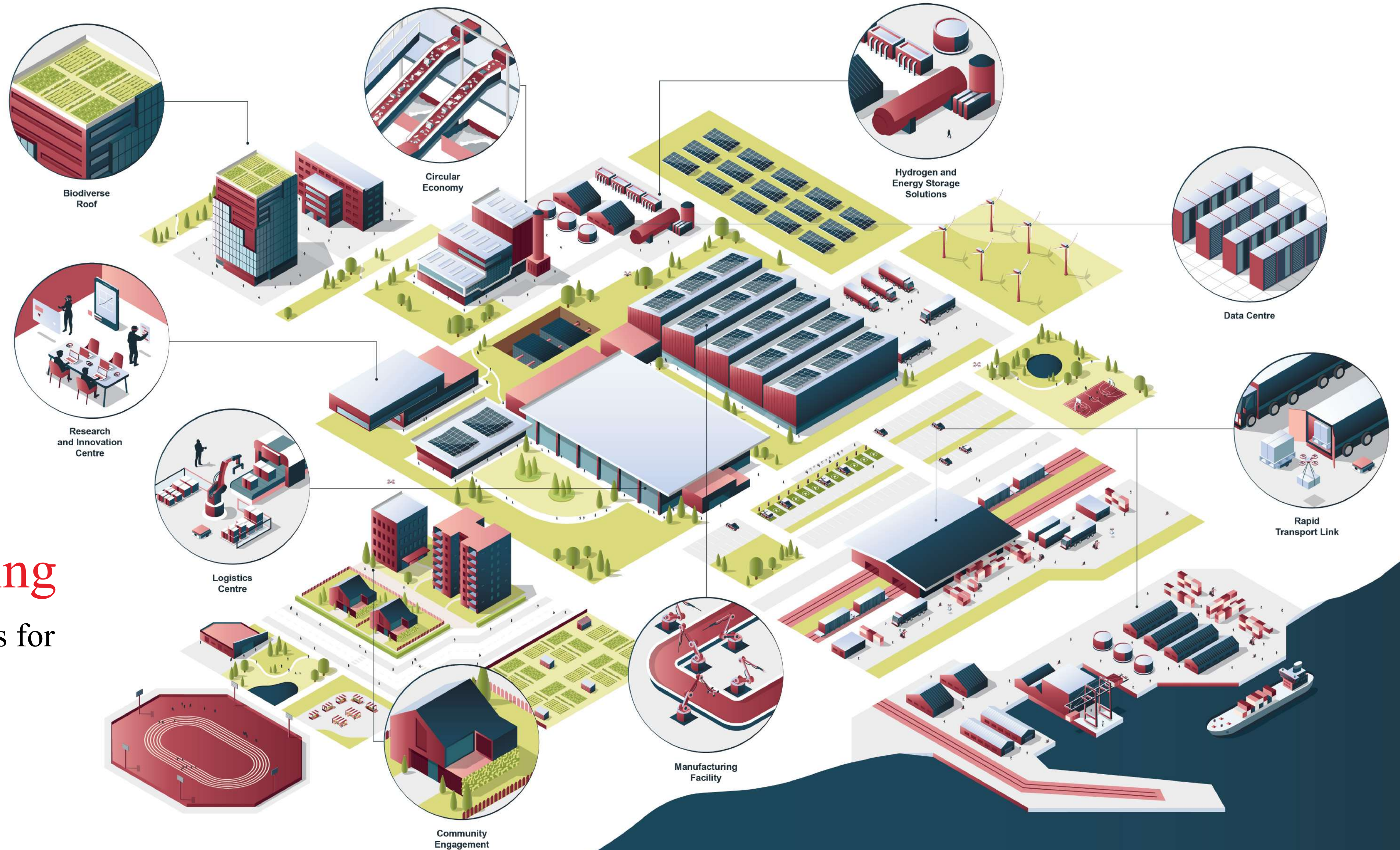


Advanced Manufacturing

Innovative solutions for the industry



A new era of opportunity

Influenced by consumer demand, market forces and legislation, the advanced manufacturing sector is driven by innovation. This sector is constantly evolving its systems to create efficient and sustainable products to meet customer requirements.

This challenge to adapt is accelerated by societal demands and the evolving control and governance requirements of national and regional governments.

These competing and often conflicting demands require agility and effectiveness in facilities, operations and people as organisations strive to respond to the challenge.

Drivers for advanced manufacturing

Consumer demand

User specific, sustainable products, digitally enabled, cost focus.

Competition

Innovative products, material scarcity, supply chain effectiveness, cost pressures.

Global challenges

Climate emergency and resilience, decarbonisation and political influence, circular economy, digitalisation.

Government influence

Regional policies such as EU Green Deal, taxonomy, compliance, reporting and carbon emissions.

At Arup, our track record in Advanced Manufacturing spans more than 50 years. Combined with our expertise in the latest global demands of sustainability, digitalisation and resilience means we are well placed to support you in these challenging areas.

Our integral approach covers all phases in an asset lifecycle – from business case development and funding through site selection, design, procurement, construction support to site handover and operations.

Our expertise in sustainable development and digital allows us to support organisations making transformations in decarbonisation, circularity, and resilience, while delivering rapid, automated and data driven solutions for speed and efficiency.

Our advisory teams support organisations in their fields of strategy and insight, finance and economics, major programme deliveries, organisational change, assets and operational improvements, in addition to response and creation of opportunities from governmental influences.

Putting sustainable development at the heart of everything we do, we are supporting organisations across the globe in decarbonising operations, embracing the circular economy, and become more resilient in the face of an ever faster changing world. As specialists in digitalisation, we are delivering and developing rapid, automated and data driven solutions to help you ramp up speed and efficiency.

Design and technical expertise remain at our core, creating highly integrated and efficient facilities designed for effective operation and employee satisfaction.



Jaguar Land Rover, Engine Manufacturing Centre, UK
© Arup

Redefining the Green Factory

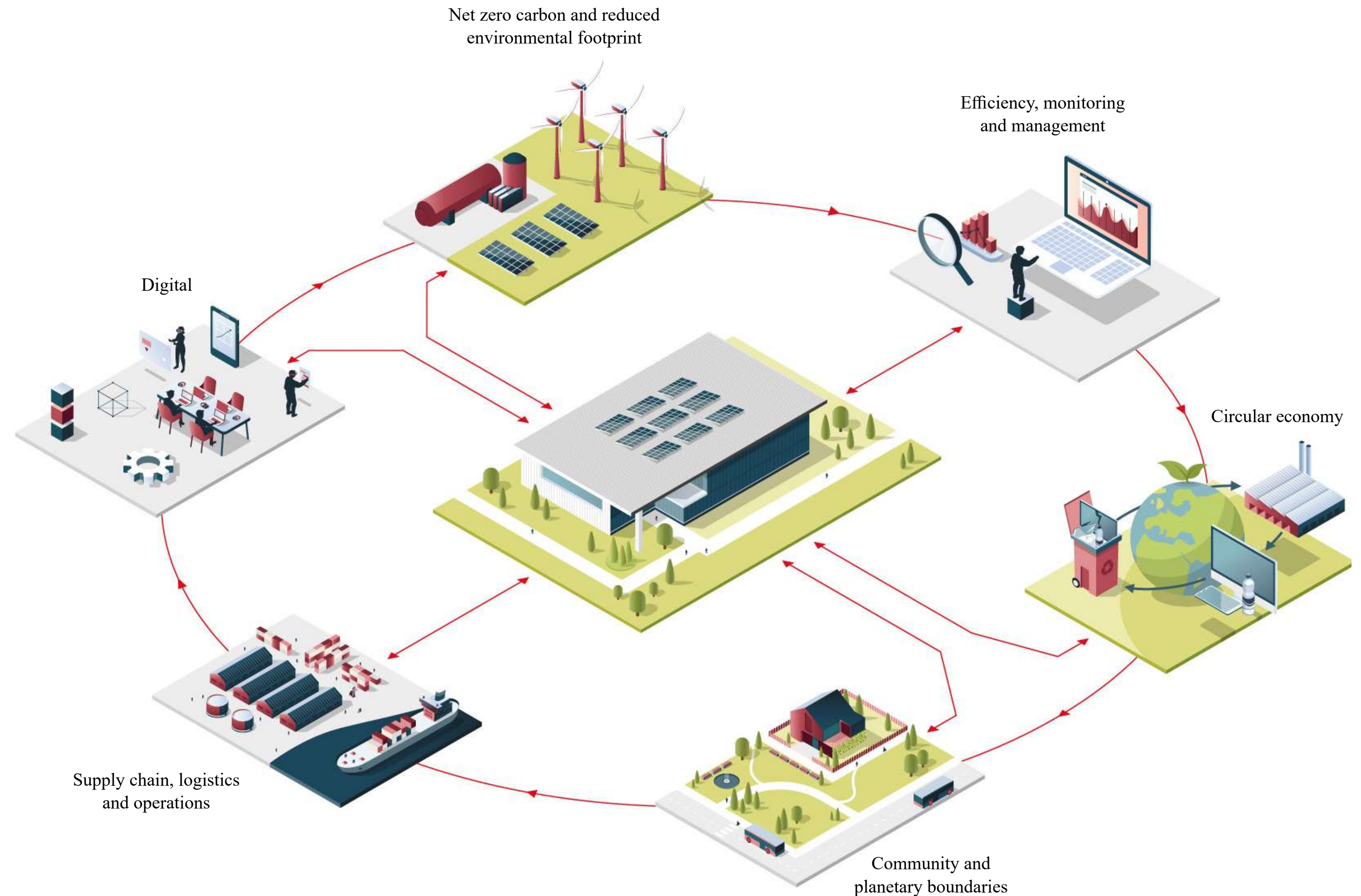
For our economies to become truly sustainable in the years ahead, a key role is reserved for the vast manufacturing sector. To address legislative, economic, consumer-driven and ecological obligations, industry leaders must transition to net zero, incorporate sustainable values, and adopt circular economy principles as soon as possible.

On the brink of this major transformation, and strengthened by our comprehensive service portfolio and extensive industry experience, we are guiding those leaders to a more circular and sustainable buildings, operations, and business model.

The Green Factory outlines a set of actions spanning across the entire lifecycle of an asset to help achieve a more sustainable and green facility. From reducing the overall environmental footprint and achieving net zero, to incorporating sustainability and circular principles to creating value for local communities.

To help our clients within the industrial and manufacturing sector accelerate their transition towards a more sustainable facility, we've identified a number of key focus areas. From embracing the circular economy principles, to decarbonizing, and using digital tools as an enabler, all the way up to creating a healthy environment for people and the surrounding natural landscape, with our integrated approach we're striving to be a holistic sustainable innovation partner, helping companies meet their climate goals, and beyond.

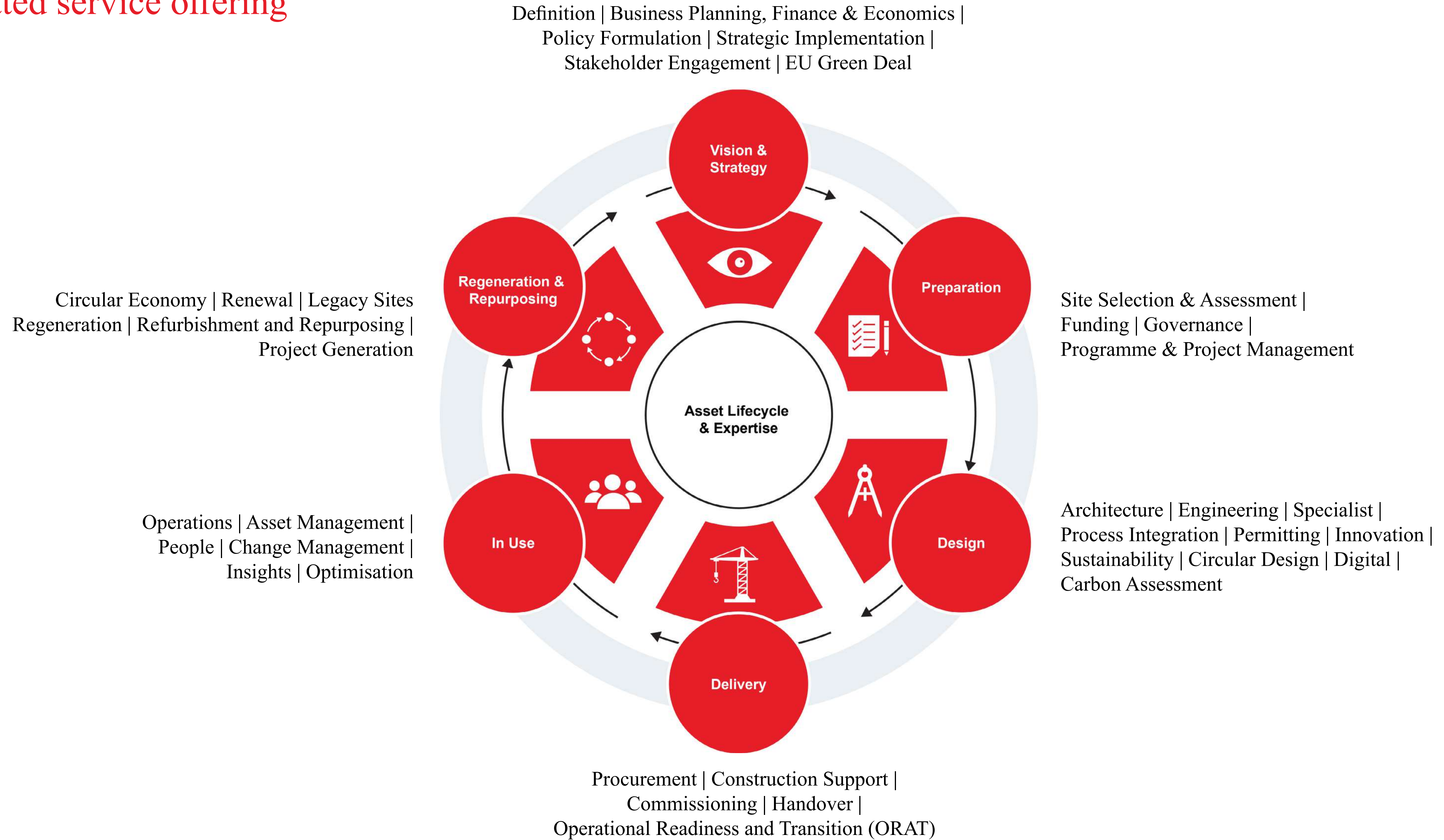
[Read more here](#)



Our services

We operate across the entire life cycle of an asset. Drawing from our vast experience and ever growing skillset, we support our clients at every project stage putting sustainability at the heart of our work.

