Project-oriented Technologies – the Next Decade: Tools, Integration, Skills and the Future Professional [1]

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Introduction

Since the early career years, the author has been closely following the progression of technologies in the project management/control environment and was always trying to 'surf the wave', either as to where the department(s) needed to be steered towards or in terms of career development. At the start of this decade (in 2020) the author drafted a '*thought*' paper looking at what technologies are/could be coming up and the possible implementation period.

Looking back six years later, it is clear that some of the author's expectations around emerging technologies proved overly optimistic, for example, the pace of blockchain adoption in construction management, while others underestimated the speed of change. Artificial intelligence (AI), for instance, was once framed by the author as three separate domains - neural networks, machine learning, and BOTs, and it was expected that they would take more than a decade to achieve widespread implementation. In reality, the rapid acceleration of AI and the proliferation of tools now supporting project management and control have far exceeded those early projections.

Considering these shifts, the author decided to reassess how we understand and group these technologies, many of which are now converging into integrated ecosystems rather than remaining distinct fields. More importantly, it highlights the need to reorient our perspective, not just toward technology itself, but toward its impact on people, skills, and career development.

This article, therefore, aims to provoke thoughtful reflection on the evolving technological landscape, encouraging readers to critically evaluate both the opportunities ahead and their own readiness for change. As we look toward the next decade, one thing is certain: the professional landscape will continue to transform in ways that demand adaptability, continuous learning, and a willingness to rethink established assumptions.

The technology areas to be discussed are shown in the table below (Table 1) and the author has deliberately focused on the people side. From a company perspective, some of the questions are

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how these technologies change the way teams plan, make decisions, share information, manage risk, and deliver consistently, not just what tools we buy. From an individual's perspective, it highlights how day-to-day roles may evolve and what capabilities people can build so they stay confident, employable, and able to lead change as these technologies become normal practice.

Table 1. Topics to be discussed as part of the technological development in the Next Decade

Topics to be discussed as part of the technological development in the Next Decade
Implementation of Blockchain in Construction
AI-oriented areas
Easier integration of project management software through BOT
Full BIM implementation
Integrated technology ecosystem
Robots in construction enabled by integrated technology
Tools that integrate "soft" (behavioural) and control-based approaches
Data, Information, Knowledge Management
Enhanced use of Augmented Reality (AR) and Virtual Reality (VR)

Implementation of Blockchain in Construction

Despite the early work conducted, to which the author contributed, implementation of blockchain has not, at least not widely publicised, shown any signs of adoption. The author, in an earlier paper (January 2023), presented the requirements for implementing blockchain in project control; however, since that time, as mentioned, nothing has come to the author's attention.

Over the next decade and beyond, and with the improvements in technology, blockchain is most likely to show up in construction when multiple organisations need to trust the same record, e.g. payments, supply-chain provenance, handover information, design change trails, or compliance evidence. The biggest shift for companies will be how people work together: agreeing on what gets recorded, who approves it, how disputes are resolved, and how the record connects to day-to-day tools (ERP, document control, BIM/CDE, scheduling). Perhaps AI agents could be used to support the environment and technology. As adoption grows, expect less "pilot tech" and more process and contract change, with clearer roles, stronger accountability and fewer grey areas that typically lead to rework and claims.

Career lens: A good personal development path is to get comfortable with information governance (what needs recording, when, and by whom), and to practice turning messy real-world processes into clear, auditable workflows. Individuals do not need to be blockchain engineers but do need to speak the language of controls, evidence, and shared accountability. Possible areas for career adaptation/expansion:

- **Data governance & evidence habits:** define what "proof" looks like (e.g., approvals, inspection records, signoffs) and build routines that capture it cleanly.
- **Process mapping & controls design:** document end-to-end workflows (payment, change, handover) and identify where an immutable record would remove ambiguity.
- **Stakeholder alignment:** facilitate agreement across client/contractor/supply chain on roles, permissions, and dispute handling.
- **Commercial awareness:** understand how records link to valuation, claims avoidance, audit, and assurance.
- **Change adoption skills:** create simple guidance, training, and "what good looks like" examples so teams use the process consistently.

