IS THE LONGBOW BETTER THAN THE CROSSBOW? EMERGING ISSUES FROM MOBILISING A LONGITUDINAL STUDY ON A MEGAPROJECT

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ABSTRACT

Longitudinal studies of occupational safety and health (OSH) outcomes in construction projects are rarely conducted, due to the financial, practical and ethical difficulties of studying people, projects, and organisations over extended periods of time. Traditionally, OSH research in the construction industry is cross-sectional – where a 'snapshot' is taken, often with a retrospective view. The focus of this paper is the mobilisation of a longitudinal research study investigating OSH policy in an eight-year infrastructure megaproject in the UK. The research examines implementation of the project's "transformational" OSH strategy, in order to develop new understandings of the effectiveness of OSH interventions. The research design uses a "strategy as practice" lens and traces the various strands of OSH policy, from development to their adoption as practice. The research context is complex, due to the complicated contractual arrangements. The research design incorporates a rarely used "tracer" methodology. During the mobilisation phase of the research project, several challenges were identified, including interpretation and implementation of this tracer methodology, coping with a large team of researchers, obtaining ethics approval and establishing the governance structure, deployment of the team to the site, ensuring consistency in the data collection, managing data sets, and the reliability of the coding. The methodology adopted is time-consuming, and the very large data sets that are generated need to be managed. Complex research project management structures and processes are required, which would not be needed for traditional cross-sectional studies. Sufficient time needs to be allowed at the start of such research projects, in order to put the necessary systems in place. The paper will be of interest to OSH researchers and those contemplating longitudinal studies, particularly those employing a tracer approach.

Keywords: complexity, longitudinal research, megaprojects, occupational health, strategy

1. INTRODUCTION

This paper provides insight into the mobilisation of a unique longitudinal study of OSH policy deployment into practice on a construction megaproject. The project being studied is a water infrastructure project, where a 25 kilometre-long tunnel is being constructed

under a major river, and is scheduled for completion in 2023. The funding for this first phase of the study, provided by the Institution of Occupational Safety and Health (IOSH), covers the first three years of the eight-year construction project. The project provides a unique opportunity to study the impact of OSH leadership, policy and practice over an extended period "in-flight" (Pettigrew, 1990) using a longitudinal approach, i.e. collecting data over a longer time period or arrow flight (Woodward, 1970; Chau and Witcher, 2005).

The project has a high degree of complexity (Baccarini, 1996), due to complicated contractual arrangements. The management company is supervising three construction consortia and a further company responsible for the installation of the overall control system. The contract itself is based on NEC 3 (ICE, 2013), which is designed to foster a high degree of collaboration between the parties. The research team consists of three academics and four postdoctoral researchers (RAs) at a UK university working on a part-time basis. The academics, including the project leader, provide direction and oversight. The four RAs have specialisms including occupational health practice, design, quantity surveying, and project management. The team has considerable experience in OSH research, including in-depth knowledge of OSH on several internationally recognised infrastructure megaprojects, e.g. Terminal 5, the 2012 Olympics, and Crossrail.

The objectives of this research are to reveal new approaches to achieving desirable OSH outcomes, together with in-depth knowledge of how they can best be managed through the process of implementation. The research will also identify the practical lessons, knowledge, and good practice that are developed and can be shared with the wider industry.

In this paper we discuss the challenges that the research team has encountered during the initial mobilisation phase of the research, and the ways these have been addressed. This will provide insights into the use of longitudinal approaches in the OSH research field, so as to inform debate about the ways in which translation of H&S policy into practice is studied. The study is at a very early stage, having only recently been mobilised, and therefore the focus of this paper is on the team's experiences during this initial mobilisation phase of the research project.

This section has provided an outline of the context of the study and the aims of the research. The following sections provide an overview of the relevant literature, a discussion of issues arising during mobilisation, and how they were dealt with, and reflections on the practicalities of longitudinal research.

2. LITERATURE OVERVIEW

The majority of social science research is cross-sectional rather than longitudinal, and it employs quantitative rather than qualitative methods (Bryman, 2012). Menard (1991) defined longitudinal studies as studies where data is collected over one or more time periods, where the subjects, or cases, are the same, or comparable, from one period to the next, and where the analysis involves comparisons between periods. He defined cross-sectional studies as studies where data is collected once for each item over a narrow space of time, such that the measurements can be considered contemporaneous for all variables and cases.

