



**REINVENTING CONSTRUCTION PROCESS CONTROL:  
WHY DIGITAL INNOVATION IN PROCESS MEASUREMENT AND CONTROL  
HOLDS THE KEY TO THE FUTURE OF CONSTRUCTION**

WHITE PAPER

# EXECUTIVE SUMMARY

It is time for construction to take control of its core processes if it is to address historic inefficiencies and finally close its productivity gap. It has begun to transform with the aid of digital technology and BIM adoption – but there is more to do, and the coming challenging economic period will demand acceleration.

Construction is a dynamic business in which managers at any level can struggle to get accurate and timely information to make sure and swift decisions. Leaders must therefore drive their businesses blind, while project leaders lack the data to assure success. Updating project controls with real-time information could generate value all across the supply chain.

Building on BIM by adding layers of as-built data to reflect the actual state of the construction process at any point in time could unlock visibility, but it depends on automating the connection between reality and the BIM-built digital twin. Solutions to enable this are emerging rapidly from construction technology innovators.

Using human resources on site to gather the data is not feasible. Enhanced control requires capturing more data, more accurately and cost-effectively than people can manage. Turning to technology releases scarce and skilled people to work efficiently, apply their skills, and use their judgement to add value, instead of input data.

Creating a virtual production control room that can transform critical decision-making at every level offers a model for transformation. New solutions offer the chance to build control frameworks that span construction businesses and projects, to unlock a raft of benefits to address legacy and future challenges.

The pandemic and approaching economic downturn have only highlighted the urgency of continuing change. They come at a time when a new world of opportunity is opening for construction businesses to gain greater control and resolve persistent productivity challenges.

**THE SECTOR IS AT A TIPPING POINT, AND IT IS TIME FOR ALL PLAYERS TO INVEST IN THE DIGITAL CHANGES THAT CAN DELIVER A BETTER FUTURE.**

**THOSE WHO DO NOT ADAPT WILL NOT LEAD, AND MAY NOT EVEN SURVIVE.**

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# I. INTRODUCTION:

## TIME FOR CONSTRUCTION TO TAKE CONTROL

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The construction productivity gap is well known and has been the topic of many industry discussions. So far there have been very few practical approaches outlined to close this gap.

Some may argue that construction faces unique challenges. Others see parallels in manufacturing which has driven great increases in productivity through automation, digital process controls and other factors. Certain ideas, such as lean manufacturing, have been adapted for construction, though with limited success.

Construction modernisation will be different. Manufacturing processes occur in fixed plant locations via repetitive tasks that rely heavily on inorganic machinery. Construction is dynamic, with work often distributed across locations that change with each project. It has a high dependency on human workers and each project brings its own unique issues. These factors make existing process control methods and platforms developed for manufacturing mostly irrelevant, although there are lessons that can be learned.

Digital transformation is critical if the industry is to drive the improvements it needs. It has adopted relatively little technology in comparison with other sectors. The 2020 pandemic lockdown has had some positive impact in accelerating adoption of cloud, mobile and collaborative office technology, but the impact of digital change on core construction processes has been minimal.

Today's construction business leaders often lack the visibility and insight they need to make informed decisions either about construction operations or the business overall. Decisions that aim to drive good results should rely on accurate, up-to-date and objective data, whether made by humans or machines. Today, decisions are more often made based on data collected and collated by people, not digital records. Without these, businesses not only place their trust in fallible human memory, but also accept their limited ability to efficiently communicate critical information to the hundreds of people involved in the construction process.

The industry's ongoing race towards BIM adoption is a first and very positive step in the right direction. It finally creates an agreed and widely accessible end-product design and specifications approach, that can integrate information from every contributor on the path of turning the concept of a structure into reality. It is hard to imagine anyone manufacturing a car without co-ordinated plans, nor relying on the team to agree at every stage of the process how to fit the different engine and body parts together. Efficient process controls would be impossible. The construction industry can now realise the potential of BIM to achieve such process control.

The term digital twin has become common, although with some varying interpretations. BIM's role in creating digital twins is accepted widely, with agreement that it should at least be the basis for developing the digital twin through the build stage, documenting, and handling the different variations. Until now, however, no existing solution has existed to assure the creation of a continuous update loop between the two.

