



User Insights Report

The Weather Ledger

July 2020

Digital Catapult is providing distributed ledger technology (DLT) and internet of things (IoT) expertise and creating a framework of standards for the Weather Ledger.



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Executive summary

As part of the Weather Ledger project, this user insights report explores and reveals insights into the human level impacts of weather based compensation events. Identifying potential improvements to the weather risk management process and the likely benefits of general process improvement and through the use of digitalisation.

By gaining a deeper understanding of the topics most relevant to potential solution users, this report provides useful insights into a pertinent distributed ledger technology (DLT) and internet of things (IoT) solution for the Weather Ledger project. This project is part of the Innovate UK funded Transforming Construction Challenge which aims to transform the construction sector and allow it to produce “safe, healthy, efficient buildings using the latest digital manufacturing techniques”.

Research methodology

This report and research has been authored by Digital Catapult as part of the Weather Ledger project. This report was informed by both primary and secondary research, with insights gained from semi-structured interviews with industry experts, as well as a wide reaching and in-depth literature review of industry reports, whitepapers, articles and briefing papers published by governments, top tier business firms and construction expert groups.

Key findings

1. Although adverse weather conditions frequently affect construction and civil engineering projects, only a small proportion of events are eligible for compensatory relief, which can have significant impact on the small profit margins and trading of project partners
2. Although application for compensatory relief is set out in industry contracts such as the new engineering contract (NEC) templates, the process for applying for weather specific compensation events (CEs) is often based on subjective data, causing contention between project partners
3. Project managers, contractors and headquartered (HQ) functions are likely to be the key beneficiaries from a pilot using DLT and IoT technology, as these technologies provide data and assurances that the existing weather compensation events process does not currently possess, which can help to streamline and improve the process
4. Whilst the construction industry is starting to increase its use of technology, the industry is traditionally slower to adopt than other sectors, and as such, widespread adoption of the proposed solution could be equally slow

An introduction to the Weather Ledger project

Digital Catapult is providing distributed ledger technology (DLT) and internet of things (IoT) expertise and creating a framework of standards for the Weather Ledger, an Innovate UK project.

Climate change is making it increasingly difficult to predict weather patterns. Combined with the general increase in more extreme weather, this has made planning and operations more difficult for the construction industry, impacting on weather-related contract disputes, the costs of which can run into billions globally each year.

This 12-month project will develop and demonstrate a real-world DLT solution for automated evidence collection, information exchange, and contract administration relating to adverse weather events at two real-world construction sites.

Internet of things devices (IoT)

Using internet of things devices (IoT) on-site, construction companies can collect accurate and highly localised weather information. This feeds into smart contracts running on a distributed ledger shared by all parties to a worksite. This immutable shared data is both transparent and auditable. Automation of contract clauses based on this trusted shared data will save time and reduce, or even eliminate, costly and wasteful disputes.

The Weather Ledger is exploring the applicability of this model, including the user experience it would provide:

- Simple governance rules, no GDPR-sensitive data, no sensitive company data
- Verification replaces trust, through visible smart contract execution, immutable data and total auditability
- Simultaneous smart contract execution by all stakeholders, according to the weather data collected by IoT devices, enabling rapid alerts and swift allocation of compensation

Smart contracts

It is hoped that this project will set a precedent for further application of distributed systems in the construction industry

- Time can be better used for tasks that will help projects to complete more effectively and on time
- Lowering the risk of dispute will enable better collaboration within the industry
- Better data in general could help with more effective scheduling, to improve project delivery times
- This data may be used to add value for other industries

Product development will be undertaken with participation from all partners, maximising the value of available expertise.

Testing and iteration will be subject to detailed feedback from construction staff, on-site and office-based.

IoT devices used on a construction site are still novel, and for them to be used to collect weather data and then for the data to be used for smart contracts is entirely new and innovative.

Smart contracts and 'legal engineering' are both highly exciting emerging fields. The Weather Ledger is a world first in commercially-applicable smart contract technology, and certainly a first for construction.

Smart contracts are intended to automate the burdensome administrative work associated with disputes, which should also reduce any friction which would otherwise arise between parties. Smart contracting frees up legal experts to address more complex issues.