Our integrated service offering



Our integrated service offering

We offer the full range of engineering and advisory services to meet the evolving needs of industry worldwide.

Advisory

Strategy and insights
 Assets and operations
 Finance and economics
 People and organisations
 Programme and project management
 Sustainable futures
 Net zero carbon advice & accounting
 Carbon neutral advice and accounting

Buildings

Accessible environments
 Architecture
 Building design
 Building envelope and facade design
 Building Information Modelling
 Building physics
 Building retrofit
 Building services engineering
 Commissioning and building performance evaluation
 Electrical engineering
 Facilities management
 Fire engineering
 Mechanical engineering
 Public health engineering
 Process Integration and process planning
 Structural engineering
 Sustainable building design
 Vertical transport design

Digital

Digital asset management
 Digital consulting
 Digital for sustainable development
 Digital design
 Emerging technologies
 Digital every step of the way
 Digital twins

Infrastructure

Airport planning
 Bridge engineering
 Civil engineering
 Infrastructure design
 Maritime engineering
 Rail engineering
 Sustainable infrastructure
 Tunnel design
 Waste management strategies
 Waste to energy solutions
 Water engineering

Planning

Economic planning
 Environmental consulting
 Flood risk management
 Landscape architecture
 Masterplanning
 Planning policy advice
 Resilience security and risk
 Smart cities
 Town planning

Technical consulting

Acoustic consulting
 Advanced technology and research
 Audio visual and multimedia
 Fluid dynamics
 Geographic information systems
 Geotechnics
 Hydrogeology
 ICT infrastructure design
 Lighting design
 Materials
 Product design
 Quantity surveying
 Seismic design
 Software products
 Technology operations and project management
 Theatre consulting
 Transport consulting
 Vibration engineering
 Wind engineering

Providing integrated solutions

Solving Complex Problems

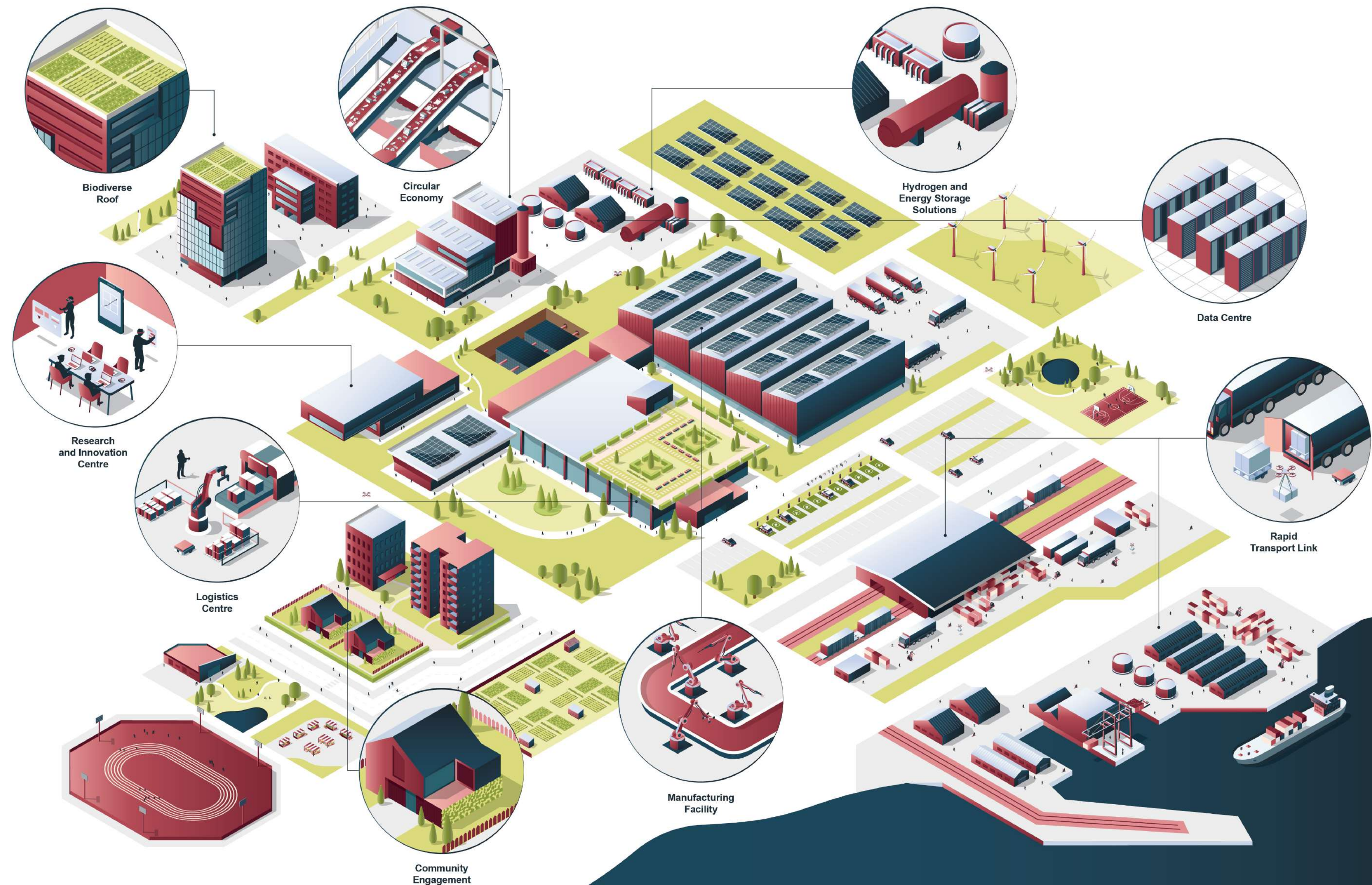
Our fundamental goal is to create durable and inspiring surroundings tailored to individual requirements, designing for long-term resource efficiency and resilience by integrating economic, environmental and social goals into every project.

Our proven track record of delivering projects within these sectors allows us to continue addressing and solving some of the most complex challenges our clients are facing. From business case advisory workstream development, value stream mapping and digital to design of highly complex and demanding building and process environments, to mapping the supply chain, we support our clients in every aspect and stage of their projects.

Industry 4.0 & Digital

The industry and advanced manufacturing sector is currently influenced by the core theme of Industry 4.0, underpinning a revolution through application of electronics and IT to further automate production.

Traditional production operation utilising information and communications technology (ICT) is increasingly obscuring the boundaries between the real and the virtual world, in what are known as cyber-physical production systems (CPPSs). CPPSs link IT with mechanical and electronic components from multiple manufacturing facilities, which communicate with each other via networks to achieve increased optimisation with real time data.



Local knowledge, global expertise

7,132

projects delivered across

42

countries



Sectors

Thought leadership for the industry

Whatever the context, we help clients adapt to the evolving innovation and challenges within the sector. Our experts offer their perspectives on the issues, trends and technologies that are shaping our world.

Transport manufacturing

Transport manufacturing facilities that are typically arranged to maximise economy of scale for a limited range of vehicle models, are now adapting to the smart factory model where equipment is flexible and readily adapted to manufacture multiple customised models within the same factory.

Arup can assist in the reinterpretation of the traditional factory form to create a flexible, sustainable and highly automated transport manufacturing facility as well as designing new innovative highly efficient facilities attracting talent.

Jaguar Land Rover Engine Manufacturing Centre, UK

The future for industrial building construction includes sustainable design, with wellbeing at its heart.

Jaguar Land Rover partnered with Arup to oversee the creation of their new UK manufacturing centre, that would accommodate over 2,000 staff and enable the production of 450,000 new engines every year.

The building required a low-energy solution with enough flexibility for its time-critical operations and any future expansion, whilst providing a space that best serves the needs of its skilled staff and the wider community. The award-winning design has achieved a reduction in the facility’s carbon emissions by 65% relative to a ‘business-as-usual’ comparison, with the flexibility to allow for further integration of renewables that would bring the net regulated carbon emissions to zero – culminating in a ‘BREEAM Excellent’ rating.

450,000

new engines produced every year



Services: Architecture, mechanical, electrical, structural & technical engineering.

65%

reduced carbon emissions



Size: Approximately 240,000m² (size of 34 football pitches)

1st

largest roof-mounted photovoltaic (PV) array in the UK

[Read more here](#)





Smart, sustainable transport



Low-carbon transport

Transport is responsible for over 14% of greenhouse gas emissions (GHG), with the largest contributor from the road sector. The technology for example electric and hydrogen fuelled vehicles is making the transition to a more sustainable low-carbon transport system, albeit at a slow rate.

Many governments have plans to reduce the reliance on private vehicle using a phase out of petrol and diesel cars in the next decade. This means we have to replace the vehicles we currently drive, improve public transport infrastructure and provide vehicle charging facilities. This will also include reducing the need for travel on a daily basis and the need to own a vehicle. The decarbonisation of the public transport systems like rail and bus are key.

To enable this transition, existing and new vehicle manufacturers have responded by producing EVs and hybrids by developing alternative fuelled vehicles. Many have declared the phasing out of fossil fuel vehicles in line with government legislation. We have seen many new entrants into the vehicle manufacturing business who have changed the dynamics in the industry. There is change ahead for the transport industry which is seeking new technologies in manufacturing using IoT and Industry 4.0 digital interventions, low-carbon energy storage using Li-ion batteries and mass personalisation of products to meet customer expectations.

Sustainability is at the forefront of the transport industry not only within the products they produce but also built environments in which they operate. The manufacturing industry is responsible for over 21% GHG and therefore has significant challenges to meet its reduced carbon aspirations.

Our involvement in advising clients on how they achieve these sustainable goals, designing new state-of-the-art factories of the future and supporting them through this transition is one way we are contributing to the future of low-carbon transport in the advanced manufacturing sector.



Daimler AG Russia Moscovia Plant, Russia

Arup carried out full engineering design of Mercedes’ new production plant in Moscow. The concept for the plant comprised of placing the manufacturing building under a single roof that incorporates the vehicle body and assembly shops.

Utilising the latest production technology, the plant adopts cutting edge innovative Industry 4.0 technologies designed to enable multiple vehicle types produced on the same assembly line. Driverless transportation systems convey the bodies between production subsections, and automated shopping cart systems are used in assembly.

The facility also adopts numerous environmentally friendly and resource-saving solutions such as paperless documentation, emission-free electric forklifts, heat recovery in the buildings and the use of water-soluble products in painting to support sustainable and green production.



[Read more here](#)

Daimler AG Russia Moscovia Plant, Russia
© Arup

25,000

vehicles produced per year



Services: Project management, cost management and multidisciplinary building design and engineering services.

21

months total project delivery time



Size: 85,000m²



BMW Dealerships, Sustainability Upgrade, China
© Kristopher Grunert

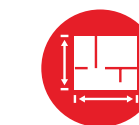
BMW Dealerships, Sustainability Upgrade, China

Arup was appointed as sustainability consultant to review the design standards and processes for BMW showrooms in China. Our team worked to incorporate sustainable strategies throughout the design process to generate cost-effective sustainable design solutions.

Multidisciplinary consultancy solutions have been delivered into major retrofit work of dealerships successfully. Arup has provided sustainable solutions for upgrading façades and lighting to meet the architectural visualisation requirements for car gallery areas.



Services: Building physics consultancy including site visit, provide upgrading strategy and produce checklist.



Size: various

Rolls-Royce, Marine Engine Test Facility, UK

Arup was commissioned to undertake the project management, building engineering design and process engineering for a new complex marine engine test facility. The facility provides Rolls Royce with the capability to deliver a testing functionality for the WR-21 engine on its Bristol site.

Arup delivered the engineering and architectural design to scheme stage before managing a tender process to select the main contractor for the works. As acting project manager throughout the project lifecycle, Arup provided full building and process installation in addition to operational handover to the client team including assurance with the Ministry of Defence.



Rolls-Royce, Marine Engine Test Facility, UK

© Arup



Services: Structural, civil, mechanical and electrical engineering design to scheme stage, architectural design, management of the tender process, project management, cost management and contract administration, CDM co-ordinator and stakeholder engagement.



Size: 600m²

Rolls-Royce Precision Casting Facility, UK

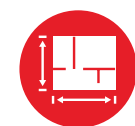
The Precision Casting Facility (PCF) is a manufacturing building located at the Rolls-Royce campus in Derby, UK. The PCF manufactures turbine blades comprising of various production spaces and a finishing room. The building was constructed in 1970 and was in need of significant refurbishment as the business looks towards the future.

The PCF building comes under the ‘Canaveral 2’ works, with the main objective of the upgrade project being to extend the life of the building by a further 20 years. This will be done by replacing critical building services equipment whilst keeping full operation and output production going throughout the duration of the upgrade works.

Arup was initially appointed to this project to survey the facility and provide a design for the upgrade phases, which were to be taken forward by a contractor under a design and build contract. After a successful tender process, Arup agreed a ‘works monitoring’ role on the PCF for the Phase 1 works, which will involve engineers attending site to assess the installation condition of the replaced assets, and to monitor the contractors works on behalf of Rolls-Royce.



Services: Building services engineering surveys and design to RIBA Stage 2.