The dynamics of construction projects have seemed a barrier, but now technology providers are emerging to help overcome this challenge. Construction technology innovators are bringing digital technologies and data together in new ways. They are applying them to construction's real-world challenges to automate, streamline and transform costly and time-consuming processes, unlock real-time insights that were always impossible, reveal information that was invisible, and inform and accelerate decisions.

As the sector looks ahead to what may be a challenging economic period in which growth may be tough, it is even more vital that it starts to address its most stubborn efficiency and productivity challenges as a matter of urgency. Construction businesses face too many unforeseen risks and project failures. Margins that are already wafer-

thin will be under further pressure in any downturn. Grasping all opportunities to streamline, automate and boost efficiency of core processes is vital for a sector that faces a very real problem of an ageing workforce and an uphill struggle to attract young talent.

There remains a vast amount of work still to do – but the promise is huge. McKinsey Global institute calculated that sector digital transformation could deliver 14-15% productivity gains, 4-6% cost reductions, and boost value added by \$1.6tn<sup>1</sup> globally. Only parts can be delivered by embracing new delivery models, such as offsite manufacturing and prefabrication, supply chain integration or adoption of new materials.

**DIGITAL TRANSFORMATION OFFERS CONSTRUCTION THE ABILITY TO TAKE CONTROL OF ITS CONSTRUCTION PROCESS, AND THUS ITS FUTURE. IF CONSTRUCTION BUSINESSES ARE TO SURVIVE, THRIVE AND PLAY THEIR ROLE IN DRIVING RECOVERY, THEY CANNOT DELAY ANY MORE.**

**FOR A DIGITAL TRANSFORMATION TO BE SUCCESSFUL, EXECUTIVES AND MANAGERS MUST START WITH A CLEAR DEFINITION OF HOW DIGITAL WILL CREATE VALUE FOR THE BUSINESS. DURING THE TRANSFORMATION, THEY MUST SPEND AS MUCH TIME, IF NOT MORE, ON OPERATIONAL CHANGE AS THEY SPEND ON TECHNOLOGY.**

- MCKINSEY <sup>2</sup>

## 2. GAINING CERTAINTY & AGILITY: CONSTRUCTION PROCESS CONTROL

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All contractors face one enduring challenge: that execution never goes quite according to plan. It is inevitable that all projects will generate unforeseen challenges. Causes range from ground conditions, to resource shortages, to delays in supply and beyond. The pressure to deliver on time creates conditions in which project teams strive to re-think, re-plan and reschedule work constantly to minimise delays. As they react and are forced to make fast decisions, they benchmark their progress and goals against the original programme. Projects drift away from originally planned sequences of work, much time is absorbed in finding fixes and conceiving solutions and, despite their best efforts, completion deadlines are often still missed.

Leaders are recognising that they need to become more agile to adapt to the challenge of driving certainty against a backdrop of resource and efficiency issues. They can no longer drive their businesses blind, relying on out of date, incomplete and subjective data. Better data is becoming key for faster and better decision-making, making it essential to update current project controls with real-time data.

More detailed and frequent tracking with accurate measurement offers control and visibility benefits at every level, by supporting faster, more efficient, and more precise and targeted decisions by project owners and delivering a clearer picture to operational leaders. It could help programmes remain closer to their intended path thanks to earlier warning of impending issues and closer measurement of problems.

Traditional management and control of projects must evolve. Taking a more proactive, collaborative, and structured approach to construction process control is essential if businesses are to assure both the success of projects and their positive contribution to the bottom line. It is an essential area of investment for any construction business that intends to thrive.

Enhanced construction process control spans monitoring and measurement of on-site activities to deliver and integrate real-time information that can then enable:

- swifter and informed decisions in response to real-time updates to process status
- clearer understanding of the flow of work, resources, equipment, and materials
- earlier indicators of emerging risks and threats to the project programme timeline
- more accurate measurements of current progress creating a firm basis for projections
- tighter estimation of resourcing requirements for activities, also enabling efficient sub-contracting
- more frequent and focused programme adjustments to hit stage and final completion deadlines
- greater opportunities to monitor, aggregate and quantify operational risk at a business level
- building a better knowledge base to inform future estimating, bidding, and planning

Improved construction process control benefits everyone involved, enabling construction managers' ability to deliver on time, on budget, every time while giving operational leaders the information and understanding with which to make smarter business and workforce decisions.