The Weather Ledger is an Innovate UK funded project led by consortium partners EHABITATION (EHAB) Limited and supported by Clyde & Co, Connected Places Catapult, Digital Catapult, Ferrovial Corporation UK and BAM Nuttall.

Weather compensation events

Context and industry standards

This section of the report examines industry guidance for compensation events in the UK, current standards requirements and the importance of weather compensation events to contractors.



Compensation events in the construction industry are defined as:

...variations, loss and expense and extensions of time; a single assessment that deals with the entire effect of an event on time and money.”¹

Events are accounted for in new engineering contracts (NEC), the primary template governing project management contracts between civil engineering and construction partners in the UK.² Compensation events are not necessarily the fault of either party, but merely relate to any instance that hinders the speed, efficiency, or resources of a construction project, including site conditions, force majeure, and weather conditions.

Whilst NEC provides the template and guidance for overall project management, including clarity on adverse weather conditions, contract partners are also permitted to amend contracts to add or remove clauses relating to data recording and metrics. As such, despite weather conditions being viewed as an objective matter of fact, it is quite the opposite.³ Disputes amongst project partners may arise over issues as diverse as; what constitutes adverse weather conditions, what could have been reasonably foreseen and questions over whether the data recorded is sufficient to warrant delays and/or elevated costs. Contract criteria can include issues such as if the weather in question actually hindered the construction project, how severe an event has to be to constitute a hindrance, and what, if any, relief the contractor is entitled to under the terms of the contract.

3-5%

Due to the high thresholds required, weather compensation events are some of the least common, with experts interviewed citing that they compose approximately 3-5% of CEs.⁴

Whilst it is a common understanding that in setting out an intended timeline for project completion, the contractor will factor in the possibility of adverse weather affecting operations, weather conditions that are exceptionally adverse may override this previous timeline as they may not have reasonably been foreseen.

Further issues in weather compensation events arise with regards to the location of the data collection site. As current methods mean that weather data is collected from weather station equipment that may be tens or hundreds of miles from the construction site, a degree of objectivity and factual accuracy is lost. As such, accurate compensation may be paid or lost incorrectly.

The construction industry, as with many other component parts of the UK economy, has suffered from stagnant productivity levels. Contractors are faced with both higher material costs and falling order numbers, effectively squeezing contractors' margins - one bad deal could have a significant impact on trading.⁵ As such, there is an impetus to improve the ways in which compensation events are conducted, and a compelling argument that piloting a technological solution using IoT data and a distributed ledger as proposed in the Weather Ledger project can successfully address this.

Key stakeholders of weather compensation events

This section explores the key actors within a weather compensation event process, their roles and responsibilities, and who the primary beneficiaries of the Weather Ledger pilot are likely to be.

Whilst every event is different and management will differ from organisation to organisation, the process of claiming on a weather compensation event involves several processes and many individual stakeholders throughout the different stages. Typical parties to a weather compensation event will include those operating on a site such as engineers and planners, as well as more office based participants such as quantity surveyors, project managers, contractors, sub contractors, commercial officers and legal representatives.

The players within a weather compensation event can broadly be coupled into three major groups - on site stakeholders, dual on and off site stakeholders, and those in HQ functions. All three will have to be considered for any holistic digital solution to this issue. In claiming for compensatory relief in this context, the majority of operations occur at site level.

On-site

At the initial stage, employees in a commercial function of the contractor's organisation will raise the compensation event in question, and will liaise with the on-site engineers to determine which resources and operations were affected. This is completed in anticipation of receiving instruction from the project manager to proceed to submit a quotation.

Dual/off-site

Once this has occurred, as a commercial obligation there is a joint operation between engineers, commercial officers and planners to confirm that there was a notable CE and to notify the project manager. At this stage, engineers and planners on the project use their experience to advise on the remaining resources and how the programme is required to be revised as a result of this compensation event and the planners would revise the programme.

