Projecting for the Future

Harmonising Energy and Environment

A five-year update on the big conversation

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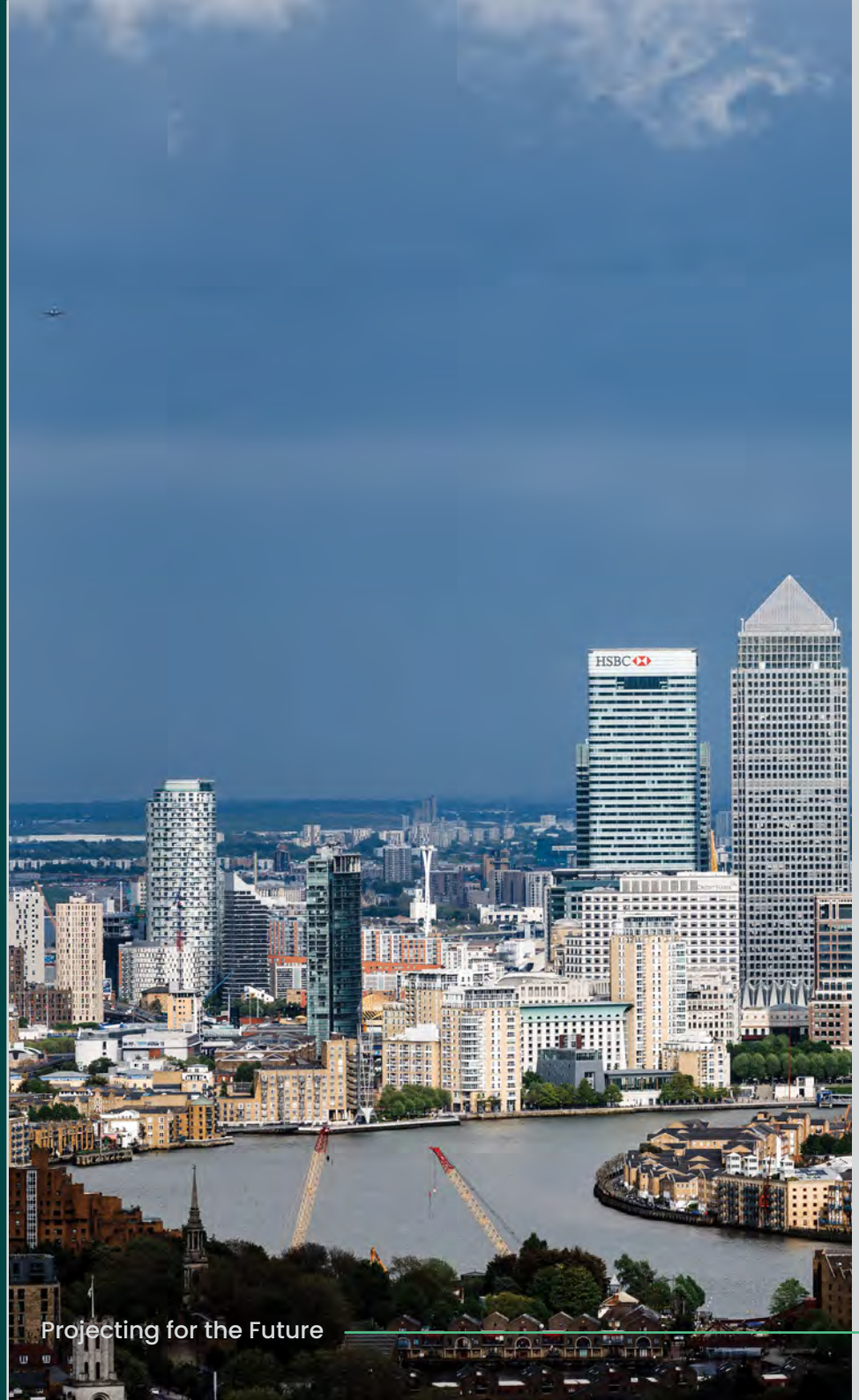


Executive summary

We report on the findings of the third cycle of reflection on the future of the project management profession. The study was conducted to provide insights into what the profession sees as the most important future trends that are likely to impact the way project managers practise their profession, to identify what might need to change in our professional practice as we progress.

The report provides an overview of APM's thought leadership initiative to date, placing that development in the context of the growth of the profession through the four industrial revolutions that have made our world what it is today. We assess where we presently are as a profession by summarising the recent Golden Thread exercises and talking with APM members through a structured focus group process. We then build on the previous two cycles to make some suggestions as to where we might be going. The synthesis of this work gives rise to 10 recommendations for consideration by APM and project professionals:

1 Evaluate the profession's ownership of the role of 'projector'.

2 Initiate a strategic reflection on whether to position our profession as the convening profession, and the implications for our practice.

3 Commission a review of corporate project management development programmes to examine how they align with corporate career paths, and identify best practices to support corporations wishing to develop their programmes in the future.

4 Increase the focus on leadership development by working collaboratively with the likes of the Major Projects Association and university providers of project leadership programmes to commission a review of complex project leadership, and to establish a coherent leadership doctrine, model and competency framework.

5 Evaluate the overall certification offer, identifying what is generic to all project managers, and then build a suite of certifications that cover the full range of project management activity as practitioners specialise in their careers.

6 Review the integration of commercial competencies within project management certifications.

7 Commission collaborative research on how greater modularity and industrialisation will shape the way that infrastructure projects are delivered.

8 Sponsor debate and research that conceptualises the mission level of change, and how it relates to projects, programmes and portfolios, and the convening role of the project profession.

9 Develop a framework for measuring project-level sustainability performance to align with the UN's Sustainable Development Goals (SDGs).

10 Initiate a reflection on the specific contribution of equality, diversity and inclusion (EDI) to successfully projecting the future through psychological safety.

We hope that this report provides valuable insights into current thinking about the profession, the challenges we face and changes to be made to pave the way for how the project profession might help support the UK economy and society in the coming years.

1.0 Introduction

APM launched Projecting the Future in June 2019 to debate the challenges and opportunities for the profession. It built on the 2017 Future of Project Management exercise conducted by Arup and University College London. Its premise was that we are in the early phases of the fourth industrial revolution, based around digital technologies, while also facing grand challenges such as achieving net zero by 2050. Projecting will undoubtedly play a profound role in these transformations, as it did during the first three industrial revolutions, but, arguably, much of our current practice is rooted in the third industrial revolution. For influential commentators, such as Mariana Mazzucato on the mission economy, the epitome of project management remains the Apollo programme, which for many is still our benchmark today.

For this third phase of reflection on the future of the project management profession, we first take stock of the reflections to date, and then place that development in the context of the development of the profession through the four industrial revolutions.

We then assess where we presently are as a profession by summarising the recent 'Golden Thread' exercises, talking with APM members through a structured focus group process, and identifying the central importance of EDI issues for the profession. We then discuss what we see as the most important future trends that are likely to change the way project managers practice their profession: the digital revolution as manifested in Project Management 4.0; the drive for net zero; the lessons from the achievements of addressing the COVID-19 pandemic; and the importance of project leadership if we are to claim a seat at the top table – a place in corporate boardrooms. The three perspectives of past, present and future will then allow us to identify what might need to change in our professional practice, and what we can confidently take from practices from earlier periods. We make this identification in the form of recommendations for consideration by both APM and the project profession more widely.

We have much evidence to work on as we reflect on the ways in which projects are changing. This includes the following:

- Much stronger stakeholder engagement from active citizens who are ready to question the trade-offs between further environmental degradation in the present and sustainability benefits in the future. This adds another level of social complexity. Examples include onshore wind farms, lithium mining and the ongoing debate around nuclear power. How can these dynamics be used to speed up the projects we need rather than bogging them down in regulation?

- Individual projects – even megaprojects – are increasingly interventions in existing 'systems of systems' rather than standalone enterprises. This requires qualitatively higher levels of technical complexity and a much deeper understanding of how social and economic infrastructure interacts with natural ecosystems. How can the tensions between these three systems of systems be resolved positively?

- The digital revolution is starting to transform our projects, in terms of both the technical complexity of delivering cyber-physical systems, and the new digital tools for managing that delivery. The digital revolution holds great promise for Project Management 4.0, but what new individual competencies and organisational capabilities do we need to seize these opportunities?

- A recent McKinsey report argues that a 60% increase on present capital investment levels will be required to reach 2050 net zero targets – mostly in infrastructure projects of various kinds. Projects are central to the global response to the grand challenges we face. Additionally, in the UK context, these investment programmes need to be mindful of the urgent need to rebalance the UK economy away from the southeast.

- Projects played a central role in the response to the COVID-19 pandemic. Multiple accelerated vaccine development projects were extraordinarily successful, relying heavily on innovative portfolio management techniques. Emergency hospital facilities were delivered in record time. Mass vaccination programmes were swiftly launched. What can we learn from these innovative projects, both for future pandemics and more widely?

This paper attempts to address these issues by building on earlier APM thought leadership work through explorations of where we have been as a profession, where we are now and where we are likely to be going, before making some recommendations.

2.0 APM thought leadership on the future of our profession

As the Association for Project Management approached its 50th anniversary in 2022,[1] it commissioned a series of thought leadership exercises on the future of the profession to support its newly achieved chartered status. The first was the 2017 Future of Project Management exercise conducted by Arup and University College London.[2] The forward-looking exercise identified seven global trends impacting on the ways in which we manage projects:

- Globalisation and the shift to working in virtual teams.
- The shift from a closed innovation to an open innovation culture.
- The growing diversity of the project workforce.
- Automation, artificial intelligence and human-machine collaboration.
- The growth of the gig economy and contract work for the project workforce.
- Digital construction and growing project complexity.
- Changing corporate cultures towards a much more decentralised way of working.

1 See *Project*, Summer 2022 for more on this event.
2 UCL, APM, & ARUP. (2017). Future of project management (1st ed.). UCL, APM, & ARUP.

The report provided a series of sketches illustrating the diverse future project management workforce and the changing needs of project owners, supported by vignettes of advanced practice on current projects. It concluded with calls for a continuing process of reflection on the future of project management from the three organisations contributing to the report.

This call was taken up by the Projecting the Future[3] initiative launched in 2019, chaired by Tim Banfield, then of the Nichols Group. Its premise was that we are in the early days of the fourth Industrial revolution, driven by artificial intelligence (AI), big data and robots. Climate change and the need for sustainability demand that we radically rethink how our economy works, while the revolution in human longevity is challenging long-standing norms about how we live and work. Over the following year, APM undertook a 'big conversation' across the profession, using a variety of channels. The stimulus for this conversation was a set of six challenge papers:

1. *The Fourth Industrial Revolution: Data, Automation and Artificial Intelligence (AI)* addressed the promise of a digital future, associated digital transformation projects, and the opportunities for the profession around big data and the development of project data analytics towards Project Management 4.0.

2. *Climate Change, Clean Growth and Sustainability* identified the challenges of our changing environment and the opportunities to address those challenges with infrastructure projects, such as renewable energy generation and flood defences.

3. *Ageing and Demographics: The 100-year Life* discussed the opportunities offered by increasing longevity and the implications for society and the economy, as well as a wide range of new medical product development projects.

4. *The Future of Mobility and Transport* laid out the exciting topic of autonomous vehicles and explained how new product development projects, supported by infrastructure projects, could achieve the electrification of existing transportation modes.

5. *Smart Cities, Urbanisation and Connectivity* assessed the implication of the growing importance of cities to our economy and society, and how cities can become truly smart through new product development projects for intelligent sensors and mobile devices, and the infrastructure projects that allow them all to connect.

6. *The Future of Work and Skills* explored the implications of digital transformation projects on working lives – on both the development of platform systems and the gig economy, and the transformation of office work in a world of AI. It also assessed the place of project managers in this transformed world of work.

3 apm.org.uk/resources/research/projecting-the-future

These six challenge papers were broad in scope and thought provoking in the questions they asked. Generally, they sketched out a positive future for project managers, while emphasising the importance of leadership competencies rather than the traditional project management technical competencies. The responses to these challenge papers were captured through social media, meetings and surveys, as well as in a Corporate Partner Forum. This wide-ranging conversation drew out the following insights as the basis for recommendations for the profession (APM, 2020):

- Casting project management as the 'adaptive profession' at the heart of creating and delivering change in organisations and society. This requires adapting to shifting conditions through continuous learning, while developing competencies from project data analytics, thereby building diverse teams and engaging with stakeholders.
- Meeting these global challenges requires a resilient pipeline of entrants to the profession, both from those leaving education and from those entering the profession in mid-career, such as armed forces personnel. They will be attracted by an "emphasis less on the processes of project management and more on the transformational, inspirational, benefits of projects" (APM, 2020: 12).
- Strengthening the profession by supporting 'learning through life', with project professionals taking responsibility for their careers.
- Winning a "seat at the top table" (APM, 2020: 12) in corporate boardrooms, perhaps in the role of chief project officer, who would take both a strategic and a delivery view of projects so "that project expertise is part of deciding what to do – not just how it can be done" (APM, 2020: 14).
- Collaborating with complementary organisations will be essential to improve the delivery of projects.
- Promoting APM itself, to broaden its influence and highlight the contribution of the profession "as an agent of change working across the economy and society" (APM, 2020: 13).
- Developing an evidence base of what works on projects despite their non-repetitive nature.
- Embedding sustainability into the heart of what the profession does.