A more consistent approach to process control can benefit the entire business, significantly enhancing transparency and enabling a flow of information to inform project and business decisions alike. However, it reinforces that decisions about digital change may increasingly need to be made more centrally and at a strategic level in organisations which, until now, have often left project teams and functional teams to make their own IT and software choices.

**MODERN DIGITAL SOLUTIONS CAN NOW HELP MONITOR THE PROCESS OF CONSTRUCTION IN WAYS THAT WERE SIMPLY NOT FEASIBLE IN THE PAST. DIGITAL TECHNOLOGIES TO IMPROVE THE VISIBILITY, MEASUREMENT, AND CONTROL OF EVERY PROCESS ARE NOW EASILY ACCESSIBLE. THEY WILL BE KEY TO THE NEXT PHASE OF CONSTRUCTION DIGITAL TRANSFORMATION.**

# 3. STARTING A NEW CHAPTER: BUILDING ON BIM

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BIM marked the sector's first step towards the digital future. Incentivised by governments, supported by EU and national BIM groups and industry organisations, and enthusiastically adopted by designers and architects, it drove a shift in thinking and kickstarted construction's digital evolution.

It was the first singular and co-ordinated representation of the design of a built asset, with the aim of enabling and informing the end-to-end production process. This altered the sector's relationship with data, while the idea of collaborative working and a smooth exchange and flow of information allowed everyone in the process a role and potential value.

Releasing this value has been limited by slow and varied adoption, despite offering some direct benefits for contractors and their clients. Better and more detailed design at the start offers the potential for more effective planning, streamlined execution and less on-the-fly decision-making. Contractors have adopted BIM to very different degrees, with many unsure of whether it will deliver sufficient direct value and immediate ROI, and their clients unwilling to bear additional costs. Some have simply struggled to see BIM's relevance after the design stage. Others made investments in software and digital skills, established BIM teams and started using 4D planning, with a few exploring 5D and beyond. Adoption has still reached only 40% of UK contractors<sup>3</sup> and 29% of European construction businesses<sup>4</sup>. However, it is now part of the landscape, even starting to creep into the building planning permit process in some European countries<sup>5</sup>.

Taking the BIM model into the construction process is the way forward, adding layers of as-built data to reflect the actual state of the process at any point in time. This presents a compelling proposition for contractors and clients alike.

Applications that enable the input of reality data into BIM models already exist in some companies. They rely on humans to manually input progress and other types of data for the tens of thousands of objects. Such manual processes are time-consuming, prone to error, and usually retrospective. This offers little benefit to aid real-time decision-making and thus aid project delivery for project leaders who have neither easy access to the data nor a way to identify actionable insights.

Technologies automating the connection between the BIM-driven digital twin and reality already exist to some extent, with data capture processes based on various devices such as wearable sensors, cameras, laser scanners, IoT devices and others. The importance of these disruptive technologies is recognised by their priority inclusion in programmes such as the EU Horizon-funded SPHERE<sup>6</sup> and the UK's CDBB National Digital Twin Programme<sup>7</sup>.

**“THE TASK OF MEASURING BIM  
BENEFITS IS COMPLEX: IT IS  
HARD TO ELIMINATE ALTERNATIVE  
EXPLANATIONS FOR THE  
RELATIONSHIP BETWEEN A BIM  
CAPABILITY AND AN END BENEFIT”**

**- CENTRE FOR DIGITAL BUILT BRITAIN <sup>4</sup>**

The last missing piece of the puzzle is the ability to drive decisions based on the digital twin, requiring tools taking those enormous amounts of data and outputting actionable insights to inform the day-to-day decisions and aid coordination of activities. Machine learning can help spot anomalies in a process, providing early indicators for issues and suggesting possible mitigations while leveraging data and lessons-learned from thousands of projects. Predictive analytics can enable construction leaders to look ahead, visualise the future asset at any point, see the real impact of alternative decisions, and evaluate solutions to issues or threats to completion.

Solutions are emerging from Construction tech innovation hubs all around the world – such as Israel’s Tel Aviv based Construction Innovation Zone and start-up incubator<sup>8</sup> and the UK’s Construction Innovation Hub<sup>9</sup>. McKinsey sees the emergence of new business models and archetypes who will play a key role in helping unlock the goal of \$1.6 trillion of productivity gains. It sees first movers in areas such as platform integrators, vertically integrated manufacturers, lean executors, and new material suppliers<sup>10</sup>.

