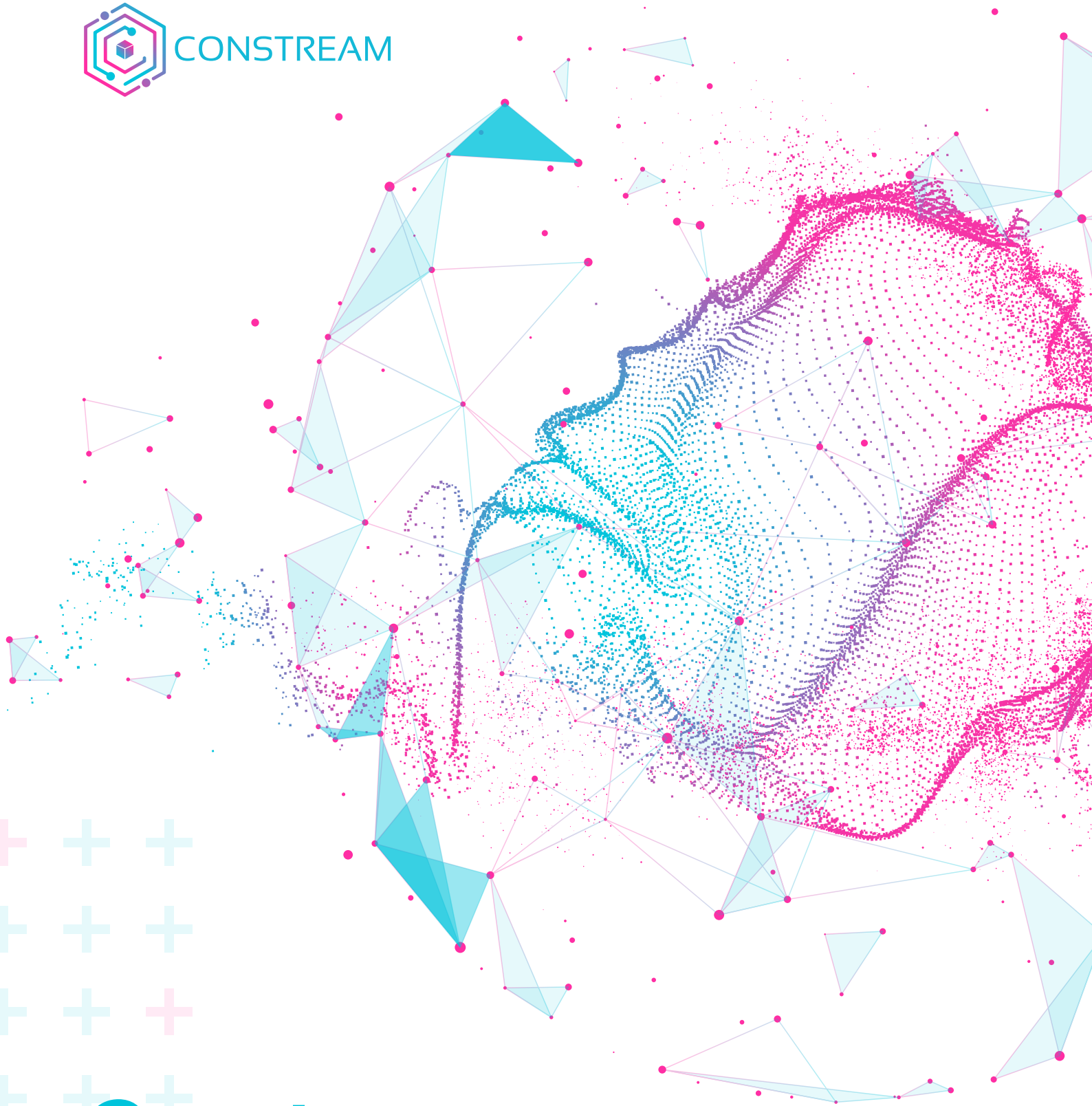
CONSTREAM



Constream

different worlds in sync

Advanced construction enterprise platform

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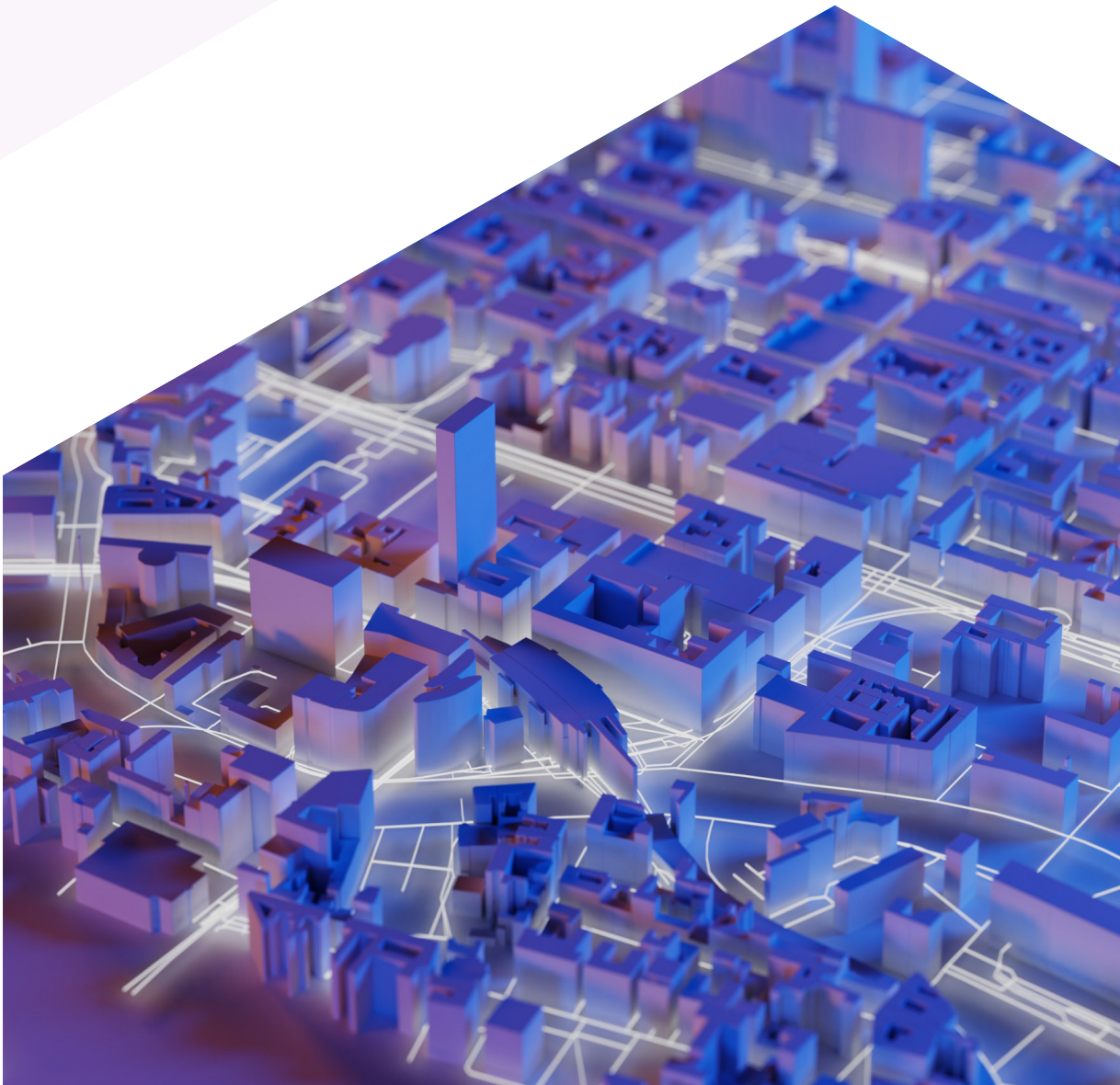
Constream is an advanced construction enterprise platform, built on transparent, immutable, and auditable data ensured by Hyperledger technology.

Construction projects often feel like different worlds governed by different rules, flows, regulations, and procedures – but with a single, common goal. The goal is clear but getting there proves much more difficult than it should be. That's why we decided to sync and empower them to move forward at the same pace right from the start.

Constream is a suite of connected modules, where each one is focused on recreating a specific construction management process and serving solutions to day-to-day problems. Our ecosystem is designed with blockchain technology at its core in order to exploit the full potential of decentralization and fragmentation of the construction industry. Why revolutionize something that only needs to evolve?

Our Ledger concept supports your business growth by enabling trust, transparency, and accountability across each project transaction. Own your data and have absolute faith in the integrity and immutability of data that belongs to other project participants, too.

State of the art architecture ensures big data, Internet of Things, and supply chains of the future become manageable pieces of the Industry 4.0 jigsaw you now have the solution for.



1. Introduction

Every construction project involves at least several entities – and that's if you're lucky. We're talking about architects, designers, builders, supervisors; it's a small army of specialists, each focused on delivering their side of the bargain to the highest standard. Sensible and orderly project management is essential to keep everything ticking in the right direction.

