CATALOGUE OF
CONSTRUCTION
TECHNOLOGY
TYPES

C-TECH CLUB

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In every field of endeavour, technology drives progress. Construction technology continues to increase efficiency, productivity, safety, and quality. The C-Tech Club, through its industry outreach and promotion of start-ups, is accelerating this progress whilst supporting an ecosystem of innovative companies that will positively impact all facets of construction. That is why Elecosoft is proud to partner with the C-Tech Club and sponsor this publication.

Elecosoft enables companies supporting the building lifecycle to drive efficient operations with innovative, market-leading software. From its operations in the UK, Sweden, Germany, the Netherlands, Romania and the USA, Elecosoft's established portfolio of software facilitates early planning stages

through to construction, interior fit-out and design, asset management and facilities management, project portfolio management, estimation, visualisation, and Building Information Modelling (BIM).

At the heart of every Elecosoft solution is its customer. In-house software development and custom integrations, training, technical support, and consultancy services align with our world-class products to enable our customers to create certainty and accelerate their digital transformation journeys.

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CEO

Elecosoft®

Contents

Introduction

Construction technology is moving from individual 'tools' to connected 'toolkits', with data integration and interoperability increasingly important.

This all-new version of the C-Tech Club's Catalogue has a particular emphasis on the type of data associated with each construction technology tool. It features a new function, 'golden thread', for how the various technologies can best be made to work together.

This is the second year that the C-Tech Club has produced its Catalogue of Construction Technology Types. We feature 167 companies from 15 countries, organised around 31+1 types of technology.

Start-ups continue to lead the way with new tools, services and capabilities. The C-Tech Club is here to champion the excellence of founders and start-ups, but this Catalogue also features the best of the more established AEC software vendors.

We were pleased to receive the feedback that last year's Catalogue was seen as a helpful source of reference for the range and breadth of the best that construction technology has to offer.

Project and construction managers clearly found the structured approach and taxonomy particularly useful.

This year's Catalogue has been fully updated and is testament to the speed of endeavour of companies working in this space. It remains the case, though, that technology alone is not enough.

It requires the combination of technology, process and people to deliver real improvements in business performance and better outcomes.

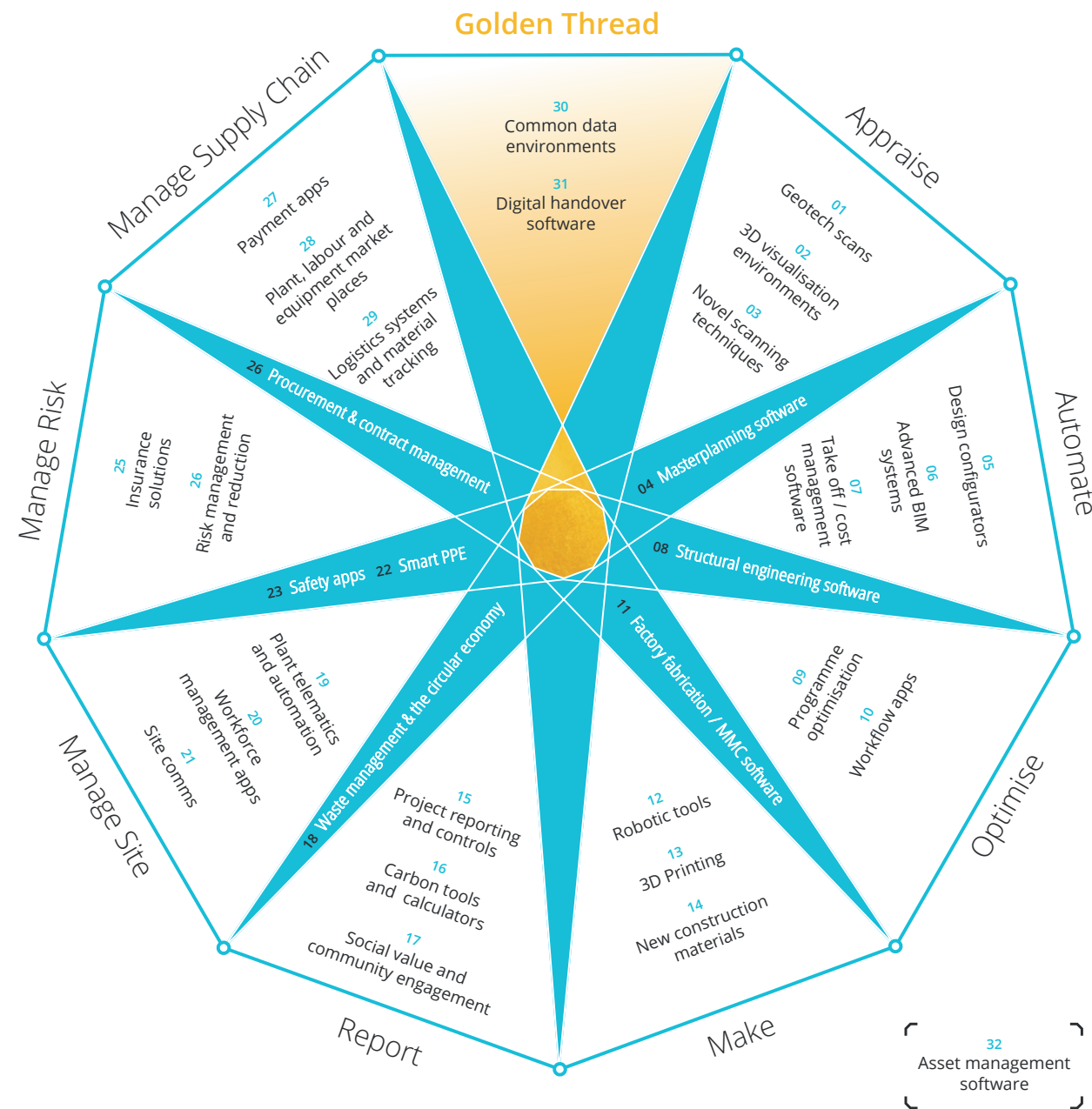**John Priestland**
Founder
C-Tech Club
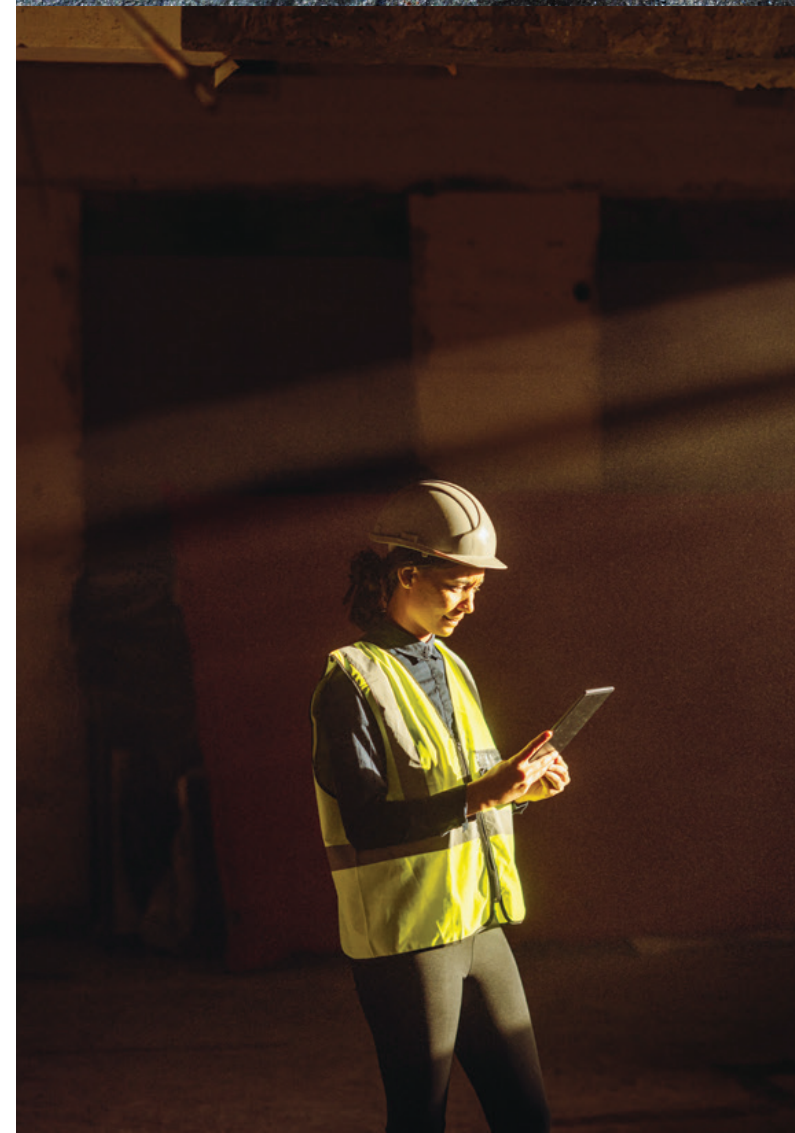
Construction technology is shifting from being seen as 'innovative' to something that is very much 'business as usual'.