HQ functions

This group includes the roles of legal officers and those in corporate risk and insurance. Operating as somewhat of a last resort in the process, when an agreement is unable to be reached at earlier stages, legal officers - whether in house counsel or external officers - seek to clarify the entitlement to compensation based upon the contract terms and the evidence presented in relation to the event in question. Those in HQ functions often spend significant amounts of time at great cost gathering and assessing any technical details on which the arguments rely.⁶

Potential beneficiaries from the Weather Ledger pilot

Project managers and contractors are perhaps the most important stakeholders in compensation events, as they are responsible for driving the majority of the process forward, coordinating the retrieval of necessary information and overall management of their respective side's part in the process. As such, these two roles are likely to be the key beneficiaries of a technological solution to improve and streamline the coordination of the process.

Those in HQ functions are also likely to be beneficiaries of an automated CE process, in that having a digital tool that collates all required data, with a fully traceable and immutable ledger of the contract clauses, communication, guidance and evidence and with annexes that provide for the possibility of pre-defined hurdles in the process, there is a greater degree of certainty that legal officers can apply to determine just cause for a CE decision. Using a shared (distributed) ledger to increase levels of objectivity with regards to the history of data, what was communicated and when, allows more focus to be placed upon the effect of the CE as opposed to its validity. This would greatly reduce the time spent by legal, insurance and corporate risk workers on the administrative parts of the process, freeing up their time to determine next steps and wider legal implications.

It has been noted in expert interviews that whilst automation for weather related compensation events would be useful to industry as a whole, it could be of particular interest to those that are more likely to be affected by extreme weather conditions, such as those operating in sites on the coast.⁷ In this circumstance, an automated solution could be linked with tide tables or shipping forecasts so as to provide the maximum amount of data to work from.

Other instances in which automation of this type could have significant impact include the bidding stage, where having highly specific forecasting data for the specific area could help to inform the ways in which contractors will manage risk, for example if high or even medium strength winds could prevent crane activity from being carried out safely and effectively.

Interviewees indicated that any solution should be easily accessible, with an interface that is intuitive and similar to commonly used electronic devices, that allows for clear and efficient notification of one-in-ten year weather events, informs all participants of the current status of the application and what is required next, and gives the specific data required in an accessible format.

Interviewees have also suggested that high levels of granularity would be key to ensuring the most optimal automated solution. Providing readings for metrics such as wind speed, if it was raining, cumulative rainfall, humidity and ambient temperature, all at particular times of day, would assist in the planning of construction activities for the day and what is feasible to do and when.

Having specific data to reference at relevant locations for these types of metrics would also help to ascertain the objective facts of a particular event, and save the potential time and effort that may arise from working up a claim that there is no redress or recovery from.

Challenges within the compensation event application process

Interviews with industry experts have revealed several points of contention and a lack of clarity within the current claiming process. This section explores some of the key challenges that stakeholders can face within both the current process, and with any solution to be piloted, such as the Weather Ledger.

Whilst every event is different and management will differ from organisation to organisation, the process of claiming on a weather compensation event involves several processes and many individual stakeholders throughout the different stages. Typical parties to a weather compensation event will include those operating on a site such as engineers and planners, as well as more office based participants such as quantity surveyors, project managers, contractors, sub contractors, commercial officers and legal representatives.

The transactional nature of a weather compensation event means that there are several moving parts within the process, each with their own requirements, challenges and points of contention. This process can become extremely time consuming, as the data capture, information exchange and contract administration between parties are relatively manual processes that take significant amounts of time.

For a compensation claim to be valid, it requires:

- a measurement of the actual weather conditions at the location stated in the contract, which is either on site or at a nearby weather station recorded before the completion date for the whole of the works
- that it is shown to occur on average less frequently than once in ten years
- that it is reported as an “early warning notice” (including “defined costs”) to the client within 30 days of the event

To simplify the weather related CE process for submitting a claim, following the event in question, the project’s contractor is required to notify the project manager within a period of seven days. Following this, the project manager will advise the contractor to submit a quotation that will either be accepted, chosen not to proceed, suggested to be revised, or otherwise decided upon by the project manager. From the contractor’s perspective, a best case scenario would consist of this process being completed in a timely fashion, resulting in an acceptance of the claim. Interviewees have noted the use of contract management software to ensure adherence to NEC3 guidelines and ease the reporting of the event.⁸

However, the interceding parts of the process often become mired, when issues of data criteria, mistrust and legal processes are called into question.