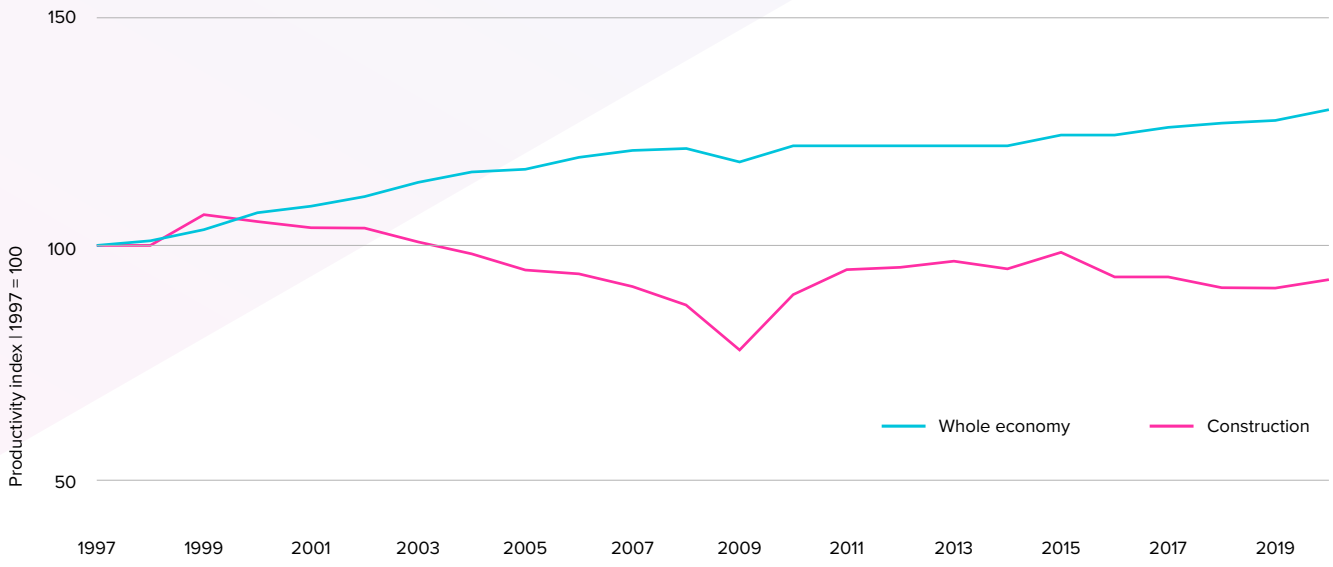
It wouldn't really be a problem if the only issue was keeping project participants in line and focused on the task at hand. That seems relatively easy – after all, it's a group of high-level professionals.

The real issue lies in the fact they're all separate entities. They do things according to their internal policies, procedures, and ways of addressing project issues. It's all backed up by experience, Excel spreadsheets, and a certain dose of well-that's-how-we-do-things-round-here mentality.

We've all been there. You're thinking to yourself that there's got to be a better way of performing a particular task. Surely, there must be a more efficient way of dealing with problems that could have been avoided but for lack of transparency...right?

And indeed you are right. Some of the largest consultancies in the world – Deloitte, KPMG, and McKinsey – all asked their research departments to look at these issues. They arrived at really staggering conclusions which are largely in line with what you intuitively thought must be correct. Let's get some numbers on board.

According to studies conducted by the Construction Industry Institute, inefficient management – incomplete valuations, missed deadlines, exceeded budgets, claims between contractual parties – all add up to nearly 70% in lost margins for General Contractors.



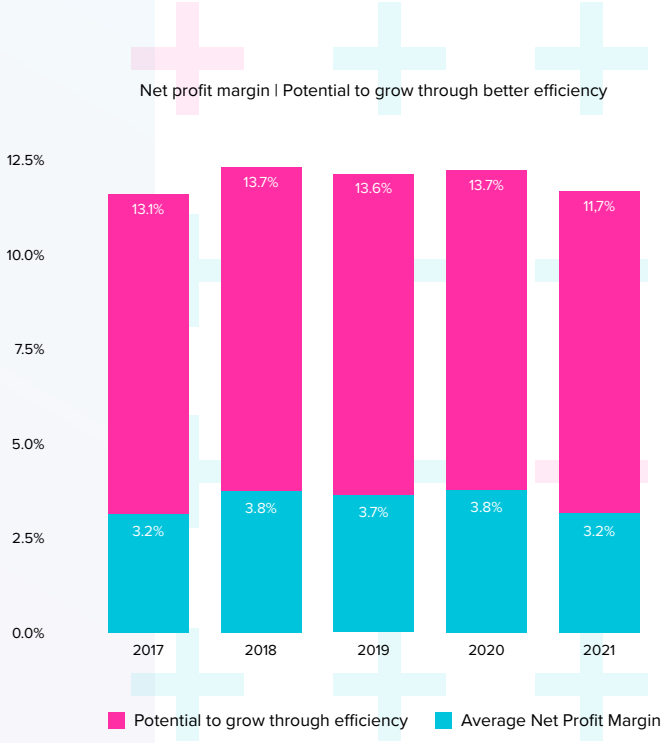
Comparing output per hour worked, construction industry and the whole economy, UK, 1997 to 2020, index 1997 = 100
Source: Productivity in the construction industry, UK: 2021, Office for National Statistics - United Kingdom Agency

According to KPMG, construction business is unpredictable and thus hinders company growth because 8 in 10 projects have to deal with missed deadlines and schedules – both time and money-wise – by more than 10%. Finally, McKinsey found that falling productivity is the main blocker when it comes to margins – between 1997 and 2020 manufacturing noted a 28,8% rise in productivity compared to a 17,3% DECLINE in the construction industry. This negative trend has been going on for decades effectively stifling the industry's profitability growth.

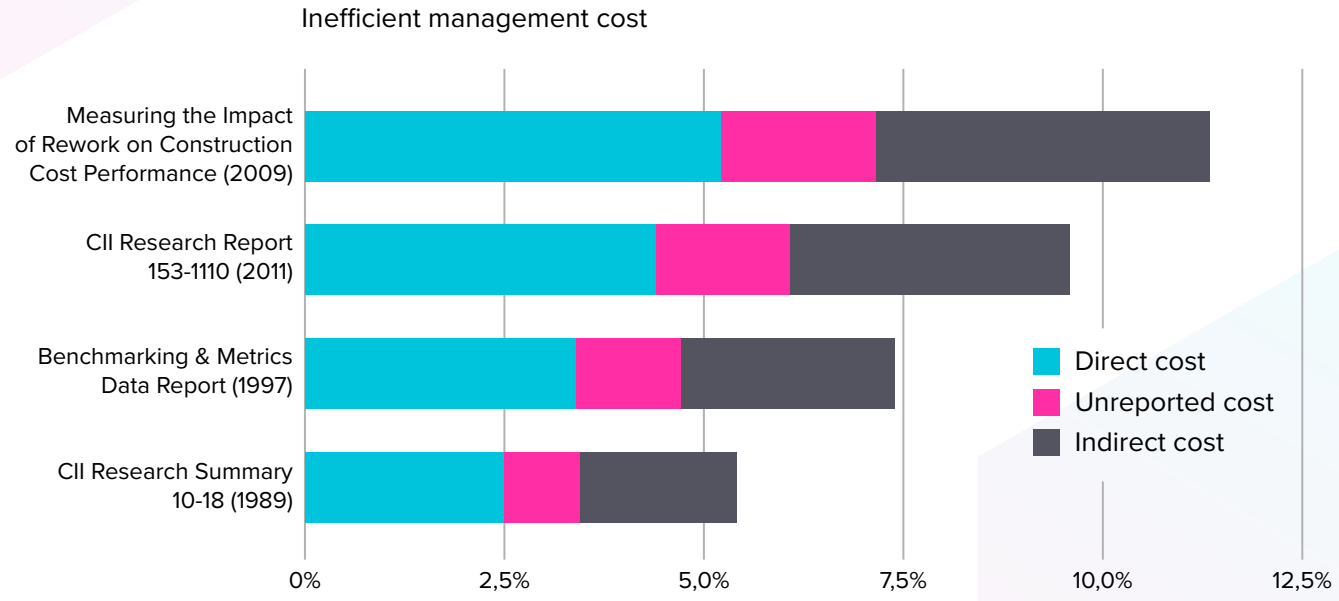
That's the macro picture and it's looking fairly bleak. It's not made any better when there's more subcontractors added to the mix as the project grows. Some of them may be coming from abroad and have different legal regimes when it comes to, say, auditing. When you start adding more people on the backend to deal with the increasing project complexity, in reality you're only further contributing to the problem you're trying to solve. 'Too many cooks spoil the broth' holds as true as it ever did because it's the environment that's broken and not the people who are there to solve it. Employee turnover starts creeping up, and increasingly desperate ideas are bandied about. Long story short...well, you know this all too well.

Troves of data generated each day; information flowing in from right, left, and center; different policies regarding pretty much all areas of business activity. How to ensure data integrity and security – in real time and between participants using their own policies and procedures? How can you analyze the project retrospectively and trust that the information has not been changed since it was logged into the system?

Constream is all about switching gears rationally. Improving project management is a marathon, not a sprint – but you've got to start somewhere. We respect individuality and recognize that restoring trust and rebuilding confidence will take time. This is why Constream functionalities focus on incremental changes and are founded on existing solutions. We see ourselves as streamlining your processes, not reinventing them. Syncing different worlds means understanding where they can fit with one another in order to create a single ecosystem – the most crucial condition for implementing a complicated construction project. We came up with four pillars, underpinning our modules and the Constream platform more generally.