AI-oriented areas

In addition to what is currently happening and during the next decade, AI in project management and controls will shift from "nice dashboards" to everyday support for how teams run projects, supporting people to spot emerging issues earlier, focus attention where it matters, and reduce the burden of repetitive coordination. From the technologies that are currently available (and there are more coming up continuously) companies will use AI for forecasting (cost, time, productivity, improving performance), early scenario building, and early warning (risk, change control. safety, quality), but the real difference will come from how companies and teams adopt it - consistent data habits, clear escalation routes, and shared confidence in what the model can and cannot do. BOTs, agents and copilots will increasingly take on routine admin, e.g. reports, drafting updates, reconciling changes across schedule/cost/RFIs, chasing actions, summarising variance, freeing people to spend more time on judgement, stakeholder management, and problem-solving.

Career lens: It is the author's view that the people who thrive will be those who can work well with AI: framing the right questions, checking assumptions, proactively informing stakeholders and explaining outputs in plain language. Values are very likely to move from "producing reports" to interpreting signals, making decisions, and coaching others on how to use automation responsibly. Possible areas for career adaptation/expansion:

- **Prompting & question framing:** turn messy problems into clear questions an AI agent/copilot can help with.
- **Data literacy:** understand inputs, assumptions, data quality, and why forecasts can drift.
- **Model scepticism & assurance:** sanity-check outputs, spot bias/overconfidence, and document decisions.
- **Automation-friendly reporting:** write concise, structured updates that are easy for tools to summarise and reconcile.
- **Human judgement & communication:** explain what the AI is "suggesting" in plain language and decide what action to take, being the human-in-the-loop with the required expertise.

Easier integration of project management software through BOTs

In the next decade, BOTs and workflow automation should make it easier for teams to move information between planning, cost, document control, field capture, and commercial systems without so much manual rekeying and "copy/paste reporting". Integration of project management software tools will become easier as there will be more standardisation of structures (WBS, OBS, CBS, etc.) and coding. For companies, the human value-add is less time spent chasing updates and reconciling numbers, and more time spent planning for the future.

Organisationally, integration becomes a continuous transformation and an ongoing service that needs ownership and support, because people quickly lose trust when automations break or data quality slips. When done well, this improves clarity, reduces frustration and helps teams operate from a more reliable shared view.

Career lens: Individuals will need to build strength in process mapping and "how work flows" between roles and systems. People who can design practical automations complete with exception handling, ownership, and clear handoffs will become go-to colleagues/SMEs (Subject Matter Experts) because they remove friction from everyone's day. Possible areas for career adaptation/expansion:

- **Workflow design:** map handoffs between planning, cost, field and commercial teams; simplify before automating.
- **Basics of APIs and integration:** know what an interface can/can't do, and how data moves between systems.
- **Exception handling:** design what happens when data is missing, late, conflicting, or out of tolerance.
- **Data quality routines:** build simple validation checks and ownership so people trust the automated outputs.
- **Product mindset:** treat integrations as "live services" (monitoring, updates, user feedback), not one-off builds.

Full BIM implementation

So far, BIM implementation has not met expectations. Over the next decade, the most significant impact of full BIM implementation will be on how teams coordinate, not just on the quality of 3D models or on AI requirements and support. For companies, BIM maturity means clearer information requirements, smoother design-to-site conversations, fewer clashes and surprises, better implementation of project control processes (in terms of integrated scheduling and cost management), and better quality asset information at handover. As BIM becomes "business as usual", the differentiator will be the people system around it: who owns the model, how changes are agreed, how issues are resolved, how software tools between parties are integrated, and how site teams can access what they need without barriers. This can be compared to breaking down

the high-level schedule into a detailed Last Planner schedule. When this is done well, it reduces rework and strengthens confidence between disciplines and supply chain partners.

Career lens: It will be good for individuals to develop capabilities for managing the interfaces, for example, integrating time and cost, defining adequately WBS elements that will support the teams, working on and managing information, model coordination and translating design intent into buildable, sequenced work. It is the author's view that the most valuable BIM practitioners will be those who can bridge technical detail with real site constraints and communicate clearly across disciplines, perhaps with the complementary use of AI. Possible areas for career adaptation/expansion:

- **Information requirements:** help define what each discipline/site team actually needs, by stage, by WBS element, in usable formats.
- **Model coordination & issue management:** run coordination sessions, track clashes, close actions, and manage change clearly. Use appropriately the issues management process and link this to the risk register/management.
- **Classification and naming:** apply consistent conventions (assets, spaces, systems) so information is searchable and reusable. Use, as and where required, an Asset Management hierarchy.
- **Field usability:** translate model outputs into simple site-friendly views, checks, and work package information.
- **Collaborative communication:** bridge designers, site, and supply chain using shared visuals and clear decision records.