**BUILDOTS IS A PERFECT EXAMPLE. IT LEVERAGES AI TO HELP CAPTURE, TRACK AND MEASURE ON-SITE ACTIVITIES USING ADVANCED COMPUTER VISION ALGORITHMS TO DELIVER PROGRESS INFORMATION FOR DECISION SUPPORT. VIDEO DATA IS CAPTURED AUTOMATICALLY AS A SITE OR PROJECT MANAGER WALKS AROUND, CONSTANTLY UPDATING THE PROGRAMME.**

**“BIM AND GOOD INFORMATION MANAGEMENT ARE THE FOUNDATIONS FOR THE INTRODUCTION OF NEW DIGITAL TOOLS AND WAYS OF WORKING. THESE TECHNOLOGIES GO HAND-IN-HAND WITH BIM TO IMPROVE THE VISUALIZATION OF DESIGNS FOR CLIENTS, THE SHARING OF TECHNICAL DATA WITH OTHER PROJECT TEAM MEMBERS, AND THE CONNECTION OF DIFFERENT TYPES OF DATA ACROSS THE PROJECT AND WITHIN AN ASSET.”**

- NBS NATIONAL BIM REPORT 2020 (UK)<sup>3</sup>

## 4. BEYOND HUMAN LIMITS: GAINING PERSPECTIVE

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Building a complete and constantly updated perspective to make the right decisions at the right time requires the collection of vastly increased amounts of data. It must be dependably accurate, must be gathered more consistently, no matter what. Even though the process of construction is increasingly complex, most construction businesses try to build project visibility and understanding by demanding more from their people. They have invested in mobile progress management software, equipped site managers with mobile devices, and shared accountability for gathering data with teams and sub-contractors – but it is not enough.

Using human resources to gather data can only ever form part of the picture. Every team is facing resource challenges, and experienced construction managers are stretched thinly across multiple projects. The amount, speed and quality of accessible data is inevitably and inescapably limited by the resources on hand, time available, and our physical condition.

With technology to aid the collection of data coupled with digital process control, it is possible to achieve a quality and degree of insight that is cost-prohibitive or physically impossible for people.

A technology-led approach to capturing, collating, and analysing control and measurement information offers many advantages over using humans to do the same tasks:

- Complete data collection based on set criteria, with no conscious or unconscious selectivity
- Objective analysis based on parameters, with AI making no judgement
- Accurate capture free from human errors of observation or manual data entry
- Frequency of data capture unlimited by physical limitation or fatigue
- Connect raw data streams directly into programme schedules, BIM design models
- Connect analysis and reporting directly into corporate dashboards or automated distribution

**“AI CAN DRIVE PRODUCTIVITY IMPROVEMENTS AS THE SYSTEMS AUGMENT HUMAN SKILLSETS AND REDUCE THE NEED FOR TEDIOUS HUMAN EFFORT.”**

– EY “



With automated data gathering, building intelligence about what is happening on a site no longer relies on the visit of an overstretched planner or regional construction manager. It does not rely on the memory of a busy manager to check on a zone or team and eliminates any need to wait for a weekly team meeting or sub-contractor report. Risks created by data collection efforts can be greatly reduced, since capturing devices can be located at heights and in positions that would be dangerous or impossible to reach or integrated into equipment that can deliver its own updates. Technology does not get tired or accidentally mistype a figure into a spreadsheet.

Achieving this level of visibility without digital reach would not only be impossible but miss another major benefit. With technology to take on many of the mundane, low-value, repetitive data-gathering and communications tasks that today are done by construction, project, and site managers, they are freed up to spend their time more productively. They can apply their skills and professional judgement, listen, talk to people, add advice based on experience and knowledge, and identify opportunities for value engineering that help teams to delight and deliver for their project clients.