Compounding the average net profit margins earned by construction contractors from 2016 to 2021 with the potentially positive impact of eliminating the cost of inefficient management.
Source: Global Powers of Construction 2016-2021, Deloitte



Summary of research findings on the impact of inefficient management on project performance as a composite of project teams' reported three primary consequences: direct costs, indirect costs, incurred and unreported costs.
Source: Variable reports, Construction Industry Institute

Platform overview

Constream is a value-driven platform, designed with flexibility and interoperability at its forefront. These ensure every new and future functionality is built with the end-user in mind – we want to develop solutions that are there for you, rather than for the sake of looking nice. Integrate Constream into your existing environment and start getting things done straight away.

Constream Pillars

A tenant database

We said it before and we'll say it again: we want to evolve the way things are done. That holds true for the most basic, underlying feature of Constream, where each project participant is a separate entity represented by a separate database. Data can be stored and accessed anywhere, regardless of physical location. This is what really matters to you and drives your decision-making process – having a safe and easily accessible storage place is essential. Such a database can be downloaded at any time, thus providing its owner with an up-to-date copy of information.

Every company on Constream is a 'Workspace'. Think of it as a unique, individual space that may be governed by your own regulations and with its own workflow. Swiftly connect to other Workspaces and execute on a project in an incredibly intuitive way.

The Constream Ledger – A Blockchain-Based Source of Truth

A bus and a central register of changes and events that let you keep track of all the goings-on inside a project. By its very nature, blockchain is an immutable and irreversible tool that guarantees reliable information and provides a retrospective look into every moment of every project. Finally, audits are no longer the nightmare they used to be and ensure your decisions are fully informed. Whenever a new item is logged onto the bus it generates an event and notifies each project participant, who can then download the latest, most up-to-date information to their Workspace.

Performance Visualization

Every member of every team to have ever engaged in a construction project will tell you that seeing how the project is moving forward and understanding its progress is one of the most important things. You see what's been accomplished thus far, where are the blockers, what areas you need to focus on, and where you need to press on to deliver on time. Constream analyzes aggregate data in order to equip you with relevant and conclusive information about the ongoing status of particular tasks, as well project participants' current workload.

Risk Management

Ensure predictability and stability by mapping potential opportunities and threats you need to factor in while making a call. AI-powered tools such as machine learning allow for building a system that provides you with expert advice based entirely on data from previous iterations – it's like having an all-knowing scout that supports you every step of the way.

About Constream

We are Constream, a team of professionals coming straight from the IT, construction site, design bureaus, and architecture practices. We dedicated our careers to the construction industry because we love to create things that last for decades and changes peoples life's for the better.

Alex Zmuda

Our co-founder, CEO and CTO, responsible for the solution's architecture and development strategy, code analysis and what is most important spreading the spirit of never giving up on even harder challenges. He is connected to the web industry since 2001 gradually building competencies from full-stack developer transitioning to the managerial roles. Today he is overseeing developers' teams and being responsible for defining processes and delivering business solutions to the end users.

Over the past 20 years he focused on all aspects of web development, ecommerce, tailor-made applications. For last 6 years focused on the SaaS solutions dedicated for the construction industry - managing the development team. He also took leading role in few startups, working with the teams of e-model.io (acquired by Utopia Smart City HUB) and solely creating Taximanager (still operating in the UK market).

His special fields of interest are technologies that has the biggest potential to speed up the transformation of the whole industry. He builds the unique Constream capabilities around blockchain technology combined with high performance data collection and interpretation tools.

Lukasz Topolinski

The second co-founder, CEO, and CPO. He sees the Constream as a chance to help his former co-workers solve the problems they encountered while working in design bureau and overseeing on-site operations.

For over 15 years connected to the construction industry, working with construction market leaders like Skanska and Mott Macdonald. He gained a deep understanding of construction processes and challenges connected to them, by going through each step of the construction career ladder from on-field engineer to Project Manager of complex infrastructure projects. Last 5 years he spent on developing the digital tools for the construction industry, like e-model.io and Hustro, also increasing teams' efficiency through dedicated post-graduate BIM studies, on-site consultancy and specialized courses in financial controlling, risk management, communication and change management.

The mission he wants to fulfill in developing Constream ecosystem is to make the construction project a more attractive, accessible, and enjoyable place to work without sacrificing the business goals.

The problems we're solving

Construction industry is characterized by complex projects, fragmented processes, and ineffective communication between dispersed teams. An exciting and financially promising project can quickly turn sour – a managerial nightmare with dire consequences.

People and assets are used far below their full potential. Decisions reached are not optimal. Companies often act on outdated or incomplete information, leading to missed deadlines and opportunities. Team members, subcontractors, and vendors do not understand how project goals translate into commitments. Accountability, so crucial in every line of business, becomes muddled.

Processes tend to be disconnected from one another, which turns project management into a game of cat and mouse. Communication regarding costs, work progress, risks and opportunities is intermittent at best. When you strip communication – and, consequently, the decision-making process – from context and history, what you're left with is a project that hemorrhages money, time, and energy.

We aim to restore faith and trust within construction projects by giving teams access to reliable, immutable, and readily available tools.

Own your data

Collaboration

Store data in own geo-location

Immutability and Auditabily

Improved Tasks execution and communication

What's in it for you?

Managing an Investment Project?

You're an Investor so it's the final product that matters to you. You set up and manage an entire complex ecosystem of teams in order to achieve your objective: an office building, a shopping mall or an industrial plant – which, ultimately, is to increase your bottom line. Naturally, you're working to a schedule, within a budget, and according to high quality standards. Maximizing profits is the ultimate goal but that extends beyond pure monetary gain and needs to factor in a lot of interests. Compromise becomes your middle name – and with Constream it's a compromise on your terms and staying true to your values. Constream removes communication obstacles and is a powerful, transparent tool for target-setting and results-monitoring – for each team involved in project delivery. Quick, intuitive access to the complete history of every event pertaining to a project is further enhanced by Constream proprietary analytics, which balances implementation costs, opportunities, and threats. Every crunch decision is finally based in fact rather than hunch.

Managing a Project Team?

Constream is a perfect source of information – easy to integrate with existing systems, reliable, immutable, and always available up to date and in real time. This drives performance to previously unseen levels while reducing internal and external costs. Your team finally has a proper insight into project developments and can make crucial calls when they actually matter. Automation based in artificial intelligence allows for further time-saving. All this translates to rising confidence and trust which are the true building blocks of any successful team.

Goals

We focus on bringing construction projects back to the builders, designers, and architects. Ultimately, it's the work on the ground that gets the job done.

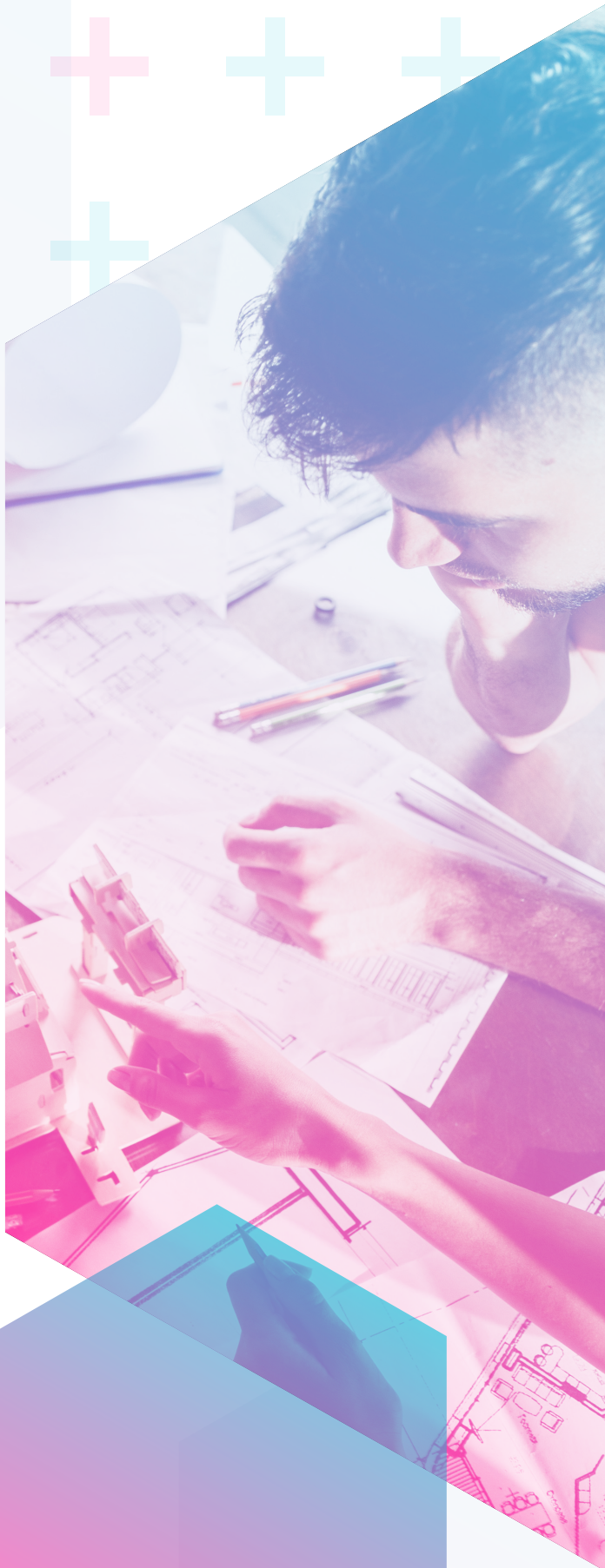
For a project to move forward at the right pace, all participants have to be on the same page. Fragmentation within teams means project management is a full-time job focused on locating and connecting the dots, often severely lacking in efficiency. Time and energy are wasted on people TALKING about their work, rather than DOING it. That's why at Constream technology reconnects the dots within a project, allowing people to return to DOING rather than TALKING about it.