From these insights, the process generated a set of actions for project professionals wishing to develop their careers over the next 5 to 10 years:

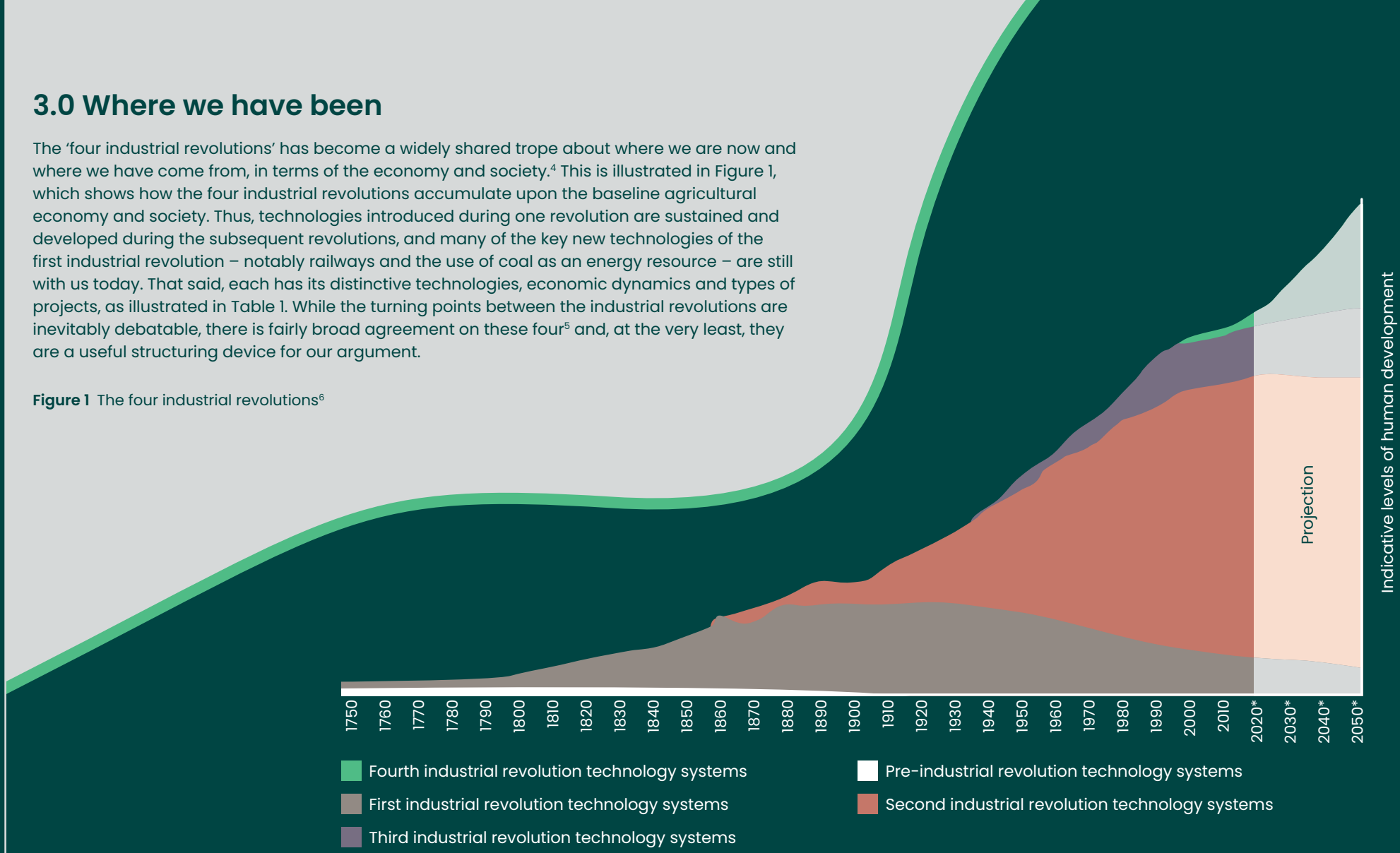
- Generate an 'adaptive mindset' because in a VUCA (volatile, uncertain, complex and ambiguous) world, change is inevitable and so project managers need to be ready to proactively shape change through learning and resilience.
- Invest in continuing professional development (CPD) with an emphasis upon two areas: technical skills associated with project data analytics, and the leading and teaming skills deployed internally and externally to the project.
- Step up to lead and prepare for a seat at the top table – in corporate boardrooms. "Project professionals who aspire to lead projects need to have curiosity, be prepared to think imaginatively, and develop 'out of the box' thinking. Building on their unique core expertise and technical skills, project professionals should develop a broader perspective on project and organisational aims, and how they can be achieved. Shape strategy not just delivery." (APM, 2020: 14)

The foreword to *Projecting the Future* started with the assertion that "the future could look daunting, but for the project profession, it shouldn't – because projects are the way that successful change happens" (APM, 2020: 4). It concluded by saying that projecting the future "is the launchpad for the next phase of the project profession's development. The ideas here point the way forward for the profession to become more adaptive to our changing world. It falls to us all, together, to make it a reality" (APM, 2020: 4). That ambition was rather stymied in the short term by the COVID-19 pandemic, but this third-phase report is part of making that ambition a reality. We now turn to how where we have been has got us to where we are, through four industrial revolutions.

3.0 Where we have been

The 'four industrial revolutions' has become a widely shared trope about where we are now and where we have come from, in terms of the economy and society.[4] This is illustrated in Figure 1, which shows how the four industrial revolutions accumulate upon the baseline agricultural economy and society. Thus, technologies introduced during one revolution are sustained and developed during the subsequent revolutions, and many of the key new technologies of the first industrial revolution – notably railways and the use of coal as an energy resource – are still with us today. That said, each has its distinctive technologies, economic dynamics and types of projects, as illustrated in Table 1. While the turning points between the industrial revolutions are inevitably debatable, there is fairly broad agreement on these four[5] and, at the very least, they are a useful structuring device for our argument.

Figure 1 The four industrial revolutions[6]



4 The original formulation is from the World Economic Forum (Schwab, 2018), and has received wider support (Fleming, 2021) from those wanting to identify the distinctive features of the present stage.

5 One eminent economic historian (Gordon, 2016), writing around 10 years ago, argues for only three. He believes that the digital revolution is not that significant, and that the significant changes came during the second industrial revolution. Another authority (Perez, 2002) is theoretically driven to identify 50-year cycles and so identifies five "techno-economic paradigms", with the first based on water power. However, it is arguable that the full implications of the digital revolution have only become apparent over the last 10 years, and that the inclusion of water power as the basis for the first techno-economic regime does not distinguish it from the agricultural age.

6 Source: Schwab, 2018, Figure 2. Used with the kind permission of the WEF.

We can use these four industrial revolutions to understand how our profession has evolved over the last 250 years or so, and how it drew on important pre-industrial developments in early modern England. Each industrial revolution can be associated with distinctive energy sources and distinctive innovations in the types of projects being delivered, and, hence, distinctive innovations in project management practice. This evolution is illustrated in Table 1, and we have, more speculatively, identified one iconic project associated with each of the four revolutions – there are, of course, other candidates.

Before we move to briefly review each of those industrial revolutions, some context about the pre-history is helpful. The most mature proto-capitalist societies of the 17th century were England and the Dutch Republic. In England after the Civil War, 'projecting' became a widely recognised economic phenomenon (Defoe, 1697; Yamamoto, 2018) as a form of private enterprise.

Table 1 The four industrial revolutions and projects[7]

Revolution	Distinctive energy source	Distinctive projects and programmes	Project organising developments	Iconic major project
First ~ 1770 on	Steam from coal	Canals and lighthouses, then railways	The contractor	Liverpool and Manchester Railway
Second ~ 1860 on	Electricity from coal and oil	Electricity generation and distribution; oil supply and refining; water and sewage; ports; town gas	The professional engineer	Suez Canal
Third ~ 1950 on	Electricity from nuclear and natural gas	Industrial-military complex; airports; motorways; telecommunications; pharmaceuticals; media; natural gas	Professionalisation of project management and systems thinking	Apollo programme
Fourth ~ 2005 on	Electricity from renewables	Digital networks; reconfiguration of second industrial revolution energy infrastructure; cyber-physical systems; digital transformations	Agile	Operation Warp Speed

Earlier projects had been enterprises of the Church or Crown, but now private enterprise was doing the projecting. Projecting not only meant developing infrastructure, such as improvements to the navigation of the river Stour (Yamamoto, 2018), but also seeking patents from the Crown to protect particular areas of economic activity. Thus, 'projectors' were what we would call entrepreneurs today and, arguably, we have now lost this entrepreneurial aspect of projecting.

> **"Projects of the nature I Treat are, doubtless in general of Publick Advantage, as they tend to Improvement of Trade, and Employment of the Poor, and the Circulation and Increase of the Publick Stock of the Kingdom; but this is supposed of such as are built on the honest Basis of Ingenuity and Improvement; in which, tho' I'le allow the Author to aim primarily as his own Advantage, yet with the circumstances of Publick Benefit added." (Defoe, 1697: 10)**

7 Sources: adapted from Winch (2022), Table 1, and Perez (2002), Table 2.2.

3.1 The first industrial revolution

The first industrial revolution was truly transformative, creating the technological foundations of the world we live in today. This revolution was positive, releasing the dynamic innovative potential of the capitalist system, with its inherent processes of 'creative destruction' (Schumpeter, 1943), but also negative in its implications for the immiseration of the new working classes and the associated wrecking of the natural environment. Most importantly for our present time, it started the processes of global warming which we are only now addressing, as captured in a new stratigraphic period dubbed the Anthropocene[8] (Steffen et al., 2011). The new types of projects that supported this industrial revolution were the lighthouse and the canal, but these were refinements of existing pre-industrial technologies. The transformative breakthrough technology was the railway, which is why we nominate the Liverpool and Manchester Railway (opened 1830) as our iconic project.

The principal innovation in project management of the period was the evolution of the contractor as a distinctive organisational actor on projects. The major projects of the pre-industrial age, such as the construction of castles and cathedrals, had employed craftsmen directly, but the rapidly growing industrial economy required the temporary mobilisation of large amounts of labour – the so-called 'navvies' of the canal and railway age. Slowly, specialist firms evolved to manage this labour on behalf of project owners and investors, while developing the technologies required to deliver the project. The Erie Canal was highly innovative in this respect (Davies, 2017), and contractors became widespread in UK construction during the early part of the 19th century (Bowley, 1966). The contractor remains central to project management to this day – very few projects are delivered without procuring a contractor which can mobilise the human and technological resources required to deliver the project. This was also the age of the infrastructure entrepreneur. Many of the early railways around the world were built by entrepreneurs such as Brunel, Meiggs and Brassey, who are very recognisable as Defoe's 'projectors'.

8 The formal designation of the Anthropocene as an epoch following the Holocene was rejected by the International Union of Geological Sciences in 2024, but it remains a powerful trope which we retain here.

3.2 The second industrial revolution

The second industrial revolution was equally transformative – some would argue more transformative (Gordon, 2016). Fundamentally, the invention of electricity transformed lives and required major projects for both the generation and distribution of electrical power (Hughes, 1983). Electrical power transformed the organisation of industry because factory layout no longer depended on belt transmission of power, enabling the assembly line. Urban transit became viable, and the first mass telecommunications technology developed – the electrical telegraph (Headrick, 2000). The massive growth of cities such as London, New York and Paris posed new challenges (Hall, 1998), and major projects, such as the Thames Embankment (Hughes, 2013) and the rebuilding of Paris (Carmona, 2000), were launched to make living in those cities healthier and more convenient, while urban transit systems allowed cities to expand their suburbs.

In parallel with these developments, the invention of the internal combustion engine unleashed a transportation revolution (Gordon, 2016), first on land and then in the air. The infrastructure implications of these developments lie more in the third industrial revolution, but the demand for oil rose dramatically, requiring investment in oil production, refinement and transportation (Middlemas, 1963). These developments all came together at the end of the 19th century in the 'networked house' (Gordon, 2016), in which individual dwellings were connected to urban infrastructure networks for water, sewage, electricity and gas, and were increasingly served by paved roads. Domestic life was transformed, massively reducing the need for servants and supporting the evolution of healthier lifestyles.

The period up to 1914 also saw the first globalisation of the world economy (Hobsbawm, 1987) and a massive increase in the demand for shipping and, hence, shipbuilding and port development projects. The opening of the Suez Canal in 1869 shortened the route from Europe to Asia, particularly to India and China, which greatly enhanced imperial trade and the integration of the global economy. Recent incidents have shown how important this route remains for global trade. For this reason, we identify the Suez Canal as our second iconic project, complemented by the Panama Canal in 1914. De Lesseps, another great projector, triumphed with the first project and failed with the second which was completed by the US.

The period also saw developments in project organising, with the introduction of the professional engineer (Perkins, 1989). The age of the great railway projectors ended with the crash of the Overend, Gurney & Company bank in 1866, which destroyed their financial model. As the society and economy changed, greater emphasis was placed upon independent professional engineers who could hold contractors to account on behalf of established project owners (Watson, 1988). Thus started the professionalisation of those involved in projects and their project managers.

3.3 The third industrial revolution

In the period after 1950, the extraordinary period of long-term growth created by the technologies of the second industrial revolution reached maturity. We entered the period of the 'great acceleration' of the Anthropocene (Steffen et al., 2011), in which the mass use of the technologies developed during the second industrial revolution accelerated global warming. Ground transportation was transformed by the widespread construction of grade-separated limited-access highways (turnpikes, freeways or motorways). The telephone network complemented the established infrastructures in the networked house. Radically new technologies, such as nuclear power, became a significant source of energy, while the exploitation of natural gas led to the construction of yet another form of grid network, linking Siberia to western Europe (Gustafson, 2020). This was also the age of the computer revolution (Gordon, 2016) and a completely new type of project, with information systems projects growing ever more challenging as information systems became more integrated across organisations. What is now Accenture supported the installation by General Electric of the ground-breaking UNIVAC 1 computer system in 1954. These developments were complemented by the development of global cable and satellite communications networks. Air transportation expanded rapidly, leading to demand for more airports and new types of jet aircraft. These last two examples in particular served to integrate the world economy in the second globalisation.

Another important development, stimulated by World War II, was the rise of the pharmaceutical industry following the success of penicillin (Gordon, 2016), producing another type of project that required disciplined project management yet with a high threat of failure if the candidate drug did not work as expected. Similarly, media production for film and television expanded rapidly. By the later years of the period, 'projectification' (Midler, 1995) was taking place across the economy and society, and projecting was becoming a 'generic business process' (Winch, 2000).

Yet it was elsewhere, in the 'military industrial complex', that the most notable developments in projecting took place. The US Atlas and Polaris missile programmes made enormous strides in developing the tools and techniques of project management (Morris, 1994, 2013), and the Polaris Special Projects Office was a major organisational innovation. In particular, the new project planning and control tool PERT (Program Evaluation and Review Technique) was described as "the first management tool of the computer and nuclear age" (Morris, 2013: 34). The Apollo programme (Sayles & Chandler, 1971) drew on these innovations, capturing the attention of the world with its aspirations and achievements, and widely influencing the practice of managing projects. For this reason, we identify it as the iconic project of the third industrial revolution.

As well as developing the principal components of the project management toolbox – for example, the critical path method was developed by Du Pont in the 1950s (Morris, 1994) – the period saw the foundation of the leading project management professional organisations. The International Project Management Association was founded (as INTERNET) in 1965 as an international network of national organisations. The Project Management Institute (PMI) was founded in 1969 with a major focus on certification. It launched the Project Management Professional (PMP) certification in 1984, and first *Project Management Body of Knowledge* (PMBoK) in 1996. The Association for Project Management (APM) followed in 1972 (founded as INTERNET UK), achieving UK chartered status in 2017, which paved the way for the launch of the Chartered Project Professional (ChPP) qualification. The APM *Body of Knowledge*, now in its seventh edition, is presently under revision. These processes of certification provide a vital foundation for the profession; indeed, PMBoK is a US national standard. However, as we will discuss, their implementation across the diverse range of projects remains thin.

The period also saw a profound evolution in thinking about projects and technology more generally. The concept of complexity[9] was introduced at the start of the period (Weaver, 1948; Wiener, 1948), more precisely defined as the problem of "organised complexity" are a "sizable number of factors … are interrelated into an organic whole" (Weaver, 1948: 539), which Wiener defined as "teleological" (i.e. goal-orientated). Some of the essential principles of systems analysis, as espoused by early project management researchers, are captured particularly well in a seminal contribution (Cleland & King, 1968; Morris, 2012). These concepts have never gone away (Gozluklu & Sterman, 2023), and are presently experiencing a revival (Institution of Civil Engineers, 2020) – more on this later.

9 This was not a neologism – Darwin had used the term for biological systems, as had Burke in writing on the French Revolution, but Weaver clarified the concept, and Wiener developed control theory, thereby providing major inputs into systems theory.