In medieval military terms, a cross-sectional study can be likened to a crossbow, which is relatively easy to use and doesn't need intensive training, and where early versions had limited accuracy, sophistication and range. The cross-sectional approach takes 'snapshots'

at the time the study is conducted, and the findings are then extrapolated backwards and forwards, outside of the time frame in which the data was collected (Yin, 2003). This method relies heavily on a combination of the recollections of research subjects and on data derived from lagging indicators. By contrast, longitudinal studies can be likened to longbows, which are more accurate, have a faster firing rate, and provide more flexibility in battle, but require more skill. Longitudinal studies need experienced researchers who can 'fit in' to organisations, cope with a greater rate of data collection, and be more adaptable to deal with changes to their area of study which emerge over time. Such studies also require more commitment from industry collaborators to provide good access over sustained periods.

In his keynote paper at the 2014 CIB W099 conference in Lund, Sweden, Andrew Hale challenged the research community about the lack of longitudinal studies covering OSH in construction (Hale, 2014). Pettigrew (1990:284) stated that "longitudinal research in the social sciences has always been a 'minority taste' research into industry practice".

The aim of the research is to develop new understandings of the deployment of the OSH strategy, and the effectiveness of the resultant OSH interventions in large, complex multi-site construction projects with networked supply chains. In other words, the research will be monitoring change within the organisations involved in the construction projects. Menard (1991) states that the two primary purposes of longitudinal research are "to describe patterns of change" and "to establish the direction […] and magnitude of causal relationships". As such, using a longitudinal approach allows the study of the OSH interventions as they unfold, revealing not only their effectiveness, but also the ways in which OSH policies and practices intersect and intertwine with other organisational agendas. A recent study in the construction safety field revealed that out of a sample of 88 papers published in 2009, 50% were quantitative research-related, 25% were qualitative research-related, and only 10% were mixed-methods research-related. OSH studies, particularly in construction, have generally been cross-sectional. The paper called for more mixed-methods research, so as to improve generation of knowledge, as well as collaboration between researchers and practitioners. Menard (1991) states that the term "longitudinal" does not describe a single method, but rather a collection of methods, which is also the approach adopted for this study.

The tracer methodology has its roots in seminal work by Woodward (1970), who used it as a method to explore managerial control systems across three case studies. There are specific terms associated with this methodology. Tracers are the processes that are of interest and are traced during the research. Tags are a means of identifying items or ideas that are to be followed. Manufacturing processes were selected as tracers to be followed through the control systems of the organisations. The interactions of the staff and their behaviours were observed in terms of how they were involved in planning, making decisions, and carrying out tasks related to the tracer (Woodward, 1970). This allowed a broader understanding of the control systems, by studying smaller elements, or subsystems, from which more focused data collection could take place as the study evolved over time.

The approach was further developed by Hornby and Symon (1994), who provided a structure for examining the perspectives of stakeholders on processes in which they have participated. Cassell and Symon (1994) refer to organisational studies as being about highly complex processes which have a variety of actors over their time span. They promoted the

use of tags attached to tracers, which are followed to identify the important processes and key actors pertaining to the research focus, as well as critical documents, events and activities.

Using this methodology, the research team will be able to follow whichever processes and people emerge as relevant to shaping OSH outcomes, rather than making an assumption that the issues and influences relevant to OSH are all known from the outset. The methodology allows a variety of research avenues to be opened up and closed as their relevance is established. In this respect, the method is particularly effective in examining the effect of specific interventions as ongoing activity. In other words, the aim of this type of study is to iteratively examine emergent issues collected through interviews, and to build upon and respond to these in later stages of the research endeavour (Chau and Witcher, 2005). The approach is particularly apposite, in that it uses tried-and-tested research data-gathering techniques (e.g. interviews, observations, and documentation reviews), but within an innovative longitudinal framework. It allows data collection to be focused in specific areas of interest, thus making the data set more manageable, and it enables better understanding of the big picture, by looking at small elements of the organisation, rather than everything at once.