Construction technology functional map

This year's Catalogue is made up of 31 + 1 Categories of construction technology arranged around nine **functions**. Some of the Categories span more than one function and so sit in the intersect between different functions.

Technology by project stage

Functional map (left diagram)

Golden Thread

- 30 Common data environments
- 31 Digital handover software

Appraise
- 01 Geotech scans
- 02 3D visualisation environments
- 03 Novel scanning techniques

Automate
- 05 Design configurators
- 06 Advanced BIM systems
- 04 Masterplanning software
- 07 Take off / cost management software
- 08 Structural engineering software

Optimise
- 11 Factory fabrication / MMC software
- 09 Programme optimisation
- 10 Workflow apps

Make
- 12 Robotic tools
- 13 3D Printing
- 14 New construction materials
- 15 Project reporting and controls
- 16 Carbon tools and calculators
- 17 Social value and community engagement

Report
- 18 Waste management & the circular economy

Manage Site
- 19 Plant telematics and automation
- 20 Workforce management apps
- 21 Site comms

Manage Risk
- 22 Smart PPE
- 23 Safety apps
- 24 (not labelled)
- 25 Insurance solutions
- 26 Risk management and reduction
- 26 Procurement & contract management

Manage Supply Chain
- 27 Payment apps
- 28 Plant, labour and equipment market places
- 29 Logistics systems and material tracking

32 Asset management software

Functional Key

Appraise > Something you to do understand the condition of an asset or the environment

Optimise > A process that allows you do something more quickly or more easily

Make > The act or process of creating materials or assembling them into structures

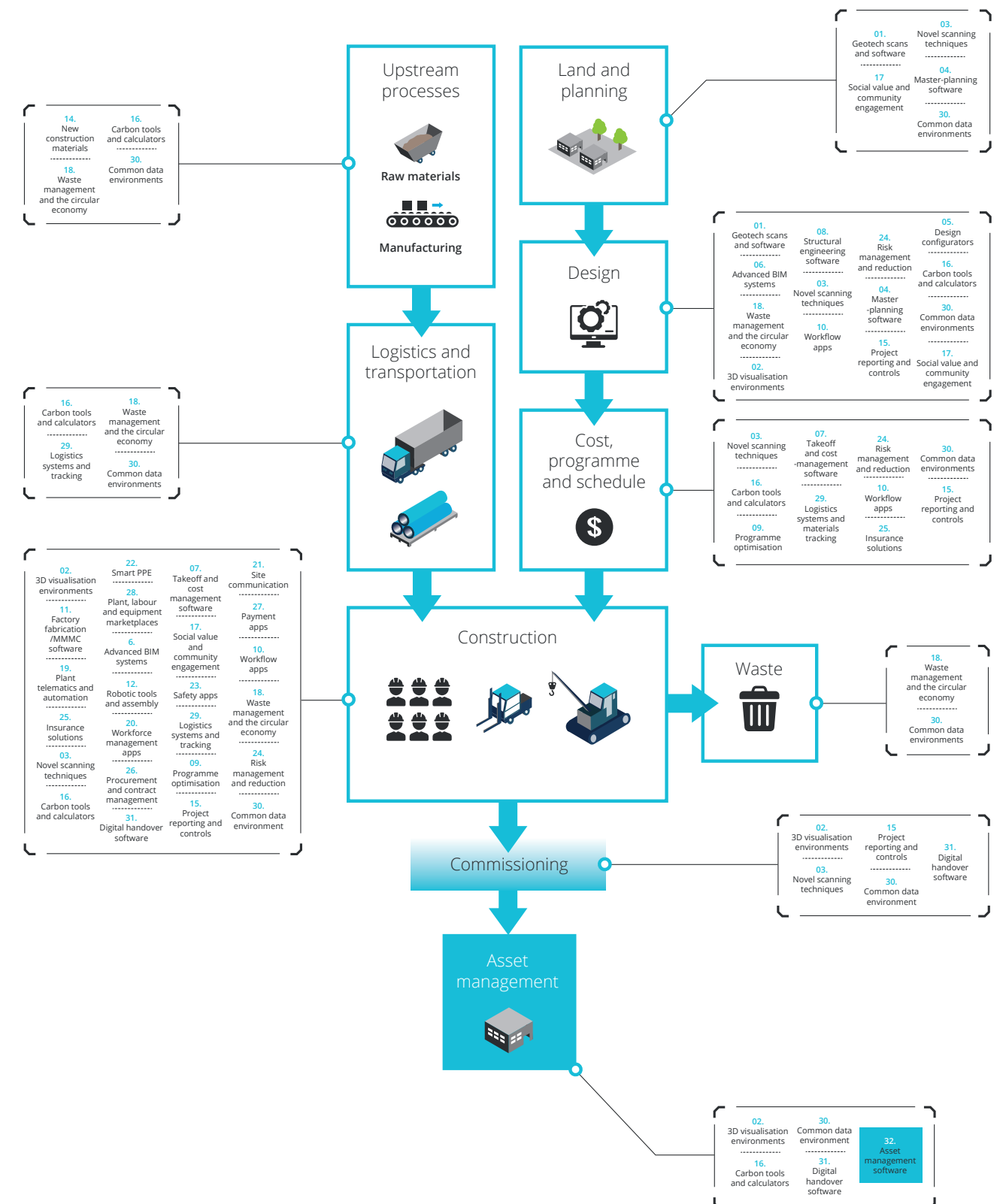**Report** > Something that tells you what is going on with your project or site

Manage site > Tasks and activities to do with the co-ordination and delivery of processes

Manage risk > An approach that makes adverse outcomes less likely to happen

Manage supply chain > Tools that help you co-ordinate the actions and activities of companies outside your own

Golden thread > The integration of data to allow information to be used across different phases of the asset's lifecycle

Technology by project stage (right diagram)

Upstream processes
- Raw materials
- Manufacturing

Raw materials / Upstream box:
- 14. New construction materials
- 16. Carbon tools and calculators
- 18. Waste management and the circular economy
- 30. Common data environments

Land and planning
- 01. Geotech scans and software
- 03. Novel scanning techniques
- 17. Social value and community engagement
- 04. Master-planning software
- 30. Common data environments

Design
- 01. Geotech scans and software
- 06. Advanced BIM systems
- 18. Waste management and the circular economy
- 02. 3D visualisation environments
- 08. Structural engineering software
- 03. Novel scanning techniques
- 10. Workflow apps
- 24. Risk management and reduction
- 04. Master-planning software
- 15. Project reporting and controls
- 05. Design configurators
- 16. Carbon tools and calculators
- 30. Common data environments
- 17. Social value and community engagement

Logistics and transportation
- 16. Carbon tools and calculators
- 29. Logistics systems and tracking
- 18. Waste management and the circular economy
- 30. Common data environments