3.4 The fourth industrial revolution

Many commentators argue that we are now in the midst of a fourth industrial revolution driven by transformations in digital technology, biotechnology, and energy generation and storage as we move away from a fossil-fuel based economy and society (Schwab, 2018). The pace of change in these technological areas is increasing as the North Sea fills with wind farms and we debate the threats and opportunities associated with generative AI. Generative AI is distinguished from discriminant AI by its ability to autonomously develop new instances of the data set under analysis, usually in response to specific prompts.[10] Most remarkably in this period we saw what could be achieved through innovative project governance to accelerate the development of vaccines against COVID-19. This is why, at the risk of being premature, we designate Operation Warp Speed as the iconic project of the fourth industrial revolution. The period has also seen the diffusion of a major innovation in how we manage projects – the agile revolution – which published its manifesto in 2001.[11] It challenges the linear, waterfall project methodology made famous by the Apollo programme by emphasising short bursts of iterative effort. In appropriate contexts, agile approaches are highly responsive to changing requirements from end users.

10 See Appendix A for a verbatim response to the prompt "project report in the style of Raymond Chandler" generated in seconds by Microsoft Copilot, 15 September 2024.
11 agilemanifesto.org

We will discuss the various aspects of the fourth industrial revolution in detail later, but here we want to make the point that we are moving to a world of cyber-physical systems. Cyber-physical systems are defined as systems where physical and computational elements are deeply intertwined to create self-managing systems for various purposes. They combine the principles of automation technologies of the third industrial revolution with the digital technologies of the fourth industrial revolution, combining sensors, networks and machine learning to create a new generation of systems that can interact with humans through many new modalities. Cyber-physical systems are increasingly paired with digital twins, which provide parallel models to enable the simulation of the behaviour of the physical system under various conditions, including stress scenarios (Lee et al., 2015; Tao et al., 2019). Major applications include (Winch et al., 2022):

- Industry 4.0 taking factory automation and the associated supply chains to new levels to achieve responsive mass customisation in manufacturing and localised production through 3D printing, integrating new materials such as graphene.
- Smart cities treated as systems of systems, where intensive monitoring allows responses to be rapidly made to stress points, and digital twins enable assets to be managed through their lifecycles, analysing the complex trade-offs required between sectors to achieve net zero targets.
- Mobile telephony linking personal handheld devices through global 5G networks, which can also be used to track carbon dioxide emissions, detect traffic accidents, provide situational awareness to first responders and monitor cardiac patients.
- Autonomous vehicles are perhaps the ultimate cyber-physical system, combining sensors such as radar, lidar and sonar with positioning technologies such as GPS, odometry and inertial measurement, managed by advanced control systems to identify appropriate navigation paths and avoid obstacles.
- Smart grids for energy distribution, which provide resilience through self-healing properties and allow the connection of localised generation units such as rooftop solar panels, remote metering of usage, and the management of peak charging loads generated by electric vehicles.

Perhaps most importantly for our argument, the development of cyber-physical systems means that established distinctions between infrastructure projects and information systems projects are disappearing – perhaps in the fourth industrial revolution all projects are essentially information systems projects, while some are embedded in concrete and steel.

Another very important aspect of the fourth industrial revolution is the attempt to reverse some of the major advances of the first and second industrial revolutions. Energy from fossil fuels – first coal and then also oil – provided the fundamental underpinning of those two revolutions. The third industrial revolution pioneered a non-fossil energy source – nuclear – which came with its own attendant problems and which has proven to be remarkably difficult to project outside China (Lovering et al., 2016). At the same time, the European North Sea has served as a remarkable test bed for the development of offshore wind farms with a successful development model relying on modularity and the industrialisation of the development process (Lacal-Arántegui et al., 2018). There are similar aspirations for small modular reactors such as the one under development by Rolls Royce.[12]

12 rolls-royce.com/innovation/small-modular-reactors.aspx

3.5 Summary

Our field, then, has evolved through the four industrial revolutions, while drawing inspiration from the projectors of early modern English capitalism. Throughout this period, Defoe's injunction to projectors remained relevant and remains relevant today:

> **"The Honest Projector is he, who having by fair and plain principles of Sense, Honesty, and Ingenuity, brought any Contrivance to a suitable Perfection, makes out what he pretends to, picks nobody's pocket, puts his Project in Execution, and contents himself with the real Produce as the profit of his Invention." (Defoe, 1697: 35)**

We summarise this evolution in Figure 2, which shows how our profession has evolved over the last 250 years or so. This forms the basis of our investigations into where the APM membership thinks we are now.

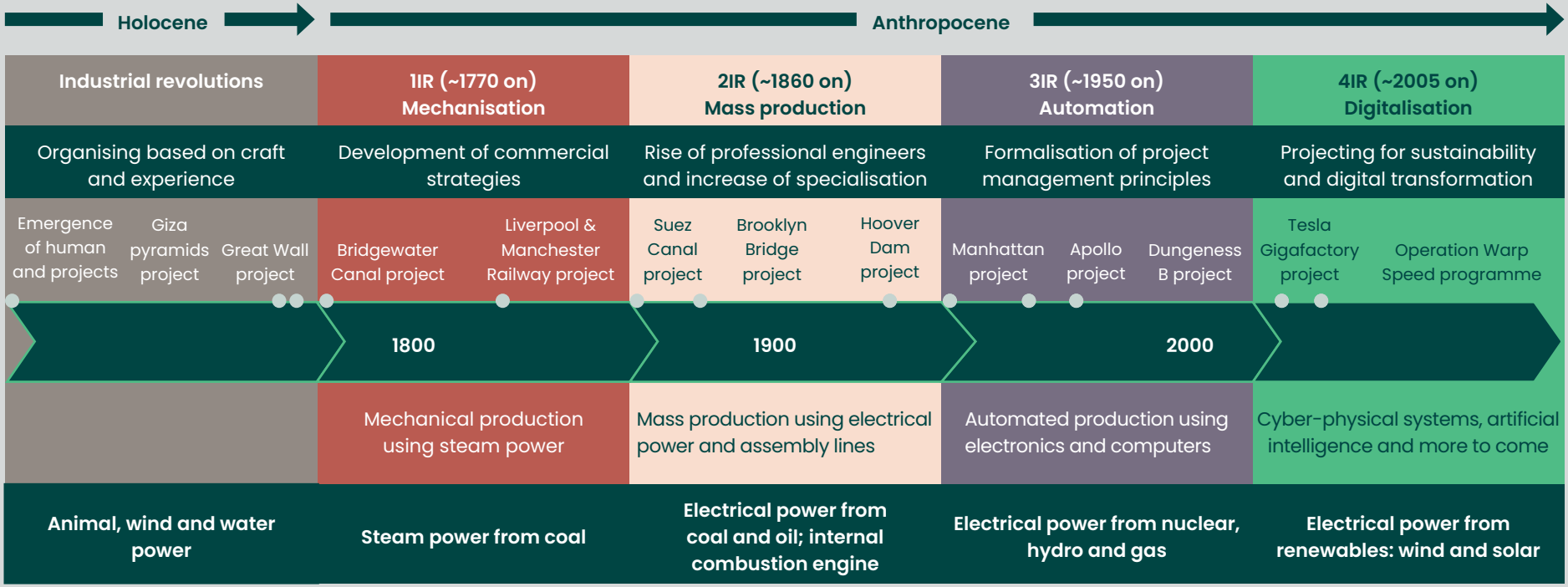


Figure 2: The evolution of projecting over four industrial revolutions[13]

13 Source: Developed from Winch et al., 2023, Figure IV.1.

4.0 Where we are now

Our discussion of where we are now has three main components. The first is a brief review of the two Golden Thread reports of 2019 and 2024. These aim to show the importance of projects – and hence project professionals – for the UK economy and society, and to remove the covers from what was described in the 2019 foreword as the 'hidden' profession. This captured the idea that the contribution of the profession to the economy and society is undervalued and not widely appreciated. The second is the report on the results from our five focus groups, which were held around the country during the latter half of 2023. Finally, inspired by the results from the focus groups, we say more about the importance of issues around EDI in project teams and organisations, and hence in our profession more generally.

4.1 The Golden Thread

The research by PwC found that, as shown in Table 2, projects make a very significant contribution to the UK economy and people in project management roles make up a significant proportion of UK employment. Moreover, these proportions are growing. Although much of this activity is concentrated in sectors such as construction, and financial and professional services,[14] the evidence is that project management activity is a 'golden thread' running throughout the economy in the public and private sectors. While most economic activity remains the routine delivery of goods and services to customers, and the figures do not support claims that we now live in a project economy (Nieto-Rodriguez, 2021), these figures underestimate the relative importance of projects and project management because virtually all intentional change in economic activity happens through projects. It follows that projects and project management are much more important economically than the raw gross value added (GVA) and employment figures indicate, because they are at the heart of any change and growth in the economy.

Table 2: The contribution of projects and project managers to the UK economy (mid-points of estimate ranges)

	2019	2024	Percentage change
GVA[15] by projects	£156.5bn	£186.8bn	+19%
Proportion of UK GVA	8.9%	9.2%	
Number employed in project roles	2.13m	2.32m	+9%
Proportion of UK employees	7.9%	8.5%	

Further growth in both the absolute and relative sizes of contribution of projects to the UK economy can be expected in coming years. Since the financial crisis of 2007, the UK has been a low-investment and hence a low-growth economy, which has resulted in the dilapidation of many assets, particularly in the public sector. These will need to be renewed or replaced. We also face the enormous challenges of addressing the transition to a carbon-free economy, which will, among other things, require a very significant increase in capital investment over the coming decades (McKinsey, 2022; National Infrastructure Commission, 2023).

14 Note that this sector includes most technical and business consultancies, including those in the construction sector.
15 The Golden Thread report by PwC. According to the OECD, GVA is the value of output minus the value of intermediate inputs made by an individual producer, industry or sector. It sums to gross domestic product (GDP) once adjusted for taxes and subsidies.

4.2 Projecting the Future focus groups

Table 3: Focus group host events (2023)

Focus group number and location	Event	Date
1. Edinburgh	Net Zero Nation and Sustainability. Scotland Branch Conference	7 September
2. London	APM Women in Project Management Conference	18 September
3. London	APM Benefits and Value and Governance Specific Interest Group (SIG) Conference	10 October
4. Bristol	Ready for the Future? Artificially Intelligent Project Professional	18 October
5. London	APM Fellows' Forum	31 October

Our empirical investigation of where we are now was undertaken through a series of focus groups conducted in 2023. These focus groups were run as part of various other APM events, and attendees at those events were asked to volunteer to participate in the focus groups, which were held either during lunch or following the main event. Attendees were given a stimulus paper which included questions for discussion, as shown in Appendix B. Discussions were recorded and then cross-analysed. Table 3 shows the APM meetings at which we organised focus groups. We also used Padlet technology to capture short inputs from one meeting as a whole, which could be displayed on the screen to further stimulate discussion. A final review meeting of invited project management professionals was held in May 2024, at which an early draft of this report was shared.

We now present the results by the themes that emerged from the cross-analysis of the focus group data. These are structured by the three key questions posed (see Appendix B).

4.2.1 Opportunities and challenges for achieving net zero for project practitioners

Institutional

- Holistic/systemic vs partial/myopic thinking
- Long-term vs short-term thinking and policies
- Clarity, coherence and commitment vs ambiguity and flippancy
- Ensure it is high on the political agenda vs low on the political agenda

Sectoral

- Recognise interconnectivity of issues
- Focus on outcomes, benefits and value vs cost, time focus
- Focus on societal impact vs focus on profit
- Provide guidance and understanding of metrics and measurement
- Determine new funding models

Practical

- Develop training for skills development
- Collaborate across the sector
- Flexible/adaptable commercial environment
- Define novel project processes for transition

Figure 3: Summary of key themes for opportunities and challenges for achieving net zero

Opportunities and challenges for achieving net zero were identified at institutional, sectoral and practical levels, and summarised in Figure 3. At the **institutional level**, both challenges and opportunities were related to the ways of thinking, and clarity, coherence and commitment. For example, in terms of thinking, two points were made. First is the need to think holistically and systemically rather than in a myopic or singular manner. This emphasises the importance of appreciating the interdependence and interconnections of issues, challenges, objectives, goals, policies and so on. As one participant said: "... we have to make sure we stay focused on those societal outcomes, environmental outcomes remain in scope so when the money goes tight, they do not get removed because it is nearly always the first thing to go". Second, and alongside holistic thinking, is the importance of long-term thinking rather than short-term thinking across the three levels (institutional, sectoral and practical), but with greater emphasis at the institutional level. Longer-term thinking is needed from government, agencies, organisations and individuals if we are to move towards the vision of net zero. It was stated that there are limitations with a lack of a strategic government approach, which has an influence on how organisations (at the sectoral level) then develop and implement their strategies. A major frustration for some practitioners is captured by these statements:

> **"A lot of the time the decision-making, particularly in the run-up to the election, it is just thinking about the timeframe to the next election." (FG1)**

> **"For me, the biggest challenge is working with government department bodies who feel that net zero is something that is in the future. 'I don't need to think about it now' type of thing. There is a big cultural shift that I think still needs to be made that is not being made at the moment." (FG4)**

> **"The biggest challenge is political, it's local politics. In terms of the project, you might have these net zero aims that need to be brought in as part of the project and then you have got a politician who says, 'Oh no, we need to steer the project down this route' and then you have got the political issues across boundaries, you get conflicting politics and that really affects the project." (FG4)**

The second theme that emerged was related to the commitment, clarity and coherence of messaging rather than ambiguity and flippancy. This theme is strongly linked to ways of thinking, particularly at the institutional level. Discussions centred around the need for political will and commitment from government and politicians, the need to make net zero a priority and see it through, linking to long-term thinking, and the need for clear messaging from government. Practitioners stated that there were many things they could do, but that there seemed to be a lack of political will. Other participants were of the view that government needs to mandate it. Participants noted how a lack of commitment has resulted in good policies being scrapped. As one participant stated: "Government is wavering. That then makes our mayors and our politicians waver and it has a massive effect across projects and programmes" (FG4) and "… Once it starts getting uncomfortably close, they [government] kick it down the line, e.g. 2016, 2025, 2070". Net zero and sustainability are not perceived to be high on the political agenda. Discussions occur at government department level but mixed messages are being received. For example, as one participant stated: "We are getting mixed messages from national government; there is a lot more that could be done. There is nowhere near enough investment going in from government into this, and the projects that are given the green light are going in the opposite direction." (FG4).