Size: 14,000m²

Rolls-Royce Advanced Manufacturing & Technology Facility, Birmingham

Rolls-Royce’s new build facility in Birmingham houses a range of manufacturing and production facilities including a wide range of specialist process systems. Central to the client’s brief was the building would be a place where the workforce would be proud to work. Whilst there was a clear recognition that complex engineering services were fundamental to the successful operation of the facility, the architectural integrity and a high-quality setting had to be maintained.

Process energy savings

Process energy loads and usage profiles were analysed in a study of energy saving options. These proposals were considered in addition to compliance with statutory carbon emissions standards. As a result of the study, cooling towers were adopted as the primary means of process heat rejection, with the building chillers contributing back-up capacity to guarantee full load in hot weather conditions and heat recovery from the large process air-compressors, to offset a proportion of the winter space heating demand via a thermal buffer-store.



Services: Civil, structural, mechanical, electrical, fire and acoustics engineering and Information technology consulting.



Size: 28,000m²

Rolls Royce Advanced Manufacturing & Technology Facility, Birmingham UK

© Arup

Confidential Campus Energy Utility Masterplan, Indianapolis, US

Arup's intervention on our client's electricity rate case not only saved them US \$3m annually after the masterplan implementation, but also saved US \$20m over a 4-year period.

Arup developed an infrastructure masterplan for two large research campuses, with efficiency, sustainability, and resilience as key drivers. The project identified alternative financing options for some capital improvements. Our scope involved an implementation framework containing phasing, capital plans, and M&O strategies. The analysis was multifaceted, confirming current and forecast demands and evaluating a range of improvement or replacement scenarios.



Services: Energy consulting, masterplanning, transaction advice and programme management.



Size: 232,257m²



Confidential Campus Energy Utility Masterplan Indianapolis, US

© Arup

Confidential Facility, Sparks, Nevada

Arup was tasked with providing layout design recommendations for our client's factory logistics. With the factory area expected to exceed 1,000,000m², a service yard of 50,000m², and complex hazardous material storage requirements, Arup's multidisciplinary team had several intricate challenges to solve.

Working in collaboration with Arup's fire engineering group, the logistics team provided service yard layout design recommendations based on each raw material's unique storage requirements and individual inventory quantities. Using swept path analysis, Arup identified a design option reorientation that could increase trailer chassis storage by 33%. The final service yard design ensured cost-effective flexibility, resilience, and operational efficiency while maintaining the necessary safety and security measures for this complex, high-profile development.



Confidential Gigafactory, US



Services: Fire engineering, and logistics.



Size: Confidential

Confidential Automotive Modular Building Concept, Germany

This modular building concept can be erected at any location worldwide within short construction times and can be flexibly adapted to local requirements.

We developed the innovative concept on an ideas competition between 2016 and 2017. It allows for quick reactions to fluctuations in demand for logistics space.

The concept is based on economical design methods that have been intelligently combined with one another. Containers are used as supporting structure, which at the same time serve as offices and can be used for transport during a change of location. Essential parts of the Flex-Hub system are reusable and designed for easy transport.

The modular logistics building offers the user individually adaptable space to optimise the respective logistics processes.



Confidential Automotive Modular Building Concept, Germany

© Arup



Services: Architecture, structural, mechanical, electrical, public health and fire engineering, energy efficiency and management consultancy including BIM.

Design phases: briefing, concept, design development and tendering.



Size: various

Airbus Wing Integration Centre, Bristol, UK

The Airbus Wing Integration Centre (AWIC) in Filton, is a £30m state-of-the-art research and testing facility designed to undertake structural testing of large-scale aircraft assemblies including full-size wings, through to the individual components and materials used in aircraft design.

The majority of the building volume is allocated to industrial testing space which includes a specialist strong floor and strong wall, various testing laboratories and a large open plan office for approximately 250 engineers. Space requirements included both flexibility and functionality to encourage collaboration across the business.

Arup provided civil, structural and geotechnical engineering services for the design of this building, which enables testing of full-size wings using the centre’s strong floor and strong wall. The structural design has been developed to accommodate the complex testing requirements of the facility, providing the necessary support and containment for heavy test rigs, hydraulic pipeline distribution and vibration sensitive measuring equipment.



Services: Civil, structural and geotechnical engineering services.



Size: 9,050m²



Airbus Wing Integration Centre, Bristol, UK
© Galliford Try

Siemens Mobility Manufacturing Facility, UK

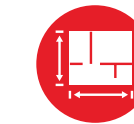
The new East Yorkshire £200m development will put Siemens Mobility at the forefront of the rail manufacturing industry with a new rail centre of excellence for manufacturing, engineering, research and development. The facility will manufacture and commission state-of-the-art trains including the new fleet of Tube trains for London Underground’s Piccadilly Line which will significantly improve the passenger experience for millions of travellers. Arup is leading a multidisciplinary team, supported by sub-architects, to deliver all aspects of the engineering design for the facility.

Optimising the location and adjacencies of the buildings to support the process flow in the train assembly was business critical. Arup worked closely with Siemens Mobility technical team to understand the functional requirements. Arup developed a compact masterplan that minimises distances between adjacent processes whilst also permitting sufficient turning for the 26m long cars.

Consideration of Siemens Mobility net zero targets heavily influenced design decisions and minimised operational costs. Industrial buildings roofs are PV ready to ensure the site is prepared for future adaptations.



Services: Structural, mechanical, electrical, public health, fire and acoustics engineering. Site development, utilities, drainage, flood risk, earthworks, geotechnical engineering and ecological services.
Masterplanning, landscape and building architecture, BIM manager, principal designer and stakeholder liaison.



Size: Phase 1 25,000m²

[Read more here](#)



Siemens Mobility Manufacturing Facility, UK
© Siemens Mobility



Opel General Motors Manufacturing Facilities

General Motors' global expansion strategy was to construct manufacturing facilities in emerging market countries.

Arup was employed as the general facilities designer for two new plants in Poland and Thailand. The team provided a holistic design service, delivering all core disciplines and process test and fit. The facilities were designed, built and equipped in 27 months.

150,000

cars produced per year



Services: Multidisciplinary engineering design and supervision with cost and construction management services.



Size: 90,000m² plant in Poland
80,000m² plant in Thailand



Opel General Motors Manufacturing Facilities
© Arup

Ferrari Manufacturing Plant, Modena, Italy

In collaboration with Ateliers Jean Nouvel architects, the new manufacturing building for Ferrari Automotive Industries is set inside the futuristic project "Formula Uomo" that is being carried out by Ferrari. The new building is built next to, and bridging over, the existing factory.

Arup's design innovation and creativity helped to realise a building that allows for maximum flexibility of the internal space. The structural strategy aimed to justify the geometry and the use of materials.



NMV Ferrari Manufacturing Plant, Modena
© Philippe Ruault

The services strategy has followed a sustainable approach. The choice of construction materials will maximise the heat that could be stored and returned.

The building represents Ferrari's innovation through its technological aspects, demonstrating the innovative concept of a modern factory, where the structure is the frame (or the body of the car) holding all the mechanical parts inside.

21,000m²

production line



Services: Electrical, mechanical, public health and structural engineering.



Size: 790,000m²

[Read more here](#)

Food and drink

Manufacturing processes, especially within the food and drink sector, are dominated by the need for rapid response in terms of production and product development, coupled with the desire for lean low-carbon production to minimise costs.



PepsiCo, Poland
© PepsiCo

PepsiCo, Poland

As part of its journey towards net emissions, PepsiCo has appointed Arup to design and develop the 54,700m² plant, which will produce crisps and other salty snacks, and generate 450 of jobs locally.

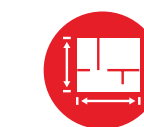
Embracing decarbonisation and circular economy principles, Arup has been working with PepsiCo since last year to calculate the factory’s carbon footprint throughout its lifecycle including a potential future demolition phase. The data gathered has allowed the team to identify key carbon ‘hot spots’ in the facility.

The entire project has been developed using Building Information Modelling (BIM) to enable modern methods of construction, and has created a digital twin of the factory to facilitate future maintenance. Using the latest digital tools, we have shortened the project timeline and successfully reduced time losses caused by changes to the project scope after market growth required an increase in production capacity. Our cost consultants are also using BIM for quantity surveying, accurately evaluating the costs of different options.

As a major transformation takes place in the food sector, which must shift to net zero, one of the world’s most recognisable brands, PepsiCo is leading the way by building their most sustainable production plant in Europe to date.



Services: Multidisciplinary services including technical due diligence for a selection of plots, permitting process, full technical design, cost consulting and support in selecting a general contractor, whole life carbon assessment, project management and site supervision.



Size: 54,700m²

[Read more here](#)

Carlsberg Brewery, Hamburg

Carlsberg's relocation of the Holsten brewery in Hamburg to a new greenfield site, provided an opportunity to improve process efficiency and to drive down operational costs. Arup was appointed to act as the multidisciplinary technical advisor based on our track record of successful client-side project delivery, and our global expertise in the food and beverage industry.

Arup's global reach allows us to draw on a multidisciplinary cross regional team on the project. We were able to combine brewery design expertise from the UK with local planning and market intelligence from our Germany offices.

Arup managed the building permitting which was specific to breweries and supported Carlsberg in their negotiations with the Hamburg authorities, dealing with environmental and waste issues.

Our planning ensured Carlsberg had a credible programme for permit approvals, ground-breaking and eventual production.



Carlsberg Brewery, Hamburg
© Arup



Services: Project management, multidisciplinary engineering, architecture and cost consultancy.



Size: 56,000m²

[Read more here](#)

“Arup’s professionalism and rigour on the project was significant, particularly in areas of business case development, master planning, procurement strategy and client-side project management.”

Lukasz Gladysz, Carlsberg Project Director



The problem on our plate



Agriculture & food production

The global population is estimated to grow by more than 2 billion by 2050, requiring a 50% increase in current food production levels to feed the world. With our global food system in crisis, conventional farming is both one of the largest contributors to climate change and one of its biggest victims. We must innovate and embrace agriculture to avoid food scarcity in the future.

Covid-19 has exposed the weakness of extended supply chains, and the urgent demand to find a reliable, local and more sustainable alternative to conventional farming is hardly surprising. We need to find a new approach to food production, not only because of the sheer scale of the problem, but also because agriculture is currently unsustainable.

Many of today's farms consume energy, water, artificial fertilisers, pesticides and other inputs in volumes that are having serious consequences for the environment. A possible solution could be Controlled Environment Agriculture (CEA), more widely referred to as "vertical farming". CEA seeks to create ideal growing conditions for plants by controlling light, temperature and humidity.

Innovation in growing meat likened to proteins within labs without the requirement to raise an animal is another possible solution for consideration. These systems are often vertically stacked and operators seek to automate cultivation and harvesting as much as possible with the help of robots.

In this exciting market, businesses need partners that are able to assist with the increasingly complex demands at an international scale. Both lab meat and CEA could feed populations with locally produced nutritious, fresh produce irrespective of changing weather or climate conditions. Salad and green vegetables can be grown pesticide free,

using 80% less of water required and as little as 1% of the land compared to conventional farming. This prospect made the idea attractive to investors, among them Amazon founder Jeff Bezos.

Integrating ideas such as these within facilities are complex and challenging. Arup staff work collaboratively across disciplines and our expert understanding of buildings, industrial processes and the built environment can assist with these innovation design solutions.

Whether you require integration of sophisticated growing systems with an efficient building layout and HVAC systems, finding the best locations for these new farming structures relative to demand and distribution, or exploring how to reduce energy demand and decarbonise the supply, Arup can help new farmers, entrepreneurs, investors or local authorities develop holistic facilities that form part of a thriving circular ecosystem. Arup can support all stages of the project, from start to finish, delivering the best results across the entire lifecycle.

[Read more here](#)

The Macallan Distillery, Scotland

The design brief required a state-of-the-art facility that will meet the growing demand for Macallan’s famous Scotch whisky, as well as welcoming visitors to enjoy the whisky making process. Arup has worked closely with the Macallan’s whisky production engineers in order to showcase the process and coordinate distribution lines and interfaces in keeping with the architectural intent.

The roof has been designed to create an undulating silhouette in balance with the delicate countryside. Composed of a rectilinear timber grillage, the grass-covered double-curved roof is one of the largest of its kind in the world.


The River Spey is used as a source of water for production and for cooling in the whisky making process, whilst rainwater is collected from the green roof, stored in buried tanks and used to irrigate the roof during dry weather.

Primary steam supply comes from a local CHP plant, powered from the local distillers’ waste product. Waste heat from the distillation and condensing process is recovered and used as the primary source of heating for the visitor centre, with gasfired boilers provided as a backup for use during maintenance downtime.

