI AP RHISIART, MANAGING DIRECTOR, M-SPARC

3. Know your technical requirements

The way a science and technology building will be used can affect fundamental design decisions. For the Department of Material Science and Metallurgy at the University of Cambridge, we built a low-vibration building with an acoustic performance 10,000-times better than a typical office to accommodate experiments from heavy-duty testing to nano-technology.

Also, the RAL Space facility at the Harwell Science Campus in Oxfordshire, which manufactures and tests satellites and their components, has low-vibration requirements as well as labs which must be set at temperatures below -260 degrees Celsius.

Spaces used for tests and research have very particular requirements – getting this wrong can add lengthy delays and huge costs to a project. "The key thing for us is the laboratory space," says Sygnature Discovery's facilities manager Tracey Allford. "We have three floors in the Discovery Building which have lab space – their functionality is crucial, making sure air exchange, air flow, and air pressure is right."

Willmott Dixon construction manager Paul Smith oversaw the construction of the Discovery Building. Getting the labs right meant research to develop a thorough understanding of air-flow patterns. "The fume hoods require a very particular low-velocity air flow that cannot be turbulent, known as lamina flow," he explains. "To achieve this, we changed the original design of vents and grills to perforated ceiling tiles, with the ceiling void acting as a plenum."

Below: The UCL Institute for Immunity and Transplantation, also known as the Pears building. **Opposite:** The Department of Materials Science & Metallurgy, University of Cambridge, is one of the quietest buildings in the world.

Department of Materials Science & Metallurgy, University of Cambridge
Key facts

– Combines five research facilities and 25 user groups from the university.

– The university's most technically challenging construction project in its history.

– Electron microscopes require low-vibration structure, extreme quiet and temperature fluctuations no greater than 0.1 degrees Celsius either way.

– Home to pioneering research into superconductors.

All roads lead to flexibility

One thing science-focused buildings have in common is the need for flexibility.

At M-SParc, the project team created workspace that could transform into laboratories in the future. The architects responded to this requirement with a design that included several risers outside each lab so that the necessary services could be connected as required.

With the Schuster Annex, room to grow has been created vertically. The whole building has been designed so that it can bear an additional floor should the extra space be required.

Tracey Allford of Sygnature Discovery recommends early brainstorming to predict future needs: "Our intention was to move into three floors with room for growth. Maybe we could have had more discussion about what the building might become. For example, with the M&E, we could have thought about what we might need in the future. We have overcome that but it would have been good to think about it in the first place."

The UCL Institute for Immunity and Transplantation (Pears Building)
Key facts

– Currently under construction, the building will be home to UCL's Institute for Immunity and Transplantation (ITT).

– Located next door to the Royal Free Hospital to encourage faster take-up of discoveries.

– Light-filled interior designed to encourage collaboration.

– Recent successes of ITT team who will be based there include pioneering stem cell transplantation treatment.

4. Funding streams

Like the future of science and technology, the funding for these facilities lies in partnerships between a diverse range of organisations and individuals.

The £42m George Davies Centre at Leicester University represents the largest investment in medical teaching and applied research by a UK university in the past decade. The building is named after fashion retailer and philanthropist George Davies, who was one of many donors from the city and county that provided £10m towards the project, with the university supplying £32m.

"As a project team, we understood the need to attract external funding. The site always had to look at its best, ready for visitors to be shown around," says James Elliment, Willmott Dixon's construction manager for the George Davies Centre.

"The quality had to be very high too: the building must attract the very best research academics who will then bring in further funding."

The Pears Building is currently being built in London, with the University College London's (UCL) Institute for Immunity and Transplantation (ITT) moving into the building in 2020.

Funding for the £49m building has come from a variety of sources including the Pears Foundation, the Royal Free Charity and the UK Research Partnership Investment Fund.

Being next door to the Royal Free Hospital is vital for the transfer of research to application – from bench to bed.

"Increasingly we are looking for pure science to become more translational," explains Willmott Dixon's science lead Briony Lumb.

"How do you get the science to a business or hospital? How do you translate discoveries to benefit the wider community?"

She adds: "There is a lot more pressure on scientists to produce outcomes, and funding requires them to demonstrate research excellence."