Integrated technology ecosystem

Over the next decade, integration, very likely through AI tools, will increasingly feel like an enabler of teamwork: fewer disconnected tools, less time hunting for the latest version, and more time aligning around the same facts. The company-level aim is near-real-time visibility that helps teams make better daily decisions with progress inferred from field capture (photos/drones/sensors), design context from BIM, commercial status from valuations, and issues from RFIs/NCRs, brought together into a coherent story for site, project leadership, and clients. BOTs will likely become a friendly front door for many users, allowing people to ask questions, check relevant information, update (where allowed/required) information and trigger actions without needing deep system expertise. The long-term success factor is trust between project team members from all the parties - inclusiveness, cooperation, consistent standards, access controls, and clear ownership so that people know the data is dependable.

Career lens: Individuals will need to strengthen their ability to work across systems and teams and be omniscient: asking good questions of integrated data, understanding how one update ripples through others, and partnering with digital/data colleagues to improve standards. This is

increasingly a collaboration skill as much as a technical one. Possible areas for career adaptation/expansion:

- **Systems thinking:** understand how schedule, cost, BIM, quality, and field data connect and where inconsistencies arise.
- **Data storytelling:** turn integrated data into a clear narrative (what changed, why it matters, what we do next).
- **Access & trust:** help define who should see what, and how to keep a single reliable version of the truth.
- **Operational discipline:** build habits for timely updates, clean status codes, and consistent metadata.
- **Cross-functional collaboration:** work effectively with digital, IT, commercial, and site teams to improve standards.

Robots in construction enabled by integrated technology

At least in UK, robots have appeared on construction sites. Although this is currently adopted by a handful of companies, construction robotics will likely expand steadily over the next decade, especially where teams need safer methods, more consistent quality, or higher productivity in repetitive tasks. The strongest use cases will be those where people and machines can work together clearly. For example, surveying/layout, inspection, precision cutting/drilling, or autonomous plant in controlled environments, e.g. self-guided diggers. For companies, robotics introduces a change in how work is planned and supervised - new competence requirements, different safety controls, and a stronger emphasis on clear tolerances and verification. Integrated digital information (design intent, positioning, progress evidence) is what enables site teams to deploy robotics confidently and repeatedly. Robots integrated with AI agents/tools could then become a powerful tool for delivering projects.

Career lens: Opportunities will grow for people who can bridge delivery and technology. Supporting robot-enabled methods, supervising safe operations, and designing work packages that suit automation. Combining these skills with those described in a number of the previous sections will be valuable/critical. Practical site credibility, combined with curiosity and learning agility, will matter a lot. Possible areas for career adaptation/expansion:

- **Method engineering:** break work into repeatable, robot-friendly 'method statement' packages with clear tolerances and prerequisites.
- **H&S and competence management:** understand safe systems of work for human–machine collaboration.
- **Digital setting-out/verification:** work with positioning, tolerances, and "as-built vs as-designed" checks.
- **Operational readiness:** plan training, support, spares, and downtime contingencies so robotics adds reliability.

- **Continuous improvement:** capture lessons from deployments and refine methods so adoption scales across projects.

Tools that integrate "soft" (behavioural) and control-based approaches

The author, through previous works, emphasised the need to support the 'soft' processes/approach to delivering projects and, in particular, how these are implemented to manage the effects of complexity. The author believes that there is a need for greater attention and emphasis to be given to developing more sophisticated software tools that enable an improved interface between the soft and control based approaches and which monitor and improve behavioural issues. Over the next decade, performance improvement is likely to blend classic controls (cost/schedule) with better visibility of the human behaviours that drive outcomes. For example, how teams are set up, how we structure the teams better, how well teams collaborate across interfaces, where rework loops start, how quickly decisions get made and how learning carries from one project to the next. More sophisticated tools may combine workflow signals with qualitative inputs (retrospectives, surveys, lessons learned) to show where the organisation is helping or hindering delivery. For companies, the opportunity is to build a healthier delivery culture through evidence-led improvements while being careful about privacy, ethics, and trust, so people feel supported rather than monitored.