Cost, programme and schedule
- 03. Novel scanning techniques
- 16. Carbon tools and calculators
- 09. Programme optimisation
- 07. Takeoff and cost management software
- 29. Logistics systems and materials tracking
- 24. Risk management and reduction
- 10. Workflow apps
- 25. Insurance solutions
- 30. Common data environments
- 15. Project reporting and controls

Construction
- 02. 3D visualisation environments
- 11. Factory fabrication /MMMC software
- 19. Plant telematics and automation
- 25. Insurance solutions
- 03. Novel scanning techniques
- 16. Carbon tools and calculators
- 22. Smart PPE
- 28. Plant, labour and equipment marketplaces
- 06. Advanced BIM systems
- 12. Robotic tools and assembly
- 20. Workforce management apps
- 26. Procurement and contract management
- 15. Project reporting and controls
- 31. Digital handover software
- 07. Takeoff and cost management software
- 17. Social value and community engagement
- 23. Safety apps
- 29. Logistics systems and tracking
- 09. Programme optimisation
- 21. Site communication
- 27. Payment apps
- 10. Workflow apps
- 18. Waste management and the circular economy
- 24. Risk management and reduction
- 30. Common data environment

Waste
- 18. Waste management and the circular economy
- 30. Common data environments

Commissioning
- 02. 3D visualisation environments
- 15. Project reporting and controls
- 31. Digital handover software
- 03. Novel scanning techniques
- 30. Common data environment

Asset management
- 02. 3D visualisation environments
- 30. Common data environment
- 32. Asset management software
- 16. Carbon tools and calculators
- 31. Digital handover software

Technology by type of client and project

	By type of client						By type of project						By project stage						
	Investor	Asset owner	Designer / consultant	Tier 1 contractor	Tier 2 contractor	Asset operator	Residential / housebuilding	Commercial building	Industrial and energy construction	Transportation and infrastructure	Upstream processes	Logistics and transportation	Land and planning	Design	Cost, programme and schedule	Construction	Waste	Commissioning	Asset management
1. Geotech scans and software			●	◐			◐	◐	●	●			●	●		◐			
2. 3D visualisation environments		◐	●	●	●	○	◐	●	●	●			◐	●		●		●	○
3. Novel scanning techniques			●	●	◐	◐	◐	●	●	●			●	●	●	●	◐	●	◐
4. Masterplanning software	◐	◐	●				●	●	●	●			●	●					
5. Design configurators			●	◐			●	●	●	●			●	◐					
6. Advanced BIM systems			●	●			◐	●	●	●			●	◐	●				
7. Takeoff and cost management software			●	●			●	●	●	●			◐	●	●				
8. Structural engineering software			●	◐			◐	●	●	●			◐	●	◐	◐			
9. Programme optimisation			●	●			◐	●	●	●			◐	●	●	◐	◐		
10. Workflow apps			◐	●	◐		●	●	●	●	◐	◐	●	●	●	◐	◐		
11. Factory fabrication / MMC software			◐	◐			●	●	●	●			◐	●	●	◐	◐		
12. Robotic tools and assembly			◐	◐	◐		◐	●	●	●			◐	●	●				
13. 3D printing			◐	◐	◐		◐	◐	●	◐			◐	●	◐				
14. New construction materials			◐	◐	◐		●	●	●	●	●		◐	●	◐				
15. Project reporting and controls	◐	●	●	●	◐		●	●	●	●	◐	◐	◐	●	●	●	◐	●	
16. Carbon tools and calculators	◐	◐	●	●	◐	○	◐	◐	●	●	●	◐	●	●	◐	●	◐	◐	○
17. Social value and community engagement	◐	●	●	●	◐	◐	◐	◐	●	●	◐	◐	●	●	●	◐	●		◐
18. Waste management software		◐	●	●	◐	◐	●	●	●	●	●	●		●	◐	●	●	●	◐
19. Plant telematics and automation			●	●			◐	●	●	●				●	◐				
20. Workforce management apps			●	●			●	●	●	●				●	◐				
21. Site communication			●	●			●	●	●	●				●	◐	◐			
22. Smart PPE			●				●	●	●	●				●					
23. Safety apps			●	●			●	●	●	●	◐	◐		●					
24. Risk management and reduction	◐	◐	●	●	◐		●	●	●	●	◐	◐	●	●	●	●	◐	●	
25. Insurance solutions	◐	◐		●	◐		●	●	●	●				●	●	◐			
26. Procurement and contract management			◐	◐	◐	◐	◐	●	●	●			◐	●	●	●	◐	◐	◐
27. Payment apps			●	●			●	●	●	●				●					
28. Plant, labour and equipment marketplaces			●	●			●	●	●	●				●					
29. Logistics systems and materials tracking			◐	●		◐	●	●	●	●	◐	●	◐	●	●	●			◐
30. Common data environments	◐	◐	●	●	◐	○	●	●	●	●	●	●	●	●	●	●	●	●	○
31. Digital handover software	◐	●	◐	●	◐	○	●	●	●	●			◐	●		◐		●	○
32. Asset management software	◐	◐	◐	◐	◐	○	●	●	●	●			◐	●		◐		◐	○

'Clusters' of technology Categories arranged by information management type

We set out below fifteen 'clusters' of Categories – the logic being that there is commonality of data structure within each 'cluster', so that integration of the tools within each 'cluster' makes particular sense.

GIS 2D
- 01. Geotech scans and software
- 04. Masterplanning software

3D
- 02. 3D visualisation software
- 03. Novel scanning techniques
- 05. Design configurators
- 06. Advanced BIM systems
- 08. Structural engineering software

Cost
- 07. Takeoff and cost management software

Project
- 09. Programme optimisation
- 15. Project reporting and controls
- 24. Risk management and reduction

Site
- 10. Workflow apps
- 20. Workforce management apps
- 21. Site communication
- 22. Smart PPE
- 23. Safety apps

Manufacturing
- 11. Factory fabrication / MMC software

Community
- 17. Social value and community engagement

Material properties
- 14. New construction materials
- 16. Carbon tools and calculators
- 18. Waste management and the circular economy

Robotic control
- 12. Robotic tools and assembly
- 13. 3D printing

Insurance
- 25. Insurance solutions

Supply chain
- 26. Procurement and contract management
- 27. Payment apps
- 28. Plant, labour and equipment marketplaces

Logistics
- 29. Logistics systems and materials tracking

Golden Thread
- 30. Common data environments
- 31. Digital handover software

Plant and equipment
- 19. Plant equipment and telematics

Asset Management
- 32. Asset management software

List of construction technologies

▼ 1. Geotech scans and software

Description:

Electromagnetic surveys involve sending an electromagnetic wave into the ground and inducing an electric current in conductive materials located in the subsurface. The currents move downwards, creating a secondary magnetic field, which is registered by sensors. The force of this field is dependent on what the subsurface consists of and can give a better understanding of ground conditions than conventional methods. Ground penetrating radar (GPR) follows a similar logic but uses a reflected radar pulse.

Example providers:

Exodigo (US) combines multiple sensors, 3D imaging and AI technologies to create complete, accurate and non-intrusive underground maps. **Quantum Structures** (UK) has built a circular rotating Ground Penetrating Radar array that can be used for assessing the integrity of tunnel linings. **SAALG's** (Spain) DAARWIN platform optimises construction projects, especially temporary works, by using the observational method and AI to reduce geotechnical uncertainties. **EMerald Geomodelling** (Norway) combines geophysics and GIS through AI to reduce ground risks for large infrastructure projects. By embedding a sensor in the digging bucket, **RodRadar** (Israel) overcomes the existing limitations of GPR to detect underground utilities.

▼ 2. 3D visualisation environments

Description:

A digital twin is the 3D digital representation of a physical asset. It allows the user to make better design and construction management decisions and to collaborate and co-ordinate more efficiently across the project team. The term 'digital twin' can be regarded as too vague, so we prefer to refer to '3D visualisation environments' that allow information from a range of sources to be combined through an easy-to-use graphical interface.