Accuracy and validity of data

NEC3 stipulations on weather related CEs require that to qualify for compensation, adverse weather must not only be severe, but that it has not occurred at that scale within a 10 year average.⁹ Conversely, an alternative suite of contracts authored by Joint Contracts Tribunal (JCT) determines that an event is valid in instances when the weather is ‘exceptionally inclement’ for the time of the year in the project’s location, but only gives scope for an extension of time, without providing additional money. One interviewee noted that amongst his peers it was not felt that either of these provisions are the fairest or most efficient ways of determining a sufficiently severe weather event.¹⁰ Whilst the NEC3 suite of contracts is the most prescriptive and simplified guidance for covering construction contracts in general and is intended to be founded upon the principle of equitable risk sharing, some have noted that it removes risk from the employer and places it on the contractor, meaning that the contractor often loses out.

This is only made more difficult when it is taken into consideration that weather stations collecting the data, whilst occasionally on-site, are more often in a different location some miles away, that may not have the exact weather conditions as the site of the disputed weather event. These incompatibilities mean that construction projects may be significantly set back by adverse weather conditions, but are unable to receive compensatory recourse under the current system. This is evident when looking at the claimability of events at sites such as airports and shipping ports, where severe weather conditions such as fog and high winds are not listed as claimable events, despite these events having the capacity to halt critical operations. There is therefore a strong case for validated weather sensors to be located on site.

Although interviewee insights have noted the usefulness of contract management software for actions such as notifying the relevant party about how much time remains on any given step of the claim, and helping to follow NEC3 guidelines, it is also noted that some software systems do not go so far as to notify when a one-in-ten year weather event has occurred, therefore enabling contractors to become aware of claims that they may be entitled to.

Insights from the interviews also suggested that these systems can be rigid and clunky, whilst relying on on-site staff to write retrospective records for dual/off-site staff to input the data into the system. As such, the time lapsed in inputting the information, and the process of relaying it between multiple parties before input could potentially cause the transmittance of misinformation that is used to determine the validity of a compensation event claim.

Mistrust within the construction industry

Trust between parties to a weather compensation event is of key importance when considering the benefits of an automated solution. Interviewees have noted an apparent level of mistrust that often exists within the construction industry, particularly around compensation events. NEC3 includes several clauses, of which the principal of neutral trust is one, so as to enable open collaboration and remove confrontations that may exist within other contracts.

However, the nature of business and the financial element of transactions mean that both parties will typically act in their own interests when executing the contract requirements. As such, a degree of mistrust arises from the apparent zero-sum game wherein one party must 'lose' and the other 'win' in a compensation event claim. Anecdotal evidence from expert interviews suggest that because of this, companies often work with the same partners that they have previously used and have had positive experiences with as a means of lessening the element of mistrust that may exist with alternative or new business partners. Essentially, those evaluating potential project contractors will likely tend to work with clients that they know they can make money with in 'the right way'. This limits expansion, exploration of alternative or more suited partners, and thus prevents any improvement on the status quo.

Legal implications of a smart contract in weather related compensation events

The utilisation of DLT as part of a solution has the potential to remove this element of mistrust, as the basis of distributed ledger is to coordinate data sharing between all relevant

stakeholders, ensuring a common view and consensus on statements of fact. This replaces trust with verification and radically transforms behaviours. Not only can data reside in such a distributed ledger, but also software programmes implementing algorithms and logic as found in industry standard contracts, such as the NEC3. These digitised contracts are termed 'smart contracts'.

Notable in discussions of a digital solution in weather compensation events are the legal implications of automation. In the current compensation relief process, several manual stages in a compensation claim exist that could be made considerably more efficient through the use of DLT, automating processes and verifications using consensus through a distributed ledger. Digitising processes through smart contracts would ensure consistent interpretation of the more boilerplate contract clauses, streamlining data sharing and notifications to all parties, triggered by factual data regarding the state of the weather.

The smart contract in this solution, as with current provisions of NEC3 contracts, would have a standard format and template that can be repeated and used in different construction projects, with parties to the contract having the ability to add and remove terms as per their negotiations.