At the **sectoral level**, both challenges and opportunities were related to three main themes: first, the need for organisations to shift or expand their strategic focus; second, to have metrics and measurement guidance on net zero; and, third, trying new funding models. The idea of both project owners and suppliers shifting or enhancing their strategic focus beyond cost or short-term profit and moving towards a greater focus on outcomes, benefits, value and societal impact was widely recognised by participants, as illustrated by these statements:

> **"I see a lot of it is cost, a lot of the supply chains see there is an opportunity for money and a lot of the supply chain are looking very short-term on profit rather than the long-term collaborative working together." (FG3)**

> **"Constrained budgets drive tension down the supply chain of some of the stuff to do with net zero. It doesn't come without cost, yet the heavily constrained budgets drive the cheaper options rather than the necessarily right one for the long-term goal. The challenge is balancing that tension." (FG4)**

The second theme around metrics and measurement guidance emerged from a perceived lack of knowledge and understanding of net zero. Therefore, the need for guidance on measurement and metrics alongside developing relevant training and education programmes was raised as a challenge of achieving net zero, as captured in these statements:

> **"How can we actually prove where we are today and where we need to get to?… What does the measurement look like and how do we demonstrate that we are meeting and hopefully demonstrating moving towards it?… I think there needs to be some guidance around that." (FG1)**

> **"The challenge is related to those harder-to-measure things, how to monitor and capture the benefits of some of the outcomes… we stick to the ones we know – time, cost, etc. – because that is what is expected." (FG4)**

The third theme emerged through a discussion about obtaining the investment to develop the programmes required to move towards net zero and looking at different approaches to financing, such as green finance. Not all businesses are ready to make investments towards net zero, given that one of the main challenges businesses face is financial. Projects therefore tend to be tailored to what can be afforded rather than strategically thinking about net zero. Therefore, the idea of different funding models was proposed, with Tideway being cited as an example[16]:

> **"We are going to be talking more about, you know, how projects like Tideway are being funded." (FG3)**

Links to the institutional level are also appreciated. Therefore, the importance of recognising the interconnectivity of issues, and the need to go beyond the delivery organisation, project-based firms and owner-operators to the institutional level was discussed, as captured in the following statements:

> **"...[recognised] the interconnectivity of the issues, in other words, achieving net zero, we have to look at social impact of project every bit as much as the metrics (time, cost, quality) and associated risks." (FG1)**

> **"It is hugely complex... [we need] systems thinking and a move away from a very deterministic approach of where we are just here to deliver a single solution." (FG1)**

> **"[The change] has to be from the government from the start. There's a huge disconnect. We've seen it throughout the morning between the time, cost, focus on project to the legacy commitments of that project. Big disconnect and I think there has to be a standard we're talking about." (FG3)**

At a **practical level**, the challenges and opportunities were related to training for skills development, greater collaboration across the sector, a flexible/adaptable commercial environment, and novel project processes for transition.

In relation to the need for metrics and measurement at the sectoral level, discussions centred around skills shortage challenges, and therefore the need for training and education for skills development emerged. This covered training and education for different roles (sponsors, project managers, programme directors, etc.) across all three domains of project organising (owner-operator, project-based firms, delivery organisation) and the opportunities for educators to develop them. There was a consensus on the need for training and education to move beyond 'time, cost and quality', and to integrate sustainability into the teaching content to increase understanding and contribute towards the development of organisational environmental capabilities. Skills that were mentioned as important included critical thinking, uncertainty management and interpersonal skills. Clearly, these are not new skills, but discussions revolved around the need for strengthening them. In addition, the role of professional bodies in helping the profession to develop these capabilities was discussed. Proposals included a series of training packages and qualifications that focused on environmental sustainability for project managers, as well as net zero, and projects to enable project professionals to integrate that thinking into current project management processes, bringing the importance of the "primordial stakeholder" (Driscoll & Starik, 2004) into projects.

16 Tideway used the innovative Specified Infrastructure Project Regulations to create a special-purpose vehicle that is directly regulated by Ofwat.

> **"Lack of skill and knowledge among project managers on how to write a business case that includes the whole-life carbon costing of the project. Professional bodies such as APM can also raise awareness on breaking down barriers for achieving the net zero goal." (FG2)**

> **"There is an opportunity for the APM to focus on the environment on sustainability for PMs to develop those formal skills so that they can integrate that thinking into formal planning… The more we do that, the more it brings to the forefront the importance of the environment in our projects" (FG4) and "APM could have a series of packages, part of a series of qualifications, on sustainability and projects, net zero and projects… with a range of case studies from different sectors to understand what net zero looks like." (FG4)**

Connected to the sectoral- and institutional-level themes is the need for greater cross-sector collaboration and a need to move towards a collective endeavour mindset to accelerate outcomes. The discussion points raised were at a practical level, such as the need to share knowledge on initiatives that work, to avoid duplication of effort and to enhance learning opportunities by moving people across the sector.

> **"I think the need for whole-sector collaboration is perhaps stronger than it's ever been and it kind of probably goes beyond sector collaboration between public, private and all that, and lots of private-sector organisations working together." (FG3)**

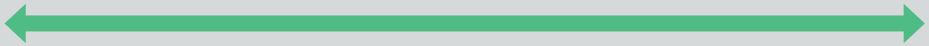
The commercial environment that practitioners create and experience on a project was also discussed, along with how that can sometimes constrain the inclusion of sustainability. This may occur, for example, where the focus is on cost and there is limited scope to consider ideas about sustainability, where the supply side is driven by cost and profit, or where there is a lack of incentive to collaborate and engage in the relevant conversations. The discussions brought attention to the behaviours of both owner and supply-side organisations.

> **"I think the biggest challenge that we face is, you know, we're delivering high-priority projects from the government and particularly we have at the moment a pretty big fixed contract. And so we don't really have the scope to bring sustainability into that; it's not something that we really consider at the forefront." (FG1)**

A final challenge and associated opportunity is related to the need for novel processes and practices. The role of projects was seen broadly the same as we transition to net zero but with the added dimension of the natural environment. Therefore, questions about being or becoming responsible project managers, of doing the right thing, were considered. Changes in perceptions (thinking beyond cost, time and quality metrics) and organisational culture (the way of doing things) were required. In addition, questions about existing processes and their relevance for future transition were also raised. Discussions highlighted that current PM processes have not evolved alongside the profession: terms such as 'stuck' and 'fossilised' were used when describing current project management processes. Therefore, this presents an opportunity for an evolution of these processes. However, there was no clarity on how processes needed to evolve. The role and responsibilities of project managers were discussed, with a proposal about the need for greater interaction between the project manager and project sponsor to manage the changes needed as the project progresses. Project managers would require the same soft skills but with more emphasis. Tensions in estimating practices where the focus is on a desire to achieve the project quicker, faster and cheaper, so the broader impacts and social benefits get reduced or removed, were also discussed as something that needed to be addressed.

4.2.2 The distinctive contribution of the profession

The second question aimed to explore the distinctive contribution that the project management profession could make to deliver the investment projects required to help address the challenges we face, as shown in Figure 4.



Strategic (emphasis)

- Boardroom education
- Better-informed directors and sponsors
- PMs involved in strategic conversations and decisions
- Engaging with stakeholders
- Projecting future vision
- Business ethics
- Evidence-based decision-making

Delivery (emphasis)

- Systems thinking
- Benefits management
- Risk management
- Change management
- Portfolio management
- Outcomes and benefits
- Innovation
- Becoming 'responsible' PMs

Figure 4: Summary of key themes for the distinct contribution of the profession towards achieving net zero

The discussions centred around distinctive contributions at both strategic and delivery levels in project organisations. At a **strategic level**, project management professionals considered they should be involved in strategic conversations and decision-making processes to make the most beneficial impact on a project and on the business portfolio. They also desired better-informed sponsors and boards of directors, given their responsibilities for decision-making. This requires an increased focus on evidence-based decision-making. Project management professionals recognised how they can help structure the investment conversations alongside considering the moral and ethical aspects of decision-making.

Although stakeholder management and engagement is a key practice for project managers, the project professionals recognised that, in the process of moving to net zero and managing the change, more attention needed to be paid to effectively engaging with stakeholders at all levels – from the executive board to local communities – to ensure net zero buy-in and net zero goal alignment, enhance net zero understanding and empower individuals to 'drive the right behaviours'. This idea is captured in the following statement:

> **"Another important impact we as project managers can make is in the way we set up the project and engage with our stakeholders to ensure they are aligned with the net zero goals. This can be achieved through collaboration with other stakeholders to drive collective action. It is important to mention that the adjustments needed for transition to net zero are required not only at project level but also at government, sector and businesses levels. Project managers can play an important role by voicing their needs [for achieving this goal] to senior leadership." (FG2)**

Distinctive contributions at the **delivery level** include systems thinking, benefits, risk, innovation, change and portfolio management, enabling outcomes and benefits realisation, and becoming responsible PMs. For example, a distinct contribution of the professions was seen to be their ability to deal with change.

> **"Project managers tend to deal with change; that is the whole point of our existence. Moving to net zero is just another change. It is a difficult change; I don't see why we couldn't be leading that, because we are already used to dealing with change." (FG3)**

> **"How should project managers operate differently? It is about being responsible. How can we become responsible project managers?" (FG1)**

> **"I'm gonna think probably increasingly we all have a responsibility to do that [talk about sustainability], but it takes a bit of courage too… how do you do that in a way that helps the organisation you're working for to do that in a sustainable way?" (FG3)**

4.2.3 The competencies required

The third question aimed to explore the specific competencies required from those who will shape and deliver these projects, as shown in Figure 5. Discussions identified a range of skills widely recognised by the profession such as leadership, stakeholder management, benefits management, business change, systems thinking and digital literacy, complemented by the soft skills of collaboration, communication, storytelling, resilience and projecting the desired future state to be achieved by the project.

> **"I think soft skill is needed, I think some sort of education on what sustainability is and, you know, PM tends to be sort of the dumping ground of all these things. The PM ends up juggling and wearing lots of different hats and you've kind of got an awareness or you're not necessarily an expert in in any particular thing, you're kind of a jack of all trades. And I think that is a risk in itself if you're, you were almost like the single point of failure." (FG3)**

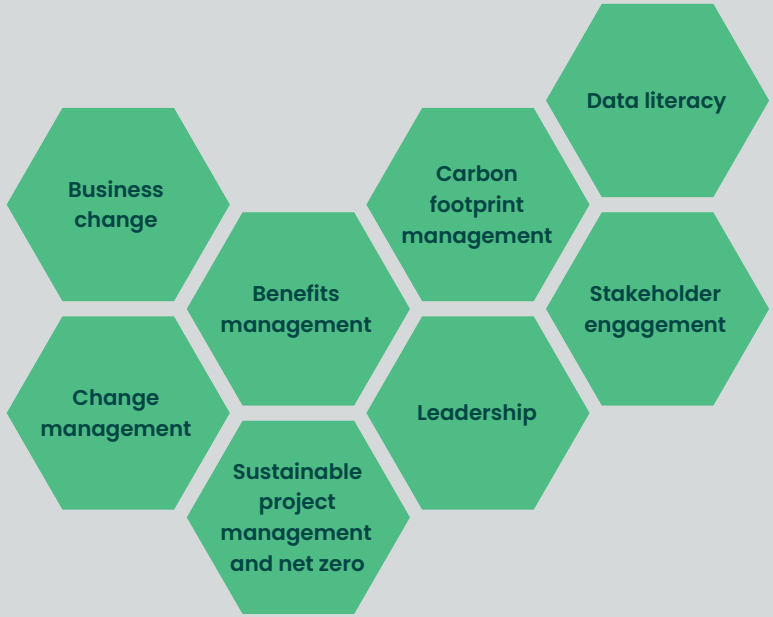


Figure 5: Summary of key skills

In addition, participants identified the need for practitioners to have a technical understanding of net zero, relevant approaches, technologies and alternatives, and skills in carbon footprint management to assess carbon impacts of projects.

> **"I think the role of the project manager is more than ever going to need to be someone who's effective at kind of gluing the team together and that point around collaboration. And I think, yes [that's what they do already], the only difference is probably more important in the future because, for whatever reason, we've got the circumstances that you articulated that we've got complex supply chains potentially more complex than we've had, maybe because of programmes or project programmes are more difficult or more challenging or maybe there's market forces that have created life to be that way. But that ability to collaborate and finally we're talking quite a bit here about the project manager and advocate in that." (FG3)**

An early version of this report was presented at an invited workshop of senior APM members in May 2024. The discussions largely validated the findings of this report, but concern was voiced that the reported findings from the focus groups lacked ambition. In other words, as one attendee commented, the findings in Figure 4 could have been reported at any time over the last 25 years. We will return to this issue in our recommendations. Other concerns raised in discussion included the rather chilling effect on innovation of New Engineering Contract (NEC) forms of contract in the construction sector, and the naivety of exhorting collaboration in commercial relationships without greater change at the institutional level. The discussion also stressed the importance of project leadership in contrast to project management, and recommended consulting the new British Army leadership model.[17] For this reason, we have included a section on project leadership in section 5.4.

17 British Army Leadership Competency Framework, Sandhurst, 2024. Note that this document is subject to the Official Secrets Act 1911–89.

4.3 A just transition: The importance of equality, diversity and inclusion

As we navigate the fourth industrial revolution, it is critical to champion EDI in the forthcoming transitions. By doing so, we can forge a future that is both *sustainable* and *just*. The project profession plays an integral role in the equitable transition towards net zero, a goal whose importance cannot be overstated. Project professionals need to adopt a holistic and forward-thinking approach to ensure that the shift to a digitally enabled net zero economy and society is not only achievable but also socially acceptable. Therefore, an inclusive approach to achieving net zero is essential, as it addresses the multifaceted challenges of climate change while simultaneously fostering economic growth and resilience (McKinsey Institute for Black Economic Mobility, 2023).

Diversity is a crucial element for a successful transition to net zero. A recent review (Gardiner et al., 2022) reveals that project teams with greater diversity display increased knowledge creation. Organisations that encourage personal development plans for teams can enhance the potential of diverse teams to be creative. The elements of diversity within the project context identified in this research include team diversity, organisational diversity, informational diversity, project partner diversity, user diversity, requirement diversity and project (technological) diversity. It is essential for the profession to recognise the need for involving diverse voices, by including people from diverse demographic, experiential and cognitive backgrounds in planning and executing net zero strategies. Recent industry research highlights the significant impact that diversity within organisations has on advancing towards a net zero future. Such organisations, by embracing inclusivity and striving for equitable outcomes, are better equipped to tackle the pressing challenges associated with net zero initiatives. The primary advantage of this diversity is the facilitation of innovative solutions stemming from a rich variety of thoughts, practices and ideas. Furthermore, it enables organisations to secure stakeholder engagement and drive behavioural change by reflecting and respecting the perspectives of a diverse population. In essence, considering a multitude of voices not only fosters innovation but also ensures that the transition to net zero is a collective and representative effort (National Grid, 2023).

When it comes to **inclusion**, the emphasis is on inclusion of individuals and stakeholder inclusiveness. All voices, especially those from marginalised or vulnerable groups, need to be heard and considered in the decision-making process when addressing the multifaceted challenges of climate change. This allows for open dialogue and collaboration. These are key aspects of procedural justice, which is one of the two main elements of a just transition, alongside distributive justice (Trimmel at al., 2024). It's essential to ensure equal access to opportunities so that everyone can contribute to, and benefit from, the green economy (Lugonzo & Chege, 2021). Equal access to resources is also crucial for enabling all communities to adopt sustainable practices and technologies. Valuing and accepting differences can create an inclusive environment where diverse perspectives and solutions can thrive, leading to more effective and equitable climate action (Baker et al., 2021).

By prioritising **equality**, we can ensure that the transition to net zero is not only environmentally sustainable but also socially just and inclusive. Empirical research on the effectiveness of gender equality interventions in UK project-based construction firms reveals that firms that recognise injustices and gender discriminations, and attempt to address these through gender equality interventions, have a strategic advantage that can drive long-term sustainability and success (Hajikazemi et al., 2024). To achieve a just transition to net zero, it is vital to remove barriers that prevent marginalised communities from participating in and benefiting from the green economy. This includes addressing systemic issues like lack of access to education, technology and financial resources. Providing appropriate support ensures that all individuals and communities have the tools and assistance they need to transition smoothly, such as training programmes, subsidies and infrastructure improvements. Addressing historical injustices is crucial for rectifying past inequities and ensuring that the benefits of a net zero future are shared equitably.