3. ISSUES ARISING DURING MOBILISATION

The mobilisation of the research consisted of a number of elements, some of which ran concurrently, including establishing the research methodology, mobilising the research, establishing the governance structure, obtaining ethics approval, and commencing the data-collection and -analysis phase of the project. This section describes the research mobilisation period from February 2016 (the official start date of the project) to December 2016, when Milestone 1 was successfully achieved. The following subsections describe the issues that arose, and how they were dealt with.

3.1 Establishing the methodology

From the outset, there was considerable debate as how the research methodology should be applied, and this continued as the project progressed. A key facet of the methodology used in this study is an adapted version of the longitudinal tracer study methodology (cf. Chau and Witcher, 2005) that was originally developed by Woodward (1970). In essence, the application of a longitudinal tracer approach allows core organisational processes or phenomena to be isolated and their progress to be followed via insights gathered at particular stages of their development.

Tags are being used to identify the important processes and key actors pertaining to the research focus, as well as critical documents, events and activities. By tagging particular people, processes and tools, the effects of interventions can be studied in real time. The choice of tags is crucially important to the success of a tracer study; tags should be relevant references to respondents, they should be malleable enough to enable issues to emerge, and they should provide sufficient data to generate and develop theory. It is essential that tags are grounded in practice and developed in collaboration with the industry partners, in order to ensure that fruitful opportunities are exploited. This is an emancipatory methodology, responding to the complex network of organisations and the approach that the people, teams and organisations are taking, and focusing on the nature, complexity and risks involved.

The flexibility of the methodology caused the research team considerable problems right from the start. Each of the seven team members had their own interpretations of what the methodology meant and how it might be deployed in practice. Team meetings would end up with long periods where the different viewpoints presented and what was meant by the various terms would be discussed. After several interesting but inconclusive discussions, a visual representation was developed, used both to stimulate ideas *and*, more importantly, to provide more focus. This resulted, after several more sessions, in the diagram shown in Figure 1.

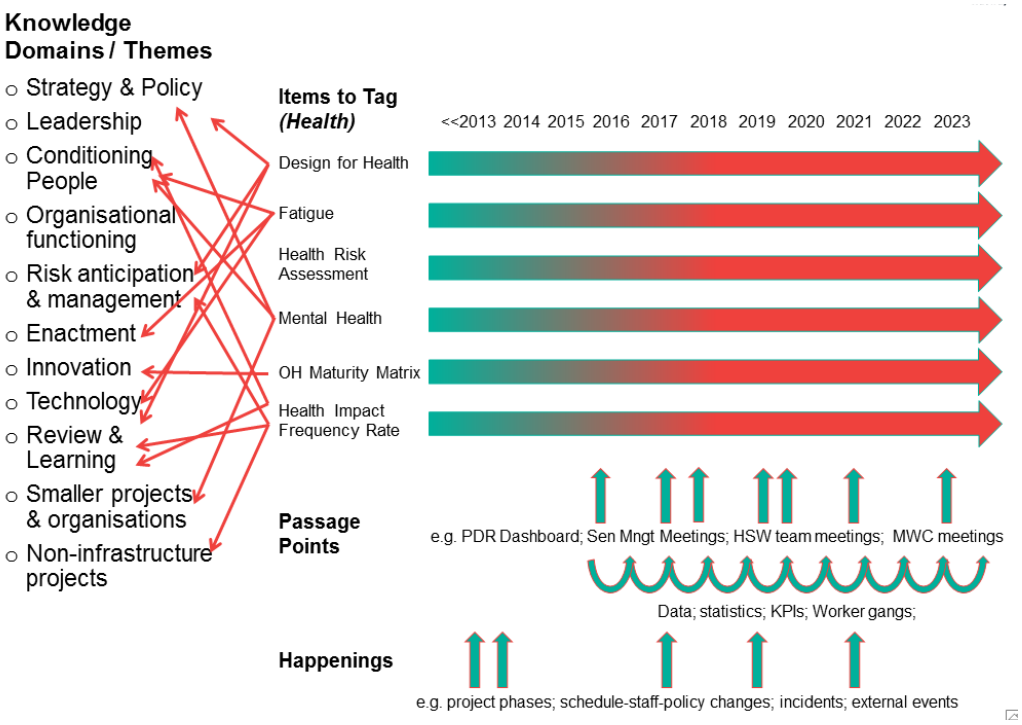

Figure 1: Tracer methodology schematic

The research team had to decide on how *they* were going to use and adapt the methodology, rather than stick with the latest existing interpretation. This helped the team reach consensus as to how the methodology was to be developed and deployed. The next task was to clarify the terminology that was to be used in the current context, namely themes/knowledge domains, tags, tracing, passage points, and happenings. This crystallised the team's thinking and provided a consistent message to communicate to others about the research methods.