An unconventional roof

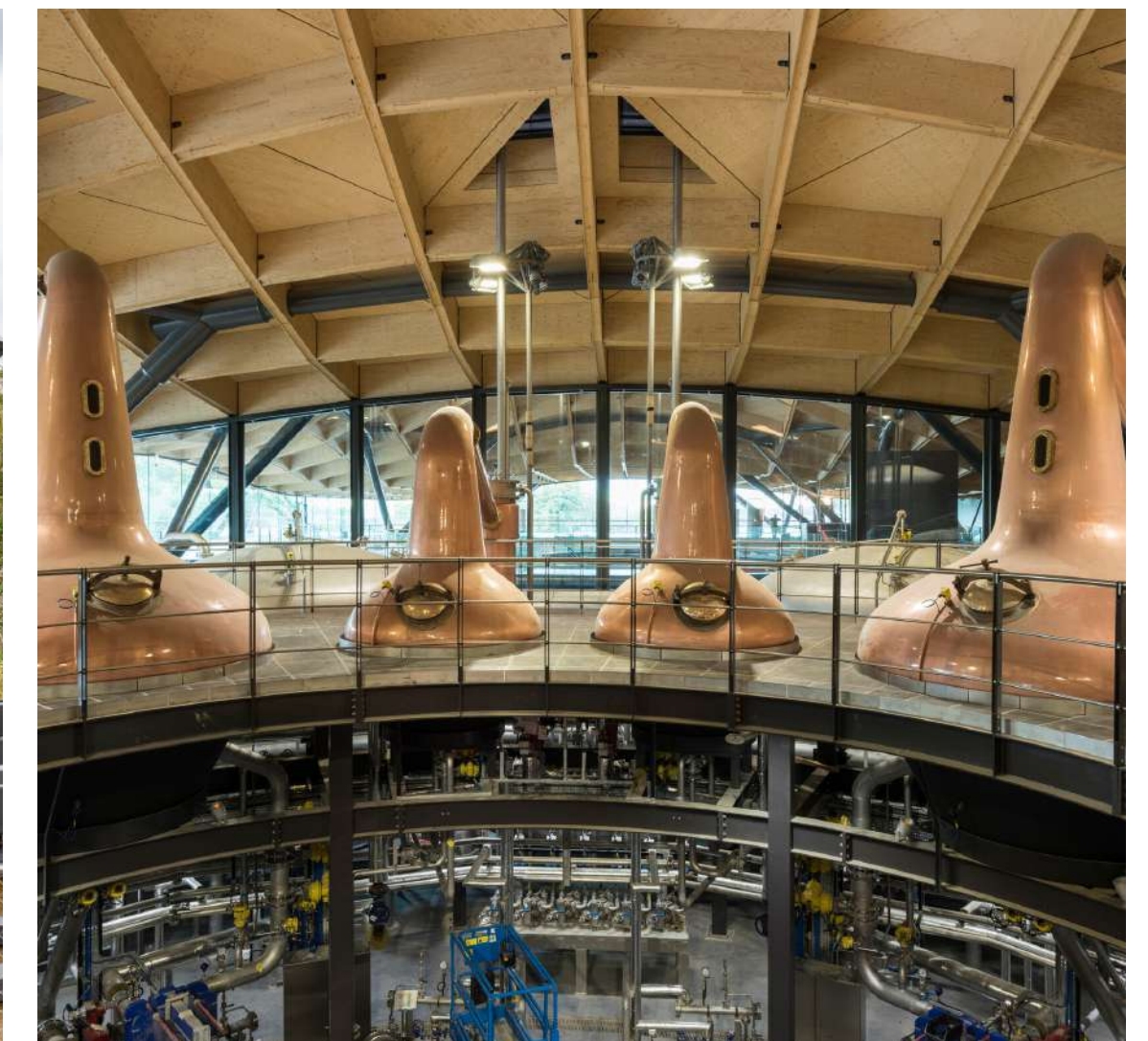
The roof has been designed to create an undulating silhouette in balance with the delicate countryside. Composed of a rectilinear timber grillage, the grass-covered double-curved roof is one of the largest of its kind in the world. The roof is raised above the process hall by steel frames which land on concrete abutments. The ground slab contains integral ventilation ducts supplying air to the process hall within its formation.

This contemporary distillery, designed with Rogers Stirk Harbour + Partners, is envisioned to complement the natural beauty of The Macallan Estate, meeting the client’s vision of an iconic, truly inspirational building as part of their luxury spirit brand. The distillery and visitor centre opened to the public in 2018.

 **Services:** Structural, mechanical, electrical, public health, civil and fire engineering and acoustic consultancy.

 **Size:** 8,100m²

[Read more here](#)



Diageo Global Projects

Arup has provided multidisciplinary services to deliver strategic planning advice on a variety of brewery expansions, refurbishments and developments in Africa, Ireland and the UK. More recently our services have been extended to Brazil, Eastern Europe and India.

Guinness Nigeria plc and Diageo have undertaken a significant expansion of their current operations in Nigeria. This includes capacity expansion at the Benin and Ogba breweries through the installation of three new packaging lines and redevelopment of a third redundant site to serve as a distribution warehouse.

The concept and detailed designs were undertaken offshore in the UK which facilitated easier interface coordination with the German-based process suppliers. The offshore team checked the designs for local regulatory compliance before overseeing its implementation on site.

The new works were constructed adjacent to operational facilities against aggressive timelines and were achieved with minimum disruption to current operations.

Arup, through the mobilisation of on and offshore resources, delivered capacity upgrade works at both the Benin and Ogba breweries to very aggressive timelines



Services: Civil, structural and transport engineering.



Size: various

[Read more here](#)



Diageo Global Projects
© Donal Murphy

Feasibility review of FMCG operations, UK

Working in collaboration with the management team at Weetabix, we developed a site masterplan and supporting roadmap that minimised the implementation risk and prioritised the highest return activities. Our five-year operational strategy not only supported demand ambitions but improved performance of ongoing operations.

As part of a wider review of capital investments, a series of operational scenarios were considered to evaluate the best approach to return on investment. This included the opportunity to realise additional value through an improvement programme that would tackle some of the outdated equipment, processes and restrictive practices in the historic site.

Arup deployed specialist consultants in operations, supply chain, material handling and engineering to work closely with the client executive team to produce a detailed analysis focusing on:

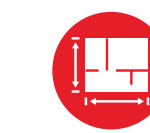
- An operational step change in cost and quality
- Flexibility to adapt to anticipated market changes
- An ability to be delivered in phases and with minimal risk
- Options for a Greenfield masterplan for all manufacturing



Feasibility review of FMCG operations, UK
© Arup



Services: Operations consulting, strategic review, conceptual engineering and conceptual CAPEX input.



Size: various



Cadbury-Wedel Confectionary Plant, Poland

The project involved the construction of the major greenfield confectionary manufacturing plant in Skarbimierz Poland, followed by transfer of manufacturing operations from Cadbury’s Somerdale facility, and represented a significant undertaking for Cadbury. At peak production the facility is capable of producing more than 80,000 tonnes of product per annum and will employ over 300 people.

Arup carried out design work encompassing masterplanning, architecture, geotechnics, roads and mechanical, electrical and plumbing systems.

Arup cost managers worked closely with design and project management teams in Poland and the UK, to ensure the client was informed in a timely and accurate manner of the impact of all design options and decisions. The project was delivered on time and within budget.



Services: Strategic advice for business case justification, project management and multidisciplinary design services including architecture and process engineering via sub-consultants, management of permitting and statutory approvals and cost management services.



Size: 60,000m²

[Read more here](#)

Cadbury-Wedel Confectionary Plant, Poland
© Cadbury

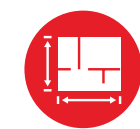
Sviluppo, Sanpellegrino Flagship Factory, Lombardia, Italy

In the creation of a flagship factory for Sanpellegrino S.p.A, an Italian natural mineral water brand, Arup provided building services, civil engineering, building physics and energy strategy services for a 17,000m² facility housing their new headquarters and a bottling plant. Arup supported a design team led by BIG Architects in winning the international competition of this new flagship factory in northern Italy. The design features an arcade, a boulevard, a square and a porch to create an architectural environment where production and consumption, nature and architecture are integrated to elevate the experience for visitors as well as the Sanpellegrino staff.

Through innovation and collaboration, the project succeeded in achieving a timeless, functional new landmark for the Sanpellegrino region, while maintaining a feeling of immersion in nature for visitors and Sanpellegrino staff. The historical heritage of the area was also respected.



Services: Mechanical, electrical, public health, civil engineering, and building physics.



Size: 17,000m²

Sanpellegrino Flagship Factory, Lombardia, Italy
© Arup

“Arup achieved a “truly integrated and sustainable design by drawing on the best international expertise combined with our local knowledge to shape a design solution that meets the client’s needs, is environmentally friendly efficient and respectful of the existing context.”

Giammichele Melis, Project Director

BRITA Headquarters, Taunusstein, Germany

The BRITA Group plans to expand its headquarters in Taunusstein near Wiesbaden in order to accommodate its strong expansion and economic growth with infrastructure and personnel growth. After winning an ideas competition, Arup was commissioned to design the new BRITA campus. Our modular design envisages five elegant office pavilions grouped in a loose arrangement around a central reception terminal with green roof terraces and inner courtyards.

The buildings blend harmoniously into the gentle Taunus landscape and encourage employees to actively use the green spaces in their everyday work. In total, around 20,000m² of additional gross floor space will be created for up to 750 workplaces.

The BRITA campus will first be “built” digitally. This means that the Arup methodology “LEAN” with BIM will be used. During virtual inspections, the project participants can discuss technical challenges and find suitable solutions together. A particularly important aspect: In the event of planning changes, BIM planning shows the concrete effects on the time and cost plan.

With the help of forward-looking project and design management, the multidisciplinary team is able to respond to entire “real” customer requests at any time. The overall design concept can perhaps best be summed up by an “elegant sobriety”: The design process is always holistic and focuses on the discussion about the “best” solution. The design follows four clear drivers: purposeful, simple, efficient, beautiful. And thus, always puts the human being at the centre of our design.

20,000m²

additional gross floor space

750

workplaces

5

elegant office modules



Services: Architecture, structural, mechanical, electrical, public health, fire, façade, and materials handling engineering.



Size: Approximately 20,000m²

[Read more here](#)



BRITA Headquarters, Taunusstein
© NH Studio & Arup

Molson Coors Renaissance Programme, UK

As part of Molson Coors' investment to modernise Britain's biggest brewery, Arup provided strategic advice and project management services. Our site masterplan enabled the business to improve efficiency by selling land, create a smaller site footprint and increase beer production capacity.

Arup was appointed initially to undertake a review of all Molson Coors's operations and assets with a view to consolidate and streamline operations as well as incorporate modern technologies for now and the future. Under robust project management leadership, experts in urban design, planning, cost management, environmental, operations and logistics formed an integrated team to generate conceptual site development options and associated business case for the redevelopment of the brewery and wider property portfolio across the town.

We developed a ten-year phased site redevelopment strategy which enabled the reconfiguration of the site to continue in phases and allow production activities to continue without disruption.

The strategy included identification of potential uses for redundant land and assets within the estate to maximise consolidation and recognise possible land disposal.



Molson Coors Renaissance Programme, UK
© Arup



Services: Assets and operations, programme and project management, masterplanning and urban design and environmental consulting.



Size: 340,000m² estate

[Read more here](#)

“Arup is very professional. On this project we wanted rigour and discipline and we definitely had that. Arup brought confidence to us around administering the contracts, the processes and also in rolling out the processes - our staff on the team adopted them too and this ensured consistency.”

Pete O'Connell, UK Supply Chain Capital Project Manager, Molson Coors Brewing Company (UK) Limited

Pearl Red Winery, Xingning, South China

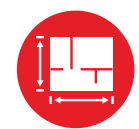
Arup assisted Pearl Red Winery with development of a new factory on a site of 115,000m² with a GFA of 120,000m². It serves as a production facility and visitor centre for tourists coming to Xingning, an area famous for tea production and honey. In addition to traditional white rice wine, the client’s product range includes Hakka yellow wine and health wine. The new facility intends to increase production to 10,000 tonnes per year and enable expansion into international markets.

The restricted layout of the site meant that extensive geotechnical analysis was required. The challenge for the team was to produce a design that ensures that the surrounding slopes and retaining structures are safe, while simultaneously balances the cut material against fill requirements to meet the sloping profile of the site. Additionally, a reservoir located to the north of the site had to be considered for flood risk.

The facility has been designed to maximise standardisation and use of modular off-site construction to assist the contractor to build efficiently and to a high-quality standard in a challenging rural location. Echoing traditional Hakka buildings, the winery creates a new kind of ‘Baijiu’ tourism for China.



Services: Architecture, structural, civil, geotechnical, mechanical, electrical, public health and traffic engineering. Sustainability services, programme and project management, landscape and lighting design



Size: 115,000m²

[Read more here](#)



Pearl Red Winery, Xingning, South China
© Zhangchao

“This is a radical rethink of new and old. Centuries old hand making techniques are balanced with high technology clean room manufacturing. This ethos is echoed in the elegant contemporary architecture in a stunning setting.”

Mark Richardson, Lead architect, Arup



Gerber Juice Factory and Warehouse, UK

Gerber had outgrown their old, disjointed facilities and were acutely aware of the need to reduce environmental impact with a particular focus on minimising waste, increasing efficiency and reducing environmental impact.

Arup provided a single point-of-contact from initial business strategy development through to site supervision for this new 50,000m² facility. Our pragmatic and hands-on approach meant that all key stakeholders were actively engaged throughout which resulted in successfully meeting expectations of all parties. Consequently, our client benefited from a single multidisciplinary team, who worked collaboratively with the design and build contractor to deliver the facility right first time, on time and to budget.

41%

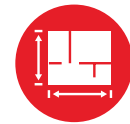
increase in productivity

78%

reduction in waste



Services: Programme management, design management, feasibility, costs and business case followed by full design service to tender for geotechnical, civil, structural, mechanical, electrical and public health engineering plus logistics, acoustics, fire and environmental consultancy for two PPC (Pollution Prevention and Control) applications and emissions trading.



Size: 50,000m²



Gerber Juice, Factory Warehouse, UK

© Arup / Hufton + Crow

Nestlé R&D Centre Expansion, Askeaton, Co. Limerick, Ireland

Arup was appointed to deliver project management and full engineering services for the Research and Development Centre for Nestlé Nutrition on their existing site in Askeaton, Co. Limerick.

The Arup multidisciplinary engineering team collaborated intensely with the design and construction teams and facility end users, to generate the complex coordinated design intended to merge the existing research and development functions into one location.

Arup was responsible for all aspects of the project from concept with a collaborative BIM design model developed to fast track the project design period and to resolve site issues during construction.

41%
increase in productivity

78%
reduction in waste



Services: Commissioning and testing, fire safety design, mechanical and electrical engineering, planning supervision, procurement services, project feasibility, project design and cost management, structural engineering, value and risk management and BIM.



Size: 3,300m²



Nestlé R&D Centre Expansion, Askeaton, Co. Limerick
© Arup

Nestlé Waters, Bursa, Turkey

Following research of the business requirements and concept development, a reference factory on a theoretical site was developed, built from a kit of parts and fabricated in three phases. The Standard Factory Modular Design (SFMD) was developed for Nestlé Waters, building on the lessons learned from previous projects and bringing together winning model practices and experience of water bottling factories.