The smart contract, as with any other contract, would be legally binding and as such must be written in a way that executes the necessary functions in accordance with legal precedence. The use of smart contracts in a solution for the Weather Ledger product would require careful consideration of how digitalisation would be incorporated into the process, looking in detail at aspects such as the certainty of contract terms and the ways in which they operate, so as to ensure that unintended consequences and actions do not arise due to non-specific wording or misunderstandings of how the process would operate.

In designing the smart contract, experts interviewed noted that one important function to include would be to ensure human checks and balances. For example, it could ensure that rather than an action triggering an automatic payment, it would merely trigger a payment request, enabling the relevant parties to actively confirm the action and provide an extra layer of protection. This is particularly important in establishing the contract at an early stage, as amending the contract further down the line could hold significantly more challenges both from a technological and legal standpoint.

Separating the terms of the contract into different layers and having a 'wrapper agreement' in which annexes and additions to the contract add further clarity would be of particular importance here, ensuring that as many relevant eventualities as possible are considered and provided for, therefore enabling the process to be significantly more streamlined and efficient.

The impact of technology on weather compensation events

The construction industry has an increasing level of adoption for digital technologies, albeit at a slower pace than several other sectors. When applied correctly, these technologies are shown to have a significant positive impact on productivity and efficiency. This section will explore some of the technologies that are currently used within weather compensation events, and benefits that can be realised from the use of IoT and DLT in the Weather Ledger pilot.

Weather compensation event stakeholders have already noted the benefits that contract management software can have in simplifying the process and improving the efficiency of resolving compensation events.¹¹ Furthermore, the UK Government has recognised the transformative impact that business information modelling (BIM) can have on the sector, enabling the construction and software industries to collaborate in a manner that enables 'opportunities and synergies for both'.¹²

The integration of DLT and IoT technology could have similar, if not greater transformational impact on the process of claiming for compensation events, primarily for reasons already noted in this paper.

Whilst contract management software is useful for indicating the timelines of actions, other relevant process milestones such as completed or in-progress actions are not tracked, meaning that relevant information is often held in several locations and across various software applications. Process automation and shared visibility through DLT has the potential to offer a compelling solution for the management of weather compensation events in construction, in-turn delivering the several benefits to all construction stakeholders.



Improved contractual compliance

Process automation can be configured to ensure adherence to NEC3 and NEC4 industry-standard contracts with strict early warning timelines, automate the audit trail, and reduce points of friction or dispute between stakeholders.



Minimisation of overheads

Automating event-based compensation reduces the burden placed on those in the back-office, and the risk of manual mistakes or reduplication of effort (for example, double-checking weather to ensure validity), thereby enabling them to redirect their time to other important areas of work and increasing productivity.



Improved supply chain resilience

Streamlining and automating the processes will likely result in a reduced number of payment delays, which currently disproportionately impact SME subcontractors. This is of particular relevance to public sector clients who are required to reduce payment delays and failures.



Reduced disincentives

The execution of a smart contract in compensation events minimises human factors to ensure all events are flagged. This in turn is likely to lead to more effective compensation relief, in addition to better risk and pricing of contracts.



System integration

Digitising processes with open application programme interfaces (APIs) leads to greater extensibility and interoperability with other key construction related technologies, including future versions of BIM, data analytics tools, and project management systems.

Potential barriers to adoption

Whilst there is a compelling argument for the adoption of distributed ledgers and IoT to improve the process of claiming for weather compensation events within the construction industry, issues also exist that could potentially act as barriers to adoption. This section looks at some of the key cultural and financial barriers, including the industry being a technological laggard, financial disincentives and the costs of capital expenses at a time when industry is shrinking its innovation expenditure.

Cultural

The construction industry in the UK, as with many other industries, is increasingly introducing technology into daily operations, with programmes such as building information modelling (BIM) taking centre stage in terms of innovation. However, although the industry is beginning to increase adoption, historically, technological adoption has been significantly slower in construction than in other industries. One interviewee noted that the traditional nature of the construction industry means that despite seeing the benefits that technological advances may have on business and operational functions, diffusion of technology has been slow. Industry experts have noted that whilst there are several innovators in industry who have fully implemented technology and now benefit from it, there are significantly more laggards in industry, who are struggling to catch up.¹³ As such, although the implementation of a solution using IoT and DLT may improve the process of weather based compensation events, the struggle may lie in changing attitudes towards technological adoption.