The best way to achieve this is transparency. Constream solves for muddled and complex project management by clearly allocating particular tasks to particular people and setting them in the bigger project context. See how your contribution corresponds with the work done by others and deliver a working solution in a comprehensive, collaborative way.

Utilize Constream in order to align budget with costs, timelines with schedule, risks with potential opportunities and threats. Hyperledger blockchain technology means you will finally stop comparing apples with oranges and give your people proper insight into how their work slots within the larger whole. Want to add more entities into the project? No problem – they will have to conform to the same standards so that you're all perfectly aligned from day one.

When information symmetry stemming from transparency is built into a system, people start COMMUNICATING with one another, rather than TALKING to one another. Perform, log, communicate, move forward – it really is that easy.

At Constream we are building a well-lit path to project implementation, while leaving behind a dark alley where everyone was fending for themselves. Seeing how every small step counts towards reaching the final goal is one of the most powerful incentives out there – and we want to finally unlock the potential



Looking into the future – aligning construction projects with technologies of tomorrow

One of Constream's fundamental drivers is future-proofness. The platform is designed to accommodate various facets of the far-reaching technological revolution – such as Industry 4.0, VR / AR, and process automation in the area of finance and accounting. Our goal is to make the platform as flexible as possible, meaning new features are smoothly integrated into a solid, tested, and safe foundation. Being ready and embracing change as it comes is being halfway there on the path to success. We define this area as 'Sci-Fi' and it covers things like:

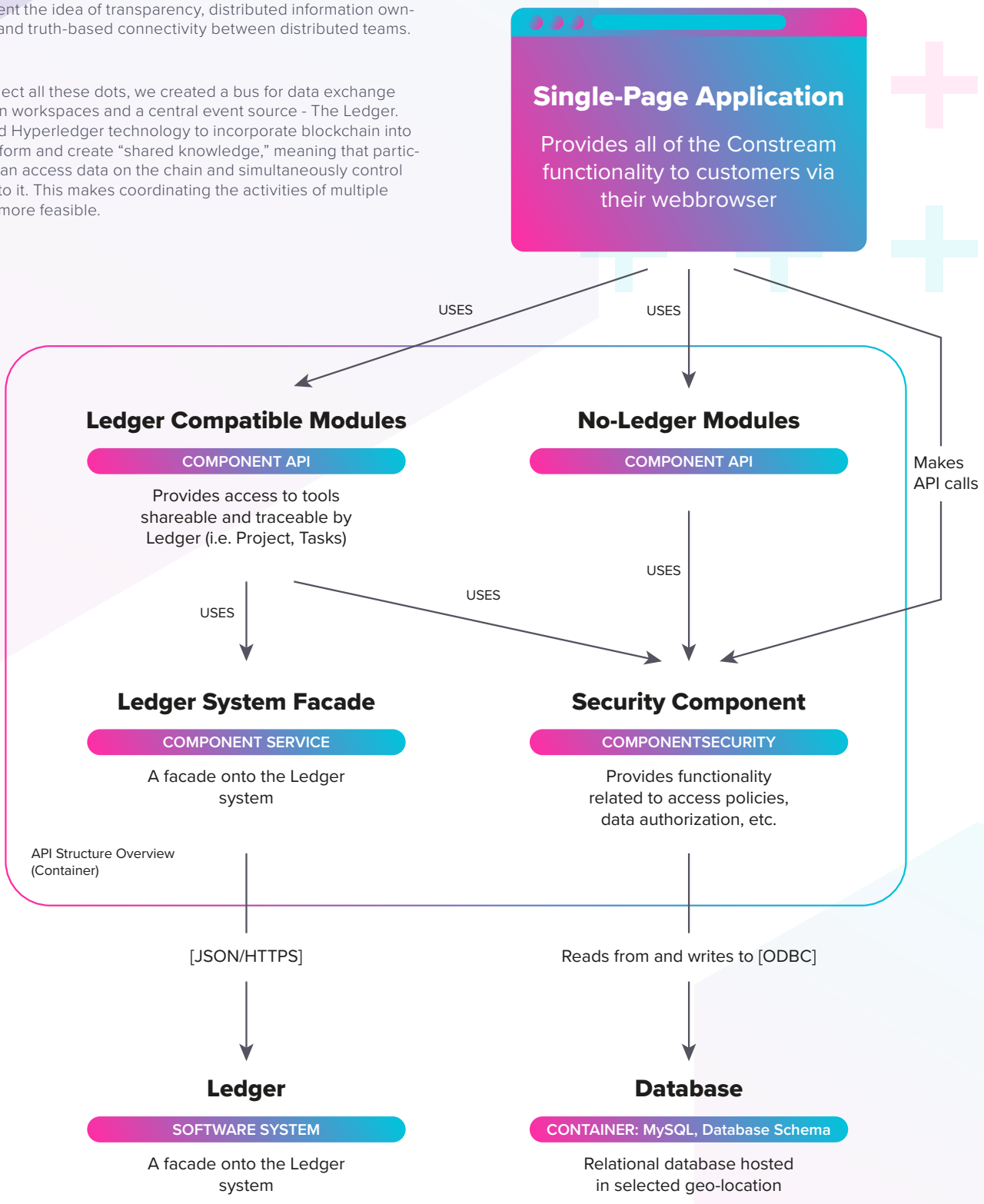
- **Industry 4.0**, which primarily concerns connected on-site delivery allowing for informed decision-making using data gathered from field equipment – based on Internet of Things device management and communication principles – leading towards cost optimization that fits into the broader concepts of minimalism and ecology;
- **VR / AR** – a genuinely immersive, on-site communication channel. An intuitive way for project management and on-site teams to communicate, making use of augmented reality to support communication with real-time data on construction sites or employees. Imagine walking around a construction site wearing AR-enabled smart glasses that provide basic info on your employees (full name, working hours, etc.) as well as live charts and graphs on the progress of individual construction segments per your request;
- **DeFi (Decentralized Finance)** – streamlining payment workflows, creating transparent and secure approval workflows, building the bridge to low fee financing sources. Blockchain-based DeFi solutions will enable different billing and accounting systems integration;
- **Anticipation Module** – an AI-based module suggesting the optimal execution for your processes.

We like to think that setting your sights on the Moon is a great goal but you'll need a proper space shuttle to get there. And this is what Constream is all about – a scalable, decentralized system in which all the basic elements of project, budget, and personnel management are designed to perfection, and the architecture enables new Solution Blocks to be added seamlessly, enriching the platform with new functions.

2. Architecture overview

The main assumption of the Constream architecture is modularity. With this approach, it is possible to add new functional blocks without affecting the already working elements of the system. Additionally, each workspace is separated at the database level to implement the idea of transparency, distributed information ownership, and truth-based connectivity between distributed teams.

To connect all these dots, we created a bus for data exchange between workspaces and a central event source - The Ledger. We used Hyperledger technology to incorporate blockchain into our platform and create “shared knowledge,” meaning that participants can access data on the chain and simultaneously control access to it. This makes coordinating the activities of multiple parties more feasible.



[Component] Company – API Structure Overview
The component diagram for the API Application

Workspaces Concept

Workspaces are among the defining concepts behind Constream. The easiest way to understand what they are is to think of every company using Constream as a separate entity on the platform, a cubicle of sorts. Workspaces reflect complete control each company has over their policies, workflows, and data accessibility

A Single Workspace Layer

Workspaces are among the defining concepts behind Constream. The easiest way to understand what they are is to think of every company using Constream as a separate entity on the platform, a cubicle of sorts. Workspaces reflect complete control each company has over their policies, workflows, and data accessibility – you may customize these spaces according to your specific needs. Each Workspace has an individual, dedicated database which means data is company-specific and can only be accessed by the authorized people or teams within that company. In terms of location, you may store your data wherever you choose, solving for security or legal requirements that often surround this issue.

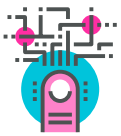
Multi-Tenancy

Cooperation is the name of the game in pretty much any industry; nowadays, you simply can't exist in splendid isolation. And fragmented industries, such as construction, are characterized by a real plethora of interconnections and dependencies between a variety of partners. This adds further layers of complexity and the already convoluted web we call 'construction project' is fast becoming a real management nightmare. Information flow, access to resources, security, legal requirements – as questions are mounting, entropy is rising, and you find yourself managing expectations rather than the project itself. Multitenancy is the technological solution we employ to tackle these issues.

Project Layer

Project is the glue that connects many companies working together towards a common goal.

This is the space where all events are logged and where all resources are sorted and parsed into logical sub-modules. The resources are made available to authorized persons or teams within each company. 'Job' is the word we use to describe tasks performed on Constream. Every project event results from an activity or a Job – be it order, inquiry, or any other type of work required to get a Job done.