The key objectives included consistent quality and key principles for a successful and sustainable design from the outset of each site development: modularity, clear organisation and identity.

The factory was designed to be built in phases, from a minimum investment configuration (57,500 bottles/ hr), to a full three production lines plant (139,000 bottles/ hr) with the relative expansion of the logistics spaces, making full use of all the buildable area on the site. This is the first of the SFMD pilot projects, which benefits from the concept and integrated thinking behind it and contributes to the development of the model for projects to come.



Services: Project management, architecture, structural, civil, mechanical, electrical and public health engineering and project management.



Size: 28,000m²

Consumer products

Faster innovation cycles, together with constantly changing market conditions and demand patterns require flexible and adaptable spaces. Modular and adaptable factory buildings allow companies to quickly set up or expand production capacity, or shift production from one type of product or location to another.

P&G, Łódź, Poland

Fast track multidisciplinary engineering design for P&G Blades and Razors factory designed in Łódź, Poland.

The facility consists of three buildings: a manufacturing hall, a packing hall and a warehouse.

Arup's experience and knowledge helped in reducing the design time to a minimum which had a significant impact on the project schedule. Owing to this, the design was completed within five months.



Services: Civil, structural, mechanical and electrical engineering design plus acoustic and flood risk analysis.



Size: 75,000m²

[Read more here](#)



Top: P&G, Łódź, Poland

© Arup

Bottom: P&G Planta Milenio, Irapuato, Mexico

© Paúl Rivera

P&G Planta Milenio, Irapuato, Mexico

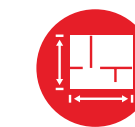
Planta Milenio is Procter & Gamble's (P&G) facility devoted to manufacturing, packaging, and shipping blades and razors to distributors worldwide. Planta Milenio is P&G's first fully sustainable manufacturing facility in Latin America. Arup worked with Davis Brody Bond on a fast track programme to complete the project within two years.

This facility is the first project completed under Procter & Gamble's (P&G) new Global Facility Sustainability Guidelines, a set of company-wide sustainability standards authored by Arup.

The facility's water is 100% recycled, with waste water and rainwater collected and treated at an onsite water treatment plant before being put back into use. Other sustainability measures include exploiting natural daylighting and using energy efficient systems and equipment such as a water cooled chiller, variable frequency pump drives, low energy fluorescent light fixtures and premium efficiency motors on major building equipment.

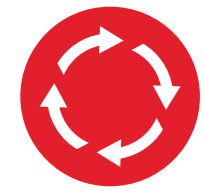


Services: Civil, structural, mechanical and electrical engineering design; acoustic and flood risk analysis.



Size: 75,000m²

[Read more here](#)



Protecting people, assets and operations



Supply chain transparency & resilience

A global pandemic accelerated and tested various businesses and sectors on how well and fast they could respond to the ever changing market parameters and sentiments. In manufacturing, this has exposed the sector to multiple challenges that cannot be easily resolved with the traditional mono-sectorial approach.

An effective solution will require knowledge not just from multiple technical disciplines but rather an ability to integrate different domain knowledge across different sectors and businesses for today's ever more complex challenges.

Supply chain transparency and resilience have often been described as synonymous to visibility and traceability to product component. They also associate with the trend to drift away from "just-in-time" approach on inventory control in manufacturing. However, this may not be the case when fast and adaptive changes are called upon. Adaptive advance manufacturing is the current demand from the market and it would take a rather different view to transparency and resilience on supply.

Resilience in supply could no longer be satisfactorily defined as just more-than-one source. The relocation of manufacturing to location capturing lower skilled-labour cost has proven to be a risky business proposition. Suppliers cannot be simply taken as a supply chain element but rather a wider ecosystem within which the core manufacturing is to take place efficiently and sustainably as key component of the ecosystem. Logistics and storage play another key role in the ecosystem including inventory and buffer.

However, the spoken speed (of change) and eco system do not quite share the same relativity in the scale of time. One is calling for instinctive quick response while another is adaptive equilibrium often achieved over time. Only possible way that both can be balanced or achieved at the same time will be when all market unknowns or uncertainties can be reduced or eliminated. One of these unknowns include market demands.

Today these challenges can possibly be addressed with the advancement in science and technology. The broad availability and easy access to AI and machine learning, fast maturity of 5G and the proliferation of affordable IoTs sensors are all contributing to feasible and robust solutions to these challenges. Data and information allow for insights. IoTs allow for finer control and optimisation of even existing plants that may never be possible previously. The critical factor is the bringing together of all relevant domain knowledge across different sectors and businesses for a federated solution.

In Arup, we not only have the domain knowledge of different business sectors but also a critical understanding of them across geographical regions and engineering disciplines. We can formulate a solution for different phases of a project on behalf of the client from our advisory services to full engineering design and management services.


[Read more here](#)




Manufacturing Facility, Lagos, Nigeria

This diaper production factory in Lagos, Nigeria, intends to serve the market across Nigeria and act as the distribution hub for the entirety of West Africa.

Arup was appointed to provide multidisciplinary design services throughout the project, from concept design through to completion. A collaboration between Arup offices in London and Nigeria, the facility is an example of total holistic design across office locations, to provide the best possible service to the client.

 **Services:** Architecture, mechanical and electrical, civil engineering, cost consulting and project management.


 **Size:** Admin building: Approx. 920m²
Factory building: Approx. 13,200m² (Phase 1 only)

Boots Manufacturing Operational Improvement, UK

Arup worked within a client team to develop an operational concept design and implementation plan for the transfer and consolidation of four sites and overarching manufacturing concept.

The consolidation plan considered skills and knowledge capture and transfer as well as optimisation of physical assets identifying £5.5m annual cash benefits from operating efficiencies.

Arup deployed a multidisciplinary team which included specialist resources in operations, supply chain, material handling, engineering and CAD. This team worked in close collaboration with a large client team to develop the overall concept and implementation plan.


 **Services:** Manufacturing strategy, process layout, material flow modelling, process improvement, in-bound logistics, site development planning.

 **Size:** various

Procter & Gamble Taicang manufacturing campus, China

Arup led the consultancy for the design-basis masterplanning, and front-end engineering for this greenfield diaper manufacturing plant from project registration to technical supervision of the ‘design and build’ contract. The project required the construction of a new baby care production facility, as an expansion of the existing facility which produces beauty care products.

The building houses eight identical diaper production lines with new process utilities systems installed to provide dust control, vacuum, compressed air, trim removal and raw materials delivery to the manufacturing lines.

 **Services:** Building services, civil and structural engineering, architectural design, logistics and industrial consulting, geotechnical engineering, management consultancy and project management.

 **Size:** 24,000m²

Manufacturing

Manufacturing is entering a new era. Key to this shift is the intersection of the virtual and physical worlds, made possible by the integration of software, sensors and communications within cyberphysical systems.



Asia Aluminium Flat-Rolled Product Facility, Guangdong, China

The flat rolled product (FRP) facility includes the construction of a group of interconnected single storey industrial buildings with an overall area of 250,000m².

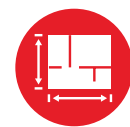
The Asia Aluminium FRP project in Guangdong is a notable success story for Arup. It is the largest aluminium rolling mill in China, constructing on a challenging site, and with multiple equipment suppliers and contractors. The project comprises state-of-the-art cold rolling and hot rolling mills, cast and melt shops, coating and finishing lines, plate department for further fabrications, packing and shipping shops, grinders for the maintenance of roller equipment and stand-alone utility buildings, serving the whole facility during production.

Working closely with the client’s process engineers, Arup provided a fully coordinated utility system design to allow successful extension and hook up by the process designers and suppliers.



Services: Project management and total engineering design including architecture, structural, mechanical, electrical and fire engineering.

Geotechnical engineering and utilities from scheme to detailed design and construction documentation.



Size: 250,000m²



IBM Manufacturing Facility, Shenzhen, China

Arup acted as lead consultant, working closely with the client and sub-consultant teams to design this high-specification facility. We applied a rigorous course of testing and commissioning of all systems and plant equipment on site, to ensure the plant could operate as per the design. This included an integrated systems test to ensure all the equipment was operating at the required efficiency, without wasting additional energy.

To meet the stringent deadlines of the construction programme, the Arup project team prepared, tendered, assessed and co-ordinated design-and-build packages for the cleanroom and de-ionised water systems.



Services: Programme and project management, mechanical electrical, structural engineering, cleanroom design, IT and communications systems.



Size: 10,000m²

[Read more here](#)



AstraZeneca Management Services, UK

Arup were commissioned as technical advisors across the AstraZeneca (Cheshire Unit) industrial sites, with a primary focus of site energy supply, demand and generation systems.

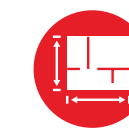
Our team modelled of a range of options to ensure that a biomass CHP technology selected was flexible and appropriate for the site’s requirements.

Arup undertook the role employing the most suitable of client’s engineer to oversee the technical aspects of the design. This included responsibility for the economic modelling and sensitivity assessment of changes to the proposed design. The biomass CHP scheme was not progressed but had the potential to save around 20,000 tonnes of CO₂ per annum.

We developed a site energy consumption administrative architecture, databases of logged data from automated and manual energy meter and sensor readings, and the carrying out of performance analytics. The approach and reporting methodology led to site certification and accreditation by National Energy Services.



Services: Energy management.



Size: various



Digital insights to real world solutions



Digital Twin

Arup is committed to shaping the digital built environment. Tougher market conditions, rapid technological innovations, and changing customer needs require companies to become more responsive to customer desires and expectations. For manufacturing, the shift from selling to servicing a product is the future if manufacturers wish to increase profit margins.

A digital twin is a digital representation of a real-world entity, process or system: a production process, a production line, a factory, a campus, even an entire portfolio, aimed at making the curation of that entity safer, more efficient, and more resilient to change. Digital twins will revolutionise the manufacturing industry, and will have a major impact on the ways organisations anticipate the future.

A digital twin combines data gathered from real-world sources, usually sensors on buildings, equipment and other assets, to produce a data-rich, live and updating virtual model which can help to better understand and test issues. This is possible thanks to the convergence of existing, emerging and affordable technologies like BIM, 5G and sensors, supported with programming expertise.

By reviewing the current state of the digital twin landscape, we are able to elucidate what is still lacking in the typical twin, most obviously, the ability to learn and reason. The digital twin provides insights into an asset's current usage, occupancy levels, productivity, workers wellbeing, performance details and operating costs by turning disparate data into actionable business intelligence.

Ultimately, the evolution of digital twins will help asset owners, managers and society at large to take more informed decisions, on the basis of real-time data.

While we currently have widespread autonomy of warning systems, this will turn into widespread predictive systems, and finally into reasoning twins. It will be central to enabling developers and owners to invest and operate efficiently and profitably, helping them to stay ahead in a world where users and tenants' expectations keep changing.

Machine learning is now endowing the digital twin with predictive skills, and the insights this will generate will soon become common across the industry. At Arup, as we continue to drive forward the development of the digital twin, our clients will reap the benefits.

So how do you develop a digital twin? The first priority is to define common data standards, and connect previously disparate systems, so that a single, continuous, 'live' picture of a building's use and performance can be generated. Achieving this takes a combination of existing domain knowledge from the built environment, digital skills and some new IT investment. Achieving an effective integration of these elements is the central challenge.

[Read more here](#)

Arup Neuron is an app that integrates our insights into the built environment with emerging digital technologies into a single platform

IDA Advanced Manufacturing Centre, Ireland

Transformation is a key area of focus for IDA Ireland's new future strategy and as part of the manufacturing transformation agenda, IDA Ireland commenced building a new Advanced Manufacturing Centre (AMC) in Limerick. This will be a national industry-led manufacturing centre that will work with both indigenous and foreign direct investment manufacturing clients, enabling them to onboard industry 4.0 technologies and processes in the areas of artificial intelligence, robotics, automation, so they can future-proof their manufacturing operations in Ireland.

The purpose of the facility is to foster increase levels of collaboration on training, technology and testing across MNCs, Irish enterprises and the interlinking of the research and education systems.

The AMC will house digitised / smart manufacturing technologies and produce significant amounts of data which will require installation of an appropriate IT, mechanical and electrical systems. Arup provided the full multidisciplinary design of the building from masterplanning through to construction and handover. The facility is due to open in 2022.



Services: Civil, mechanical, electrical and structural engineering, project management.



Size: 3,053m²



IDA Advanced Manufacturing Centre, Ireland
© IDA

Taizhou Valeo Wenling Production Plant, China

The plant is a single storey manufacturing building with a two-storey office building for the manufacture of automotive wiper and washer products for the car industry. Valeo operates under a long term lease with an option of ownership transfer at the end of the leasing period.

Due to business needs, Valeo decided to transfer its current facility from a traditional Chinese style multi-storey industrial building in Wenling downtown to a modernised new industrial facility in the Wenling Economic Development Zone (WEDZ).

Arup was initially assigned to undertake a site due diligence for the proposed new plant. It was obvious during our involvement that there was a big gap in expectation on WEDZ to fulfil all Valeo's technical requirements of the development.

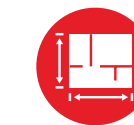
Acting as client's representative, Arup was further engaged in providing design management, interface and technical advice on the preliminary design of the base building by Wenling Municipal Local Design Institute (LDI). Specifically, Arup was also appointed to provide concept design, and preliminary design and construction design support for the HVAC systems.



Valeo Wenling Production Plant, China
© Valode Pistre Architectes



Services: Structural, mechanical, electrical and public health engineering design.



Size: 30,500m²


Alcatel-Lucent Submarine Network, Greenwich, London, UK

The design of a new facility incorporating clean room production areas producing electronic components, stores, dispatch and engineering, customer support, research and development and support function office space. An existing clean room facility (Building 050) is retained and incorporated into the new design.

The primary objective of the project was to reduce the building footprint and running costs. Arup assisted the client in introducing staff to the concept of the flexible office environment, which maximises the use of available space in comparison to traditional cellular office areas. Working examples of flexible offices were visited, including Arup's 8 Fitzroy Street.