The essence of considering EDI values in this journey is to make sure that the shift towards digitally enabled net zero does not leave anyone behind and that everyone has an opportunity to contribute to, and benefit from, the transition. This journey perhaps starts with educating project professionals on the importance of EDI in the context of climate action and raising awareness of how climate change can significantly impact socioeconomic development, especially marginalised communities (McKinsey Institute for Black Economic Mobility, 2023). A crucial element of EDI in project teams and organisations is psychological safety (Edmondson, 2019). Psychological safety is the property of the team or organisation that encourages members to speak up about their concerns, particularly regarding issues as safety and performance. The ability to voice a concern without perceiving a risk of being admonished or belittled is vitally important for teams and organisations engaged in complex tasks. Note that it is not an individual competency but an organisational climate and culture that favours openness and discussion around the challenges the project faces in achieving its mission.

The transition to net zero presents a promising horizon for employment in the UK, with predictions of the creation of 135,000 to 725,000 new jobs across low-carbon sectors, including building retrofits, renewable energy and electric vehicles (Climate Change Committee, 2023). These sectors are predominantly project based, underscoring the necessity for the profession to forge inclusive pathways for diverse talent. This involves not only providing training and skill development but also ensuring job descriptions are welcoming and accessible. Additionally, the cultivation of mentorship and sponsorship opportunities is vital. To fully realise this potential, a concerted effort in reskilling and upskilling the workforce is required, particularly in pivotal areas, complemented by government support. Such comprehensive measures are essential to harness the full spectrum of talent needed for a sustainable and inclusive net zero economy.

Moving away from decision-making driven by short-term metrics of time, cost and quality, and focusing on benefits and the broader impact of projects and programmes calls for extending the EDI principles to the supplier domain. For instance, project owners should encourage suppliers to adopt sustainable practices and diversify their workforce, for example by considering supplier diversity metrics when evaluating partnerships. This could include adopting gender-inclusive practices in commercial management to enhance resilience and sustainability. It is also important to raise awareness of how the profession will be impacted if EDI principles are disregarded. For example, the cost of ignoring gender in equality has been estimated at $28tn to the global economy (McKinsey, 2015).

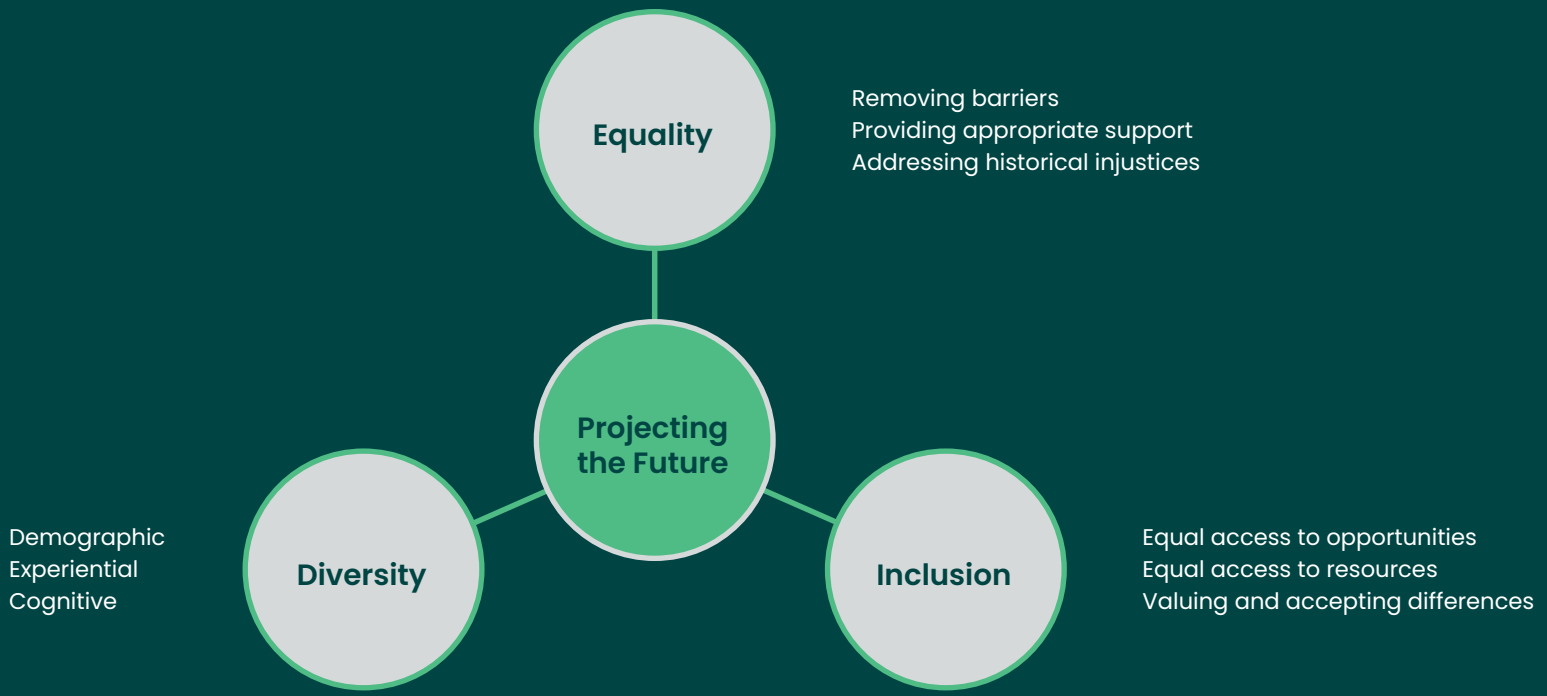


Figure 6: EDI for Projecting the Future (developed by authors)

The concept of a just transition offers a pathway to address and dismantle the barriers of sectoral and job segregation, close the gaps in wages and skills, foster inclusive dialogue within society, enhance working conditions and strengthen social protections. Additionally, the emergence of new opportunities in the labour market can promote the transition of informal jobs to the formal sector. In the pursuit of a low-carbon, sustainable economy, a just transition is pivotal in ensuring that no roles are marginalised, safeguarding all contributions that drive green growth and sustainable development for everyone (UN Women, 2023).

The various aspects of EDI in a project context can be summarised, as shown in Figure 6. This illustrates how addressing equality can make projects more acceptable for communities and increase the pool of available talent. The various aspects of diversity across different demographics (age, gender, ethnicity, etc.), of experience and – often overlooked – of cognitive styles, are all important in reducing the risk of groupthink. Inclusion, to ensure that no group is left behind either digitally or as we move towards net zero, is vital for social acceptability, while equal access to resources and opportunities is central to allowing all to participate in these transitions. Running through all this is a culture that values and accepts differences.

5.0 Where we might be going

We now turn to where we might be going. As the nuclear physicist Niels Bohr reputedly said: "Prediction is very difficult, especially if it's about the future!"[18] This section is inherently speculative, drawing largely on extrapolations of existing trends and inevitably ignoring what has not yet been invented. This reliance on extrapolation for prediction underpins the epigraph from Bill Gates' 1995 book, which opens the first challenge paper for the Projecting the Future initiative: "We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten" (Gates, 1995). This section is, therefore, more a provocation for debate than a predictive 'roadmap'. What we do predict with more confidence is that the outcomes of this debate will be crucial for shaping the future of the project profession.

We will start by exploring in more detail what the fourth industrial revolution means for projecting. There are two aspects to this – the first is the implications of digitisation for the practice of managing projects in what *Projecting the Future* dubbed 'Project Management 4.0'. The second is how the profession is going to step up to the challenges of addressing the net zero challenge alongside the other SDGs. We then turn to the surprising lessons of our responses to the COVID-19 pandemic, of learning how to achieve specific societal missions. Finally, we will introduce a recently developed project leadership model to provide the basis for discussion about this aspect of the future of the profession.

5.1 Towards Project Management 4.0[19]

Industrial revolutions are characterised by shifts in the socio-technological 'regimes' that underpin economy and society (Geels & Turnheim, 2022) and are inevitably characterised by the increasing pace of the dynamics of 'creative destruction' (Perez, 2002; Schumpeter, 1943). The array of new digital technologies is extraordinary, and we attempt to summarise those that are likely relevant for Project Management 4.0[20] in Figure 7.

This shows three different aspects of the digital revolution. First, it shows the levels of data transformation from raw data which is consolidated into the stock of knowledge in the form of analyses, reports and the like. Putting this knowledge into use provides the flow of information[21] with which to address particular challenges. Successfully combining this information with human judgement constitutes wisdom in choosing a particular course of action. Second, it shows that that Project Management 4.0 is an iterative process that cycles through data capture, data modelling, data storage and sharing, and data analysis and application. Third, it shows how the various different digital technologies are underpinned by AI applications.

18 quoteinvestigator.com/2013/10/20/no-predict/ Apparently, Bohr was reiterating an old Danish proverb.
19 We are very grateful to Dr Nicholas Dacre for his help in developing this section.
20 The concept was first introduced by Projecting the Future in 2019. It is derived from German industrial policy's Industrie 4.0 (Xu et al., 2018), and builds on the earlier concept of Project Management 2.0 (Whyte & Levitt, 2011).
21 A classic metaphor for knowledge not being turned into usable information is the blind librarian Jorge who would rather murder monks and burn the library down than let them access the knowledge in the monastery library which he could not access himself, in Umberto Eco's novel *The Name of the Rose*.

This digital transformation is evolving rapidly, with recent research exploring the implications of advanced technologies on sustainability, human-centricity and resilience (Dacre et al., 2024). In the context of project management, AI has emerged as a particularly relevant and transformative technology. AI allows a digital system to perform tasks commonly associated with humans (Dacre & Kockum, 2022; Wilks, 2019) and underpins the technologies we discuss here (Xiao et al., 2023). It has a wide potential across all aspects of projecting, but its fundamental requirement is for accurate data collection. The most available source of usable data during project delivery is the 'data plume' that is generated by project controls systems. This has the potential to provide the core of a new discipline of project data analytics (Paver, 2018). The inherent one-off nature of projects also means that data sharing between projects is of enormous value and so the development of project data trusts to share such data between competing contractors is vital (Paver, 2018).

AI is particularly relevant in the context of increasingly complex projects, where conventional project management tools may struggle to process the volume, variety and velocity of data involved (Whyte et al., 2016). Project Management 4.0 aims to develop the potential of AI and the emerging technologies that depend upon it (as shown in Figure 7) to enhance project success rates and improve the ability of project managers to handle complex, data-rich environments (Dacre et al., 2019). For instance, the advent of generative AI raises the potential for transformational changes in the way we manage projects. Three distinctive sets of applications can be identified (Project Management Institute, 2023):

- *Automating*, where generative AI is used to prepare reports of meetings from recordings, analyse existing project documents and perform calculations for analytical work.
- *Assisting*, where generative AI is used to prepare first drafts of documents and analyses, such as project schedules from existing project data, for review and enhancement by project professionals.
- *Augmenting*, where generative AI supports complex decision-making where there are many interdependencies and variables.

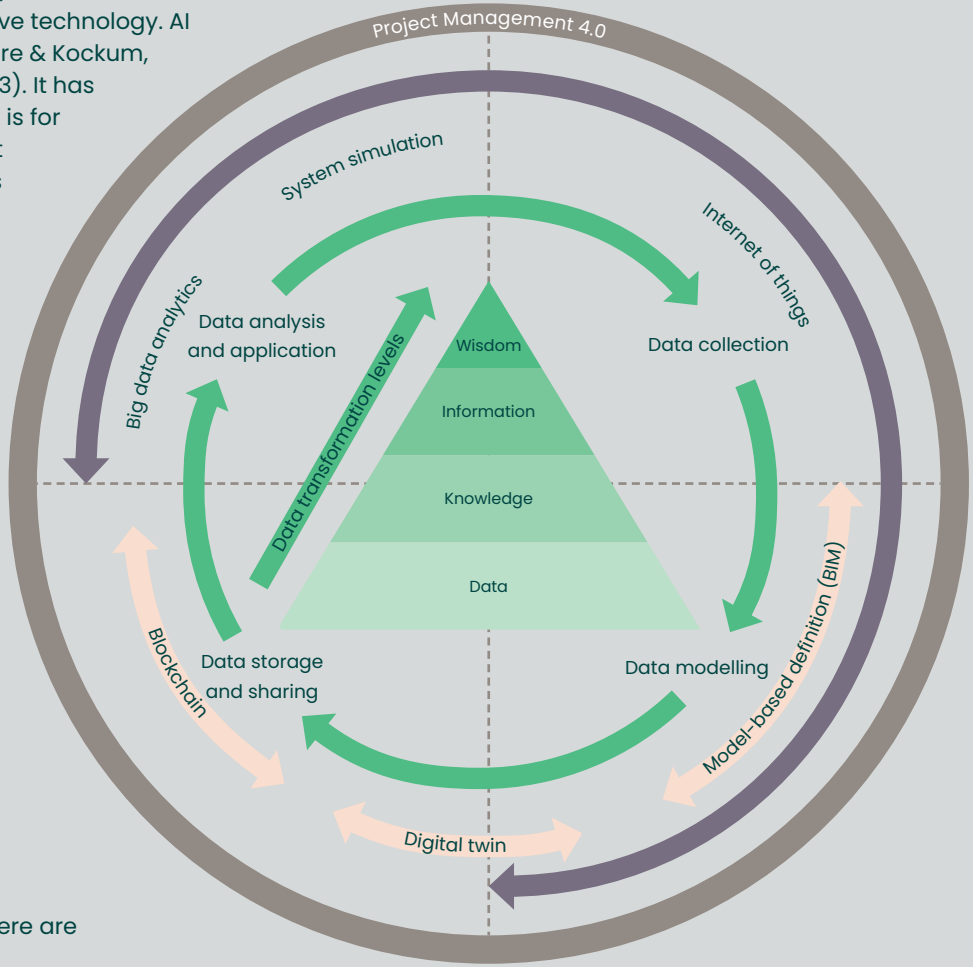


Figure 7: Project Management 4.0[22]

22 Source: Developed from Winch et al., 2023, Figure IV.2.

The internet of things (IoT) is essentially a sensor network connected through Wi-Fi or proprietary networks that enables real-time collection of physical system status (Martek et al., 2023). It removes humans from the data collection process and hence the risk of data input errors, as well as speeding up that process. However, IoT systems represent a major investment and are difficult to justify in the context of one-off projects, and so are much more suited to operational environments. The opportunity here is to install early in the project the IoT systems that will be used during asset operation, providing the data inputs for digital twins through asset life. With a few exceptions, data acquisition on physical asset projects is likely to remain a manual process, albeit with direct input into handheld devices. Of course, things are rather different on information system projects.

Big data analytics, and the associated concept of machine learning, is the analysis of very large quantitative data sets using sophisticated techniques of statistical inference to uncover patterns in the data (Wilks, 2019). It thus underpins the application of project data analytics to the data plume from project controls systems (Paver, 2018), but there are other potential data sets, including communication patterns that can be generated from email traffic in communications systems as the basis for social network analysis (Lu & Xu, 2023). Fundamental for big data analytics is the automatic collection of data from computerised information systems; otherwise, the data is costly to acquire in the volumes required.

Blockchain is a distributed ledger system which does not require a centralised database in order to prove ownership of specified assets (Papadonikolaki & Jaskula, 2023). More notoriously associated with crypto currencies, blockchain has a variety of applications in projecting, particularly in managing the commercial interface between project owners and their suppliers. In many project-based sectors, supply chains are very long, with layers of subcontracting requiring careful allocation of ownership as the project moves through its life cycle. When linked to IoT technologies such as Request For Information (RFI) tagging, the physical tracking of materials can also provide great benefits during project delivery.