Example providers:

Sensat (UK) combines data to create a digital version of the world that is understandable to AI, and can therefore help project teams take better decisions. **DTO** by GHD (UK) allows rapid rendering and visualisation of very large high-resolution photogrammetry, LiDAR, BIM and GIS datasets through a standard web browser. RHDHV's (the Netherlands) **Twinn** digital system combines the WITNESS predictive simulation capability (formerly under the Lanner brand) with a new 3D environment. This makes it particularly good for modelling constraints. **Amutri** (UK) rapidly produces detailed visualisations of projects from the information in BIM models. **CUPIX** (US) uses AI to produce 3D visualisations of a job site from footage from a camera in a construction hard hat. **vGIS** (Canada) produces a highly accurate augmented reality (AR) visualisation environment.

▼ 3. Novel scanning techniques

Description:

Novel scanning techniques often involve the use of 'computer vision', which is a field of artificial intelligence that focuses on the ability of algorithms to derive meaning from visual inputs such as photos and videos. Applications in construction include improving workplace safety, improving productivity and efficiency, monitoring progress and helping with quality management. Other techniques include multi-spectral cameras to secure additional insights, for example around the ecological health of the flora and fauna associated with a site.

Example providers:

Herotech8's (UK) 'drone in a box' technology provides both routine (e.g. 3D modelling) and reactive (e.g. security) on-demand drone services, with no human intervention required. **Route Reports** (UK) uses computer vision algorithms coupled with in-vehicle sensors to spot defects (potholes) on the road network. **SiteHive's** (Australia) Hexanode devices are real-time environmental monitoring sensors that capture information on noise, dust and vibration, including images and audio. **BuildAI's** (Australia) CraneCast technology provides an aerial view of a construction site while leveraging applied AI to identify opportunities to improve productivity. **GScan** (UK) uses cosmic-ray muon tomography for critical infrastructure testing, including for bridges and dams.

▼ 4. Masterplanning software

Description:

City-scale planning and project planning at a massing level takes the form of a 2D plan or a 3D representation, and software can augment this with further layers of detail. This additional data – such as economic and ownership information or natural features such as topology – helps the designer or planner to make better decisions. Additional functionality includes carbon modelling, the automation of the massing of buildings, the route planning of linear infrastructure using evolutionary algorithms and, prospectively, AI.

Example providers:

Giraffe (Australia) combines architectural design and urban, financial and environmental analytics. **Archistar** (Australia) enables the rapid analysis of development sites and the generation of 3D designs. **AgiliCity** (Slovenia) has developed Modelur, which is a parametric urban design tool for fast and accurate 3D massing and feasibility studies. **Geosite** (US), recently acquired by Descartes Labs, is a geospatial marketplace that sources, visualises and analyses data from satellites, drones, aerial and IoT. **Cetopo** (Finland) combines various data sources with intelligent algorithms to automate the production of high-quality 3D site models. **Continuum Industries'** (UK) Optioneer platform combines geospatial data and design rules to generate a shortlist of tailored options in a few hours.

List of construction technologies

5. Design configurators

Description:

Design configurators allow users to customise standard designs based on a small number of inputs using pre-engineered components and according to pre-determined topology and assembly rules. They effectively automate and streamline the design process and are best suited to repeatable projects such as apartments, schools, petrol stations and bridges.

Example providers:

Forma (US), formerly Spacemaker, is Autodesk's cloud-based solution for early-stage planning and design. **TestFit** (US) provides real time AI configurators, making feasibility studies faster and more cost effective. **Hypar** (US) automates conceptual, schematic and design development tasks, generating building systems and configuring construction products. **Propster** (Austria) is an online customer platform for property companies that includes a white label apartment configurator. GHD's (UK) **Automation Studio** improves design efficiency with rules-based automation, producing 3D models, construction drawings and calculations from an asset-specific configurator. **Laing O'Rourke's** (UK) bridge configurator allows users to run multiple options with the bridge kit of parts to select the best ones for the desired project outcome.

6. Advanced BIM systems

Description:

Revit is the established BIM system for buildings (with Civils3D and Bentley Microstation having a similar popularity in infrastructure) but contender systems are emerging. Some are add-ins to existing packages; some perform additional functions such as design checking and others intend to offer complete design environments. Additionally, Large Language Models (LLMs) are expected to augment BIM systems to provide additional functionality and control.

Example providers:

Skema (US) creates BIM in minutes from schematic designs based on a company's best designs and standards. **Qonic** (Belgium) is a cloud-based BIM platform with construction-level details. **Snaptrude** (US) is a collaborative 3D BIM tool on the cloud with a parametric engine that makes it easy to go from a sketch to a 3D parametric model. **Verifi3D** by Xinaps (the Netherlands) is an AI model-checking solution that validates building designs with its advanced rule-based engine. **Solibri** (Finland) is one of the most established rule-based model checking and validation tools, and **BIMAudit** (UK) is a new entrant into this space. **Revizto** (Switzerland) is a BIM collaboration platform that supports 3D and 2D workflows in a single unified user environment. **Bimify** (Sweden) is an automated platform for creating and maintaining digital building models.

7. Take-off and cost management software

Description:

Take-off software helps to quantify the materials necessary to start and execute the project. It can be 2D or 3D, depending on whether it uses file types such as PDF and CAD, or whether it is based on 3D models and BIM files. Additional features include error detection and validation and data insights. Takeoff software links to more general cost management and estimating software that also supports cost control, budgeting and forecasting.

Example providers:

Kreo (UK) is a take-off tool, with a variety of additional features, that predicts what a user will want to measure and helps find all the objects or text on a drawing that are similar to the selected one. **PlanSwift** by ConstructConnect (US) can be customised for a specific trade, allowing the creation of assemblies of commonly used materials, waste and labour. **Building Estimate & Design Co** (BEDC) (New Zealand) uses patented AI technology and skilled team members to provide accurate and fast structural designs. It also allows customers to manage job workflows, compare variations to plans and estimate design complexity. **BEXEL Manager** (Slovenia) is a flexible 5D BIM platform that enables advanced analyses such as model-based cost estimation. It integrates spatial and temporal dimensions with cost data schedule creation and optimisation.

8. Structural engineering software

Description:

Structural engineering software tools automate the calculation of standard details and connections, eliminating the labour-intensive bespoke approach. As well as streamlining manual processes by recognising patterns and providing calculations instantly, they remove human error and reduce data fragmentation. This enables engineers to focus on the anomalies and offers transparent reporting, providing new approaches to assurance and checking.

Example providers:

ClearCalcs (Australia) provides a library of pre-created structural engineering calculations and a 'no-code' calculations builder. **Calctree** (Australia) allows users to automate complex calculations, data processing and design tasks. **CLT Toolbox** (Australia) makes mass timber easier to design by automating design processes and including a solver to enable optimisation. **Pathw.ai** (Belgium) streamlines the detailed design process for steel fabrication and offers insights based on previous schemes and suggests validated solutions. **Preoptima's** (UK) CONCEPT platform handles the generative design of structural systems, automating material quantity take-offs and delivering up-to-date carbon impact data to inform structural system design. **BKwai** (UK) generates structural health insights from multi-sourced site monitoring data to enable smarter decision-making on site.

List of construction technologies

▶ 9. Programme optimisation

Description:

Improving construction schedules can lead to huge savings in terms of time, cost and carbon. Software in this Category enables enhanced coordination across disciplines and provides better visualisation via digital rehearsals. 'Generative construction' uses evolutionary algorithms to run millions of scenarios to present the 'best' approach. Users can then make trade-offs between different priorities. Optimisation can also come from adapting lean thinking to work within a digital platform. AI is likely to start making an impact too.

Example providers:

ALICE Technologies (US) is a leading proponent of 'generative construction'. In 2024, it launched 'ALICE Core', which enables customers to begin the process of optimising their construction schedules by importing a P6 or Microsoft Project schedule. **Frontline** (Singapore) offers optimisation software to help companies find the best sequence of actions with optimal resource loading to improve their construction schedules. **Visilean** (UK) is a collaborative planning tool, built on Last Planner principles, that also provides real-time visualisation through its BIM integration. There are also a number of more general tools that help project planners to optimise construction project management.