Arup was responsible for multidisciplinary services on the refurbishment of an existing site with significant upgrades to the building envelope, fit-out and building services also implemented. Careful phasing of the construction works ensured that the office and sensitive production operations have continued to operate throughout the refurbishment process. This assisted in reducing the overall footprint of the building and improve efficiency and reduce overheads and running costs for the client.

Significant consideration was given to optimising the flow of people and materials through the facility. The design minimised the movement of large, heavy components and hazardous chemicals used in the process.

 **Services:** Project management, architectural and engineering design, cost management and construction, design and management (CDM) consultant.

 **Size:** 10,000m²



Top: Alcatel, Greenwich, London, UK

© Arup

Bottom: West Pharma Ireland Expansion, Waterford, Ireland

© Arup

West Pharmaceutical Ireland Expansion, Waterford, Ireland

Arup was appointed to provide full EPCMV services for the design and construction of this state-of-the-art manufacturing facility. This was a significant appointment that followed our involvement in delivering the basic design and all statutory permitting.

The facility includes high quality manufacturing spaces meeting GMP requirements, containment spaces, cleanrooms classified to ISO 5, 7 and 8, Clean Media room, laboratories, GMP warehousing, technical and administration areas. Most of these were heavily serviced with both clean and black utilities. The structure is reinforced concrete with a steelwork penthouse for mechanical equipment. The manufacturing, cleanroom and laboratories have appropriately specified ceilings, walls and floors. Compliance with GMP guidelines and future cleanability of the spaces dictated the finishes used. Utilities and services distribution was typically routed through zones outside of the envelope of technical and laboratory areas. Where required, walk on ceilings were provided. This also allowed maintenance to be performed outside of the manufacturing areas. Plant rooms were planned to provide efficient use of space while ensuring ease of access for maintenance. The utility plant was designed to maximise energy efficiency.

Services: Design management, stakeholder management, planning and licensing.



Architecture, structural, civil, mechanical and electrical engineering.

Utilities, process coordination, cost management, schedule management, procurement, construction management, commissioning and qualification and validation.



Size: 22,835m²

Somfy Electric Motors Factory, Poland

With a need to accelerate the time to production and adhere to budgetary constraints, Somfy a world leader in automatic controls for openings and closures within homes and buildings, appointed Arup to support them in delivery of their electrical motor plant in Niepołomice near Kraków, Poland.

Engineering a factory in 13 months, we met the fundamental goal of commencing production as soon as possible. Critical long-term strategy was crucial to the quick delivery of a production and logistics centre for Somfy.

Working closely with Somfy to respond to their business objectives, our planners divided the project into four phases. Completing the final design within the first phase ensured a seamless process throughout the project and optimised the costs and schedule.

Challenging ground conditions on the construction site required significant, additional expenses as the soil across the entire plot needed to be replaced up to two meters down due to swampy structure.

To include the extra expenditure within the initial budget, our cost management team worked closely with our engineers analysing and iterating multiple possibilities to work out the most efficient solutions.

“Through all stages of the project Arup proved to be a reliable partner to Somfy. Your team’s professional approach and commitment to delivery contributed to the achievement of Somfy’s business goals.”

Fabienne Larroumets, Group Construction Manager, Somfy



Services: Project management, civil, structural, mechanical, electrical, public health and geotechnical engineering.

Concept design, architecture, building permit design, tender, detail design, author’s supervision, construction supervision and cost engineering.



Size: 13,000m²



Somfy Electric Motors Factory, Niepołomice, Poland
© Arup



Northvolt Battery Manufacturing Plant, Sweden
© Northvolt

Northvolt Battery Manufacturing Plant, Sweden

Arup was appointed as Technical Advisor to the Lenders for this project, to provide financial advice for the operation and maintenance of a lithium-ion electric vehicle (EV) battery manufacturing facility.

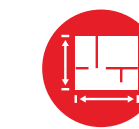
Located in Sweden, the facility will commence large scale manufacturing by 2023, with Northvolt planning to reach a minimum of 25% of the EU’s production capacity by 2030.

The plant will support the reduction of CO₂ emissions through the use of CO₂ free power. Northvolt also targets 50% of the raw materials to be sourced from recycled materials during operation as well as its direct support to the EV industry.

Our role on the project involved a review of the proposed design for the manufacturing plant, proposed equipment and technologies. We also carried out a review of the construction strategy and programme, key contracts and the operations and management strategy.



Services: Civil, mechanical, electrical, production, and chemical process engineering, management and energy consultancy.



Size: various

Research and innovation

Many factories are now designed to enable research, development and design teams to work on the same factory floor, enabling enhancements to products and processes at the point of production rather than in segregated spaces. With the integration of vertical collaboration within organisations, digital and physical factory spaces can be designed to facilitate greater openness and integration. In such an environment, people, technology and process drive value, while space is a key enabler.

University of Warwick, National Automotive Innovation Centre, Coventry, UK


As a showcase of British design and engineering, the National Automotive Innovation Centre (NAIC), which houses up to 1,060 technical staff and engineers, was designed to create an environment to foster collaboration and knowledge sharing. Engineers, designers, academics and research and development teams sought to create and develop technologies to reduce the UK’s automotive sector’s dependency on fossil fuels.

The scale, complexity, and technical diversity of the range of spaces in the building is almost unparalleled.

Despite this, the team achieved an overriding sense of calm and composure to the interior and exterior of the building. Re-using process waste energy, connecting to the University’s District Heating Centre and incorporating 1,900m² of photovoltaic panels, our design has achieved BREEAM excellent.



Top: University of Warwick, National Automotive Innovation Centre, Coventry, UK
© Cullinan Studio / Hufton + Crow
Bottom: Nokia China Campus, Beijing, China
© Arup

 **Services:** Civil, structural, mechanical, electrical engineering, fire, acoustics and information technology and communication.

 **Size:** 38,000m²

[Read more here](#)

Nokia China Campus, Beijing, China

Designed for optimal sustainability and energy-efficient performance, the Nokia China Campus, also known as the ‘Nokia green building’, is the first newly constructed commercial building in China to have been awarded a Leadership in Energy and Environmental Design (LEED®) Gold Certificate by the United States Green Building Council.

The complex serves as Nokia China’s new headquarters and Research and Development hub, providing office space for 2,300 employees.


We used advanced design technologies to achieve the client’s objectives and sustainability requirements. These included computational fluid dynamics, thermal and energy modelling, structural optimisation and building sustainability toolkits.

This campus building is in line with Nokia’s corporate sustainability policy, and an exemplary addition to Nokia’s green asset portfolio. The campus site is inherently flexible to allow for future growth – a reflection of Nokia’s long-term business investment in China’s telecommunications market.

37%
reduction in water consumption

20%
reduction in energy consumption

1st
newly constructed commercial building in China awarded with a LEED® Gold Certificate

 **Services:** Multidisciplinary design including architecture, building physics, lighting and acoustic, facade, fire, master planning, mechanical, electrical and public health engineering, structure and LEED consultancy.

 **Size:** 74,000m²

[Read more here](#)

People - led digital transformation



People & skills

Today, market challenges have added a degree of complexity because nature and the sustainable environment have been disrupted to a critical stage. Many worldwide uncertainties and unknowns, including the extent and duration of any global pandemic (and any possible subsequent new viruses), have forced all of us to accelerate the acceptance of a new norm. This new norm requires a capacity for constant changing, adapting and recovering from numerous environmental and economic disruptions.

Regarding market dynamics, this trend focusses on tackling the fluctuation of demands and their varying requirements with adaptive manufacturing. Previously, the challenge was how far could you match up to market dynamics using passive manufacturing processes? Controlling demand is a more viable strategy now that we are better equipped with advanced technology. Data analytics, predictive manufacturing and target marketing will help match supply and demand.

New challenges require a new approach to reach a resolution. The broad knowledge and awareness of specifics across industries and technologies, will be key to managing and finding a solution to new uncertainties. These skills and expertise will be required of the next generation of problem solvers. The “general specialist” will integrate relevant domain knowledge for the formulation and implementation of a united solution.

Relationships will also change. Companies have been supporting their suppliers throughout the pandemic, which has deepened the bonds between them. New opportunities exist within these challenges.

[Read more here](#)

AMRC Cymru, University of Sheffield, Wales


The AMRC Cymru advanced manufacturing research centre is a new flagship facility in North Wales that will provide a research hub for the aerospace, automotive, food and nuclear market sectors. Working directly for the Welsh Government, the project was delivered through a close collaboration with University of Sheffield Advanced Manufacturing Centre (AMRC) who will manage the building, and Airbus who will be one of the anchor tenants.

A key design objective was to enable the Airbus ‘Wing of Tomorrow’ programme, focused on designing aircraft wings using advanced metallic or composite materials to make them cheaper as well as faster and easier to assemble. In addition to the Airbus workspace, AMRC will manage collaborative workshop spaces for complementary research and development businesses.

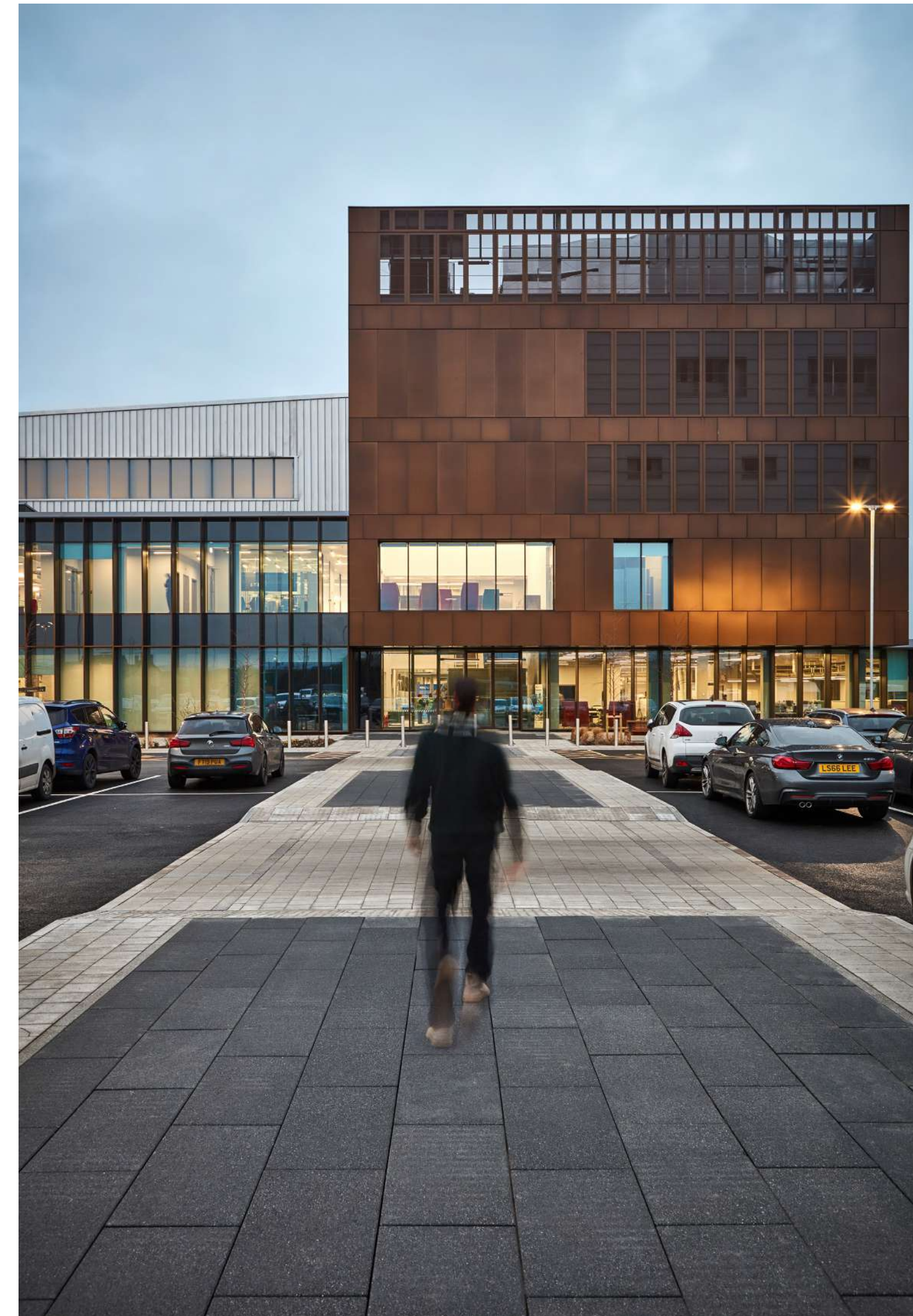
The main building is 19m high with cranes to cover the single storey workshop space, while the adjacent space is four storeys with offices on the ground and first floor and plant on the second, third and fourth floors. The building design is flexible and the two workshop areas can be adapted to one space. Additionally, a flexible floor plate was incorporated utilising a grid of flexible fixing points to replicate a range of manufacturing cells from the Airbus production facility.

The new facility, targeted to achieve BREEAM Excellent, will be a ‘Centre of Excellence’ to showcase the most innovative manufacturing techniques of today and the future. It is expected to attract over 800 visitors annually to the public space and viewing gallery that will showcase research, innovation and technology.

A key feature of the building design was to make it flexible and future proof. The design team could not have predicted the turn of events, but its flexible design enabled the building to be used in the fight against Covid-19. The Ventilator Challenge UK Consortium which includes Airbus, Siemens, BAE Systems, Rolls Royce and GKN Aerospace converted the facility into a manufacturing centre for over 13,000 ventilators for use by the NHS.

 **Services:** Mechanical, electrical and public health engineering consultancy services.

 **Size:** 6,000m²



Advanced Manufacturing Research Centre North West

AMRC North West is a new advanced research manufacturing centre based in Preston, developed by Advanced Manufacturing Research Centre (AMRC). The project includes the first building plot which will be 4,500m² and triple height. It will house a workshop which will be approximately 60% of the overall area and this space will be supported by offices, teaching spaces and ancillary spaces. The external space on the plot includes external delivery, holding areas and car parking.