Perhaps this is an area where more sophisticated software tools are/could be developed that enable an improved interface between the soft and control based approaches, and which monitor and improve behavioural issues

Career lens: Building strength in change management/leadership will be important: running good conversations, improving decision-making habits, and using evidence to adjust governance without losing the human side. The ability to create psychological safety while still driving performance will become a key differentiator. Possible areas for career adaptation/expansion:

- **Facilitation:** run retrospectives and problem-solving sessions that lead to actions, not blame.
- **Coaching & feedback:** support better behaviours (handoffs, responsiveness, decision-making) practically.
- **Metrics with empathy:** use indicators to start conversations, while protecting trust and psychological safety.
- **Governance design:** shape meeting cadences, decision rights, and escalation routes that reduce delays.
- **Ethics and privacy awareness:** help set clear boundaries on what is measured, why, and how it is used.

Data, Information & Knowledge Management

There will be a need for stronger data, information, and knowledge management, not only because of AI requirements but also because it makes it easier for people to find what they need, learn from past work, and make better decisions under pressure. For companies, the goal is to turn project delivery into a learning system: common language and taxonomies, searchable records, curated lessons learned, and reusable benchmarks for cost/schedule/productivity. The author is in the process of publishing a conceptual framework where there can be an integration of a very well established theory, in a different field, with that of management of data.

The overall shift needs to be one from storing documents to capturing decision context and creating information that teams actually trust and use.

Career lens: People who can turn experience into usable knowledge, clear standards, playbooks, templates, and well-structured datasets will be increasingly valuable. Combine this with delivery credibility and an individual is better placed to help whole teams perform better. For this particular case, CoEs (Centres of Excellence) within PMOs will play a very important role. Possible areas for career adaptation/expansion:

- **Knowledge capture and dissemination:** being able to design a good 'lessons learned' system that captures and disseminates these continuously, write concise lessons learned with context (what happened, why, what to do differently).
- **Taxonomy and tagging:** apply consistent metadata so others can find and reuse information quickly.
- **Structuring:** understand, enable and implement appropriate structuring of project data.
- **Standardisation:** turn good practice into templates, checklists, and playbooks that teams actually adopt.
- **Benchmarking:** understand how to compare projects fairly (normalisation, assumptions, and limitations). Utilise the appropriate AI tools to enable accurate and good benchmarking exercises. Be the human in the loop.
- **Community building:** create forums/communities (through the CoE) of practice that keep knowledge alive and improving.

Enhanced use of Augmented Reality (AR) and Virtual Reality (VR)

AR, as well as VR, have been slowly rolled out (at least since 2014) in project delivering organisations. However, over the next decade, AR/VR will increasingly be used to help people see and agree what "good" looks like before work starts: immersive design reviews, constructability rehearsal, safety planning, training, and on-site AR guidance for installation and inspections. A combination of AR/VR with drones can provide an even better level of understanding progress. It is also very likely that developments from the various war fronts can provide improvements in the integration of these technologies. For companies, the long-term

benefit comes when AR/VR is tied to trusted sources (BIM, method statements, quality checklists) and becomes part of how teams communicate and learn and not a one-off visualisation. As devices improve and content becomes easier to produce, AR/VR can reduce misunderstandings, support faster onboarding, and build capability through realistic practice.

Career lens: Focus on the human outcomes: designing AR/VR use cases that genuinely help teams, keeping content aligned to controlled information, and facilitating sessions so everyone is heard and decisions are captured. Communication and learning design will be just as important as the technology. Possible areas for career adaptation/expansion:

- **Use-case selection:** identify where immersion reduces ambiguity (handover, safety rehearsals, installation checks).
- **Workshop facilitation:** run effective VR/AR sessions that capture decisions, actions, and open issues.
- **Content curation:** keep models/scenes aligned to controlled BIM and project information so teams trust it.
- **Learning design:** create training scenarios with clear objectives, assessment, and feedback loops.
- **On-site adoption:** support practical rollout (devices, hygiene/maintenance, simple guidance, champion users).