**“MACHINES NO LONGER SIMPLY ANSWER THE QUESTIONS POSED BY PEOPLE; THEY GUIDE PEOPLE TO ASK BETTER QUESTIONS IN THE FIRST PLACE, AND OFFER FASTER AND MORE INSIGHTFUL ANSWERS.”**

**- WORLD ECONOMIC FORUM<sup>12</sup>**

**IT ISN'T ENOUGH, AND IT IS NO LONGER NECESSARY, TO DEPEND ON HUMAN TEAM MEMBERS TO GATHER INFORMATION WITH WHICH TO WEAVE AN OVERVIEW OF A PROJECT IN ORDER TO MAKE DECISIONS OR SPOT PROBLEMS. IF CONSTRUCTION IS TO MAKE A SIGNIFICANT IMPACT ON THE INTELLIGENCE IT GATHERS AND SEEK THE IMPROVEMENTS IT WANTS, IT MUST LOOK TO DIGITAL INNOVATION FOR THE ANSWERS.**

# 5. TOWARDS OUR DESTINATION: PRODUCTION CONTROL ROOM

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Construction management was designed to deal with uncertainty. Weekly trade meetings, countless phone calls, emails and other workflows are all targeted at communicating progress and issues. Critical decisions are made without the relevant data, leading to bad performance and low overall sector productivity. The existence of up-to-date and accurate digital records change all that, shifting the managers focus from collecting data to making data-driven decisions.

The digital twin that is evolving from BIM with layers added automatically throughout the project using advanced technologies such as computer vision, now becomes a key source of information for the project. It holds the data needed to make the right decisions at the right time. Additional data from sources such as finance, human resources, logistics and others can also be integrated, reflecting an increasingly full picture.

A virtual control room can now be created, providing full control of every aspect of a construction project. Similar to a manufacturing plant's control room, it would support meetings, decision-making, reports and planning processes. Data would be presented in an intuitive way, for perfectly supporting any workflow on the construction project that can leverage this newly available data.

This can support and serve the varying needs of different leaders. It can help construction managers to maintain oversight, balance resources and adapt each day to new circumstances to keep a large number of projects on track. It can deliver a new order of insight to operational leaders, to understand the impact of everything on the business's risks, choices, and bottom line.

This concept can be further expanded to a central control centre. This could aggregate data from dozens of projects managed by a single contractor and summarise financial data, risks, progress, and issues to support business level decisions and processes. Such a centre could also help support smaller projects which might not have all the necessary functions available on site on a daily basis.



It offers a chance to build the control frameworks that can help address both legacy and future challenges. Creating a new control model to span projects and divisions and inform managers and executives across a construction business is compelling. However, it is wholly dependent on capturing, collating and consolidating control data about progress and other key processes in a consistent and centralised framework, to enable comparison, analysis, and data-driven decision-making.

A production control room powered by real-time data can enable numerous benefits:

- Automatically, effortlessly, and remotely collect large quantities of data from sites
- Analyse site and project data at speed and on a continuous basis
- Automated monitoring, analysis, and alerts for predicted risks such as time or cost overruns
- Automatically scan for risk patterns emerging, such as around health and safety
- Constantly integrate incremental progress changes into an As Built model
- Track progress of sub-programmes or trades, to aid resource planning or supply management
- Predictive analysis of time to key stage completion or milestone achievements
- Generate current status and client reporting rapidly and as frequently as required
- Capture complete and auditable As Built records to support future legal discovery
- Build a bank of historic project data to inform future bidding and drive continuous improvement

**CREATING THE CONTROL ROOM AND CENTRE, BY LEVERAGING ADVANCED TECHNOLOGY TO DOCUMENT EVERY PART OF THE CONSTRUCTION PROCESS IN DIGITAL RECORDS, IS A REAL GAME-CHANGER.**

**“ON-SITE PRODUCTIVITY CAN BE INCREASED BY AS MUCH AS 50 PERCENT BY IMPLEMENTING A CLOUD-BASED CONTROL TOWER THAT RAPIDLY ASSEMBLES ACCURATE DATA IN NEAR REAL TIME THAT IS BOTH BACKWARD LOOKING AND PREDICTIVE”**

**- MCKINSEY GLOBAL INSTITUTE<sup>13</sup>**

## 6. TAKING ACTION: THE NEXT STEP

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Construction is at a tipping point, and the pandemic may give additional impetus to the need for action. The sector is already making efforts to reshape and create more efficient business and supply models that will leverage the maximum value of off-site and pre-fabrication. It is embracing aspects of automation and robotics to assist limited resources on site, something that is very much front of mind with Covid-19 concerns. Yet these alone cannot tackle all the productivity issues that persist on site and within organisations.

For the first time it is possible to gain greater control and resolve many persistent productivity issues. Businesses today not only have options available to gain the visibility they have wanted, but to transform it into actionable insight and business value that can support decision-makers across the organisation, deliver insight and answers on demand, maximise use of resources, and enable enhanced operational control.