"THERE IS A LOT MORE PRESSURE ON SCIENTISTS TO PRODUCE OUTCOMES, AND FUNDING REQUIRES THEM TO DEMONSTRATE RESEARCH EXCELLENCE."
BRIONY LUMB, WILLMOTT DIXON'S SCIENCE LEAD

5. The right supply chain partnerships

Delivering each project featured in *Brilliant Buildings* requires three things: people with the right experience and capabilities; commitment to delivering exactly what is required; and, perhaps most important of all, a collaborative approach which opens up the problem-solving process to the project team.

As well as the customer and main contractor teams, the all-important supply chain members are valued members of project.

On M-SParc, the Corian cladding could have caused issues to cost and programme. More usually seen on high-end kitchen worktops, there is only one company in the whole of the UK that can provide Corian for cladding. Multiple meetings between designers and the various supply chain members helped thrash out the details before the project was on site.

"The design that had to go into the interfaces was intense," says Willmott Dixon construction manager Chris Baker.

On the Schuster Annex, the quality of the brickwork was crucial. Construction manager Simon Atkinson spent time with the manufacturer to ensure the glazing details were right, and programmed the build so that the best bricklayers could be employed. "I asked for a specific supervisor, who I know has an eye for quality and detail," he says.

The George Davies Building was a first from a sustainability perspective. Ultra-energy efficient to help the university meet its carbon-reduction targets, it was designed and built to Passivhaus standards, which are usually applied to residential buildings. This meant that the team was breaking new ground on multiple systems and pieces of equipment.

"It was very tough at times but when we handed the building over we had a happy customer because we delivered what we said we would deliver," says James Elliment, Willmott Dixon's construction manager for the George Davies Centre. "The university has the building they wanted and their energy bill has been massively reduced."

Schuster Annex at the University of Manchester
Key facts

- Aims to attract the best students to the School of Physics and Astronomy.
- Ideas Mill has changed how students from the school and beyond work and collaborate.
- Glass first-floor walls allow a window into the department for the community – no 'them and us'.
- Building's striking glass façade has a Voronoi diagram, taken from university research, etched into it.

6. Getting it right with stakeholders

Science and technology has a complex network of stakeholders: multiple user groups, multiple funders, owners and users, operators and the wider community. Understanding these various needs and viewpoints is an important part of any project.

"My advice would be to have good, early collaborative engagement with as many stakeholders as possible in a well-managed, structured way," says James Elliment, considering his experience on the George Davies Centre, for which he is construction manager.

"Engagement and early involvement of contractor and design team will ensure you can iron out tweaks and changes before you start on site."

The challenge can be when the project team doesn't exactly know who the stakeholders will be, as was the case at M-SParc. "You have to go with the people you have discussed it with, people who have told you that they want to take some space. It can be difficult to get to the bottom of it," says M-SParc managing director Pryderi ap Rhisiart.

Willmott Dixon's laboratory expert Adrian Gainer adds: "Understanding that students, scientists, technicians and support staff all enjoy their work environment better when they have more daylight, views to the outside and more control may seem obvious, but these factors are rarely written into a brief and if we ignore this we threaten the very success of a science research facility."

Post-completion, an ongoing relationship between contractor and user ensures the building is used to its full potential.