A challenging timeline

The author has developed a high-level, forward-looking and deliberately challenging schedule (see Figure 1), setting out the key phases that construction (as well as other) organisations will need to navigate as part of their technological transformation, from early conceptualisation through to full adoption. Figure 1 further expands selected high-level hammocks to illustrate the depth of detail underpinning other phases, while maintaining alignment with the standard lifecycle set out in the APM Body of Knowledge (2019). The durations assigned to each phase are indicative, reflecting not only the technical complexity of emerging solutions but also the need for substantial effort during the concept and definition stages. They also account for the organisational, cultural, and behavioural challenges that are most acute at the front end of transformation programmes, where uncertainty, alignment, and capability-building are critical.

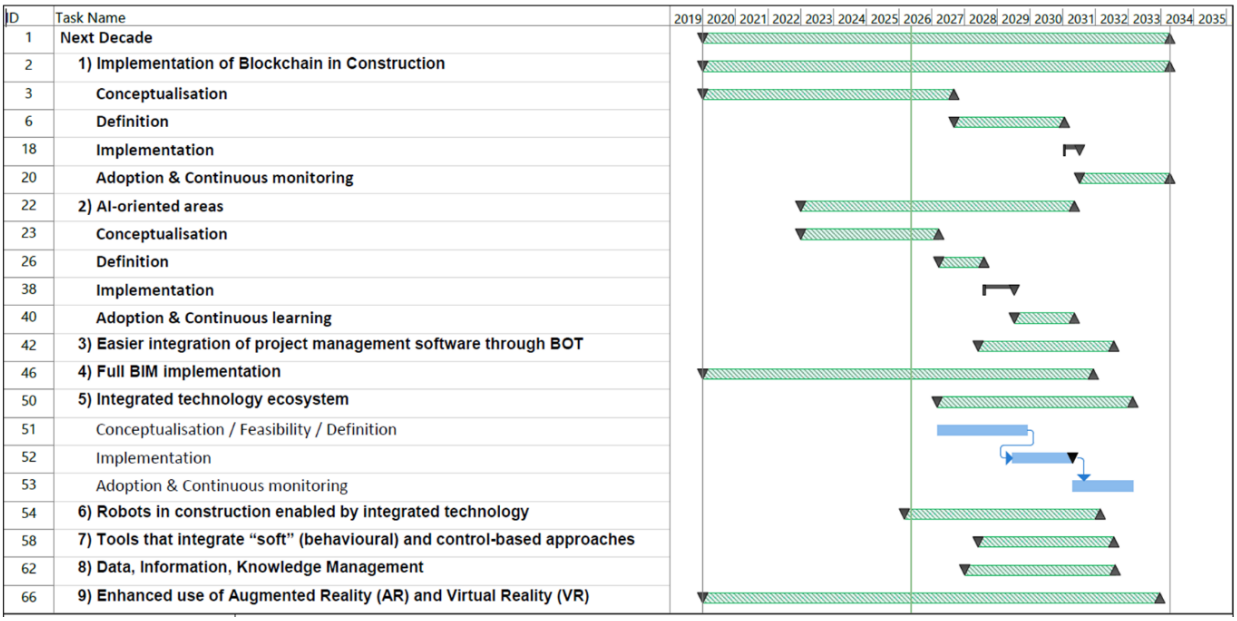

Figure 1. High-level schedule of a challenging set of transformations

Although technologies such as blockchain, robotics, AI agents, and integrated systems are evolving rapidly, their adoption is often constrained by organisational realities rather than technical capability. Implementation may be slowed by internal politics, resistance to change, limited trust in digital solutions, poor data quality, fragmented legacy systems, cybersecurity concerns, contractual risks, and regulatory uncertainty. Organisations may find that their biggest hurdle is moving from fragmented tools to truly integrated ecosystems, a process that requires robust data governance, standardised structures, and a cultural shift that values human judgment and "human-in-the-loop" expertise over mere output production.