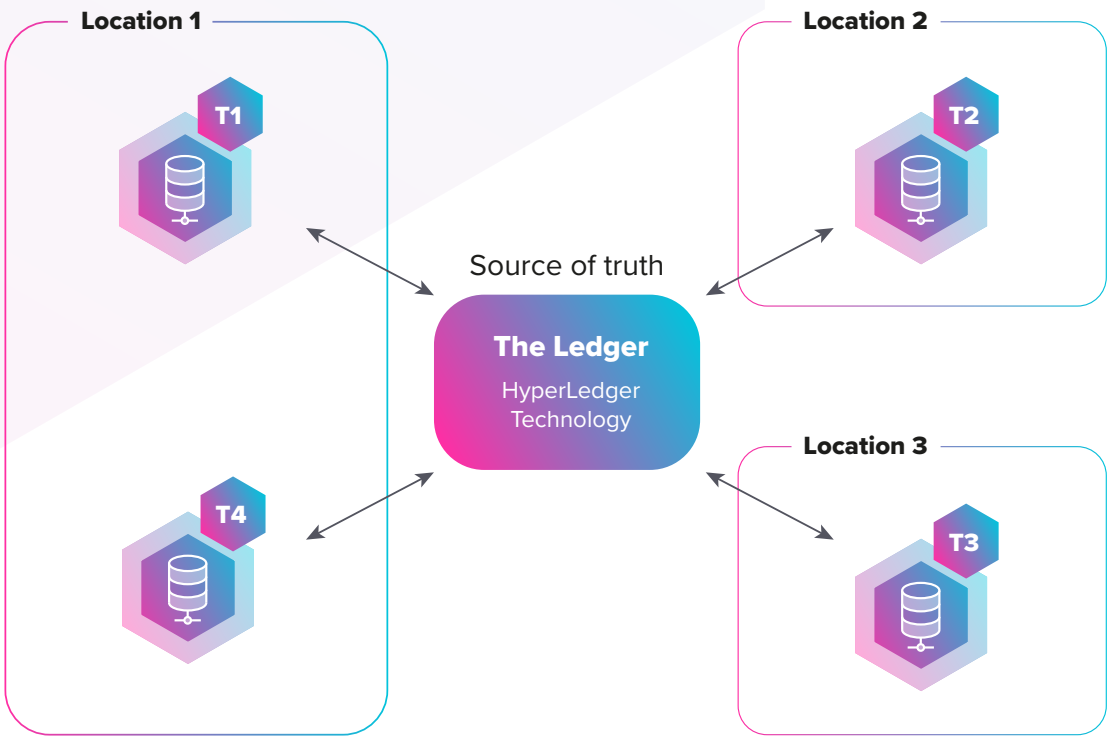


Access Layer

We already mentioned this, but it's really crucial to bear in mind that you can set and manage access to all project resources – thus assigning particular people or teams to particular project areas. Access may be limited in time or visibility may be set to cover only a specific portion of the project timeline. This also applies to your interactions with other companies based on the Workspace principle.

Ledger

The idea of a Ledger – a central registry – was born out of the blockchain. Standardizing all companies and imposing the same work models and methods is quite clearly impossible, because each company is a unique entity. Grouping all companies in a single database is a road to nowhere, too, because doing so would put restrictions on data security, location or access layers. Even multitenancy may not be enough here – data at the company/ Workspace level is indeed separated, but how to solve for data sharing between Workspaces? That's the reason we opted to create the Ledger. It's the very heart of the Constream system, allowing tenants to exchange data and information in a secure manner. Ledger is a bit like the Big Brother who knows everything that happened in every project and at every point in time. Data is thus collected in a private blockchain which, by its very nature and design, is immutable and represents a single source of truth. Our solution is based on the **HyperLedger** technology.



Hyperledger – platform core

HyperLedger Fabric is an open, safe, enterprise distributed ledger platform. Its advanced privacy solutions ensure only network participants with relevant security authorizations work on specific data that has been shared with them. Smart contracts store business processes which are automated by way of self-executing conditions woven into the code. The code itself as well as the smart contracts exist in a distributed, decentralized blockchain. Transactions are trackable and cannot be undone – so that you can have full confidence in your business partners, and vice versa. This enables companies to make more informed decisions while saving time, driving down costs, and reducing risk.

Data Sharing Bus

The Ledger itself is actually a big set of information, which only becomes genuinely helpful when a bus for information exchange is put in place. We have thus created the Data Sharing Bus concept which is based on events. The principle is simple: each event that goes into the Ledger generates a notification for every recipient concerned by this information. Once the recipient(s) acknowledge the notification, they may act on it within their own Workspace and download and implement changes to their own project layer – either manually or automatically. Actually, it is very similar to the way the GIT system operates as it all boils down to the push/ pull way of information dissemination. This ensures each project participant has an identical copy of the information, backed by blockchain, in their database.

Job Layer

Constream architecture ensures your working environment becomes extremely efficient. Finally, you can reliably share secure data with other companies, and on your terms. This vastly improves workflows and gives every project a real boost. Jobs, which we mentioned a few paragraphs above, are Constream's currency – they stand for 'a job to be done' and neatly define our ethos. But in order to perform a Job effectively, you'll need a no-nonsense mechanism that will provide you with specific information on the what, the how, and the when.

Data Aggregation

Our system and its building blocks – the Modules – aggregate information from a whole variety of sources. It is key to present them in a context-rich way that changes according to the recipient's identity. Constream's modular structure ensures we can carry on adding more blocks and information sources as we go on without losing sleep over the architecture's scalability.

Data Presentation

Two key visual components regarding any set of data have got to cater for two things: who the set is designed for and how it is presented. Never before was information as omnipresent as it is now, which calls for innovative ways of displaying it. It's pretty self-explanatory that a CEO needs to interact with different data sets to those compiled for a Project Manager. And this is where the Constream 'Perspectives' concept comes into the fore. Data is grouped and aggregated according to certain smart principles ensuring it reaches and impacts the recipient in a meaningful way. The 'Delivery' perspective will focus on the project delivery progress by hierarchically grouping information, indicating potential threats and risks along the way. 'Delivery' will thus present the big picture, taking all factors into consideration. The 'Team' perspective will, in turn, focus on the project participants and show their degree of involvement in particular tasks. Constream offers traditional tools such as Kanban, too; however we strongly encourage the use of hierarchical information presentation – somewhat similar to what is known as the tech tree, where you may only reach C after reaching A and B.

Integrations Layer

Comfort of use and implementation flexibility are at the forefront of our approach. Constream provides easy integrations with external ERP systems and accounting systems via REST API. We provide OpenAPI to our external partners allowing them to quickly build an API client, integrate it with their own apps, and start benefiting from all the Constream tools as quickly as possible.

3. Platform Modules
Project Workspaces

Project Workspaces is one of the first modules to be used by the user starting to work with the Constream platform. It is also a foundation where the project team defines the rules of cooperation. Workspaces reflect the organizational scheme, responsibility assignments, information access levels, and authorization workflow of the project.

We treat a project as an overarching framework consisting of one aggregate Workspace or multiple combinations of specialized Workspaces. In case the user chooses to compose the project framework from various Workspaces, dividing the scope of work and responsibility among different groups of project contributors, he can use one of the breakdown keys:

- product-oriented
- phase-oriented
- contracting parties oriented
- team specialty oriented
- localization-oriented

Regardless of the breakdown key applied every defined Workspace becomes an individual workspace, sharing project resources, but also giving the possibility to customize the:

- scope of the Constream platform modules and functionalities access
- scope and depth of project data sharing
- user's access - role-based, authentication key based
- dashboard and home page content
- interface look and feel

Budget & Forecasting

The budget and Forecasting Module is the core of the Constream solution, gathering information about the influence of all the actions and decisions taken by the project team and transforming them into a common denominator of money. The architecture of this module based on the project's WBS (Work Breakdown Structure) allows users to take actions with a full understanding of the dependencies between scope, time, and costs of the project.

The Budget & Forecasting module delivers value for each major group of end-users considering their particular needs. While designing the user interaction scenarios, we took three perspectives covering the needs of a typical construction project.

Perspective 1 - Production - Task level - Project executive team

Support individual team members in making decisions about how to execute and monitor and provide feedback on the planned budget, by:

- delivering accessible tools to monitor and control individual input to the project goals within the scope of assigned work
- giving an opportunity to define and monitor productivity goals adjusted to the reality of the project environment and performed work
- simplifying and streamlining the way information is entered into the system thanks to a user-friendly interface that saves time and number of potential errors

Perspective 2 - Management - Project level - Project Managers and Construction Managers

Empower the management team responsible for securing the project's profit in delivering a clear definition of intermediate financial objectives to the project team and make full usage of on-filed data to control the effectiveness of the delegated tasks, by:

- allowing for the tracking, updating and reporting key financial indicators using one tool throughout the whole project, cutting the need of referring to external sources, i.e. Excel files, individual notes, paper reports, and others.
- gathering in one place information from all the processes where first signals of cost variations are picked up and estimated by the project executives, with special regard to: RFI's, Change Requests, QHS&E non-conformances, and Risks.
- overcoming reluctance of project team executives to participate in financial controlling activities by simplifying the process of data input and linking individual team members responsible for the portions of the budget with the tasks related to budget update
- creating context for effective and data-based decision making process giving the ability to define and compare financial outputs of different operating scenarios connected to alternative action plans
- building the culture of co-responsibility by showing contribution of the contractors and team members to the financial output of the project, by setting up and visualize progress of sub objectives

Perspective 3 - Management - Corporate level - Corporate Executive Team

Take control over the profit and cost centers of the projectized organization by combining the information about progress, cost effectiveness of the operations, and monitoring the risk exposure with constant access to the source data, thanks to:

- rendering current business situation and most probable final projects' outcome by introducing standardized and thorough process of forecasting, considering all groups of incurred, accrued, and projected costs. Showing the real impact of risks on the project bottom line, while building proactive and auditable action plans supporting the desired scenario
- monitoring cash flow position on each project with easy to use and monitor tools dedicated to planning and reporting projected costs and sales

Risk Management

We treat a Risk Management Module as key layer of information responsible for interpreting and visualizing uncertain events that can, and probably will affect one of the project's goals. We are gathering information from the front line and giving them additional managerial usability by considering all the possible interactions and projects' big picture.