Finally in this quick overview of the technological elements of Project Management 4.0, we turn to model-based definition (MBD), which is known as building information modelling (BIM) in the construction sector. MBD is the latest tool in the long evolution of computer-aided design (CAD), which has its roots deep in the information technologies of the third industrial revolution (Arnold, 1983). It creates 3D parametric models of the asset to be delivered by the project. Its first full use was on the Boeing 787 Dreamliner project (Cao et al., 2023), which entered service in 2011. From a projecting point of view, a notable complement to the 3D model is the addition of the schedule to provide a 4D model which can simulate project execution. MBD also provides the technological basis for 'digital twins' (Tao et al., 2019) of the asset being delivered by the project. These can be used for asset management through its life to optimise performance and simulate the effects of proposed refurbishment projects.[23] Digital twins allow both the system simulation of the asset being delivered by the project, and the 4D simulation of the project execution process itself, supporting better planning of project execution and also deeper understanding of the potential of the system in use.

Our perspective on Project Management 4.0 starts from the argument that project organisations are essentially information processing systems that learn as they move through a distinctive lifecycle (Winch, 2015). These technologies – AI, IoT, big data analytics and blockchain – collectively address the intricate nature of project data, which can span dimensions such as complexity, structure, volume, velocity and variety (Whyte et al., 2016). This is particularly pertinent to megaprojects, where the sheer volume and variety of data can overwhelm traditional project management approaches. The potential for the implementation of digital information technologies is therefore enormous but will require major changes to how we organise projects. The implementation of information systems has long been understood to have profound implications for organisations in general (Zuboff, 1988). Yet this type of work has hardly begun for Project Management 4.0, although an agenda is being laid out (Whyte et al., 2023).

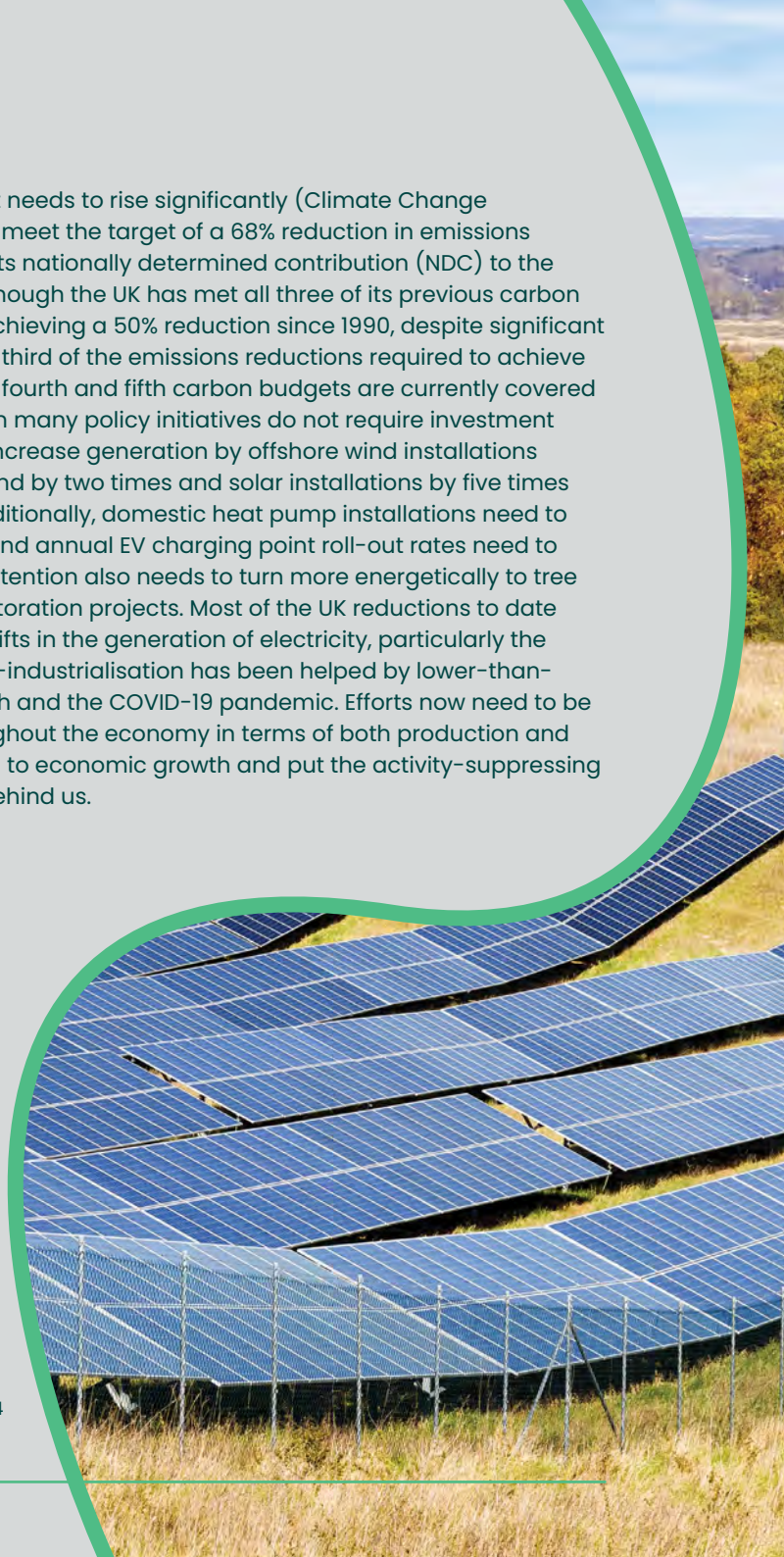
23 The profound power of digital twins is shown by how quickly the reconstruction of Notre Dame cathedral started following the fire in 2019, when drones were used to compare the smoking ruins with the existing digital twin (Winch et al., 2025).

5.2 The challenges of net zero

From an energy perspective, the fourth industrial revolution is about reversing the fossil fuel-based innovations that drove the first and second industrial revolutions, leading to the great acceleration in greenhouse gases during the third industrial revolution as those innovations became widely consumed both within and across nations. Succinctly put, the ambition is to completely replace coal, oil and natural gas as sources of energy for both generation and transportation. Achieving this ambition relies heavily on the most important innovation of the second industrial revolution – electricity – and partially on one of the most important of the third – nuclear power. It is for very good reason that Boris Johnson, when UK Prime Minister, said that "the coming industrial revolution is green power plus the electrification of the whole country".[24] The capacity of the electrical grid needs to be significantly expanded to replace all the energy that is presently distributed in gas networks and by oil tankers. It also needs to be significantly reconfigured because, for example, the sources of power have shifted offshore and are more distributed, and power is needed to be delivered to new places to support electric vehicle (EV) charging. Batteries also need to be integrated into the grid.

The Second National Infrastructure Assessment (National Infrastructure Commission, 2023) argued that UK economic infrastructure required significant investment in order to achieve net zero ambitions, support economic growth and improve the resilience of our infrastructure systems. This implies major upgrades to our energy generation, storage and distribution systems, water infrastructure, urban and inter-urban transportation, and fibre and 5G communications systems. Much is already happening, but the National Infrastructure Commission estimates that, overall, UK investment needs to increase from the current £55bn per year to £70–£80bn per year in the 2030s, dropping slightly to £60–£70bn a year in the 2040s, with around one-third being financed by the public sector. In addition, major investment is needed in our social infrastructure of schools, hospitals and, of course, housing. This capital investment is almost entirely in the form of projects of various kinds, from millions of microprojects for the retrofit of the existing housing stock, through thousands of medium-sized projects across all infrastructure sectors, to megaprojects[25] to develop new transportation infrastructure. Assuming there has been no increase in the productivity of project managers, this implies an increase of over 40% in the numbers required, unless other areas of activity are closed down.

The pace of UK investment needs to rise significantly (Climate Change Committee, 2024) if it is to meet the target of a 68% reduction in emissions from 1990 levels by 2030 (its nationally determined contribution (NDC) to the 2015 Paris Agreement). Although the UK has met all three of its previous carbon budget commitments – achieving a 50% reduction since 1990, despite significant economic growth – only a third of the emissions reductions required to achieve the 2030 target during the fourth and fifth carbon budgets are currently covered by credible plans. Although many policy initiatives do not require investment projects, the UK needs to increase generation by offshore wind installations by three times, onshore wind by two times and solar installations by five times over the next six years. Additionally, domestic heat pump installations need to be increased by 10 times and annual EV charging point roll-out rates need to increase by three times. Attention also needs to turn more energetically to tree planting and peatland restoration projects. Most of the UK reductions to date have been achieved by shifts in the generation of electricity, particularly the phase-out of coal, and de-industrialisation has been helped by lower-than-expected economic growth and the COVID-19 pandemic. Efforts now need to be spread more widely throughout the economy in terms of both production and consumption, as we return to economic growth and put the activity-suppressing effects of the pandemic behind us.



24 Speech before the Annual Conference of the Confederation of British Industry, 22 November 2021. He was consciously echoing Lenin's famous speech before the Eighth All Russia Congress of Soviets on 22 December 1920: "Communism is Soviet power plus the electrification of the whole country".

25 We define a megaproject as greater than $3bn investment value. This is based on the original megaproject definition of $1bn in 1984 US dollars (Merrow, 1988), inflated by the depreciation in the value of the US dollar since that date to 2025.

This is, of course, a global problem and a profound challenge for our profession (Morris, 2017). On a global scale, an increase in annual capital investment of over 60% from $5.7tn to $9.2tn is required just to achieve the net zero transition (McKinsey, 2022), much of it in developing economies. In addition, significant additional capital expenditures are required to achieve other SDGs such as '6: Clean Water and Sanitation' and '11: Sustainable Cities and Communities'. The scale of the challenge for our profession is massive, both nationally and internationally, and international competition for the best project managers and programme directors could reduce the supply of key skills in the UK even further.

Against this landscape of urgent and massive transformation, the present response of the profession is, arguably, disappointing. Most of the attention has been on mitigation (Morris, 2017); that is, the reduction of the carbon and other environmental impacts of projects that would happen anyway. This is important ongoing work with differing emphases through the project life cycle (Aarseth et al., 2024). During project shaping, the project owner takes the lead by incorporating carbon reduction into the business case and setting stretch targets for design consultants to ensure that operational carbon is minimised. During project delivery, project suppliers lead by innovating new ways of reducing embodied carbon, both in the asset being delivered and in its delivery.

However, relatively little attention is paid to the various kinds of projects that we are only carrying out because of our aspirations for a net zero future (Winch, 2022). Such projects can be considered as 'vectors of change' towards a net zero future (Terenzi et al., 2024). Yet there is an assumption (Mazzucato, 2021) that the way we managed projects for the third industrial revolution is appropriate for the fourth (Winch, 2022). This is unlikely to be the case for a variety of reasons. In addition to the implications of Project Management 4.0, the scale of the transition required means that it is unlikely to be achieved by traditional approaches to project, programme and portfolio management for the following reasons:

- Most transition projects are interventions in existing systems of systems of great complexity (Centre for Digital Built Britain, 2020). Figure 8 illustrates this for urban systems of systems, but the same principle applies to other systems of systems. For example, the electrical system requires reconfiguration as a result of new sources of generation (wind and solar) and new demands (such as from heat pumps and EV charging), as well as a major upgrading of capacity.

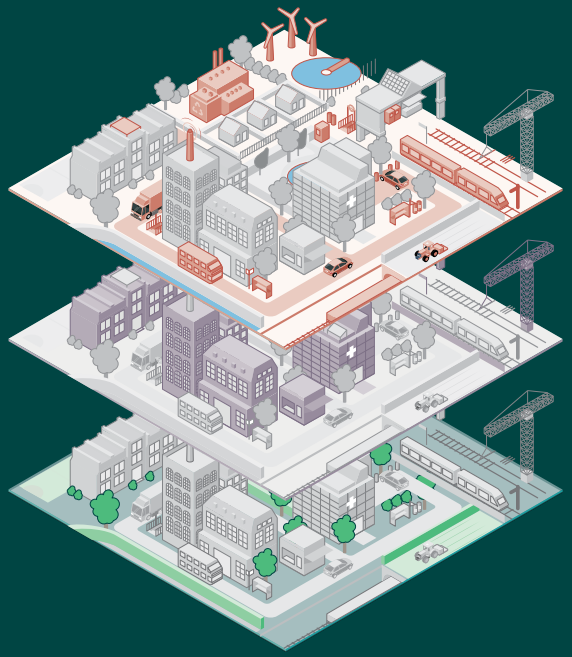


Figure 8: Urban systems of systems[26]

- The experience from the development of offshore wind generation in the North Sea is that strong and capable project owners shifting from a project-by-project development approach is vital for attracting investors, who typically equate projects with risk. Thus Ørsted,[27] the largest offshore wind farm developer outside China, stated that it was 'industrialising' the development process:
  - The first offshore wind farms were established project by project, but, since the start of 2009, Ørsted has been working intensively to develop and install offshore wind farms in an assembly line concept and to enhance efficiency in all stages of the offshore wind farm value chain (2011 annual report).
  - Ørsted's strategy for cost reductions is based on standardisation: Ørsted developing an offshore wind farm concept is based on a standardised design, standard components and standard construction. The concept reduced the price of offshore wind considerably. For an industry characterised by high investment levels, especially in the construction phase, the biggest potential is in reducing construction costs, centralised design and procurement process (2014 annual report).[28]
  - Central to this development is much greater modularity in the turbine technology, which has wider benefits (Flyvbjerg, 2021). It is clear that there are similar aspirations in the nuclear sector to industrialise development and move on from the notably dismal record in delivering new nuclear power stations – the clue is in the name: 'small modular reactor'.

Neither the project management profession as a whole nor the supporting academics have started to address these much larger questions on what the future of our profession in the fourth industrial revolution might look like.

26 Centre for Digital Built Britain, 2020: 6
27 Then called DONG Energy.
28 orsted.com/en/investors/ir-material/financial-reports-and-presentations#financial-reports-presentations-and-fact-sheets

5.3 The lessons from the COVID-19 response

The COVID-19 pandemic was a major trauma for the UK and the world, but we can identify some valuable learning from the ways in which we responded in the UK that, we argue, should be taken forward as we address other grand challenges.[29] The earliest positive response to the pandemic was to set in progress a number of projects to rapidly develop the medical capacity for treating sufferers of COVID-19. There were many aspects to this, but one of the most notable was the development of seven Nightingale hospitals. Existing facilities – often exhibition centres – were turned into fully equipped hospitals within days or weeks, in a remarkably focused effort to provide surge capacity for the existing NHS England hospitals. They cost £220m and were delivered in less than three weeks. Notably, the project owner for the Nightingale hospitals was central government, rather than the various NHS trusts. Rapid mobilisation was possible because the Department for Health and Social Care used its existing ProCure22 framework agreement with suppliers. This allowed the establishment of a rapid, inclusive, problem-solving-orientated leadership of the programme.