Together, BIM and AI hold the key to reinventing project process controls. BIM was a vital and valuable foundation which developed a common language for construction data. Contractors who invested to use BIM and build digital capabilities are on the brink of the breakthrough that will finally deliver the As Built promise. It can at last enable the generation of digital twins, if they take the next step to embrace real-time data supported by advanced analytics and AI. Contractors will gain the proof and protection to defend against any litigation arising, and the ability to pass on greater value to clients in the form of FM-ready digital assets.

Digital innovators are bringing technologies together to address the industry's biggest concerns. No single technology solution holds the complete answer, but a combined approach can deliver insight and enable greater control of every site, system, and operation. Emerging construction technology leaders are already collaborating and working towards agreed standards for how data is formatted and exchanged.

**THE FUTURE OF CONSTRUCTION WILL BELONG TO THOSE WHO INVEST IN DIGITAL TECHNOLOGY, INTEGRATE IT INTO EVERYTHING THEY DO, AND COMMIT TO FUNDAMENTAL CHANGE TO RESHAPE THEMSELVES FOR A DIFFERENT AND DISRUPTED MARKETPLACE. THOSE WHO DO NOT ADAPT WILL NOT LEAD – AND MAY NOT EVEN SURVIVE.**

**DON'T LET YOUR BUSINESS BE LEFT BEHIND.**

**“WITH THE ROLE OF  
CONSTRUCTION TECHNOLOGY  
GROWING SO RAPIDLY, AND  
NEW USE CASES EMERGING  
CONSTANTLY, E&C COMPANIES  
THAT DO NOT INVEST IN THE RIGHT  
TOOLS RISK BEING LEFT BEHIND.”**

**–MCKINSEY<sup>14</sup>**

It is time to hit the accelerator on digital change. Not only could this help offset some of the impacts of Covid-19, it will help the industry build businesses fit for a digital future and attract the best of the next generation of construction leaders.

Identifying the technology partners that can help you evolve and build greater control over your projects and business operations is a key step. Deploying the right solutions on a strategic basis across sites will inform and empower construction and operational leaders, and enable them to collaborate around deep, rich, connected and contextualised information to drive out risk, deliver for clients, and make better decisions.

# ABOUT BUILDOTS

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Buildots is a technology provider with a platform that helps collect, analyse, and consume progress data on construction projects, using state-of-the-art computer vision technology.

The platform leverages the capacity of a simple 360° hard hat mounted camera to seamlessly capture data, then uses proprietary AI software to compare reality against the plans and delivers the data to the site team using an easy-to-use web application.

The company was founded in 2018 with a vision to turn construction sites into digitally managed environments, similar to manufacturing plants. During this short time, it has managed to develop a full-fledged platform, and deploy the product with a number of the top 10 construction companies in Europe.

Buildots has made an immediate and positive impact on the day-to-day of the construction sites it serves. With an objective and single source of truth, the collaboration between the different teams greatly increased. Everyone shares the same understanding of the project status, and the gap from the agreed plan and specifications. Efforts are focused on improving the future, rather on debating about the past and present.

In addition to soft returns, findings also show high return on investment:

- 1. Managers' time saved:** savings on data collection, reporting and visual capturing by site managers, quantity surveyors and planners estimated at over 1,000 hours yearly for a 10,000 sqm project. Additionally, managers reported more efficient day-to-day as they had a "small digital assistant" which captured and analysed issues for them.
- 2. Predicting delays:** tasks planned for periods of a few weeks are common in construction projects, and with the help of the Buildots platform, it was possible to track those closely on a daily basis eliminating the risk for unmanaged and hidden delays.
- 3. Early detection of error:** in residential projects, an average of 5 defects per apartment was identified. Immediate detection and mitigation of the errors have saved amounts ranging from a few hundred US\$ to tens of thousands per error compared to similar events where the error was identified weeks later or at the handover process.
- 4. Audit trail:** disputes, throughout the construction process and post-delivery are quite common, and the existence of an objective audit trail that is backed by visual data is priceless in terms of saving time and money. For some projects, the system had saved hundreds of thousands of US\$ by shedding light on false claims.

These findings, together with additional effects on processes such as re-planning, as-built production, commercial and others, present the tip of the iceberg in terms of how process data can disrupt and greatly improve the construction process as we know it.



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