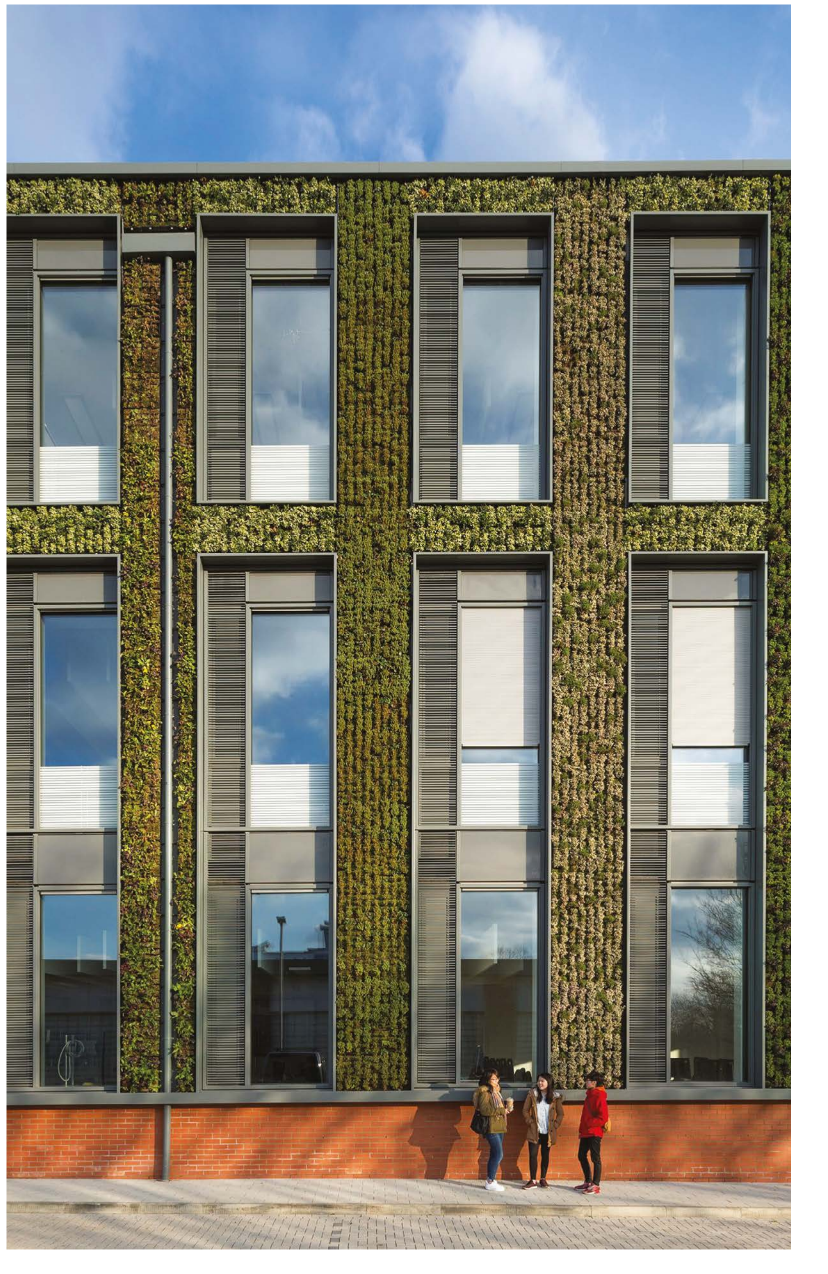
Consider a 'soft-landings' approach, where a small contractor team works with the building's users over a three-year period, advises Elliment.

"For me, the soft-landings process after completion to make sure everything gets bedded in is even more important when you plan technology buildings."

"ENGAGEMENT AND EARLY INVOLVEMENT OF CONTRACTOR AND DESIGN TEAMS WILL ENSURE YOU CAN IRON OUT TWEAKS"
JAMES ELLIMENT, WILLMOTT DIXON CONSTRUCTION MANAGER, GEORGE DAVIES CENTRE

George Davies Centre for the University of Leicester
Key facts

- Has changed the way medical students study medicine at Leicester.
- Community involvement: proportion of funding came from donations and fundraising.
- Largest non-residential building to achieve Passivhaus standard for energy efficiency.
- Soft-landings' post-construction service helped users to understand how the building works and optimise energy efficiency and comfort.



Right: University of Leicester's George Davies Centre is the UK's largest non-residential Passivhaus building.
Left: University of Manchester's Schuster Annex neatly connects to the adjacent Schuster Building and is helping to make the university a world-leader in STEM technology.

Met Office supercomputer building
Key facts

– Houses the third of three Cray XC40 supercomputers, capable of more than 14,000 trillion arithmetic operations per second.

– Located at Exeter Science Park, boosting the city's science and technology capability.

– Most powerful computer capability in the world dedicated to weather and climate.

– Delivered under the Scape framework.

Left and below: We equipped the Met Office with a home for its new 'supercomputer', which gives it unrivalled expertise in climate models and weather forecasting.

7. Manage uncertainty

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One challenge in delivering for the science and technology sector is adapting to the rapid pace of change in user needs and technological developments.