For instance, the 'instruction to proceed' with the NHS Nightingale North West hospital (located in what is now the Manchester Central convention centre) was received by the principal supply chain partner, Integrated Health Projects (IHP), on 28 March 2020. Site works started on 30 March, and the facility was completed on 12 April – a schedule of 13 days. It opened the next day. The suppliers resourced these efforts by pulling people off other projects and working 24/7 to complete the project. This achievement depended on an innovative project management approach characterised by:

- reverse engineering: less design and build; more build and verify by design
- live beta testing of a full-scale bed bay mock-up, assembled on day 2, to confirm the dimensions needed by the nursing team for the partition system layout
- change control through a process of 'see a problem, develop an answer, test it, build it', captured in an auditable document trail
- clinical liaison providing the go-between, translator and fixer, linking the clinical teams with the IHP team.

However, with hindsight, the Nightingale hospital programme was a classic case of focusing on outputs rather than outcomes because they were hardly used. Hospitals do not cure people – doctors and nurses do. Staffing the Nightingale hospitals would have posed considerable challenges, not least by significantly increasing commuting times for many healthcare professionals. Existing hospitals did a remarkable job of reconfiguring their processes to provide care within existing hospital facilities.

29 All the cases presented here can be found with supporting references in Winch et al., 2021.

The typical time taken to develop a vaccine is measured in years rather than months, so how was it achieved at warp speed[30] – or more precisely, in 326 days from the Chinese publication of the genetic sequence on 11 January 2020 to the UK licensure of the Pfizer/BioNTech vaccine on 2 December? The key is that project owners (governments responsible for national healthcare systems) removed the liabilities for development project failure from suppliers (pharmaceutical companies large and small) by both pre-purchasing vaccines and directly funding research and development projects. Vaccine development typically costs millions of pounds and takes years due to the absolute requirement to ensure that the vaccine is both safe and effective. Generically, the life cycle for pharmaceutical development projects is like that shown in Figure 9. However, a candidate drug may fail at any gate for reasons beyond the control of the project team because, simply put, it does not work. Vaccine development projects face even greater difficulties because, firstly, safety concerns are enhanced as the vaccines are injected into otherwise healthy people; secondly, they need to be manufactured at a scale of billions of doses; and, thirdly, the virus may naturally exhaust itself before the vaccine is ready (which happened with earlier coronavirus epidemics). The external threats facing vaccine development projects are existential.

In response to these threats, vaccine development projects conventionally move cautiously through tightly managed stage gates, as shown in the upper half of Figure 9. Following a pre-clinical phase, including animal testing, Phase 1 typically involves 25–30 volunteers and principally assesses the safety of the vaccine candidate. Phase 2 follows, with hundreds of volunteers, including a control group, to assess whether the candidate stimulates an immune response. Phase 3 involves thousands of volunteers across multiple countries, half of whom are in a control group who receive a placebo, to see whether the candidate actually works in practice. Phase 3 is a significant investment in its own right, which needs to be supported by an initial investment in manufacturing facilities. The length of Phase 3 is indeterminate because it relies upon volunteers becoming infected naturally to test the efficacy of the candidate. Phases 2 and 3 are blind, in that the investigators and participants do not know who has received the placebo. Once the data is in from Phase 3 trials, they can be submitted to national regulatory authorities for licensure. Scale-up and licensing for volume manufacturing follows. Phase 4 is monitoring the effectiveness of vaccination programmes.

Each of these phases is subject to oversight by external independent monitors to ensure rigour in the evaluation methods. An important innovation in the UK was rolling regulatory approval. Normally, national regulators wait until phases 1 to 3 are complete before starting their evaluation of the data prior to licensure. The rolling approach involves the regulator engaging with the data as it is being released by the trial phase, and this, too, compressed the development process. The output of the development process is a safe vaccine with a known efficacy for preventing infection. Of course, the vaccine is only an output – achieving the desired outcome of an inoculated population is another very important aspect.

30 This is a reference to the US name for the vaccine development portfolio: Operation Warp Speed. The UK initiative using similar portfolio management principles was the Vaccine Task Force (Bingham & Hames, 2022). In science fiction, warp speed is travel faster than the speed of light, which therefore breaks the laws of physics. Did Operation Warp Speed break the 'laws' of project management?

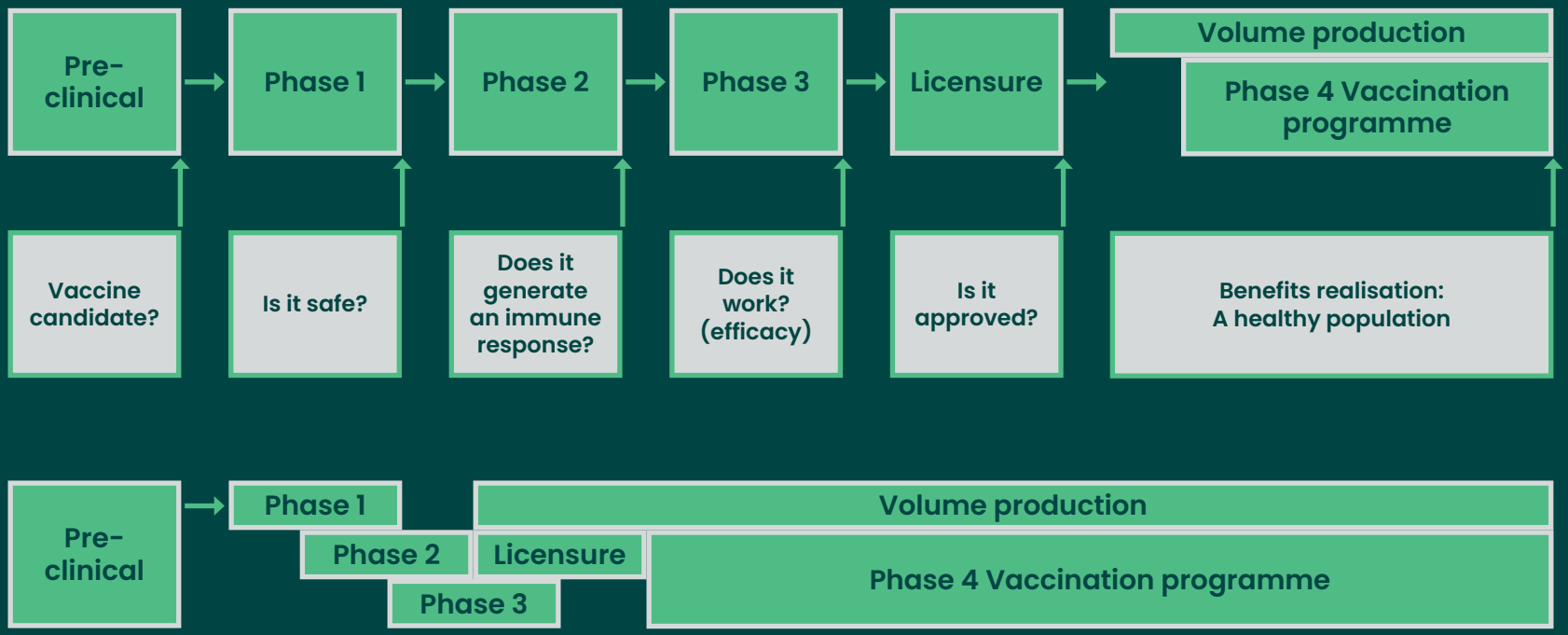


Figure 9: The COVID-19 vaccine development process[31]

31 Source: Winch et al., 2022, Figure 9.7.

5.4 Leadership

There is growing debate within the broader projects community around how to lead projecting. If the project profession is to gain 'a seat at the top table' of corporate boardrooms, as advocated by the Projecting the Future exercise, then it needs to clearly articulate the distinctive contribution it can make to the organisation's (owner or supplier) senior leadership team. There are challenges here, as a recent Institution of Civil Engineers report states:

> **"The larger and more complex a project, the less likely it is that it can be successfully led by a 'warrior' leader who can manage crises by force of will, or by a super-project manager who is focused overwhelmingly on process and deliverables." (Institution of Civil Engineers, 2022: 44)**

A similar argument was espoused in a recent Major Projects Association (2024) report that called for 'no more heroes' in project leadership. Heroic leaders are, arguably, part of the DNA of our profession. The great projectors of the first industrial revolution, such as Thomas Brassey and Isambard Kingdom Brunel, typically promoted their own projects exactly as Defoe would have expected and achieved both private gain and enormous public benefit. However, stakeholders are now much more complex (Winch, 2017), not least because of the urgent attention we need to pay to the primordial stakeholder (Driscoll & Starik, 2004) – our planet. Warrior styles of leadership are no longer appropriate, or even viable (Winch & Hajikazemi, 2025; Winch et al., 2022).

An analysis of the memes of leadership (Zaccaro, 2014) has identified four basic types of leader – warrior, politician, teacher and problem-solver. Recent research has identified the role of the project leader as problem-solver (Winch & Hajikazemi, 2025), and this matches with the characterisation of project managers as problem-solvers in the Golden Thread. Such a characterisation encourages us to focus on what project leaders do rather than who they are, in terms of traits, competencies and psychological profile. One widely advocated model for this focus is the "incomplete leader" model (Ancona et al., 2007), which is widely discussed among project professionals (Coleman & Bourne, 2018; Institution of Civil Engineers, 2022; Major Projects Association, 2024). It starts from the position that:

> **"... it is time to end the myth of the complete leader: the flawless person at the top who's got it all figured out. In fact, the sooner leaders stop trying to be all things to all people, the better off their organisations will be. In today's world, the executive's job is no longer to command and control but to cultivate and coordinate the actions of others at all levels of the organisation." (Ancona et al., 2007: 92)**

This incomplete leader model identifies four different practices that leaders need in order to lead: the enabling axis of sense-making and relating, and the action axis of visioning and inventing. Embedded in the spirit of the model is the realisation that these practices can be distributed around the leadership team – the designated 'first among equals' as project or programme director does not need to excel at them all.

Over 15 years of working with this two-axis incomplete leader model on project leadership executive programmes, for the likes of BP and BAE Systems, has encouraged us to develop it further so it is aligned more closely with the specific challenges of leading projects and programmes. An initial issue was that there was no apparent decision-making interface between the enabling and action axes, so the concept of business and commercial acumen was introduced as this decision interface (Forsyth & Gavin, 2017). A second issue was that we wanted to capture the specificities of the project context in the model and so changed 'visioning' to 'projecting', following Defoe, and 'inventing' to 'creating' to capture the much wider range of organisational design and innovation needed by the project leader in setting up a temporary organisation. An earlier attempt to combine these two issues in a revised model (Winch et al., 2022) was inadequate because it did not have an ethical dimension to the decision interface. In order to develop this dimension, we turned to the leadership literature on *phronêsis* (Aristotle, 2014) – usually translated as 'practical wisdom' – and wise leaders who:

> **"... are those people who have developed a refined capacity to intuitively grasp the most salient features of an ambiguous situation and to craft a particular path of response, in their search for a way out of their difficulties, while driven by the pursuit of what is good for their practice." (Shotter & Tsoukas, 2014: 381)**

The revised project leadership model (PLM) that we currently use in our project leadership development is presented in Figure 10. In the PLM model, sense-making and relating provide the information a leader needs to project the mission for the project, which captures why the project is being done. Creating is the practice where the 'why' turns into 'how' (Winch et al., 2022). Sense-making involves answering the question of 'What is going on here?' under conditions of uncertainty and complexity, which means that there are no correct answers to that question, simply better assessments. The leader also needs to relate internally with the various teams on the project, including externally with the stakeholders to obtain the latest information about what is going on from those closest to it. All this, which cannot possibly be done by one person, calls for collaboration among a team, and an integrative decision-making practice named 'judging' in the PLM. This increases the relevance of leaders' judging ability to manage constructively the meaning of various situations to influence the entire sense-making activity within the project.

Judging involves choosing a course of action (Vickers, 1965) towards the desired future. This action axis in the model consists of two dimensions – projecting and creating. Projecting has two facets: the persuasive narrating of the project mission and the motivational storytelling of why we are doing the project. Once the project mission has been projected, leaders need to create how it is going to be realised. Again, this involves two facets. Innovating is the problem-solving application of new ideas. Similarly, the leader needs to design the temporary organisation that is going to deliver the outputs and the arrangements for the governance of the project. This emphasises the importance of designing ways of achieving project outputs and outcomes as an important leadership function. Inventing and designing thereby form the two facets of the creating practice.

Linking the enabling and action axes is the judging practice within the PLM, which consists of three facets – experience, intuition and value – in the sense of both an orientation towards realising the outcome benefits of the successful delivery of the project output, and ethical principles of interpersonal behaviour. Intuition is at the centre of this reflection (Klein, 2017), defined as "the use of experience to recognise key patterns that indicate the dynamics of the situation" (Klein, 2017: 33). Intuition is the ability to quickly recognise the salient features of the situation, form an assessment and decide on a course of action. All of these require past experience of similar situations coupled with a deep understanding of the particularities of the present situation, to provide generative solutions to the problem at hand.

In Aristotle's thinking, *phronêsis* is framed by what is considered to be the good life. In the PLM, this is made more specific by distinguishing both 'value' in the sense of the outcomes aspired to in the business case, and 'values' in terms of the ethics of interpersonal behaviour at work. According to Project 13 research, a 'value-driven mindset' is central to the capabilities required for major infrastructure projects (Maytorena-Sanchez & Winch, 2022), while the values embodied in the APM Code of Conduct are central to its status as a chartered profession.

Figure 10: The project leadership model[32]

32 Source: Winch and Hajikazemi, 2025, Figure 1.

6.0 Conclusion

We have covered a lot of ground in this thought leadership review of where the profession has been, where it is now and where it is going. In doing this, we identified three broad themes: professional identity, career progression and development.

We showed how our profession has evolved, using the four industrial revolutions as a way of understanding this development, and the role of the 'projector' in this evolution. This understanding provided the foundation for discussing 'where we are now'. The review of the two Golden Thread reports (2019 and 2024) shows the importance of projects and the profession to the UK's economy and society. The Chair's introduction to the 2019 Golden Thread argued that project management had for too long been seen as the 'hidden profession', with its contribution to economy and society under-appreciated. While the data in the two Golden Thread reports shows that this is empirically wrong, such data does not easily capture the public imagination. In addition, the Projecting the Future overview report argued that project management should be seen as the 'adaptive profession'. On our reading, this a rather passive and reactive formulation and does not capture well a sense of positive contribution. It is clear from the Golden Thread research, which shows very low occupational closure for the project profession, that it is operating in a crowded market with many other professional associations claiming to include project management within their competency frameworks. On our analysis, the project profession offer is distinguished by its role as a *convening profession*, bringing together all the other professional contributions to complex projects. Therefore, there is a need to evaluate and determine the project profession's identity more clearly than just the ability to manage projects with a particular toolbox, foundational and important as this is.

Project management as the 'accidental profession' is a well-established trope (Pinto & Kharbanda, 1995) that captures the ways in which project managers find themselves managing projects without significant prior training and support, forcing them to learn on the job. Although this is changing, with large corporates, such as the UK Civil Service,[33] BAE Systems[34] and many others, developing sophisticated competence development programmes, our impression is that large gaps remain, and the significant increase in the numbers of project managers required carries the risk of recruiting more 'accidental' project managers. Our ambitions for a presence in the C-suite suggest that the profession needs to give a much greater emphasis to leadership in contrast to management. Yet we have only hazy ideas about the distinctive dynamics of project leadership and hence our potentially distinctive contribution to leadership in business and government overall, although we have presented our own thinking on this important topic. The fourth industrial revolution poses a variety of challenges around skills across the economy, and a distinctive set of challenges for those managing projects. Presently, competency frameworks for project managers focus mainly on the traditional skill set and are unitary in that they do not take into account the differences in the contexts in which project managers work. These differences include the following:

- Achieving Project Management 4.0 implies both new and significantly adapted project management roles (Paver & Duffield, 2018).
- Project management roles in owner organisations and supplier organisations are very different (Godbold, 2016; Winch et al., 2022).
- New roles associated with achieving net zero are required, such as 'retrofit coordinator' under Publicly Available Specification (PAS) 2035.