Overarching themes, or knowledge domains, as shown in Figure 1 above, are the key areas covered by the study, which, based on the OSH literature, are likely to be of interest to practitioners and academics in the field of OSH strategy and implementation. Tags will be used to identify things that we are interested in, such as specific interventions or initiatives (e.g. inductions, and onboarding), and broader initiatives (e.g. mental health, and design for health). These tagged items or ideas can be traced, in order to see how the relevant areas of strategy are implemented over the project life cycle, and how this implementation is affected by other factors. The things that are tagged will be subject to change as the project moves forward – for example, project induction might evolve into a different format, and

the research will seek to identify the nature of the change, the causes of the change, and the impact on other tagged items and on the project outcomes. In terms of collecting data, passage points can be used in the same way that a suitcase tag would be checked on various occasions at different airports during the suitcase's journey. In this context, passage points will include meetings, interviews with key players, and KPI (key performance indicator) data.

Another phenomenon of interest is the 'stuff' that happens during the course of a project (the happenings), which affects the way the project is enacted, OSH performance, and resultant outcomes. These may be internal-expected (e.g. project phases, etc.), internal-unplanned (e.g. changes in key personnel, or incidents), or external (e.g. Brexit). A log of happenings relevant to the project will be maintained, so that the team can check how these affect the things that are tagged.

There was also considerable discussion of the theoretical perspectives to be used in the study. Given the fact that the topic under study was the implementation of strategy, the use of a "strategy as practice (SaP)" lens was considered a good fit by the team (Pettigrew, 1990, 1992; Jarzabkowski, 2004; Whittington, 2006). Further review of the literature established that work in the "organisational change" field (Tsoukas and Chia, 2002) would also aid in the understanding of how policy is translated into practice. The SaP lens will be used to examine the various strands of OSH policy, as they are traced from their development through to adoption as practice. Due to the emergent nature, both of the methodology and of the research being conducted, these discussions are ongoing but are increasingly more focused.

3.2 Mobilising the research

The research team took several months to assemble. Each of the RAs was allocated roles and responsibilities for the various activities according to their knowledge and experience. Each led on one or more subject areas, in addition to being allocated to build relationships with one of the joint ventures or the management company.

Following allocation of roles and responsibilities, the original research plan from the proposal was then updated, and revisions were approved by the IOSH. A high-level research plan was produced, covering the initial three-year research period. From this, detailed research plans were produced for individual elements of the Milestone 1 deliverables. The plans for the individual elements covered familiarisation with the topic and the staff involved, data collection, data analysis, and preparation of outputs. The plans are reviewed on an ongoing basis.

The initial team meetings were sometimes a little unproductive, as the team strove to develop the processes necessary to manage the project. As with any new team and/or project, the personalities involved need time to 'gel' together (or not) into a cohesive performing team. Geography was an additional challenge, with two RAs living 1–2 hours' drive away from the university, and the project being studied being a two-hour train journey away and involving sites located all over the city. This challenge was mitigated by having weekly meetings at the university – in person if possible, or via Skype. Other collaboration tools were used with varying degrees of success: OneNote, Slack, Google Docs, and good VPN (virtual private network) access to the shared drives. The meeting structure has evolved over time, as different approaches were tried, and they were discarded if they were

found not to work. The RAs meet together and with the lead academic every two weeks, and monthly as the entire team. There are separate monthly meetings between the main site-based researcher and/or the lead investigator and the industrial HSW (health, safety, and well-being) director and HSW leader, and regular meetings with the IOSH project manager.

After nine months, several particularly useful project management processes have been introduced, including the use of a standard slide pack as the review meeting agenda and to capture actions, adoption of a rotating chair and minute taker, to enable the leadership role to be shared across the RAs, and producing a document where the responsibilities of each team member (including ownership of particular key files, processes and records) were outlined, so as to give greater clarity of what was required from each person.