▶ 10. Workflow apps

Description:

Construction projects are a series of processes where resources (people, materials and equipment) are brought together to deliver parts of the programme. These steps can be captured in workflow tools that can then help to optimise and support the way in which tasks are undertaken. The very act of capturing processes is helpful, as it supports standardisation. Further, it can lead to the re-engineering of these processes, driving out waste and supporting lean thinking, as well as supporting better project assurance and error reduction.

Example providers:

Planradar (Austria) is a digital platform that creates time and cost savings by digitising task management, documentation and communication. **Archdesk** (UK) is an alternative that is particularly customisable to a company's needs. **Inauro** (Australia) specialises in linking IoT data to operational systems, to help automate operational workflows. **CONQA** (Australia) is a construction field management tool that equips site teams to capture a record of work, report accurately and get paid faster. **Qualomate** (Canada) extracts data from PDFs and reduces the time taken to review and manage quality assurance and management. **Fonn** (Norway) promotes collaboration by linking drawings and documents with task management.

▶ 11. Factory fabrication / MMC software

Description:

This Category is for the 'operating system' software that links a standardised and customisable kit of parts with the design environment and the manufacturing world. That is, software that allows the design, procurement, fabrication, assembly and assurance of a building using an integrated and non-traditional approach. There are still some challenges to the cost-effectiveness of Design for Manufacture and Assembly (DfMA), but the use of digital systems to track, manage and assure the manufacturing, logistics and installation processes will help.

Example providers:

Ark (Australia) converts masterplans into a schedule of components, provides an online fulfillment marketplace and helps manage the logistics of delivery and installation. **KOPE** (UK) is a purpose-built software platform for offsite construction. It allows designers and suppliers to apply real-world products into digital design models. **Trunk** (UK) is combining production, quality and site installation into a single project delivery software system – accelerating the delivery of sustainable buildings. **Modulize** (Norway) offers a take-off and cost estimation tool that feeds into a bidding platform for modular construction that includes structured and comparable data.

▶ 12. Robotic tools and assembly

Description:

Robotic tools may replace or assist human workers or allow tasks to be completed and information to be gathered in new ways. Use cases range from automated site layout systems to tools for cutting paving slabs. Robotic tools are well suited to unsafe environments such as confined spaces, working-at-height or where there is radiological risk. However, the complexity of a construction site can make it difficult to deploy and maintain robots, as well as to integrate robotic processes into more conventional construction activities and workflows.

Example providers:

Monumental (the Netherlands) builds autonomous ground vehicles (AGVs) and robots to help address labour shortages and rising costs. **Q-Bot** (UK) uses intelligent robots to apply spray foam insulation to the underside of a suspended floor, which can reduce heat loss from existing homes. **Roborigger** (Australia) is a load control device that allows the orientation of lifted loads to be controlled wirelessly to avoid the need for taglines. **Hausbots** (UK) has developed wall-climbing robots for concrete and infrastructure inspections and to prevent working at height. **nLink's** (Norway) robotic arm and sensor technology can plan and excavate sites, install fence posts and even pour concrete. **Advanced Construction Robotics** (US) has developed Tybot, a rebar-tying robot.

List of construction technologies

13. 3D printing

Description:

Construction 3D printing, or 'additive manufacturing', is the computer-controlled sequential layering of materials to create three-dimensional forms. The most common type of printer is based on a robotic arm that moves back and forth while extruding concrete. Subtractive manufacturing is used much less frequently in construction. It is the process of creating objects by starting with solid blocks, bars or rods of plastic, metal or other materials, and shaping them by removing material through cutting, boring, drilling and grinding.

Example providers:

Mighty Buildings' (US) 3D printing system and its composite stone material – made from 60% recycled glass – allows it to build homes much more quickly and with less material and waste. **Q4D's** (US) Zeero technology prints full-scale 3D printed houses in 48 hours. **ICON** (US) has launched Phoenix, its robotic-arm-mounted 3D printer, that can create fully-enclosed, multi-storey structures from a low-carbon concrete mixture. **COBOD's** (Denmark) large scale printers are based on a modular truss structure and can extrude a range of various concrete types and forms. **D-Shape's** (UK) technology works by depositing alternating layers of granular matter and specially formulated binding 'ink' that fuses the grains together.

14. New construction materials

Description:

This Category encompasses innovations in concrete, insulation, steel, aggregates and other commonly used materials. Challenges associated with their adoption include: the investment required to manufacture them at scale; proving that they will maintain their properties over the design life of a building (and where that risk lies); meeting building standards; and compliance from a UK Building Safety Act perspective, including in combination with other products.

Example providers:

Amatec's (US) High-Density Gypsum (HDG) is a patented replacement for concrete with a faster curing rate and less carbon. **Carbicrete** (Canada) is developing cement-free concrete using slag from steel factories to replace cement as a binding agent. Because CO_2 is injected and sequestered, the product is 'carbon negative'. **Natural Building Systems** (UK) makes hemp and timber panels that are demountable and form a kit of parts that removes more carbon from the atmosphere than they use in being made. **Mykor** (UK) also makes 'carbon negative' building insulation from industrial residues. **Mimicrete** (UK) has developed a self-healing concrete system based on a vascular network containing a healing agent. **KENOTEQ's** (UK) first product is the K-Briq, an unfired construction brick made from 95% recycled material.

15. Project reporting and controls

Description:

The technology to automate the collection of project information is straightforward, but the problem is cultural: Excel is the most commonly used tool and there is a lack of consistency in data structure. Improvement will come through the combination of technology, people and process. Automation will enable more real-time reporting. The next step will be the use of AI to flag up problems and early warning indicators. This area is likely to advance quickly.

Example providers:

Foresight (UK) supports project controllers with scheduling insights, as well as C-Suite level decision-making with comprehensive dashboards. **Fonn** (Norway) enables drawings and document management, variations and real-time communications, so users can monitor projects via a single platform. **Buildots** (Israel) is combining AI and computer vision to automate on-site progress tracking. The platform provides progress reports and predictive performance forecasts, helping to reduce delays and increase project efficiency. **Nodes & Links** (UK) is using generative AI to predict project outcomes and is automating processes to enable teams to allocate more time to more strategic tasks. **Aphex** (UK) is a multi-user planning tool to build and communicate detailed lookahead schedules.

16. Carbon tools and calculators

Description:

Carbon footprinting requires the analysis of a large number of materials, products, processes and assemblies, the data for which is often ambiguous or unavailable. High quality embodied carbon calculators are therefore essential to support any claims of carbon neutrality. AI and other natural language processing systems are increasingly used to automate and optimise the calculation process. There are also carbon tools that will track, support and reduce the carbon impact of various construction processes, especially those around concrete.

Example providers:

One Click LCA (Finland) is a life-cycle assessment platform, providing BIM and other integrations and incorporating generic LCA data and manufacturer EPDs globally. Morgan Sindall (UK) has developed **CarboniCa** to measure whole life carbon emissions and pinpoint where savings can be made. **Preoptima** (UK) integrates whole life carbon assessments (WLCAs) and carbon optioneering into the earliest stages of building design, allowing building stakeholders to make data-driven decisions. **Cloud Cycle** (UK) provides real time insights into wet ready mix concrete loads, helping to avoid wastage. **Converge** (UK) deploys smart sensors and AI-powered software to help contractors reduce embodied carbon by selecting lower-carbon materials and reducing waste and rework.

List of construction technologies

▼ 17. Social value and community engagement

Description:

In the context of the built environment, social value is created when buildings, places and infrastructure support environmental, economic and social wellbeing. This is challenging to measure, and it is hard to ensure transparency and fairness. We feel that there is more that technology can do to improve data collection and impact reporting. Community engagement involves contractors actively consulting and communicating with residents, businesses and services to ensure construction impacts are minimised and people's views are considered.