33 See the IPA Project Delivery Capability Framework: assets.publishing.service.gov.uk/media/65561f36046ed4000d8b9a33/PDCF-V3.pdf.
34 See the suite of CP3 programmes for BAE Systems and the Atomic Weapons Establishment at Alliance Manchester Business School (AMBS). Please note that these are not featured on the AMBS website, for security reasons.

The development of new approaches to integrated project delivery, such as that advocated by Project 13,[35] requires much closer integration between project management and commercial functions, both to improve project delivery effectiveness generally and also to take full advantage of Project Management 4.0 affordances (Cao et al., 2023). Therefore, continuous attention to career progression and professional development is required.

Further research is needed to enhance our understanding. For example, achieving net zero will require new ways of managing projects, as the example of North Sea wind generation shows. What might this look like? In addition, there is growing advocacy of a 'mission' level of projecting (Mazzucato, 2021) to address the grand challenges we collectively face. This language has, for instance, been adopted by the incoming Labour government. Although Mazzucato herself used the Apollo programme as an exemplar of a mission, we suggest that this is inappropriate because missions to address grand challenges are above the level of the single project owner, such as NASA in the case of Apollo. For instance, the transformation of the UK electricity grid involves multiple generating companies, the transmission infrastructure owner, the regulator Ofgem, the national energy system operator, multiple distribution companies and suppliers of EV charging facilities, among others. Each will have its own investment portfolio. Moreover, the Apollo programme is the quintessential third industrial revolution complex waterfall programme. Arguably, we need a new conceptual framework distinct from projects, programmes and portfolios to grasp the mission level of change at the system of systems level.

EDI is central to projecting better futures for all in society. While EDI should be part of the core values of the profession, as for any other chartered profession, EDI also has a specific contribution to make to projecting the future, as indicated in Figure 6, and in fostering psychological safety in project teams and organisations.

35 Project 13 is a collaboration of UK infrastructure owners coordinated by the Institution of Civil Engineers: project13.info

7.0 Our recommendations

Our reflections on where we have been, where we are and where we might be going generate the following set of recommendations for how the project profession might support the UK's economy and society as it negotiates the enormous challenges of the fourth industrial revolution. On our analysis, the future is very much open, but it will take clear-sighted strategy to seize the opportunities that it offers for the profession to project collective action to achieve desired socioeconomic ends (Sergeeva, 2024; Winch, 2024).

1. Evaluate the profession's ownership of the role of 'projector', which could allow us to articulate the historical contribution of projects to social and economic development and more clearly articulate the profession's contribution to achieving future societal aspirations (sections 2, 3, 4.2.2 and 5).
2. Initiate a strategic reflection on whether to position our profession as the convening profession. What would this mean in practice?
3. Commission a review of corporate project management development programmes and examine how they align with corporate career paths, identifying best practice to support those corporates wishing to develop their own programmes in the future (sections 4.2.1, 4.2.2 and 5).
4. Increase the focus on leadership development by working collaboratively with the likes of the Major Projects Association (MPA) and university providers of project leadership programmes to commission a review of complex project leadership. The goal is to establish a coherent leadership doctrine, model and competency framework, potentially drawing on military leadership models as appropriate (sections 4.2.1–4.2.3 and 5.4).
5. Evaluate the overall certification offer, identifying what is generic to all project managers, and then build a suite of certifications that covers the full range of project management activity as practitioners specialise in their careers (sections 4 and 5).
6. Review the integration of commercial competencies within project management certifications (sections 4 and 5).
7. Commission collaborative research on how greater modularity and industrialisation will shape the way infrastructure projects are delivered (sections 4 and 5).
8. Sponsor debate and research conceptualising the mission level of change, and how it relates to projects, programmes and portfolios, and the convening role of the project profession.
9. Develop a framework for measuring project-level sustainability performance in alignment with the UN Sustainable Development Goals (SDGs).
10. Initiate a reflection on the specific contribution of EDI to successfully projecting the future through psychological safety (section 4.3).

Appendix A

Project report: The case of the missing deadline

Introduction

It was a dark and stormy night in the office. The kind of night where the fluorescent lights flicker just enough to make you question your sanity. The project, codenamed 'Operation Deadline', had been missing for weeks. The boss was breathing down our necks, and the team was on edge. It was time to get to the bottom of this mystery.

Objective

Find the missing deadline and deliver the project on time. No excuses, no alibis.

Methodology

1. **Stakeholder interviews**: We grilled the usual suspects – developers, designers and the elusive project manager. Each had their own story, but none of them added up.
2. **Document review**: We combed through emails, meeting notes and the project plan. Somewhere in the paper trail, the truth was hiding.
3. **Data analysis**: We crunched the numbers, looking for patterns. The data never lies, but it can be misleading.

Findings

1. **Communication breakdown**: The team was talking, but no one was listening. Messages were lost in translation, and critical updates were missed.
2. **Scope creep**: The project had grown legs and walked off the map. New features were added without approval, stretching the timeline thin.
3. **Resource misallocation**: Key players were pulled into other cases, leaving the project understaffed and overworked.

Conclusion

The deadline wasn't missing; it was buried under a pile of miscommunication, scope creep and resource misallocation. We had the clues all along, but we needed to piece them together.

Recommendations

1. **Improve communication**: Establish clear channels and regular updates. Make sure everyone is on the same page.
2. **Control scope**: Stick to the original plan. Any changes must go through a formal approval process.
3. **Allocate resources wisely**: Ensure key team members are dedicated to the project and not pulled into other tasks.

Closing remarks

As the rain pelted against the window, we knew the case was far from over. But with these recommendations, we had a fighting chance to bring Operation Deadline to a close. The boss would be off our backs, and we could finally get some sleep. Until the next case, that is.

Appendix B

Projecting for the Future: Harmonising energy and environment

Stimulus paper

APM launched Projecting the Future in June 2019 to debate the challenges and opportunities for the profession, building on the 2017 Future of Project Management exercise conducted by Arup and University College London. Its premise was that we are in the early phases of the fourth industrial revolution while also facing remarkably wicked grand challenges such as achieving net zero by 2050. Projecting will undoubtedly play a profound role in these transformations, as it did during the first three industrial revolutions (see Figure 1), but much of our current practice is rooted in the third industrial revolution, when PERT was lauded as the 'the first management tool of the nuclear and computer age'. For influential commentators, such as Mariana Mazzucato on the mission economy, the epitome of project management remains the Apollo programme, and for many this is still our benchmark today.

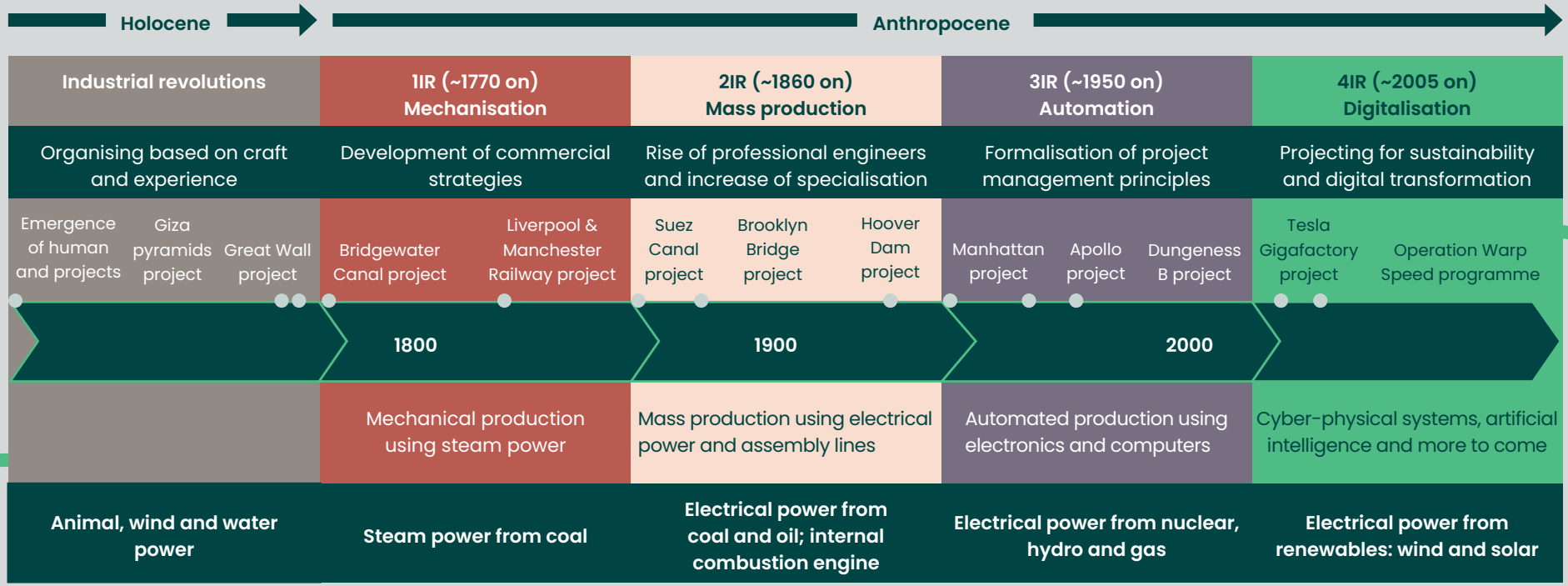


Figure A.1: The evolution of projecting over four industrial revolutions[36]

36 Developed from Winch et al., 2023, Figure IV.I

For this third phase of reflection on the future of the project management profession, we first take stock of the reflections to date, and then examine in greater detail what needs to change in our professional practice and what we can confidently take from practices in earlier periods. We have much evidence to work on. Projects played a central role in the response to the COVID-19 pandemic. Multiple accelerated vaccine development projects were an extraordinary success, relying heavily on portfolio management techniques. Emergency hospital facilities were delivered in record time. Mass vaccination programmes were swiftly launched. Projects also play a central role in responding to the environmental challenges. A recent McKinsey report[37] argues that a 60% increase above present capital investment levels will be required to reach 2050 net zero targets – mostly in infrastructure projects of various kinds. Projects are central to the global response to the grand challenges we face. Additionally, in the UK context these investment programmes need to be mindful of the urgent concern to rebalance the UK economy away from the southeast.

As we more urgently address these grand challenges, we need to reflect on the ways in which projects are changing, including the following:

- Much stronger stakeholder engagement from active citizens who are ready to question the trade-offs between environmental degradation in the present and sustainability benefits in the future. This means another level of social complexity. Onshore wind farms are an example, as is lithium mining, and the debate around nuclear power continues. *How can these dynamics be used to give speed to the projects we need rather than to bog them down in regulation?*
- Individual projects – even megaprojects – are increasingly interventions in existing systems of systems (see Figure A.2) rather than standalone enterprises. This means qualitatively higher levels of technical complexity and a much deeper understanding of how the three systems of social and economic infrastructure interact with natural infrastructure. *How can the tensions between these three systems of systems be resolved positively?*
- The digital revolution is starting to transform our projects both in terms of the technical complexity of delivering cyber-physical systems, and the new digital tools for managing that delivery. *The digital revolution holds great promise for Project Management 4.0, but what new individual competencies and organisational capabilities do we need to seize these opportunities?*

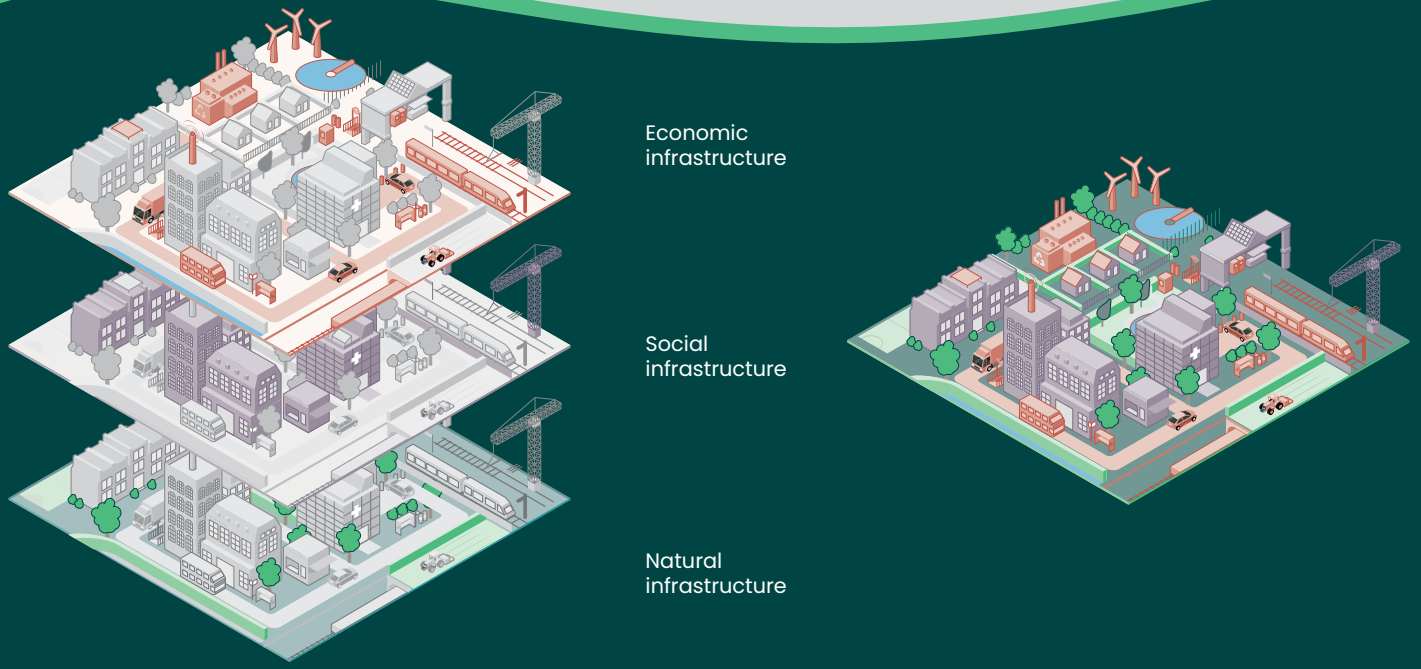


Figure A.2: Urban systems of systems[38]

The premise of this third round of reflection is that our profession has much to be proud of in its achievements over the last 50 years, while it also has much to do to step up to the challenges of the next 50. We hope that you will engage with us in that reflection.

37 The net-zero transition: What it would cost, what it could bring, January 2022 mckinsey.com/~/media/mckinsey/business%20functions/sustainability/our%20insights/the%20net%20zero%20transition%20what%20it%20would%20cost%20what%20it%20could%20bring/the-net-zero-transition-what-it-would-cost-and-what-it-could-bring-final.pdf

38 Centre for Digital Built Britain, 2020: 6.

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