There were considerable advantages to having four RAs, as they have a vast range of experience and many ideas, resulting in cross-pollination of ideas. There were also some major disadvantages, in terms of the extra time needed to share information, the time needed to reach consensus, and coping with different styles of working. There was also an inherent perception among other project parties that we had four RAs who were 100% attached to the project, and it was easy for them to forget the 1.6 FTE (full time equalvalent) time restriction. A key consequence of having four rather than two RAs was the increased proportion of available researcher time spent at meetings – so that a one-day meeting involving all four researchers used up half of the week's total allocated time on the project. There was also the recurrent challenge of meeting deadlines for written outputs, due in part to the pressures of each RA needing to simultaneously work on their own outputs and comment on those of others. Better research planning and realistic allocation of time to the RAs will be required as the research progresses. For example, it was suggested that for future outputs, there will be a lead writer and a second support person, so as to minimise the number of team members involved.

A key enabler to building an effective research team was the fact that the personalities involved were able to reach a suitable compromise position for any issue that came up during the mobilisation. This point should not be underestimated, as research staff and academics are, by the nature of their work, often highly skilled at putting a viewpoint across and defending it against all comers. With a less collaborative team, it would have been much more difficult to make progress. What enabled the team to be more collaborative was using a rotating chair for the project meetings, rather than selecting one RA as the leader. By contrast, a more autocratic approach may have been more task-focused, but it would have been less effective, as it would have stifled debate and creativity. The methodology allows much flexibility in how data is collected and analysed, which suits a more cooperative approach to an emergent topic of study. What was needed was better project management, which was eventually achieved through the meeting structure and the rotating leadership model that evolved.

A series of initial research questions were developed to guide the investigation and collection of data, namely the following:

- How does OSH policy translate into practice on major construction projects?
- How is OSH policy propagated through complex organisations created by megaprojects?

- How effective are the OSH interventions that are implemented on megaprojects, and how have they been managed?
- Which findings will be of most relevance and use to industry practitioners and researchers?
- How do people cope with complexity and change in megaprojects?

These research questions are emergent due to the longitudinal nature of the research and the topic(s) under investigation. At research team project meetings, the topics are reviewed to determine which topics will remain under active investigation.

3.3 Governance structure

The governance structure for the project is a vital area of concern, given the research topic and duration. There are multiple stakeholders, whose needs must be taken into account and managed, and so a number of groups have been set up. An overall steering group represents the main stakeholders in the research and other key industry representatives. This includes the IOSH as the main funding body, which is keen to see that there is a focus on practical outputs for OSH professionals, as well as wider social and economic impact. In addition, there are two reference groups, from industry and academia, respectively, to provide sounding boards for findings and to maximise the applicability in terms of impact and benefit to the broader construction industry (e.g. smaller projects and other construction sectors) and the research community. Formal reports will be produced annually, with interim reports issued as necessary.

The governance structure provides the necessary independent oversight through the steering group and input from the reference groups. Management of these groups requires significant amounts of time for making preparations and arrangements for meetings and associated workshops. This has, on occasion, threatened to detract from the main research activities of collecting and analysing data. It is important that the governance process is proportionate and adds value to the overall research over the life of the project.

3.4 Ethics approval

Approval from the university ethics committee was required. The submission made to secure this included consideration of the following: the details of the project, the research team's experience in the methods proposed; participant information; observation/recording; consent; participant withdrawal; storage of data, and confidentiality; incentives; risk assessment; and declarations. As the research was mobilised, a number of research protocols and related documents were developed, namely a research overview, a consent form for recorded interviews, information sheets for interviews, observations, and meetings, an action research log, and a researcher diary.

There were several minor issues in relation to ethics. The first was the lack of understanding by the ethics committee of the realities of carrying out research on live construction sites. This was overcome by revising some of the initial material in the submission, and by meeting with the committee chair to discuss the research. The need for written consents for recorded interviews can discourage participation by some subjects, and, in fact, in two cases participants were happy to be interviewed and recorded, but unwilling to sign a consent form. These interviews proceeded with handwritten contemporaneous notes being taken, instead of recording.

In the case of a longitudinal study, there are a greater number of consents to be obtained, and there is the issue of researchers influencing outcomes in the organisations being studied. As participant observers, there is the risk that the researchers may influence the activities under observation. Some of this influence may be incidental, but some will be a direct result of the role the research team is playing, particularly as the project is keen to learn from the research team's work, and to adapt what they are doing. There is, therefore, an element of 'action research' in the approach. A protocol has been developed, which includes a log for documenting any activities that may influence how things are done.