Example providers:

Compliance Chain (UK) offers social value as one of its three main modules, alongside supply chain and project management. **Social Value Portal** (UK) is a cloud-based solution that helps organisations procure, measure, manage and report social value. It is used in construction but is not construction-specific. **Loop** (UK) forecasts, monitors and evaluates social value over the lifecycle or projects and aligns with common social value frameworks (e.g. the National TOMs – Themes, Outcomes and Measures – and sustainable development goals). **Commonplace** (UK) is an online citizen engagement platform with AI integration. **Sitepodium** (the Netherlands) specialises in better community engagement and communication.

▼ 18. Waste management and the circular economy

Description:

All construction companies are legally required to reduce, reuse and recycle demolition and building waste before disposal. Circular economy thinking can help, where reuse is designed into the assets from the outset. Waste management software can help ensure compliance and improve data transparency and reporting. Reuse can be promoted by using software to assess and understand the materials within an existing building.

Example providers:

Qflow (UK) tracks material and waste movements during construction, automatically assessing compliance and the supply chain. **Madaster** (the Netherlands) has created an online registry for materials and products. This allows data to be recorded about each object, including whether it can be dismantled and reused. **Upcyclea** (France) provides structured and verified data to help transform assets/buildings into digital material banks. **Material Index** (UK) is a digital platform for the cataloguing, management and resale of building components during deconstruction. **Construction Waste Portal** (UK) combines procurement, supply chain management and data science to provide forecasts of expected construction waste tonnages and costs at the outset of projects. **Urban Machine** (US) has developed robots that reclaim wood waste for reuse as premium lumber products.

▼ 19. Plant telematics and automation

Description:

This Category divides into three subcategories. First, telematics can track position, fuel efficiency and performance. Secondly, there are sensors designed to prevent accidents and report near misses. Thirdly, there is semi- or fully-autonomous connected plant, which is connected to its environment through sensors or wireless transfer of data, and which moves around a site under its own control or the control of a remote operator. At present, plant is more 'connected' than 'autonomous' and progress appears slower than expected.

Example providers:

MachineMax (UK) provides tools to optimise heavy equipment management. **Hiboo** (France) collects, centralises and delivers equipment data to improve fleet productivity and energy efficiency. **Tenna** (US) also combines this with a fleet and asset management module. **VisionLink** (US) is a joint venture of Caterpillar and Trimble. It offers vehicle tracking, fuel and carbon emission management, exception and alert notifications and vehicle maintenance schedule notifications. **Presien** (Australia) places computer vision sensors on plant and equipment to help prevent accidents and improve near-miss reporting. **Built Robotics** (US) recently introduced an autonomous robotic pile driver to add to its fully autonomous trenching capability.

▼ 20. Workforce management apps

Description:

Workforce management tools support recruitment, onboarding, onsite management and safe working. Ideally one system manages and integrates the whole 'lifecycle' of workforce contact, with a single dataset covering all aspects of the worker experience. This is particularly important as construction resources become scarcer. There are significant links with Categories 10 (Workflow apps), 21 (Site communication) and 23 (Safety apps), and the benefits of good integration – through Category 30 (COMMON data environments) – are clear.

Example providers:

innDex (UK) began as an app for worker onboarding, and has broadened to offer site access control, RAMs, permits and other worker-based site tools. **BuildPass** (Australia) is an AI-native operating system offering a suite of integrated tools to run construction projects, including health and safety, quality assurance, asset management and site management. **Rhumbix** (US) is a time and resource management tool capturing data around labour, equipment and materials. **Assignar** (US) supports scheduling, time-tracking and reporting self-perform General Contractors and subcontractors executing work in the field.

List of construction technologies

21. Site communication

Description:

This category covers applications that support communication and collaboration between workers and/or with clients. This can involve the integration of existing means of communication, such as texts, emails and calls, or wholly new ways of communicating. There is a significant overlap with Category 22 (Smart PPE).

Example providers:

SymTerra (UK) is a communication tool built for on-site project teams, replacing WhatsApp and linking with existing systems to better report and understand what is happening. **GoTradie** (Australia) is a dedicated messaging app that helps streamline the way teams, subcontractors and clients communicate and collaborate. Unlike consumer apps such as WhatsApp, it manages traceability, data ownership, privacy and compliance. **Powerplay** (India) allows stakeholders to communicate in real-time, share files and documents seamlessly, assign and track tasks. It also provides project updates and status reports. As part of its project management suite, **Capmo** (Germany) offers centralised communication through a single tool that helps avoid misunderstandings and save time.

22. Smart PPE

Description:

Smart PPE is either wearable devices that can be worn physically by people at a construction site or smart protective equipment to improve safety. Wearables range from 360° cameras and smart helmets to Apple Vision Pro glasses. Safety-related PPE includes equipment to cushion the impact of falls or ways of helping people lift objects in a lower risk way. AI is now supporting real-time environmental monitoring, predictive risk analysis and automated emergency response mechanisms.

Example providers:

XYZ Reality (UK) has created the Atom – a custom-built construction safety headset that combines augmented reality displays and in-built computing power. **Wakecap** (KSA) provides workers with a harness that connects to a construction hardhat and a non-GPS site network. It improves both safety and efficiency by tracking worker position. **Kwant's** (US) smart badges have built-in real-time location safety features like fall detection alerting, SOS alerting, near-edge miss alerting and zone restrictions. **German Bionic** (Germany) has developed wearable exoskeletons to protect against musculoskeletal lower back pain and injury for lifting, loading and assembly tasks. **Scaled** (UK) is a nature-inspired material technology offering mobility and protection for injury prevention. **Eave** (UK) has developed ruggedised smart earmuffs for construction workers that enhance situational awareness, protect hearing and monitor health and compliance.

23. Safety apps

Description:

Safety apps is one of the largest categories of construction technology by number, replacing paper-based systems and offering new functionality, for example through AI. These systems make it easier to report safety incidents, with workers able to enter data in real time through smartphones or tablets. The data can then be managed and reported more rapidly. Computer vision is allowing systems to recognise unsafe practices and, potentially, intervene to prevent an incident occurring, thereby reducing risk. There are links with Categories 21 (Site communication) and 22 (Smart PPE).

Example providers:

1Breadcrumb and **Hammertech** (both Australia) are examples of new-style software systems that streamline safety and compliance workflows. **Invigilo** (Singapore) provides AI-enabled safety management, especially for high-risk activities such as works at height. **Onwave's** (UK) OWL platform combines wearable technology with accurate positioning to automate safety alerting and capture real time site information. **Safeguard AI** (Israel) uses machine learning to predict and prevent accidents during construction. **Saifety.ai**, developed by Navatech (UAE), utilises AI technology to provide site workers with individualised safety guidance. **Evotix** (UK) is a global EHS and sustainability solution that helps companies create safer, healthier and more sustainable workplaces.

24. Risk management and reduction

Description:

If 5D BIM is the combination of design, programme and cost, this category covers the more advanced cost and risk management tools that are being developed. Risk management has moved on from focusing on audit and compliance to proactive systems providing real-time insights. AI is also set to make a significant improvement in flagging issues and enabling earlier interventions.

Example providers:

Riskwell (UK) is a next-generation risk management tool that features risk and action registers, dashboard reporting and built-in Monte Carlo analytics. **Beawre** (Spain) has created a continuous risk control platform that monitors each business process in real-time and recalculates its severity using AI-based predictions. **Octant AI** (Australia) is an AI prediction tool that gives early warning of the risk of a change in a project's financial performance. **nPlan** (UK) uses AI Deep Learning to help predict project outcomes and mitigate risk across individual projects and portfolios. **EHAB's** (UK) weather risk management platform combines hyper-local aggregated data and machine learning to help minimise down days. **ArchAI** (UK) uses AI to detect risks and opportunities from historic land use practices using earth observation data and historic maps.

List of construction technologies

▼ 25. Insurance solutions

Description:
Construction operates within a complex arrangement of insurance, warranties and bonds. New insurance solutions challenge the existing approaches to reduce transaction costs. One example is the creation of novel ways of securing retention bonds through insurance-based products rather than using organisations' bank deposit facilities. Another is encouraging greater transparency between contractor and insurer as to the way in which the project is managed because this can lead to lower premiums.