Every application of the Constream platform creates a possibility to associate positive and negative risks with the events that are taking or will take place on the project. Risk Management Module builds more realistic view of the project state by allowing project executives to make a most probable estimates on the cost and duration of the specific project's event (task, design change, non-conformance resolution) and at the same time define and quantify risks that can influence planned results.

It al boils down to the new quality of forecasts, budgets, and schedules that respects the need of giving the precise information about final cost, end date, and margin with extremally better understanding how known opportunities and threats can change the projections as well as what to do next if certain risk will fire up.

Smart Log

The Smart Log Module is our information hub where we aim to gather the most of front line and decision-relevant data possible to distribute through the business-specialized Constream platform modules.

The Smart Log users choose one of the predefined templates, adjusted to the performed role and project type the are working in, to optimize the number and type of relevant data fields. The template is associated with the user to reduce setup time during subsequent use. We configured the Smart Log templates in the way they focus on the most important information grouped in editable sections:

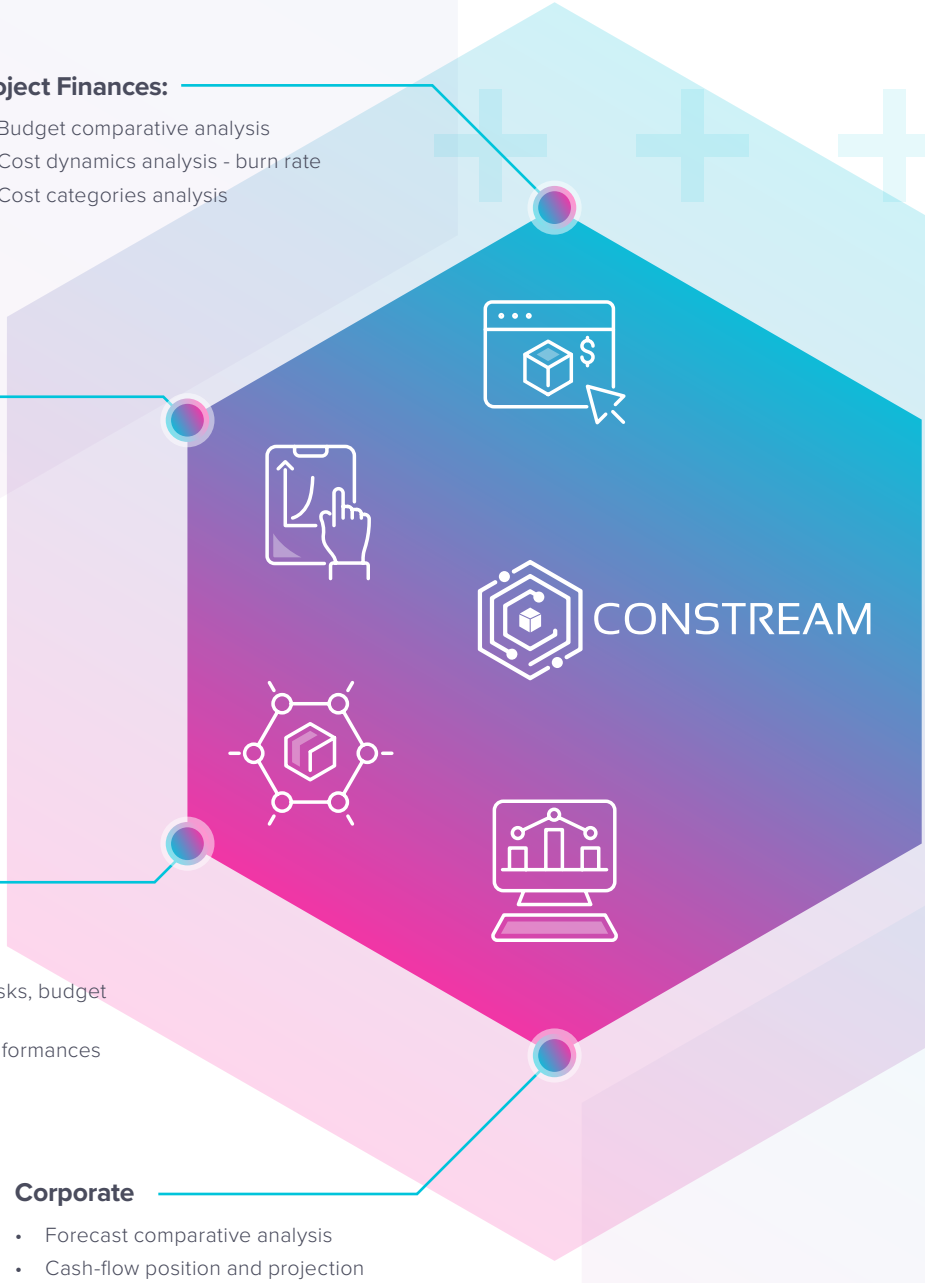
- work conditions
- localization
- people engaged and potential decision makers
- resources involved
- productivity tracking
- progress reporting
- observations and improvements
- connected business processes
- team communication

Data input fields are connected to the project database, speeding up the reporting process and structuring the data with automated selection of related WBS elements, contributors, resources, actions, root causes, connected business processes.

The order, arrangement and range of data fields is designed to optimize the time user spends using Smart Log and promote taking immediate actions with the gathered information. We want to initiate adequate business processes responsible for problem resolution by providing intelligent guidance regarding the events pre-qualified as potentially impactful, i.e. QHSE non-conformances, design changes, out of scope work.

Reporting

Knowing all is good but knowing things that matter, fast, is better. Construction projects are complex and so is the way we should look at how we gathering and interpreting information. Constream focuses on making connections between raw data, events, and project actors to present the valuable insights in every area responsible for project's execution. The Reporting Module gives not only the 'What?' happened but also the 'How?' we came to this state, and 'Who?' was responsible along the way.



Project Finances:

- Budget comparative analysis
- Cost dynamics analysis - burn rate
- Cost categories analysis

Work efficiency

- Resources productivity
- Goals tracking
- Earned Value analysis
- Materials usage
- Quality costs

Managerial

- Risk exposure
- Resource usage
- Team members responsibility load - tasks, budget items, non-conformances, RFI
- Root cause analysis for QHSE non-conformances
- Timeline analysis - event based
- Connection analysis - event based
- Task execution tracking

Corporate

- Forecast comparative analysis
- Cash-flow position and projection
- Risk dynamics analysis
- Internal audits and potential misconduct detection
- Subcontractor assessment
- Procurement audit
- Portfolio analysis - projects aggregated data

Proposal Budgeting & Submitting

Bidding process within the construction industry is a constant attempt to reconcile two opposing goals. At one end of the spectrum, the tenders prepared must be very well thought out, precise and thoroughly reviewed. At the other end there is a need to prepare subsequent proposals very quickly and to be able to maximize the time of the teams involved in new sales creation. Constream Proposal & Submitting Module balances these goals and ensures competitive advantage through methods proven in a traditional business environment that have been elevated through the process digitalization and automation.

On the operational level of bidding process we speed up decision making and increasing win ratio focusing on delivering two tier solutions. Tier one provides fast yet precise estimates, and key financial metrics at the very beginning of negotiations process. Tier two gives ability to deliver detailed estimations for the most promising business scenario.

First tier estimates

First tier estimates are based on the simplified budget templates, making it easy to make transition from the initial client's specifications to entry proposal, using

- top down budgeting
- visible target margin analysis
- risk markup
- initial cash flow and cost of credit analysis
- sales projection

Second tier estimates

Second tier estimates opens the full tender preparation process for the selected offerings, where bid team make use of:

- High level risk analysis reflecting the company project risk assessment strategy. Users go through self-defined phases and areas of evaluation, in most cases including: legal risks analysis, KYC (Know Your Client) analysis, technical risks analysis, operational risks analysis, stakeholders analysis, vendor analysis. As the scope of work to be done regarding risk assessment is individually configurated by the users, Constream focuses on structuring the process and preparing the coordinated tools set consisting of:
  - risk assessment templates
  - heat maps
  - guided risk valuation
  - connected risk log
- Detailed estimates based on the resource usage costing activating the specialized knowledge of the individuals and cooperators about the exact resource usage and the impact of external conditions on the final expenditures. The automation tools provided by the Constream platform focuses on quick access to the relevant information, by integrating in one place:
  - Previous bids and projects cost databases
  - Enterprise databases
  - External market data providers
  - Individual quota requests

The authorisation process map all the decision makers and create the feedback loops. Bid team uses one of the existing workflow for repeatable proposals or define individual approval path making it possible to gather valuable insight from internal a external experts.

By working in connected environment of the Constream platform all the operations undertaken during bid preparation have an additional added value because at the same time we prepare to move smoothly to the implementation phase of the project. The proposal budget structure is used as a base structure for the project's WBS and operational budget. All the data supporting the detailed bid estimates is connected and available to authorised executive teams, speeding up the process of auditing and updating budget assumptions. All the risks analysis transforms into active elements of the project's execution plan safely transferring the experts' knowledge between the project phases, in which typically, the greatest information losses occur.