3.5 Data collection and analysis

Data collection will be based mainly on qualitative methods, where interviews, archival analysis, and observation will be used. In addition, focus groups and surveys will be employed as a means of triangulation for any findings. The management company has been very supportive of the research, from board level downwards. Involvement in the research was contractually written into the works information, and this was seen as part of the transformational approach to OSH. The process of gaining access to work on the project was complex and consists of three stages on three or more separate days: attendance at the central onboarding facility (COF), for security and health checks; attending the employer's project induction centre; and, finally, site induction for any site to be visited (including office locations). All researchers are required to have a Construction Skills Certification Scheme (CSCS) card, as this is a requirement of all those working on the project, including office staff. Anyone who wishes to enter the tunnels will need to attend a tunnel safety training scheme course.

Initially, the research team had to learn about many different things at once, but this had to be balanced against the need to work within the team's allocated resources. The project OSH policies have to dovetail with those of the Tier 1 joint venture contractors (and their parent companies), and they are therefore likely to take different paths as the work progresses. Interviews with the key practitioners acting at these intersections will be used to reveal the interrelationships between these policy trajectories. The study of the phenomena emerging at these intersections will include reviewing specific OSH-relevant metrics (e.g. accident/incident data) and other data (e.g. minutes of meetings, documents, and newsletters, etc.), in order to explore the contexts and effects of policy implementation over time.

Building relationships has been important, and locating the team members alongside specific units of analysis was important, i.e. one researcher for each contracting consortium, and one for SI (systems integration) and the management company. This will allow the team to have a deeper understanding of the politics involved in the project, and the drivers in different parts of the project. There are geographical and logistical issues, due to the large number of sites (there will ultimately be 24 main sites and a main office), their accessibility, and the need to attend meetings at various times of the day. All this led to some initial inefficiency, but this has been overcome through better visibility of the on-site activities of the research team members, and better planning through calendar sharing.

Over time the data set has grown rapidly, and the data analysis needs to be carried out in a timely and efficient manner. Not knowing what might become important may lead to continuing to collect data, which might or might not be needed at some point in the future.

In the first nine months, the team carried out 49 interviews, observed 57 meetings, and undertook one survey. To aid management of the data, the team is starting to index files using meta tags (not to be confused with the longitudinal methodology tags) within an overall shared file structure, accessed via a VPN connection when away from the university.

A key area of discussion has been the use of NVivo for coding and analysing data, which is labour-intensive. Coding and indexing data is not made easier by the evolving nature of the research questions, which increases the risk of data having to be repeatedly recoded or refiled. Gaining agreement on coding structure has been time-consuming. Consistency of coding between different researchers will need to be managed. The team is already on its second iteration of the shared file structure, and is about to relaunch its third coding structure.

4. REFLECTIONS ON UNDERTAKING LONGITUDINAL RESEARCH

So is the longbow better than the crossbow? The answer is simple. It depends on where you are in the battle cycle, what fighting resources you have at your disposal, where the battle is taking place, how skilled your troops are, and how you plan to overcome the tactical challenges presented. Longitudinal research is similarly challenging.

The challenges identified in mobilising such research have included the following: the interpretation of a little-used longitudinal methodology within a large research team; establishing a governance structure for long periods of study; ethical considerations; data overload, from too many lines of inquiry and easy access; consistency of data collection; and the challenges of inter-rater reliability in coding. Other features, which have been covered in less detail, have included frustration at 'missing' the action, and the inherent uncertainty in working with ideas of organisational becoming. Further publications during the course of the research project will be able to provide more details on specific challenges.

Carrying out longitudinal research on such a large scale is a significant undertaking, and the team has a large amount of data which they need to make sense of in order to meet the research aims and objectives. The team has worked hard to mobilise the methodology and devise a project management approach that suits the needs of all stakeholders. The project is at a stage where the team needs to become more focused and concentrate on producing high-quality outputs. The processes introduced, e.g. the meeting structure, and the indexed shared file structure, are starting to regulate how the team operates and make it more efficient and effective within the resource constraints. The opportunity, provided by this unique study, to make a difference in how learning about OSH in megaprojects is generalised for use by the wider industry needs to be carefully managed to a successful conclusion. This is being made easier by the unrestricted access to all areas of the project – both people and data. The team are totally committed to the task, but they will need to bring all their experience to bear.