Example providers:

Rosetta Risk Management (UK) is a SaaS platform that aggregates construction risk and performance data, helping to reduce premiums by making claims resolution faster and cheaper. **Sync Technologies** (Australia) is a visual-first solution provider aiming to streamline claims servicing and insurance contractor management processes within the building insurance sector. It simplifies the entire procedure, from site inspection and data collection to tender and repair works. **Shepherd** (US) is using AI for the analysis of certificates of insurance (COI) and endorsements. **Volente** (formerly BILD) (Australia) is using an insurance product to replace the letters of banking credit required for retention at the start of construction projects.

▼ 26. Procurement and contract management

Description:
Procurement management platforms help contractors manage their procurement processes from beginning to end. This can include lead management, supplier management, tender issuing and the consideration of responses. Contract management software helps companies write and check contracts and automate change management and claims. It can include natural language processing to 'read' contract documents and claims, and workflow engines to automate the production and signing of contracts.

Example providers:

Protenders (KSA) is a procurement platform that shortlists bidders, centralises tender documents, manages RFIs and receives and compares bids online. **ProcurePro** (Australia) helps users reduce the time they spend procuring to increase visibility, consistency and control. On the contract management front, **CEMAR** by ThinkProject is a dedicated contract management solution for NEC, FIDIC and other contract types. **Juro** (UK) is a more general contract management system, which is used in construction. It helps parties to agree contracts more quickly and automates contract administration. **Document Crunch** (US) simplifies the way construction contacts are reviewed, quickly identifying critical risk provisions and providing guidance so that teams can mitigate risks throughout the entire project lifecycle.

▼ 27. Payment apps

Description:
Certifying and assuring payments is one of the most fraught parts of the construction process. Payment apps can check and accelerate the payment cycle, helping reduce working capital and financing costs while encouraging transparency. Project bank accounts are also easier to manage, which can be an important part of encouraging collaboration between different members of the team. This can support 'Enterprise' working as part of Project 13*.

Example providers:

XpedePay (Australia) manages payment claims for the entire supply chain giving greater transparency of payment status and compliance. **Konstructly** (UK) digitises subcontractor payment applications and links them to quality assurance and progress-tracking workflows. **Webcontractor** (UK), which was recently acquired by Payapps, automates the subcontractor payment process, reducing risk and allowing people to focus on higher-value tasks. **Saible** (UK) provides digital parallel payment accounts (DiPPAs), which work like project bank accounts, to encourage transparency. **Trayd** (US) is a construction payroll platform designed for weekly, bi-weekly, and same-day pay options. **Truss** (US) is a custom banking solution for subcontractors that offers instant settlements, so they can pay and get paid for labour and materials more quickly.

*See www.project13.info for more information.

▼ 28. Plant, labour and equipment marketplaces

Description:
This new Category reflects the fact that technology can bring buyers and sellers of construction-related materials and services together in new ways. While the marketplace does not provide the service or product, it can reduce transaction costs and provide access to new sources of supply. Some of the agency and intermediary fees from traditional working suggest that the savings may be considerable. Construction-specific marketplaces are up against more general e-commerce and internet auction sites, such as Amazon and eBay.

Example providers:

Fixed Construction (UK) is tackling the inefficiencies of skilled worker recruitment – a tech solution in preference to a traditional agency-based approach. **Skrap** (UK) is a portal that allows users to order waste services, bulky materials and plant hire. **Materials Market** (UK) is a way to access building materials, such as timber, plasterboard and insulation. **Bulk Exchange** (US) focuses on finding/listing materials, accessing list prices and submitting/responding to RFPs for bulk materials. **YardLink** (UK) enables contractors and subcontractors to access the entire supply chain, minimising costs and reducing the time to order from days to minutes. **EquipmentShare** (US) not only facilitates equipment rentals and sales, but also offers its T3 'operating system' to enhance efficiency.

List of construction technologies

◤ 29. Logistics and materials tracking

Description:

Logistics tracking systems monitor where a component or assembly is located, from the factory gate to arriving on site (and even where materials are within the site). Some systems will also track components through each stage of the manufacturing process. Disposable GPS stickers are starting to replace QR codes for higher value items. Added to this, route optimisation provides savings in terms of fuel and carbon. The use of intermediate set-down areas ('hubs') and 'control towers' to take a holistic view of deliveries also improves efficiency.

Example providers:

Voyage Control (UK) helps contractors manage their loading areas and on-site resources, including tower cranes and hoists. Material deliveries can then be scheduled on the mobile app or web platform. **Propergate** (Poland) assists with the planning, registering, ordering, scheduling, unloading and reporting of material deliveries to site to support 'just-in-time' working. **Veyor** (Australia) is a delivery and material management software system that covers order management, logistics, crane scheduling, driver tracking and compliance. **Ynomia** (UK), now part of PCE, tracks and reports progress of all building packages, materials and components from design and fabrication through to install and handover.

◤ 30. Common data environments

Description:

The common data environment (CDE) is a central repository where construction project information is housed. It links datasets so that individual software tools can function effectively together. The UK Building Safety Act means it is now critical that information is structured in such a way as to allow people to understand the steps needed to keep both the building and people safe by providing a 'golden thread'. The CDE is an essential part of this regulation.

Example providers:

Gryps (US) is a fully managed data platform that aggregates construction data, creating a common data layer of construction intelligence for capital project owners. The **Zutec** (Ireland) CDE brings 3D models, structured data [IFC/COBie] and project documents together into a single platform. **Onetrace** (UK) provides subcontractors with one system to capture, monitor, review and report on all work being conducted on site in real time. **Buro Happold's** (UK) BHoM provides a common language between applications. One single link can connect multiple applications together. **AgaveAPI** (US) is a tool for connecting and syncing data between different construction software systems. **BIMLauncher** (Ireland) automates workflows across different project information management systems. **Morta** (UK) provides easy-to-customise hubs that connect information, point solutions and teams together.

◤ 31. Digital handover software

Description:

The digital handover is the moment when the main contractor releases the site to the end-user with the proof that everything has been reviewed and approved. It is an opportunity to make the most of the work done on digital by passing this information over to the building management team. However, there are contractual challenges around getting alignment between developer, project manager and contractor. Done well, this can include using the Asset Information Requirements (AIR) to support the creation of an Asset Twin for smart Facilities Management.

Example providers:

Invicara's (Ireland) Twinit solution includes templates, a process framework, data management tools, training and support for the contractor to deliver an Asset Twin at project handover. Similarly, **Glider Technology** (UK) defines, collates and validates Operation & Maintenance (O&M) information during the design and construction phases to ensure a seamless handover to the operations phase. **BuildPrompt** (UK) allows organisations to access private AI models to help automate the extraction, analysis and workflow of their data. This may be able to help automate the handover process, given that it is currently a time-consuming and manual data gathering and validation exercise.

◤ 32. Asset management software

This is not strictly speaking a category of construction technology (as it clearly relates to the operational phase of an asset) but we include it in this list for completeness.

Description:

Computerised maintenance management software (CMMS) is used to streamline and automate maintenance tasks. This may be linked to a (digital) Asset Twin or sensors that enable condition-based or preventative maintenance. Intelligent building management systems (IBMS) automatically monitoring and controlling the building's services. Increasingly optimisation, including the use of AI, enables these systems to respond to the needs of occupants in real time.

Example providers:

Upkeep (US), **Limble CMMS** (US) and **MaintainX** (US) are mobile-based CMMS solutions that provides insights to move from reactive to preventative maintenance. **BrainBox AI** (Canada) supports a '24/7 self-operating building' that requires no human intervention and maximises energy efficiency. **Metr** (Germany) improves energy efficiency through data insights, especially for housing schemes. **Hitachi Energy's** (Switzerland) Lumada suite supports asset reliability and maintenance, automates workflows, digitises inspections and even predicts when tree growth may cause power outages. **Quarterbac's** (Australia) WorkUp system enables integrated scenario planning for asset management, especially for the transport sector.

Final summary

The last twelve months have been challenging for start-ups, with the outlook for investment tightening markedly.