Non-conformance Management

Non-conformance management at the individual project's level should always be set in the context of the customer's requirements. The aim is to transform the client's final product acceptance criteria into set of benchmarks which will guide team members in making day-to-day decisions during project execution phase. We decided to build the the Non-conformance Management Module around four complementary priorities:

- Reducing the time needed to report non-conformities;
- Include production teams in the non-conformance management process (identify and solve problems where they arise);
- Make decisions based on verified first line data;
- Create visibility and clear communication for the continuous improvement initiatives

By adopting such defined strategy into Constream solutions used on every single project, we determine the possibility of achieving repeatable and predictable results at the level of the entire company.

Functionalities delivered in Non-conformance Management Module turns strategic concepts into project's reality, starting from defining three step process for effective work: Identify - Manage - Close

Identify

Based on our experience to date, we know that the most negative impact on margins comes from from those events that are not reported early enough. The level of detail initially associated with the non-conformance is less important here than the time it takes to prepare first response and redirect to the right process. Constream addresses these needs by:

- streamlining the identification process by automation of initial information discovery, filling in the data about-data, originator, localization, non-conformance type, process type, budget and WBS element
- reducing the amount of information required to minimum - user can end up first step by simply adding a photo or video from the construction site
- facilitating the communication by connecting all the involved parties using the smart assistant functionality giving recommendations based on the background data

Manage

The essential characteristic of quick and cost-effective non-conformance resolution is to gather the decision-relevant data, create a responsibility chain where the party causing the problem is involved, and define the manageable set of actions to solve the problem. On top that the management team needs to control the QHSE tasks, balancing the priorities of the entire project and understanding the compound effect of all the active non-conformities on the project's margin. We approached the 'Manage' part of Non-conformance Management Module by delivering the tools that:

- providing the standardised data sets connected to the project's database, including: Budget line items, WBS elements, team and cooperators contacts list, root causes, predefined corrective actions
- catching estimations regarding cost, time and resources engaged and improving them along the way
- making smart connections between identified issues and platform modules responsible for gathering and transforming field data into financial projections, including Budget and Forecasting, Risk Management, Planning and Execution
- tracking the effects of implemented corrective actions
- creating searchable and immutable event timeline based on the blockchain technology
- making it easy to initiate additional processes connected to the issue: Change Request, RFI, Budget Change Request
- creating analytics focused on the non-conformance process, with native solutions projecting: average resolution time, level of risk exposure, level of team members workload and level of assigned responsibility, root causes analysis, trend analysis, forecasted non-conformances cost, non-conformances localization analysis, subcontractors impact analysis.

Close

The non-conformance closeout process secures the company's ability to create additional profit stream based on the investment made on the project's level while managing the non-conformities.. We treat all the data collected in the 'Identify' and 'Manage' steps of the process as a means to improve the cost effectiveness of ongoing and future operations. The deliver the practical dimension of continuous improvement by implementing:

- marking and activating the most exemplary non-conformances to be transferred as best practice via predefined template
- QHSE Wiki for engaging and onboarding new employees at any time
- increased availability of information related to final cost and time of the non-conformance resolution, compared to the initial estimates and subsequent updates

Document Management

Constream creates a robust environment for data exchange covering all the industry standards, set by CDE (Common Data Environment) class solutions designed to support BIM (Building Information Modeling) projects and popular cloud solutions, delivering:

- file versioning allowing for making file updates not affecting the ability to restore previous versions
- document or aggregated documents authorization workflows - allowing to present and store information about the current status
- access to industry specific file types, including BIM models exchange formats
- safe remote access using Multi-Factor Authentication technology
- discovery tools finding files using quick search by keyword or metadata value
- file sharing through safe links and time limited links

Apart from delivering the industry standard solutions we are putting special emphasis on the user interface personalization and user interface streamlining, as we see it as one of the most efficient way to use the full potential of the file-based working environment. We have designed the Document Management interface in the way it allows for:

- pin the most important documents on the top of the screen
- save searching filters
- customize look and feel of the folder icons, collections, color schemes associated with metadata
- define, save and reuse workflow templates including authorisation schemes

Constream harness the power of metadata used as means to adjust the construction project environment to the specific business needs of the production teams. We created a robust and easy to use interface allowing for connect raw data with additional layers of information that speeds up the communication and build the right context for the specialized groups of users. Below are examples of user-defined usage scenarios:

- GPS localization - search documents (images, drawings, documents) by the root localization to understand what happened in the exact place of your project
- connect cost documents with the cost codes, cost type, authorization status, responsible person, localization
- associate documents with the processes making preparation for commissioning or issuing appendices to partial payments with just one mouse click
- create virtual folders and file collections where you can store documents with no need to make multiple copies or being concerned about the validity of the file version
- Use AI for automated file tagging, making it simple to get the

All the functionalities of the Document Management Module has been designed with security in mind. Analyzing data leakage cases reported by individual projects or taken from general industry-specific reports we noticed that in most cases the root cause of the unauthorized access lays in the weak access management system to the shared data pool.

Constream focused on providing the increased visibility and availability of the information about who and to what extent has access to the particular data, significantly reducing the number of unforced security breaches. We streamlined the process of sensible data access management by introducing multiple methods of access definition. User can set the boundaries choosing from complementary options:

- associate with workspace
- associate with a project team role
- associate with company
- associate with individual user account

RFI Processing

Request For Information (RFI) is the main communication channel used by all the parties of the built environment when the need of official expression of the project related event arises. But the process of exchanging the communicates does not move its participants towards working solutions until it is not programmed to do so.

At Constream we look at RFI process as an action hub, designed to provide perfect communication based on data at the very beginning - ending up with all the conclusions embedded and visible for every actor of the project.

We close the gap between communication and decision making by guiding users through the initiation and consultation process giving them:

- easy access to the relevant project data including Smart Log, Budget and Forecasting and Document Management
- full access to the process history and visualization of the communication timeline
- easy to use workflows based on the best practices gathered from the construction sites and design projects
- ability to identify and track events where action has not been taken for a long time
- decision points at the end of each stage where all involved parties are motivated to push the process towards resolution

Our platform transforms effective communication in to actions resulting from it. As every RFI can lead to various resolution scenarios we focus on gathering the data about its potential impact on projects success criteria: cost, schedule, resources and clients satisfaction level. Having most important information at hand, user can launch the action plan straight from the RFI process level using multiple actions:

- change request including: scope, budget and schedule
- non-conformance processing
- risk update process

Planning & Execution

The Planning and Execution Module serves as a set of specialized toolkit, used by project professionals to get job done. The most important driver that has guided our work whole designing the functionalities, was to create a framework in which users will minimize effort needed to push their part of the project toward the completion zone with total focus on reducing waste in each of the performed activities. This work attitude implemented in the Planning and Execution Module is deeply rooted in Lean Management principles adapted to the characteristics and limitations of the construction industry. We have grouped the functionalities to emphasize the main goals defined by our users:

Push project jobs through the consecutive stages everywhere it is possible

Although construction projects are a network of interrelated elements when it comes to the everyday life of design engineer, construction engineer or foreman we spent most of the time executing the short term activities. The overall condition of the project roots from the effectiveness achieved on forefront of the successive work packages defined in the WBS. Constream focuses on clearing the path for fast track project execution by:

- Identifying idle tasks and make them visible for the management
- Finding bottlenecks and making smart communication on every stage of the decision making process
- Making planning easier to manage and monitor - allowing divide project into manageable chunks of Workspaces, subprojects and task lists

Use visual communication to streamline the task execution process

Project teams can track the execution process performance as a accuracy of how consecutive plans transforms into successfully closed tasks. The weak point of the transition between planning and execution phase is communication. Information loss, lack of understanding, message's detail level not matched to the recipient's skills - these are the main blockers undermining the effort and initiative team members put into day to day work.

Constream introduces omnichannel communication which means we deliver the most important information using different channels to achieve common understanding, reducing informational noise and cross team interpretation errors. Key data visually represented in the most frequently used user interface screens:

- tasks status
- progress recognition
- connected risks
- individual accountability

Identify and fight waste

We identify and fight waste interpreting insights gathered from the basic project processes: Smart Log, Non-conformance Management, Material Management, and change requests. Lean production oriented analytical tool seek first signals of ineffective resource usage constantly verifying selected characteristics of:

- Non-conformances root causes
- Tasks and material delivery delays
- Productivity variances
- Average jobs execution velocity

Planning & Execution

Make everyone involved and accountable

The practical aspect of building great teams starts with creating an environment in which employees know what they are responsible for and understand the criteria for fulfilling their job. Taking this perspective while defining the Planning and Execution Module we designed a accountability pyramid to assure the basic and specialized needs are met.

- Tier 5 - Accountability board - analytics focused on controlling individuals' contribution to the Workspace and Project goals
- Tier 4 - Sub-tasks - for managing activities that evolved throughout the execution process
- Tier 3 - Intermediate goals - team oriented sub-objectives based on productivity measures
- Tier 2 - Workspaces - dedicated space for maintaining team focus
- Tier 1 - Unlimited access - No restrictions on user number in pricing plans

Make budget, forecast and risk analysis an efficient managerial tool

At the managerial level, each decision must be financially justified but should also be measurably better than the available alternatives. The quality and the overall impact of the decisions made throughout the project lifecycle roots in the ability to build, validate and assess the right context within very limited time.