Financial

A barrier to adoption may also lie in the fact that the current compensation process, although often fragmented and disjointed, benefits some players more than others, both financially and commercially. One interviewee noted that as companies involved in weather compensation events make a lot of money from the status quo, there could be commercial disadvantage from streamlining and automating the process and using more accurate data. Financial disincentives to streamlining the current process through a technological solution have the potential to halt integration of a solution that would otherwise have the potential to revolutionise the claims process. As such, a policy incentive to require adoption as an industry standard may be the most useful method of mitigating the impact of this barrier, and would also serve to support the UK Government's wider interests to reform the sector.

Barriers to adoption of a new technological solution may also exist in terms of the expenses that would be required to implement and roll out the solution. As previously noted, weather compensation events are often few and far between in the construction industry and as such, financial controllers within industry may hesitate to invest capital in the technology, particularly at a time when the construction industry in the UK has reduced its innovation activity.¹⁴

Concluding remarks

A recurring theme throughout the research conducted for this report was that although project-altering weather conditions are frequently encountered within the construction industry, the threshold for compensation is extremely high, requiring the weather to be equal to or greater than the average of a one-in-ten year weather event, resulting in weather-based compensation claims forming as little as three to five percent of compensation event applications.

However, when weather related compensation events are submitted, despite guidance on how to proceed in the form of NEC3 and other contract templates, a large degree of subjectivity remains in the process. This renders it difficult to make swift and fully agreeable decisions between parties without multiple, often lengthy exchanges which are both costly and time intensive for both parties.

Designing a technological solution that is fully interoperable with existing software currently used in the construction and civil engineering industries, could provide optimal process productivity and efficiency for stakeholders in weather compensation events. Based on existing literature and interviews with industry experts, the capacity that DLT and IoT possess, including increased location specificity of data, immutability of data and transparency, could tackle the key issues of data accuracy, trust and contract execution in a manner that existing technological solutions have not yet managed to accomplish.



Appendix

In total, we conducted 11 expert interviews, those who have agreed to be included are listed below:

BAM Nuttall

Adam Walker
Colin Evison
David Mitcheson

Clyde and Co.

Lee Bacon

List of questions asked in the expert interviews

Industry insights report: key questions

1. What are the key challenges facing construction at the moment? (clustering of categories)
2. Have they changed over the past few years?
3. What technologies do you currently use within construction? Are there subsets which are highly digitised or is it widespread across?
4. Do these solutions serve the challenges that you have aptly?
5. How many compensation events (CE) happen in a year on average?
6. How many of these CEs are related to weather conditions?
7. Have you considered or used other methods to calculate weather related CEs? If so, what are they?
8. What impact do adverse weather conditions have on efficiency / productivity. Do you know how much it has impacted ROI and other important KPIs?
9. Is the process to deal with adverse weather conditions straightforward? Who is involved in the process of dealing with the dispute resolution for this?
10. What could improve the process for dealing with adverse weather conditions within construction?
11. Ideally, what would be implemented to resolve this issue? Would you consider compensation automation?
12. What does 'trust' mean within the industry? Where does trust come from - existing relationships with other companies, particular people you've worked with in the past, or trust in the contracts you've drawn up between each other?
13. How well are DLT/IoT understood within your company and within industry? Are you aware of the benefits that these solutions can bring?
14. Would you consider a solution utilising DLT and IoT?
15. Would there be an impetus to invest in the implementation of these solutions. What are the barriers? Why have solutions been explored / not explored?



