Digital Futures is the University of Manchester’s strategic response to the challenges and opportunities presented by the digital revolution. It brings together a multidisciplinary community of over 1000 researchers from across the University’s three faculties with the aim of:

- providing an integrated view of our digital research, creating a ‘front door’ for potential partners;
- bringing together cognate research communities, and exploiting synergies;
- developing a coherent strategy for addressing major societal and technical challenges.

The programme is built around challenges and cross-cutting capabilities. **Societal Challenges** focus on real-world activities that are economically and socially important, building on multidisciplinary strengths within the University. **Institutional Challenges** focus on the potential for digital technology to transform what we do as a University and how we do it: how we conduct research, what and how we teach, and how we function as an organisation. **Cross-cutting Capabilities** are digital frameworks, technologies and methods that are important areas of research in their own right and provide the underpinning for addressing the challenges. The challenges, capabilities and their interactions are summarised in the diagram below.

*Digital Futures activity matrix showing Challenges (verticals), Cross-cutting Capabilities (horizontal) and their interactions.*
Societal Challenges

Health & Care

Digital technologies have the potential to transform health and social care, improving diagnosis, providing new insights, and enabling citizens to play an active role in their own care. The theme explores how care systems can be optimised, using existing and new sources of data to understand the causes and progression of diseases, choose effective treatments, monitor responses to therapy, and power new digital interventions. The theme includes:

- Digital health and care interventions
- Precision medicine
- Learning health systems
- Digital epidemiology and public health
- Behaviour change and self-care
- Real-world trials
- Systems biology

Cities & Environment

Digital technologies, including sensors, integrated networks, data analytics and agile control systems, have the potential to transform cities, and the lives of those who live and work in them, helping us better understand, plan and manage our built and natural environment. Working closely with our city-region and others across the world, the theme takes a broad multidisciplinary approach, bringing together science, engineering, behavioural psychology, social science, public policy, spatial planning and geography. The theme includes:

- Integrated transport and air quality
- Building management and energy efficiency
- Water and waste management
- Digitally enabled public services
- Spatial analytics
- Communities and citizen engagement
- Urban and environmental policy

Business & Employment

Digital technologies are catalysing collaboration, driving business innovation, and transforming the experience of individuals in the workplace. The theme explores the potential for disrupting existing business models, opportunities for generating economic growth, and the impact of digital platforms and automation on patterns of employment – and the future of work itself. The theme includes:

- Next generation services
- Financial and legal technology
- Technology support for business decisions
- Analysis of investment risk
- Regional growth and ecosystems
- The changing skills and employment landscape
- Quality of working life

Industry 4.0

Digital technologies are transforming industry, with the combination of interconnectivity across the product lifecycle, modelling, data analytics and cyberphysical systems driving product innovation, reducing costs, and improving quality. The theme explores opportunities for driving economic growth, using digital innovation to transform industrial practice in fields ranging from advanced materials to manufacturing processes, from high tech products to food. The theme includes:

- Product lifecycle and digital twinning
- Sensor networks and data analytics
- Process modelling, simulation and control
- Materials characterisation and simulation
- Robotic, additive and on-demand manufacturing
- Sustainable manufacturing
- Supply chain modelling and optimisation
Citizens & Government

The internet and, particularly, social media present new opportunities to increase citizens’ engagement in civic and political life and deliver more responsive government. They also raise new challenges for nation states to ensure voters are exposed to accurate and diverse information sources, and are shielded from the efforts of external actors to disrupt core democratic processes and outcomes. This theme draws together researchers examining the impact of new digital technologies on democratic society, with a particular focus on:

- Elections, campaigning and political parties
- Communities and citizen engagement
- Social media networks and online protest
- Government and public services
- Digital inclusion and inequalities
- Surveillance, data-driven democracy, citizen rights
- National/transnational regulation of the internet

Creative & Heritage

Digital technologies now provide unprecedented access to cultural heritage, create new cultural experiences, and have redefined the media and creative industries landscape. The theme works with cultural organisations and communities regionally, nationally and internationally to explore how technologies ranging from social media and virtual/augmented reality to big data and AI are transforming the arts, education, and heritage. The theme includes:

- Digital creativity and creative/cultural industries
- Endangered languages & cultures
- Digital publics and cultural participation
- Virtual/augmented reality access to heritage
- AI and data cultures in arts/heritage organisations
- Digital archives and collections
- Immersive & location-based cultural experiences

Institutional Challenges

Universities need to respond to the challenges and opportunities presented by the digital revolution. We recognise we must transform what we do and the way we do it – to become a digital University. This will impact the way we do research, the way we provide teaching and learning opportunities, and the way we manage a socially responsible organisation with a billion pound turnover. We also need to rethink the ways in which we work with communities, business and government – particularly our key role in providing graduates with the skills that will fit them for the world of work. The theme includes:

- Data-driven research insights
- Enhancing research through automation
- Developing skills for the digital age
- New models of teaching and learning
- Automating and streamlining administration
- Managing and controlling our estate
- Business intelligence

Cross-cutting Capabilities

Data Science & AI

Data science and Artificial Intelligence have become increasingly successful in unlocking new knowledge and powering smart applications of digital technology. The theme brings together methodologists from across the University, to share expertise in organising, interpreting, discovering patterns in, and making predictions from, complex data. A key feature of the University’s approach is very close coupling between methodologists and translational scientists, drawing on strength-in-depth in real-world applications of data science. The theme includes:

- Machine learning and statistics
- Information management
- Text analytics
- Image analytics
- Numerical algorithms
- Privacy and anonymization
- Advanced processor technologies
Digital Trust & Security
As our world becomes increasingly dependent on digital technologies, the issue of whether we can trust the systems we use and the people we interact with has become critical. The theme underpins many of the societal challenges and is profoundly multidisciplinary, ranging across the security and resilience of the underlying technology, work practices and processes, law and regulation, human behaviour, and social norms and context. The theme includes:

- Privacy and data protection
- Cyber-enabled and cyber-dependent crime
- Digital security in the workplace
- Regulation, governance and standards
- Software security (and underpinning maths)
- Secure systems and components
- Human behaviour and trust

Human-Centred Design
As we move towards more sophisticated automation everything we design – from cars to personal digital assistants to algorithms – needs to have human understanding, behaviour and ethics at its centre. The theme explores the individual’s changing relationship with increasingly ubiquitous digital technologies, pioneers new methods for ensuring that the technology we create has humans at its core, and engineers novel interfaces that will transform our lives. The theme includes:

- Human behaviour and user experience
- Collaborative decision-making
- Citizen science and user engagement
- Cognitive robotics and human-robot interaction
- Creative media and augmented reality
- Adaptability and personalisation
- Data ethics and trust

Social Media & Networks
Social media and the social networks they support are an important facet of modern life. They are ubiquitous in peoples’ interactions with each other and with organisations, and are thus relevant to a broad range of societal challenges. Networks are also created by other forms of digital interaction. The theme explores the unique insights into individual and group behaviour that content and network analysis can provide. The theme includes:

- Societal impact
- Politics, democracy and fake news
- Social media analytics
- Individual and group behaviour
- Covert networks
- Network analysis and modelling
- Network dynamics

Internet of Things
Internet of Things technology will play a crucial role in digital transformation across a broad range of sectors, providing the link between physical and digital worlds. It will support ubiquitous sensing of personal and public environments, asset location, real-time control, and context-sensitive communication, providing opportunities for new services, processes and ways of working. The theme includes:

- Low power communications
- Sensor and ad-hoc networks
- Streaming data analytics
- Sensor technology
- Socio-technical systems
- Data aggregation and management
- Context awareness

Policy & Innovation
Unlocking the potential of digital transformation across many areas is likely to require changes in public and business policy, regulation and regional investment. The theme brings together academics from across the University, working closely with Policy@Manchester, to understand common issues and challenges and engage proactively with policy-makers to seek change. The theme will address policy and innovation challenges in areas including:

- Growth and inclusion
- Politics
- Science and engineering
- Environment and energy
- Cities and urban life
- Health and social care
- Trust and security

For more information:
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