The earlier the contractor and supply chain can be involved, the easier it is to identify where real value in a building lies for the customer, and make design decisions accordingly. Live construction cost data – from current projects in the same area with the same supply chains – is useful here and Willmott Dixon provides live benchmark data, which is of high value to customers.

"Willmott Dixon has a group of specialists in this area they are working with, so we know their cost information is current," says one customer.

Knowledge about buildability can have a huge impact on cost and value. For instance, on the Schuster Annex, proposing a reduction in the foundations and changes to the concrete floor elements helped to value-engineer the project. These and other changes brought the project under budget, where a previous contractor had failed to do so.

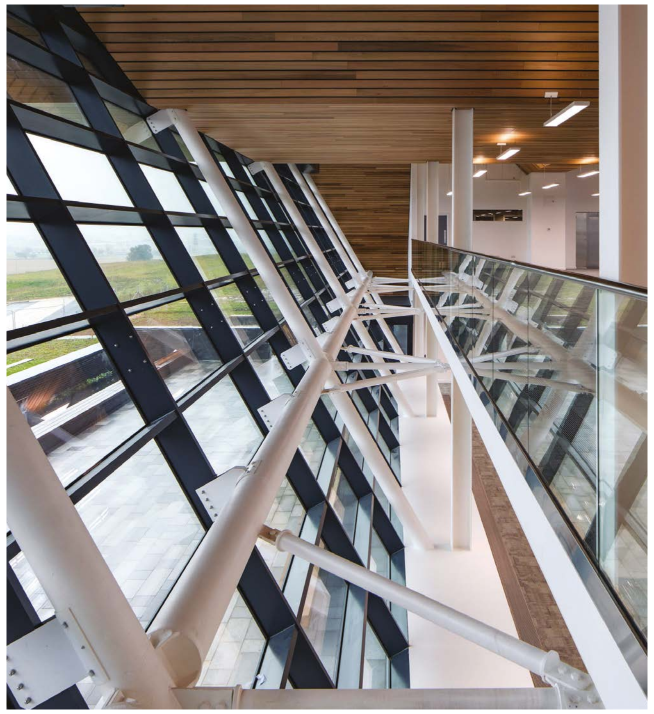
None of this has been at the expense of Schuster's look and feel: "If you look at the computer-generated images in our 2016 document, they are very similar to what has been built," says Professor Watts, who led the extension to the Schuster Building. "Willmott Dixon delivered what we saw at the time."

The design and build form of contract has been used predominantly on the science and technology projects we have worked on. In some cases, there has been a two-stage tender process, with a handful fully negotiated through framework arrangements, such as Scape.

"We found the design and build form, JCT Design and Build, to be very good and it certainly worked for us on this project," says M-SParc managing director Pryderi ap Rhisiart.

Cost control, once a project is underway, is as important as identifying where the value is. The important thing is that decisions about changes to scope are fully informed in terms of the impact on cost and programme. And that requires transparency and good communication.

"Collaborative working is vital for cost control," says Paul Smith of the Discovery Building. "We always made sure that the client knew what the cost to complete was and if any changes were proposed that would alter that, we let them know immediately."



8. Successful outcomes

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Seven steps to deliver a successful science and technology building:

1 Involve stakeholders as early as possible – understand how to create optimal spaces for people to innovate, plus funding and procurement options.

2 Early supply chain involvement – inform design decisions to give best commercial value to the users.

3 Use current cost data to aid decision-making, at feasibility phases and during delivery.

4 Collaborate to aid creative problem-solving – unusual technical challenges require teamwork.

5 Build in flexibility – during delivery and for the longer term.

6 Involve the public – not just through design but through delivery to attract the next generation of scientists.

7 Use 'soft landings' to optimise operation of the finished building.
Chris Brown, construction manager for M-SParc, says: "We all want the same thing: a good-quality product. My managers knew what they wanted throughout because they knew what the customer wanted...the greatest tool is understanding the customer."

BRILLIANT BUILDINGS

EMPOWERING SCIENCE & TECHNOLOGY

Willmott Dixon is a privately-owned contracting and interior fit-out group. Founded in 1852, we are family-run and dedicated to leaving a positive legacy in our communities and environment. Being a large company means we can create a huge and lasting positive impact on our society. This is not only done through what we build and maintain; it is achieved through the fantastic efforts of our people who make a major contribution to enhancing their local communities.

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