User insights report questions

1. How many contractors/subcontractors are involved in a typical NEC?
 2. What is the average duration of a NEC project?
 3. What is the formula to calculate weather related CE? (there seems to be some ambiguity on how the calculation is done, any precise guidance will be useful)?
 4. Who is involved in a weather compensation event and when? Project managers? Workers on site? Legal office? Etc.
 5. What impact do adverse weather conditions have on your supply chain (subcontractors)? For example on revenues, cash flows, scheduling etc?"
 6. "Which tasks in weather disputes take up the majority of your time / cost? What kind of scale of effort is required from you on these, e.g. percentage of your time, or days per year etc"
 7. where does trust/mistrust come from in the current process. What are the chief areas and causes of contention. Where does the process get too heavy/mired in legal review. What are the worst and best-case scenarios?
 8. Route to adoption for digital technology within construction, key decision makers within large companies - who controls budgets?
 9. What do you understand as a weather related compensation event?
 10. Describe the early warning notice sequence
 11. Describe the compensation event sequence
 12. How frequently do you get involved with this?
 13. Understand their day to day activities around this
 14. When do you get notified about a compensation event? How does it happen?
 15. If an early warning occurs what do you do? Could you walk us step by step?
 16. If a CE occurs what do you do? Could you walk us step by step?
 17. Understand pain points
 18. What admin do you have to do? Could you walk us step by step?
 19. Where / when do arguments occur?
 20. Understand high return x low cost opportunities
 21. Where do you think the quick wins are?
 22. Vision of ideal scenario
 23. Which steps could be improved? What would you automate?
 24. What do you think is an ambitious vision of the future for this system?
 25. What would be the barriers to this?
 26. Validate our flow
 27. Does this look right?
- Wider industry:**
28. How painful are compensation events for your organisation?
 29. Do you already, or, aspire to, use technology to solve this problem?
 30. How could we educate your organisation and the wider industry about this?
 31. Who or what could block this from being used?
 32. Who would give the green flag for this being used?
 33. What proof do you want to see before this can become something you would adopt?

Endnotes

- 1 <http://www.stevencevans.com/nec3-compensation-events-a-practical-guide/>
- 2 <https://www.neccontract.com/About-NEC/How-NEC-Contracts-Works>
- 3 NEC and the Weather Webinar
<https://www.neccontract.com/NEC4-Products/NEC-Webinars/Past-webinars/NEC-and-the-Weather>
- 4 Expert interviews conducted by Digital Catapult, May 2020
- 5 Turner & Townsend, Q3 2019 UK Market Intelligence,
<https://www.turnerandtowntsend.com/en/perspectives/uk-market-intelligence-q3-2019/>
- 6 Expert interviews conducted by Digital Catapult, May 2020
- 7 Ibid.
- 8 Expert interviews conducted by Digital Catapult, May 2020
- 9 Notes for seminar - Compensation events procedure and assessments under the NEC3 Engineering and Construction contract (Third Edition), Bezzant Limited
https://www.ceca.co.uk/wp-content/uploads/legacy-media/96888/seminar_notes_-_386e_-_compensation_event_procedure__assessment_under_the_nec3.pdf
- 10 Expert interviews conducted by Digital Catapult, May 2020
- 11 Expert interviews conducted by Digital Catapult, May 2020
- 12 HM Government, Industrial strategy: government and industry in partnership, Building Information Modelling
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/34710/12-1327-building-information-modelling.pdf
- 13 KPMG, Future-Ready Index Leaders and followers in the engineering & construction industry Global Construction Survey 2019
<https://assets.kpmg/content/dam/kpmg/xx/pdf/2019/04/global-construction-survey-2019.pdf>
- 14 Department for Business, Energy and Industrial Strategy, UK Innovation Survey 2019: Headline findings covering the survey period 2016 - 2018
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/873740/UKIS_2019_Headlines_Findings.pdf



Digital Catapult is the UK's leading advanced digital technology innovation centre, driving early adoption of technologies to make UK businesses more competitive and productive and grow the country's economy.

We connect large established companies, startup and scaleup businesses and researchers to discover new ways to solve big challenges in the manufacturing and creative industries. Through this collaboration businesses are supported to develop the right technologies to solve problems, increase productivity and open up new markets faster.

As well as breaking down barriers to technology adoption for startups and scaleups, our work de-risks innovation for large enterprises and uncovers new commercial applications in immersive, future networks, and artificial intelligence technologies.

Digital Catapult provides physical and digital facilities for experimentation and testing that would otherwise not be accessible for smaller companies.

For more info please visit: www.digicatapult.org.uk