This project is part of the Samlesbury Aerospace Enterprise Zone, which in turn, is part of the wider Lancashire Advanced Manufacturing and Energy Cluster. It will extend the client’s footprint across the north and play a key role in driving recovery, growth, productivity and innovation in Lancashire.

AMRC North West is a gateway development on the Samlesbury Aerospace Enterprise Zone which is part of the wider Lancashire Advanced Manufacturing and Energy Cluster.

The flagship facility is being built using a £20m grant from the Lancashire Enterprise Partnership (LEP) Growth Deal and extends the University of Sheffield AMRC’s footprint across the north.

The creation of a high-performing technical Research and Development team will enhance the manufacturing base of Lancashire, working with both manufacturing companies and their supply chains.

The cutting-edge research centre will combine modern office workspace with a flexible high-tech workshop facility and a triple-height atrium will form the social hub of the office space where occupants can interact and exchange ideas. A ‘social heart’ space will overlook the workshop where innovation-led R&D will be carried out with a focus on digital and additive manufacturing, vehicle electrification, battery assembly and lightweighting technologies.

 **Services:** Mechanical, electrical and public health engineering consultancy services.

 **Size:** 4,500m²

P&G Sustainability Standards, Global

Arup was appointed to assist Proctor & Gamble (P&G) in creating a global standard operating procedure, to provide guidance on the sustainable elements for all new manufacturing and office facilities, as part of their corporate commitment to sustainability. Sustainable elements in the design of P&G facilities must be sustainably and financially justified, so Arup’s guidance was required to clearly evaluate the sustainable and financial benefits.

To develop a set of guidelines that would meet P&G’s requirements, we took seven areas of sustainability that are used commonly across the industry: site, envelope, materials, water, lighting, passive, active and operations, and identified resource conservation measures (RCMs) for each of them to ensure those areas were achieved. Using a generic office and manufacturing facility as the basis for the analysis, each RCM was evaluated in terms of payback period; CO₂ tons saved per year; impact on energy; waste and water reduction; environmental quality of the workplace; and visibility to ensure that design elements were consistently designed in compliance with P&G’s corporate sustainability plan. Each RCM was also analysed in terms of appropriateness for each global climate zone: hot-dry, hot-humid, temperate and cold-alpine.

Through the analysis Arup undertook, 36 RCMs were identified across the seven sustainability areas that P&G could recommend for most projects. Of these 36 RCMs, 58% saved between 15-30% of CO₂ when compared to business as usual data and 11% saved over 30%. 72% saved energy both on and off-site.

 **Services:** Sustainability consulting.

 **Size:** various

[Read more here](#)



Designers at work
© Arup



The power of influence



Political influence

We are all social creatures influencing those around us every day, consciously or otherwise. However, at Arup we aim to associate the word with inspiring a positive influence in the world through both our projects and our people.

Indeed, Arup's core mission, to shape a better world, almost demands that we seek to influence and inspire our peers and partners.

Climate change, demographic shifts, rapid urbanisation and all the rest cannot be solved by individuals, no matter how committed or well-meaning.

Global challenges demand global solutions, so it is critical that we try to influence, and learn from, each other's expertise. This approach applies in Advanced Manufacturing just as much as other sector

The choices we make today can influence development for many years to come, especially since the scale of the investments involved often means that our decisions become 'locked in'.

As such, it is critical that we work together to 'lock in' good decisions: future-proofed, sustainable and resilient solutions.

At one end of the scale, this can mean working with policymakers, investors and clients to interrogate the true lifetime value of the work we create. Not just valuing capex, but closely examining operational and maintenance costs, along with the so-called 'externalities' that everyone in society ends up paying one way or another.

This value has to be understood to be calculated. But once it is, it has profound implications for everything from regulatory models and choice of materials through to design and the ease of dismantling required to maximise the full benefits of the circular economy for instance.

Equally, we all share a duty to understand how our work will impact the lives of individuals in quite abstract terms too in areas such as the ethics of AI, privacy and data management.

This is critical, because if we lose trust, we lose more than just potential customers – we also lose the ability to influence partners to make positive changes for the future.

This is why 'influence' is strategically important to Arup. And why Arup will always seek to drive, support and reinforce positive influences across our networks.

Logistics

Logistics design and operations consulting for industry prioritises a high level of performance and efficiency while supporting the overarching design vision.

Coordinated and efficient logistics and operational processes are particularly essential for complex and mixed-use facilities that involve diverse groups of stakeholders and interdependent systems and processes. The integration of people and vehicle flows, process, technology and physical assets is essential for those facilities and their successful operations.

Ocado Group's Customer Fulfilment Centres

Ocado Group is transforming the future of online grocery retail through disruptive innovation at the intersection of Artificial Intelligence, Robotics, IoT, big data, and the Cloud. Arup began collaboratively working with Ocado Engineering in 2015 as Ocado Group embarked on a mission to develop and build the next generation of customer fulfilment centres. The ground-breaking warehouse logistics design and automation system developed by Ocado Group took the unique knowledge gained from operating online grocery and radically optimised the process with a fleet of bots and data analytics.

Within this complex chain of logistics, Arup has supported the design process with our advanced structural engineering skills. The output is grids from the size of a tennis court up to the size of three football pitches manufactured and installed with millimetre precision that support thousands of bots each travelling more than 50km per day across Ocado Group's OSP ecosystem.

There was no blueprint for solving a design challenge of this scale and complexity. The workflow developed by Arup was based on breaking the problem down to first principles and the application of advanced analysis, data management, custom automated processes and modelling.

Challenging the boundaries of our software capability with huge data set analyses, enabled us to understand, predict and design for the exceptional fatigue effects on the grid.




Ocado Distribution Centres
© Arup

This exciting partnership between Arup and Ocado Group successfully delivered the first of this new type of fulfilment centre in 2018 with subsequent design iterations and configurations now being distributed in 10 countries worldwide. This is a growing partnership as the global Arup team continues to expand to meet Ocado Group's ambitious plans of changing the way the world shops.

3
football pitches
worth of surface area

50
item order picked
in under five minutes

 **Services:** Structural and seismic engineering.

 **Size:** various



Collaborating through digital tools



Digital

Digital is transforming the industry. By combining virtual simulations, models, dynamic analytics, Artificial Intelligence and machine learning with automation sensors, robotics, IoT and wearables, we are already seeing profound changes in business and financing models, as well as how facilities are planned, operated and experienced. Smart is here for real estates, production facilities, laboratories, warehouses and offices and it will continue to change and shape the industry and the manufacturing environment.

The introduction of 5G technology will catalyse the adoption of the above trends into a consolidated digital transformation, with resilience in supply and real time data available for planning, control, and maintenance. Customised manufacturing and use of AI are increasing in discussions within the sector to allow flexibility, reduce waste and minimise inventory in manufacturing. All are means to a sustainable circular manufacturing economy.

Digital is an enabler for manufacturers to respond to imperatives coming from legislation, competition and climate change. Enabling companies to diversify offerings, achieve more flexible production and increase their resilience, digital is also transforming the workforce and skillsets as well as how teams and organisations are structured and managed.

At Arup, we take a holistic and multidisciplinary approach to digital as well. Digital runs through everything we do. By bringing buildings and assets into the digital realm, we can produce a step change by designing more efficient spaces and operations, achieving net zero buildings, obtaining operational insights and reducing costs.

We are developing analytics tools and digital twins powered by machine learning to produce new generation of buildings, assets, infrastructure, process and supply chains that learn and are more resilient, flexible and sustainable.

Digital is transforming organisations and we believe everyone should be included in the process. Our change management experts support our clients by planning, managing and implementing changes in systems, operations and people. By combining with our Operational Readiness and Transition (ORAT) expertise, we can enable your organisation to be prepared for transformation to the new way of how manufacturing happens.

[Read more here](#)

Clarks Logistics Centres, Somerset, UK and Hanover, US

Arup led the design of Clarks' headquarters in Somerset, after which we were appointed to provide similar professional services and deliver a similar building in Hanover, as they had significantly outgrown their existing North American distribution facility.

Clarks employed Arup to provide advice on the most efficient means of increasing Clarks' distribution capacity in the US annually.

Their need focused on two principal components: the material handling system and building design and construction. These works required distinct specialties and skills, and two separate supplier selection processes. Our holistic solutions enabled the team to adopt a highly efficient, integrated approach to design this modern facility.



Services: Logistics, project management, technical advisory, architecture; civil engineering, structural, mechanical, electrical, fire and public health engineering; landscaping, environmental auditing, geotechnics and LEED.



Size: 41,000m²

[Read more here](#)



Top: Clarks Logistics Centres, Somerset, UK and Hanover, US

© Mitchell Duncan

Bottom: Zappos Distribution Centre Louisville, Kentucky

© Arup

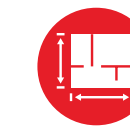
Zappos Distribution Centre Louisville, Kentucky, US

Arup was appointed to design and oversee the materials handling system for a new 55,700m² distribution center in Louisville, taking the project through planning, design, implementation, and transition. Arup's project manager worked full-time on-site during the eight-month project, allowing for any potentially critical issues to be quickly identified and rectified.

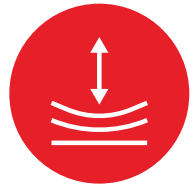
The final design allows for future expansion, and includes unconnected but overlapping receiving and shipping systems, a dedicated returns system, a static-racking system, 120 carousels carrying 1.5 million pairs of shoes, and a built-in photo lab to shoot new products as they are received. By rotating the carousel to bring the product to the picker, Arup was able to vastly improve the efficiency of the picking process.



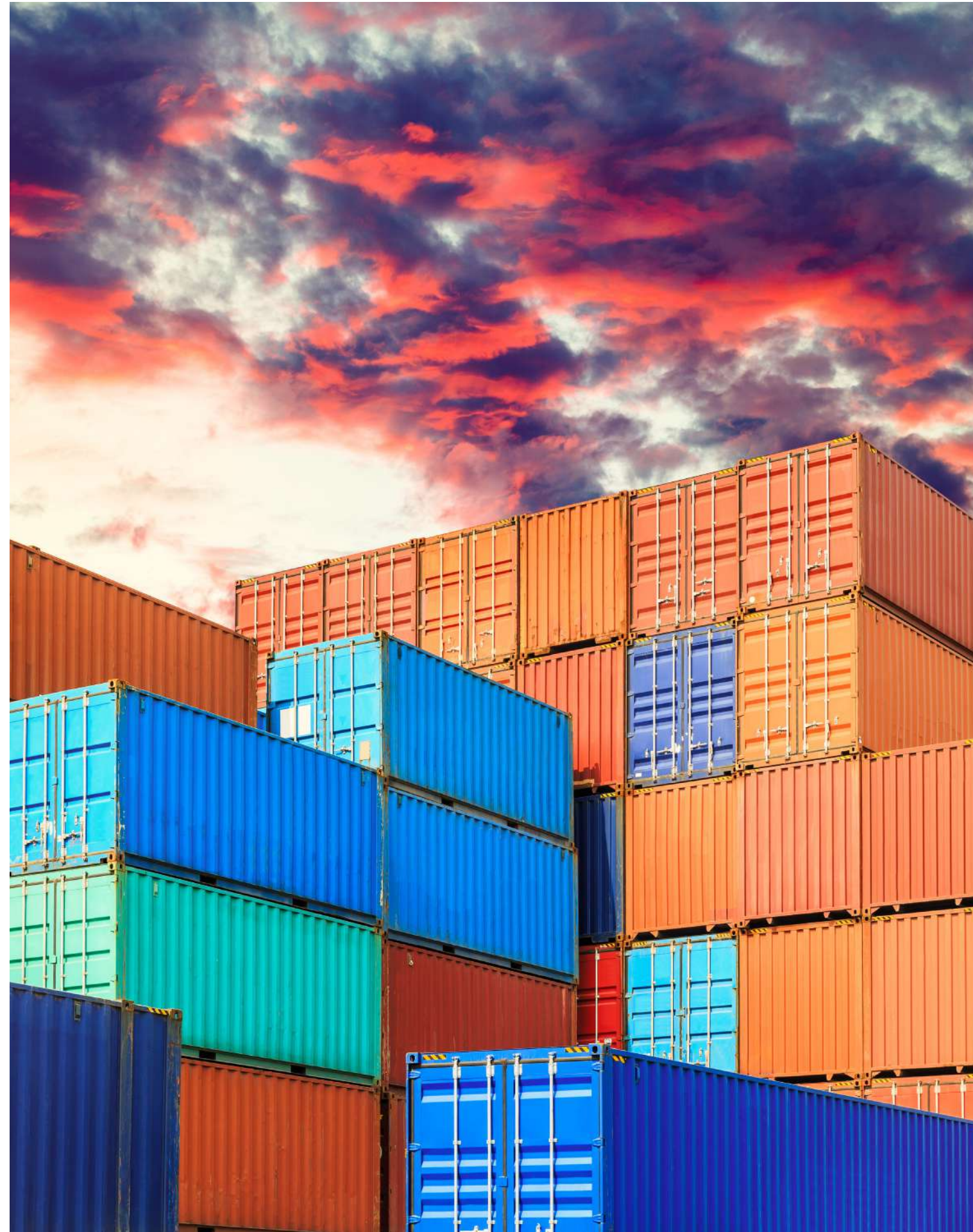
Services: Logistics consultancy and project management.



Size: 55,700m²



Strengthen your supply chain



Organisational & supply chain resilience

The COVID-19 pandemic has tested all organisations. It demonstrated that even those with robust plans had not anticipated the scale of the impact, nor the vulnerabilities this would expose within their supply chains. Two recent surveys by Foley and Lardner LLP¹² suggest a potentially transformative shift in the way manufacturing executives think about their global supply chains: from a focus on low costs and lean inventory, to one that prioritises stability and resilience.