However, and perhaps this is a characteristic of founders, C-Tech Club members remain strongly optimistic about their medium- and long-term prospects.

Since we published the first C-Tech Club Catalogue in April 2023, it has become significantly harder for start-ups to raise investment funding. Venture capital firms are struggling with the impact of higher interest rates and, when deals are available, valuations are down markedly. Investors are looking for start-ups to become profitable much more quickly.

The trend has been for start-ups to cut costs, often through layoffs, with some high-profile businesses coming to the end of their run and ceasing operations. Yet there is no shortage of new construction-tech founders wanting to enter the market.

Artificial intelligence (AI) is on everyone's lips, yet it is not a technology type that many start-ups are progressing. Rather, generalised products from the large AI giants, such as ChatGPT, are being used in construction, just as they are in most other sectors. That said, AI is likely to be a trend that develops quickly.

Through all the challenges, according to our January 2024 survey, founders remain optimistic about the future. They point to the softer aspects of digital transformation – client understanding and ability to deploy technology – as one of the particular barriers holding them back.

Our survey said...

In January 2024 we conducted a survey of C-Tech Club members

More optimistic, less optimistic or about the same about the future prospects for your company?

👍 **86%** More optimistic

9% About the same

4% Less optimistic

What are the main challenges you are going to face in 2024?

64% Raising new investment

45% Recruitment of staff

41% Reducing customer acquisition cost and preserving cash

What are the main barriers to the adoption of your technology by your potential clients?

68% Lack of understanding of the technology

40% Budgetary constraints

36% Lack of ability to deploy the technology

About the C-Tech Club

The C-Tech Club is a global community of more than 400 founders and CEOs of construction-tech start-ups that was created in late 2019.

It is a 'by-founders-for-founders' group, run on a not-for-profit basis by Priestland Consulting. The idea is that founders are able to learn from and support other founders – sharing knowledge and best practice.

Few founders are in direct competition with each other: rather, each start-up is trying to develop a different aspect of the great challenge that is Construction 2.0.

In addition to producing this Catalogue, the C-Tech Club runs monthly speaker meetings and a vibrant set of social media channels. We organise dinners, act as advocates for start-ups with governments and other key stakeholders and help raise the profile of founders, for example in the media and at conferences.

To join the C-Tech Club contact **info@c-techclub.org**

C-Tech Club Supporter Members

The C-Tech Club is free to founders to join, but a number of members have kindly agreed to support the Club financially. We are very grateful to these Supporter Members, and we reproduce the logos of their companies below:

Ark   BKWAI   BUILDOTS⁺   buildpass   BuildPrompt

CONQA   Contilio   converge   EAVE   EVERCAM

F!XED   FONN   GBuilder   hiboo   InnDex

invicara   INVIGILO   KREODx   Konstructly   MAPMORTAR

Material Index   Morta   Navatech   nCircle   NODES & LINKS

okappy   onetrace   Paperless   Qflow   Rosetta Risk Management

SAIBLE   SymTerra   THERMULON   TRUNK   VISILEAN

VOYAGE CONTROL
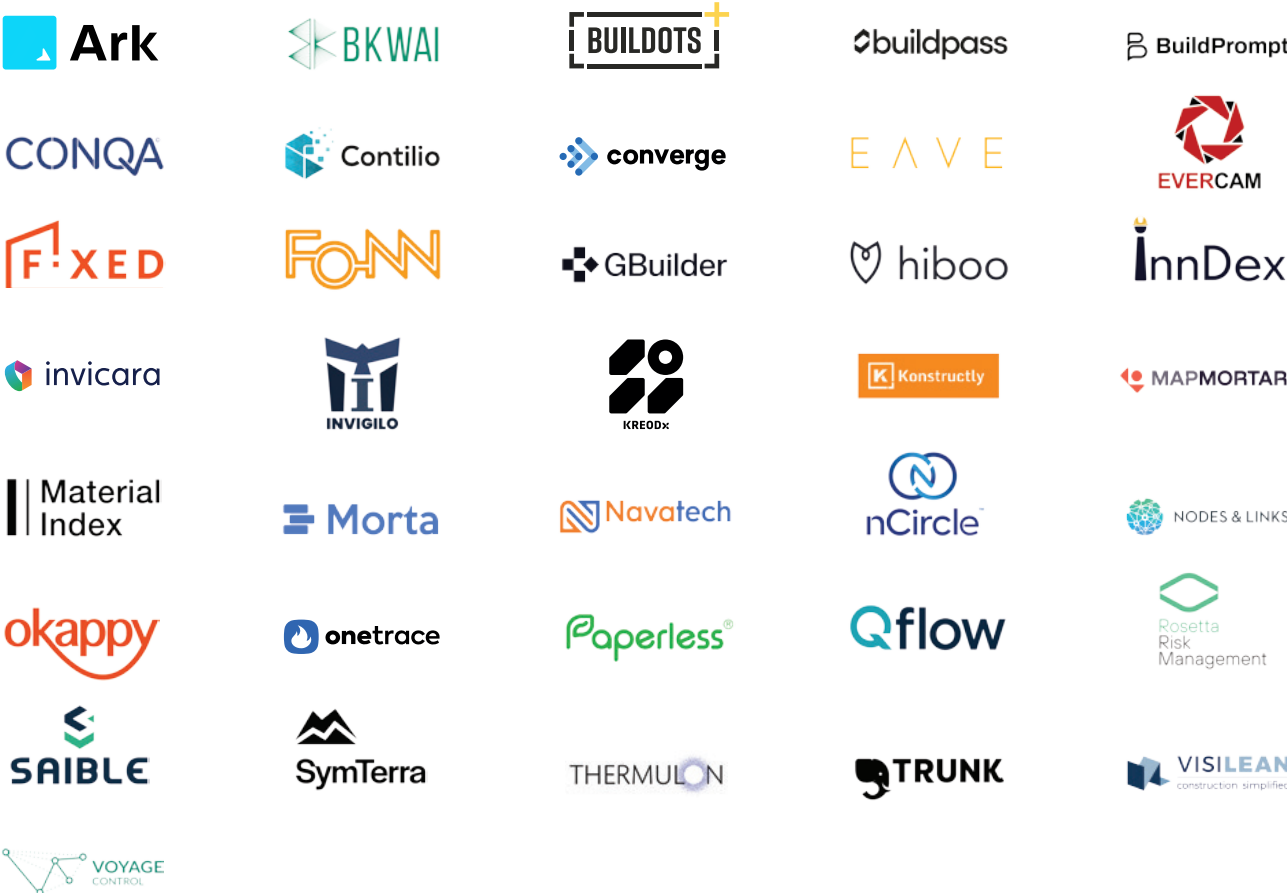
Companies mentioned in this report:

1Breadcrumb (www.1breadcrumb.com) • **Advanced Construction Robotics** (www.constructionrobotics.com) • **AgaveAPI** (www.agaveapi.com) • **AgiliCity** (www.agilicity.com) • **ALICE Technologies** (www.alicetechnologies.com) • **Amatec** (www.amatec-corp.com) • **Amutri** (www.amutri.com) • **Aphex** (www.aphex.co) • **ArchAI** (www.archai.io) • **Archdesk** (www.archdesk.co.uk) • **Archistar** (www.archistar.ai) • **Ark** (www.ark.build) • **Assignar** (www.assignar.com) • **Beawre** (www.beawre.com) • **BHoM** (www.burohappold.com) • **BIM Audit** (www.bimaudit.co.uk) • **BIM Launcher** (www.bimlauncher.com) • **Bimify** (www.bimify.com) • **BKwai** (www.bkwai.com) • **Brainbox AI** (www.brainbox.ai) • **BuildAI** (www.buildai.com.au) • **Building Estimate & Design Co** (www.bedc.ai) • **Buildots** (www.buildots.com) • **Buildpass** (www.buildpass.com.au) • **BuildPrompt** (www.buildprompt.ai) • **Built Robotics** (www.builtrobotics.com) • **Bulk Exchange** (www.bulkexchange.com) • 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