From a research community point of view, the study has already revealed some interesting insights into the application of longitudinal studies versus cross-sectional approaches. The relative advantages and disadvantages of the two approaches observed from the mobilisation of this study are outlined in Table 1.

Table 1: Longitudinal (longbow) vs cross-sectional (crossbow) research

Longitudinal		Cross-sectional	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
Multiple data sources	Too much data; complexity of data	Short time scales	Limited data
Rich data	The time taken to mobilise	Quicker results	Triangulation can be challenging
Opportunity for triangulation	Takes longer to produce outputs	Lower cost	Limited understanding of context
Better understanding of context	High cost	Requires limited time on-site	Interpretation of results can be difficult
Better interpretation of results	Researcher objectivity – the risk of 'going native'	Ethics is easier	Difficulties in verification of results
Verification of results	Changes in the team	Reduced researcher bias	Remote working
Better validity of outputs		A smaller team	
		More focused	

It is too early in the project to draw firm conclusions regarding the benefits of using a longitudinal approach, and whether the benefits outweigh the challenges encountered. Certainly the team can see mistakes being made and fixed that may not have been revealed in a cross-sectional approach. Similarly, the team will be able to observe how OSH policies and interventions are developed and then discarded or changed during implementation.

5. CONCLUSION

A key feature of a longitudinal approach is the rich data set, which is both an advantage and a disadvantage. How the data set is managed will be key to the success of the project. Longitudinal studies with large teams need to allow time for setting up the project structures and processes required to manage the research activities. These are generally less complex in cross-sectional studies.

The data set emerging from this work will afford insights into the ways in which OSH policy instruments are enacted, mediated, translated and appropriated by a broad range of strategy actors engaged in the project. Understanding how OSH plays out within and across project-based temporary multiple organisations will allow for domain-specific insights to be generated, to address some of the specific issues that arise in this hazardous sector.

6. ACKNOWLEDGEMENT

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7. REFERENCES

Baccarini, D. (1996). The concept of project complexity—a review. *International Journal of Project Management*, 14(4), 201–204.

Bryman, A. (2012). *Social research methods*. 4th ed. Oxford: Oxford University Press.

Cassell, C. and Symon, G. (eds) (1994). *Qualitative methods in organizational research: A practical guide*. London: Sage.

Chau, V. S. and Witcher, B. J. (2005) Longitudinal tracer studies: Research methodology of the middle range. *British Journal of Management*, 16(4), 343–355.

Hale, A. 2014. Construction safety management: Do we know what works? *Keynote paper at the CIB W099 "Achieving sustainable construction health and safety" international conference*. Lund University, Sweden: CIB. 2–3 June.

Hornby, P. and Symon, G. (1994). Tracer studies. In: C. Cassell and G. Symon (eds), *Qualitative methods in organizational research: A practical guide*. London: Sage. pp. 167–186.

ICE (2013). *NEC3: Engineering and Construction Contract Option C: Target contract with activity schedule*. London: Thomas Telford.

Jarzabkowski, P. (2004). Strategy as practice: Recursiveness, adaptation, and practices-in-use. *Organization Studies*, 25(4), 529–560.

Menard, S. (1991). Longitudinal research: Quantitative applications in the social sciences. Newbury Park, CA: Sage.

Pettigrew, A. M. (1990). Longitudinal field research on change: Theory and practice. *Organization Science*, 1(3), 267–292.

Pettigrew, A. M. (1992). The character and significance of strategy process research. *Strategic Management Journal*, 13(S2), 5–16.

Tsoukas, H. and Chia, R. (2002). On organizational becoming: Rethinking organizational change. *Organization Science*, 13(5), 567–582.

Whittington, R. (2006). Completing the practice turn in strategy research. *Organization Studies*, 27(5), 613–634.

Woodward, J. (ed.). (1970). *Industrial organization: Behaviour and control*. Oxford: Oxford University Press.

Yin, R. K. (2003). *Case study research: Design and methods*. 3rd ed. Thousand Oaks, CA: Sage.