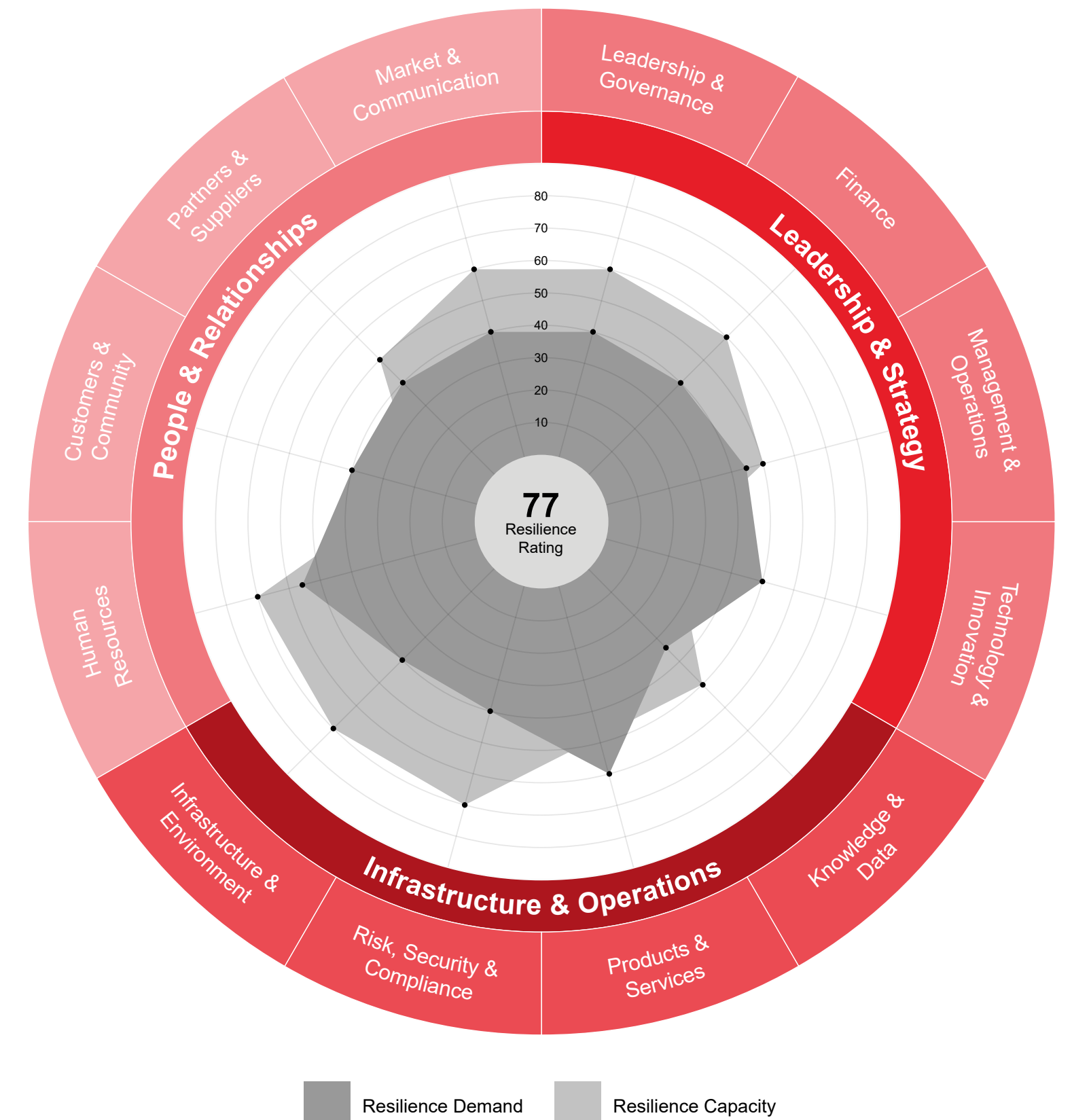
We are living in an increasingly volatile, uncertain, complex and ambiguous environment. We need to be able to flex with this volatility, adapt in the face of uncertainty, embrace the complexity and make decisions in the face of ambiguity. This requires a different approach, a resilience-based approach.

Our resilience approach has three key components;

- An understanding of how your business delivers value using system value chain mapping;
- A clear understanding of the risks, trends and opportunities to your business;
- A measurement of the organisational resilience of you and your supply chain utilising our multi-factor organisational resilience framework.

This allows you to quickly understand key vulnerabilities within your business and supply chain, monitor these vulnerabilities, and develop a clear strategy and business case, based on business value delivery, to protect and enhance your business.

[Read more here](#)



Tool developed for a client to understand their supply chain resilience during COVID
<https://www.arup.com/perspectives/strengthening-the-chain-suppliers-pandemics-and-the-worldwide-search-for-resilience>



Hong Kong Science and Technology Parks Corporation, Advanced Manufacturing Centre, Hong Kong

To grasp the opportunities brought by rapid developments in information and communications technology (ICT) and the Internet of Things (IoT), Hong Kong Science and Technology Parks Corporation has initiated a project for building and managing a specialised multi-storey industrial building for rental to innovation technology industrial partners.

AMC will be a 7-storey building built on a 2.71ha site in Tseung Kwan O Industrial Estate in two development phases. The building will focus on a selection of high value-added manufacturing with activities including research and development, logistics support, prototyping and design.

Arup was appointed as the logistics consultant to work with the lead architectural consultant, Wong Tung, and a Japanese industrial consultant, Nikken, for internal automated logistics solutions. To pave the way for future realisation of ‘Industry 4.0’ standard and just-in-time production we have explored various options of automated materials handling equipment and storage systems. These include automated guide vehicles, automated storage and retrieval system and the operation process required to link up various systems.



Services: Logistics consultancy.



Size: 108,580m²

Hong Kong Science and Technology Parks Corporation,
Advanced Manufacturing Centre, Hong Kong
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FedEx/TNT Hubs Relocation, Europe

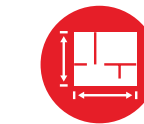
Arup was appointed to provide Europe-wide programme management led by the Netherlands office, as well as local and specific project management in each of TNT’s European Route Network (ERN) locations.

Arup’s services support the refurbishment and relocation of 15 of TNT’s ERN hub sites. Project locations include London, Warsaw, Madrid and Barcelona.

Arup successfully approaches this implementation through standardisation, programme phases and key milestones, resulting in quality across the European Regional Network.

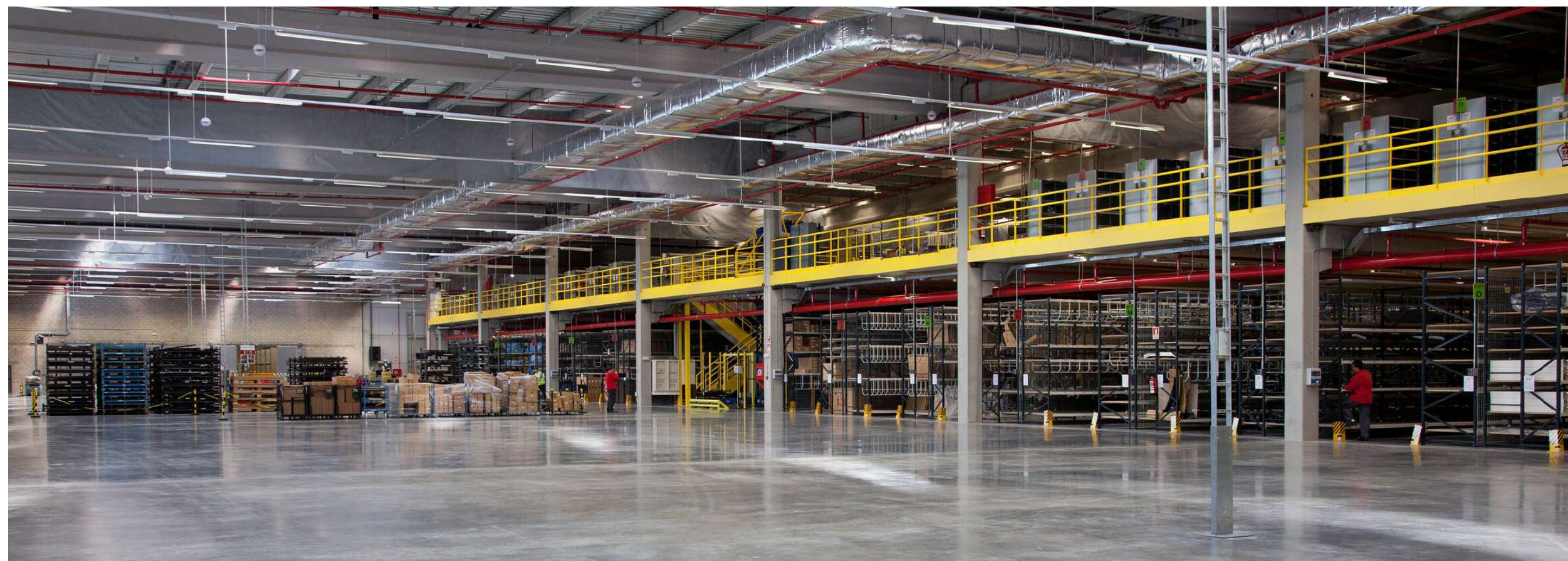


Services: Programme & project management services.



Size: various

FedEx/TNT Hubs Relocation, Europe
©Arup



Toyota Logistics Centre Spain, Toledo

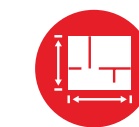
Toyota Motor Europe has invested in the construction of a new spare parts logistics centre in Illescas, south of the city of Madrid. The 20,000m² centre is the reference logistics platform for Toyota post-sales support for Spain and has been designed with the principal drivers of safety in operations, logistics efficiency, expansion capability and low energy use.

This logistics centre is designed under the security guidelines indicated in operations, logistical efficiency, capacity expansion and lowering energy consumption. As the site was a former ancient olive grove, the trees have been replanted and distributed in other locations within the site and therefore integrated in the landscaping design. The centre was designed in accordance to the new Toyota Green Guidelines for Logistics Centres, meeting their corporate expectations in the field of social responsibility.

This new centre will be converted into a reference logistics floor for Toyota post sales throughout Spain.



Services: Full engineering, architecture, and construction management services.



Size: 20,000m²

[Read more here](#)



RDS Developments Ltd Q-Park logistics centre, Kazan, Russia

During the concept design phase Arup prepared the civil, structural, mechanical, electrical and public health engineering concept designs as a basis for developing ‘Proekt’ documentation for the entire development. The firm also provided working documentation for the construction of site-wide infrastructure and the first phase of warehouse construction.

When the project reached the design development phase, Arup provided a technical review and development of the local design institute’s detailed design, enabling the local design institute to submit Proekt documentation.



Services: Transportation assessments and modelling, geotechnics, civil and structural engineering.

Earthworks, assessments of utility demands for preliminary technical conditions and M&E engineering in support of the development of the overall masterplan and concept design.



Size: 207,000m²



Mr Price Distribution Centre, Hammarsdale, South Africa

The Mr Price Distribution Centre has been described as a ‘mechanised jukebox’. It is one of the largest and most sophisticated distribution centres in Southern Africa, providing logistical support to regional, international, and online shopping services and enabling 20% year-on-year growth, increasing distribution speed, accuracy and flexibility. Sustainability and resilience were key to unlocking Mr Price’s execution strategy, with the facility being owner-occupied, aspirations for water and energy autonomy was a critical aspect. Our independent position and depth of expertise in engineering and resilience allowed for the incorporation of sustainable interventions such as the staged final full build-out 1.6MW roof mounted photovoltaic installation, a rainwater harvesting treatment plant with storage to supply most of the potable water demand, pre-fabricated steel modules and pre-cast tilt-up construction elements and a task-based worker comfort natural ventilation strategy. A South Africa market first, energy efficient lighting installation to the entire facility comprised LED luminaires, with daylight harvesting control through an integrated building management systems (BMS).



Services: Site selection support and due diligence, civil, structural, mechanical, electrical and public health engineering, site supervision, energy consulting and traffic consulting and modelling.



Size: 55,000m²

GAP Distribution Centre, Rugby, UK

Arup was appointed by developer Grosvenor Estates to progress the design of this development from feasibility, through the planning approval process and then to tender for the appointment of a Design and Build Contractor, to which Arup was novated to complete the detailed design. This 65,000m² UK distribution centre was developed for GAP and visits were made to their Nashville facility to assist in the interpretation of the brief and to build on the lessons learned.

The centre is a highly automated facility, 50% of which comprises high bay racked warehouse space with the remainder being receiving and shipping operations including 13km of conveyors. The building was constructed to a 12m internal height, the maximum height allowable using early suppression fast response (ESFR) sprinkler systems, thus achieving maximum bulk storage height.



Services: Civil, structural and building services design, fire engineering advice and strategy, coordination role of services, installation and risk mitigation.



Size: 65,000m²



Top: GAP Distribution Centre, Rugby, UK

© Arup

Bottom: Pallas Foods Distribution Centre, Dublin

© Arup

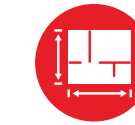
Sysco (previously Pallas Foods) Distribution Centre, Dublin, Ireland

Arup was responsible for the localisation of the Sysco standardised design for a 30,000+sqm refrigerated and dry store warehouse facility and office accommodation which was built in north county Dublin on a new greenfield site. We were responsible for the site assessment, permitting (Planning Application, Fire and DAC submissions), design, management, procurement and supervision of the design and build (D&B) construction project. We engaged with the utility providers and undertook a technical due diligence of the land including an environmental impact study.

The project was a resounding success, delivered on time, within budget and to the very high quality standards required by Sysco.



Services: Project management, stakeholder management, architecture, civil, structural, mechanical, electrical and fire engineering.



Size: 33,000m²

Construction design and management (CDM), quantity surveying (QS), commissioning, energy consultancy, environmental impact statement, façades, geotechnical advice, project supervisor design process (PSDP) and planning advice.

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