Constream platform gives managers ability to quickly zoom in and out the current budget data and create alternative snapshots of the forecasted results that:

- support decisions with great situational awareness
- create the timeline of the decision making points linked with archived data
- allow for precise communication of the expectations at every level of the project ladder

The ability to deploy fast and adequate reaction for the current situation protects the project results, but it is the possibility of anticipating and preparing for future events that opens the door to exceeding initial expectations. The Planning and Execution Module use Risk Management and Budget combined functionalities for building up early warning and rapid response system able to:

- define safety thresholds and notification strategy
- actively monitor risks and make it easy for whole team to contribute
- prepare action plans for most important threats and opportunities

Accounting & Invoice Processing

We look at the accounting processes as a gearbox that makes the whole construction project move in the right direction with the desired speed. Every company has its own personalized systems tailored to their needs. The way invoices are processed is also an effect of many iterations of IT systems and processes development and Constream is here to support existing solutions - not to confront them.

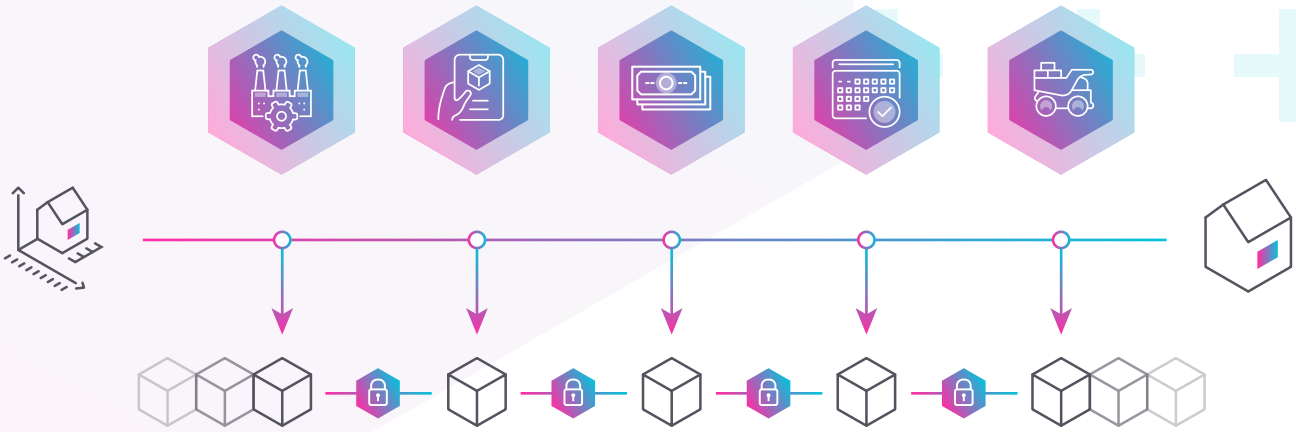
We are developing the integrations with the most popular vendors as well as with self-developed systems to make the flow of data between the project and headquarters seamless and effective. Here is what do we mean by seamless and effective collaboration:

- E-invoices connected with their proof of order execution or contractual execution using data generated by the project team, all supported with immutable characteristics of blockchain technology
- Fast authorization of every document using Constream communication tools
- Variances analysis and disputes resolution engaging all parties of the project gathered on the platform
- Automated processing and transferring data from invoices straight to Budget and Forecasting modules
- Audit tools allowing for identifying the accrued costs not properly documented by cost documents
- Compliance with new EU e-invoicing directive.

Material Management

Constream Materials Management Module supports key operations responsible for proper handling of the resource flow, which on average accounts for 20% up to 70% of the total project value.

Three connected functionalities groups of logistics planning, material tracking, and cost monitoring covers the map of major revenue leakages caused by supply chain flaws. The Material Management Module covers each of the area taking control of the entire process.



Material tracking

- Blockchain-based material tracking
  - track from vendor through logistics up to the point of building in
  - set up material-specific and vendor-specific certification requirements
  - receive and control materials with predefined templates

Cost monitoring

- Smart connections with project's financials
  - use the data of current inventory in budgeting and forecasting process
  - use material usage data in forecasting process

Logistics planning - last mile

- Simple delivery planning and last mile management
  - shipments schedule
  - active external links
  - construction site access instructions and QHSE requirements delivered before the due date

4. Deployment Options

Intro

Deployment scenario of any solution that aims to increase efficiency should fit the user needs, including all internal and external business environmental factors, no the other way around. Especially in the realm of the construction industry where the are so many organizational forms, adjusted not only to the need of optimal use enterprise's resources, but also to the method of venture financing.

The industry landscape is evenly populated by the centralized enterprises (functional organizations), decentralized enterprises (projectized organizations), special purpose vehicles (big and megaprojects organizations) as well as a mix of all the above mentioned. Every client has it's own needs regarding security and communication strategy that should be woven into the architecture of the tools they use.

That's why we designed Constream platform in the way that can deliver accessibility and business value right from the beginning, starting from the single pilot project, with the full readiness to scale up to the needs generated by the entire enterprise. Here is how we do it.

Multi-Tenant Public Cloud

The Multi-tenant model of deployment is the most elastic one and preferable for customers who do not need or do not want to host the application on their existing IT infrastructure. In this option all the data and operations are managed by the secure and robust cloud infrastructure provided by Constream. Users can access all the functionalities through endpoints, which means every web browser and mobile application. The data of each customer is kept totally separate, access of individual users is possible only after ensuring their identity using reliable authentication tool, based on Multi Factor Authentication solutions. All the information created throughout the project's execution is always available even if customer decide to no longer use the solution.

The main advantage of multitenancy approach stems from the optimal use of the IT resources (computing power and data storage) which translates into lower cost and the fastest possible route from the decision to use Constream solutions to configured and ready to use work environment.

The architecture of the Constream platform itself allows users to start with decentralized instances of the application, serving separate projects, and then merge them into one portfolio, where all the information can be exchanged and analyzed creating a complex view of company operations.

Multi-Tenant Private Cloud

Companies which has developed their own cloud computing capabilities in the form of Internal Private Cloud or Hosted Private Cloud can easily use the whole Constream's potential and scope of functionality without compromising the independent management of security policy or resources balancing. All the advantages of Constream multitenancy architecture will be available within the internal teams' work environment including online and mobile application endpoint.

The Private Cloud based model of deployment can be extremally helpful for the individual investments with extraordinary security needs that can apply to defense, industrial or critical infrastructure projects.

Saying all that the application will still be ready to scale up and share selected resources within extended hybrid environment, including public cloud, if the need arises as a result of new models of cooperation with future clients.

5. Security

Security based on the four basic layers:

Layer 1 - Key project data protected against unauthorized changes and deletion

Key project data protected against unauthorized changes and deletion

- Blockchain-based data recording and sharing
- Authorization management with transparent access scenarios
- Multi Factor Authentication adjusted to user preferences and infrastructure capabilities
- WORM (Write Once Read Many) strategy for ongoing backups and archiving the critical data that should be retained to secure business continuity and ability to recreate the exact project snapshot in case of need to support unresolved claims or litigation - so often jeopardizing hard-earned company profits.

Layer 2 - Multi-tenant application environment secured against unauthorized access and tenant's resources integrity

Multi-tenant application environment secured against unauthorized access and tenant's resources integrity

- Use mature multi-tenant cloud infrastructure regarding identity providers, supporting federated access through customer-controlled identity providers
- Multi-tenant isolation strategy separating key resources from each tenant, based on the VPC (Virtual Private Cloud) model
- Creating and maintaining private endpoints for on-premise and hybrid enterprise environments

Layer 3 - Cloud stored data protected against lost or breakdowns in access to services

Cloud stored data protected against lost or breakdowns in access to services

- Certified cloud infrastructure compliant with best industry standard, including
  - ISO/IEC 38500 – Information technology — Governance of IT for the organization
  - SO/IEC 20000-7 - Information technology — Service management
  - Cybersecurity Framework (CSF)
  - Cloud Security Alliance (CSA) Cloud Controls Matrix
- Infrastructure audits in case of using client-based cloud or hybrid application access models

Layer 4 - Personal data is protected against unauthorized processing and access

Personal data is protected against unauthorized processing and access

- Compliance with international standards
  - ISO27001 - Information security management
  - ISO27017 - Information technology — Security techniques — Code of practice for information security controls
  - ISO27018 - Information technology — Security techniques — Code of practice for protection of personally identifiable information
- Compliance with local legislation
  - GDPR (General Data Protection Regulation) in European Union
  - DPA (Data Protection Act) in United Kingdom
  - LGPD (Lei Geral de Proteção de Dados Pessoais) in Brazil
  - APA (Australia's Privacy Act) in Australia
  - CPRA (California Privacy Rights Act) and other state laws in USA
- Early adaptation and aplication of the incoming personal data protection acts
- User training

6. Conclusion

Constream is a future-proof blockchain-based collaboration tool for construction projects. We provide our users with a platform build of connected application modules mapping and alligning effective management needs with streamlined easy to deploy user interface.

Constream platform focus on projects' profit growth by setting up a financial module as a back-bone of the solution. On the operational level we translate everyday actions, taken by the project team, into the understandable projection they impose on the project's goals. The paltform creates work environment, where seemless connectivity between the modules representing key process-es allowing to make intutively informed decisions at every level of the organizational scheme.

The technology stack based on distrubuted ledger responds to the current needs of construction industry related to the demand for realible, safe and auditable information management provided for distributed projects and variable user roles. In the same time, embedding blockchain architec-ture gives the Constream users advantage of being ready to exploit the opportunities arising from Industry 4.0 on-site connectivity, immersive cooperation and decentralized finances services leap-frogging the efficiency of the construction sector in the near future.

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