Ultimately, the pace of progress depends less on the tools themselves and more on the strength of the surrounding "people system". Organisations and their transformation teams need to allocate (as with all projects) considerable effort at the front end. They must build trust in data and automation, establish robust data governance and integration, and overcome cultural barriers that hinder collaboration and new ways of working. Without addressing these behavioural and structural challenges, and fostering confidence through reliable systems and continuous learning, even advanced technologies are unlikely to achieve sustained or widespread adoption.

Concluding remarks

The past decade has demonstrated that the trajectory of technology adoption is rarely linear. Some innovations advance slower than anticipated due to organisational, contractual, or cultural barriers,

e.g. BIM and Blockchain, while others, most notably AI, accelerate far beyond expectations, reshaping industries in real time. What is increasingly clear is that the real transformation is not driven by technology alone, but by how effectively people, processes, and organisations adapt around it.

Across all the areas explored, the author considers that a common thread emerges/needs to be considered - the shift from fragmented tools to integrated, intelligent systems. Yet, the success of these systems will depend less on the sophistication of the technology and more on trust, as in trust in data, in systems, and most importantly, between the people who use them. Organisations that focus on clear governance, consistent behaviours, and collaborative ways of working will be better positioned to unlock value.

Equally, the role of the individual is changing and will be evolving much faster than in the past. The future professional in project management and control will not be defined by their ability to produce outputs, but by their ability to interpret, challenge, and act on insights, while bringing others along in the process. Skills such as systems thinking, as well as lateral thinking, data literacy, communication, and leadership, will become as critical as technical expertise.

Looking ahead, the next decade will not simply introduce new tools, but it will redefine how projects are planned, delivered, and experienced. Individuals who embrace continuous learning, remain adaptable, and actively shape their role within this evolving landscape will not only remain relevant but will help define the future of the profession.

Reflective questions

Technology & Organisation

- Are we adopting technology to solve real problems, or simply reacting to trends?
- How well do our current processes support (or hinder) the integration of emerging technologies?
- Do we trust the data we use daily, and are these structured appropriately? If not, what is missing?
- Where are the biggest disconnects between our systems, teams, and decision-making processes?
- Are we investing enough in the "people system" required to make technology successful?

People & Skills

- How is my current role likely to change as automation and AI take on more routine tasks?
- Am I developing skills that complement technology (e.g., judgement, communication, systems thinking)?
- Can I confidently interpret and challenge outputs generated by digital tools or AI systems?
- How well do I understand the flow of information across different functions and systems?
- What can we do as an organisation to safeguard positions and improve our people?

Career Development

- What capabilities will make me valuable in a more integrated, data-driven environment?
- How can I position myself as someone who enables change rather than reacts to it?
- Am I actively building experience across disciplines (technical, commercial, behavioural)?
- What steps am I taking today to remain relevant in five to ten years?

Leadership & Culture

- Are we creating an environment where teams feel supported to adopt new ways of working?
- How do we balance performance measurement with trust, ethics, and psychological safety?
- Are lessons from past projects truly captured and reused, or repeatedly lost?
- How effective are our decision-making structures in a fast-moving, data-rich environment?

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Dr Dimitris N. Antoniadis PhD MSc BEng(1st) CEng FAPM FCMI MIMechE, based in UK, has 35+ years' experience in Programme and Project Management positions, having covered project phases from concept to handover and operation / maintenance. He is currently Director in the Programme, Project Management and PMO with DANTON PROGM, technical advisor to Novacept and has set up the BSc in Project Control that is currently delivered by the partnership between London Metropolitan College and the University of West London.

He has held Senior Management posts in major utilities, infrastructure and construction organisations delivering programmes of works ranging from £250M to £3.2Bn. As Head of Programme Management Office (PMO) he has set up and run the departments within challenging partnering environments, setting up all the processes from governance to reporting. He has also led / co-led major business transformation programmes for Client organisations in UK and abroad, integrating project management software tools with ERP systems.

He is the author of the book '*Demystifying Project Control*'; contributed chapters in books on complexity, leadership and other project management topics and has written a number of journal and conference papers. He has been a guest speaker at UK Universities as well as International conferences on various project management topics.

He was awarded the PhD, from Loughborough University, UK, on the subject of '*Managing Complexity in Project Teams*', where he developed a framework for managing the effects of complexity on projects.

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