

Ontology, epistemology and methodology in construction research



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Introduction

Numerous construction projects are undertaken at TfL (Transport for London). Some projects provide an upgrade of existing assets, some projects maintain what we already have. Some projects, though, are completely new asset installation type projects which complement the primary business of TfL, which is the transportation of passengers. I am involved with the latter type of project and also upgrading asset types, where we install advertising assets that generate a secondary revenue stream to supplement the primary business income. As such, we are often faced with new key risks during a project lifecycle. Key risks can be identified using various methods, but we currently use a PMF (Programme Management Forum), a SLT (Safety Leadership Team) forum and the specific project teams themselves to identify key risks and prioritise them. How specific risks are managed will vary, but a common theme for all risks is to reduce the likelihood of them occurring and thus causing injury to our operatives on the field. Our specific business problem is the increase of injuries over the last few years. Thus, the purpose of this qualitative case study is to explore strategies that address these risks and potentially reduce these injuries.

Action research (AR) is one such method used at TfL that our team has used to solve and reduce specific risks. AR is fully underway with the likelihood that solutions would have been implemented within this year.

Manual handling and *working at height* are two such key risks identified though SLT and PLF. There are some other risks identified such as *behavioural safety*, *quality* and *slips trips and falls* but I focus on the former

two key risks to draw example. My initial thoughts for this research were to investigate the impact on reducing key risks using the AR process. The impact could have been undertaken by analysing safety accident and incident data within TfL and to look for patterns that could indicate the efficacy of AR on risk reduction. On reflection though, I observed that the AR process was solving very specific construction problems for us so we already had a sense of whether AR was working to solve a problem or not. I had serious doubts that I would uncover anything new in this area of research. Another approach I could have adopted was to explore the teams' attitudes towards AR. However, looking at our specific business problem which is that workplace injuries have been on the increase over the last 5 years, I could not consolidate the study to this problem.

Since, a solution for *manual handling*, would have been completed using the AR process by the time I would collate data I have decided to adopt an exploratory case study approach as provided by Pawson and Tilley's (1997) example. This may work better well with the TfL, AR project.

Manual handling, provided a solution where TfL introduced a new plant that is used to vertically transport our assets using escalators. The plant is modified specifically for our railway environment. The aspiration in solving this key risk is to eliminate manual handling altogether. Since its initial use it, the potential in achieving this aspiration, is more likely. However, further exploration into whether this plant is used and when it is used can be progressed further. There is scope to explore whether the proposed solution introduces new risks, or if problems arise due to the procurement method.

There is scope to investigate the "whole lifecycle" area of our solutions
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which includes the maintenance and obsolescence strategy of our solutions. An exploratory case study is one method of exploring these areas of interest.

Another key risk identified is *working at height*. The AR team provided several solutions to mitigate this risk. An evaluative case study would explore further if our initial intentions compare to what is actually happening in practice and on site. The exploration into how further to advance strategies that minimise the risk can be explored together with other strategies, through the interview process, which explore the effectiveness of AR, explore other risk strategies, and explore the experiences of the team.

Research strategy and Methods

Various ontological perspectives provide different realities according to Easterby-Smith, Thorpe & Jackson (2013). Ontology underpins the assumptions we have about reality. Epistemology provides assumptions in the way an inquiry is made into the nature of a problem. Linked to both ontology and epistemology, a methodology may be derived to support the philosophical approach of a research. My personal history of research, emerging from an engineering background tended to lean towards a positivist approach. Thus, the notion of measuring something to prove or disprove a hypothesis has always tempting for me as a practitioner. This type of research typically followed a quantitative approach. However, since undertaking this doctorate programme, I have discovered the value of qualitative research, and how realities can be constructed by convergent ideas that over time, mature and form a meaningful and useful reality for me as a practitioner.

My initial temptation in this research was to try to form hypotheses and test them through interview process and data collection. However, after much deliberation and related research, I have decided to proceed with an exploratory case study, where I will explore strategies that TfL use to reduce construction risks on live projects. This follows a constructionist epistemology. It is a qualitative research study. Interviews will collect qualitative data that will seek to find convergent themes.

At TfL we have an action research project that I will use the data from to reveal the personal experiences in using such an approach in reducing construction risks.

This qualitative exploratory case study will seek the convergence of ideas through interview questions and the analysis of these ideas to seek new insights or generate new methods of risk mitigation at TfL (Creswell, 2013). The ontological research position is relativism as per (Easterby-Smith, Thorpe & Jackson, 2013). This is because the epistemology is based on realities co-constructed between myself and the researched, and shaped by the individual's experiences. Thus, by this co-constructed epistemology, this research falls within the relativist ontological position. (Creswell, 2013).

There are numerous qualitative methods one could use as a research method, but I have opted to use a case study method. Although an action research project is incorporated within the data collection, the overall strategy of this research follows a single case study. Having considered different types of methods such as experimental, survey, archival, and historic types of research, this research focuses on how and why questions

with a focus on contemporary events (Yin, 2014) leading to a case study selection.

The primary data will be sourced from interviews. There will also be data sourced from an action research project within TfL. Convergent ideas will be themed together. The exploratory nature of the case study will peruse informal follow-up interviews to dig deeper into notions that develop subsequent to the initial data collation. The questions posed during the interviews will ask managers what strategies they adopt to reduce workplace injuries. An inquiry into the decision-making and why certain decisions are taken will be collated. In addition, how decisions are implemented will be addressed within the interview process. The inquiry will explore what strategies are used and how they are used and why and when these are used in contrast to other options. Managers sit in the centre of project decisions and highlighting what contexts lead to certain decisions that are driven by reducing workplace injuries is important.

In this regard, this research does not assume a single source of truth. A realist epistemology proposes such a truth, and as such I do not believe that to be the case in this research. A relativist epistemology may acknowledge multiple realities which are observer dependant. Therefore, capturing interviewees' perspectives may offer valuable data in relation to contextual settings. Different perspectives may illuminate new ideas in this research study.

I propose to interpret the data using an evaluation technique. The evaluation method uses multiple methods of data collection and analysis. It challenges

the positivist approach and seeks to find consensus amongst all the stakeholders (Guba & Lincoln, 1989). The evaluation method in social programmes offers a different insight into problems according to Guba & Lincoln (1989), and perhaps a more practical contribution for practitioners. For TfL and my practice this may be useful and pragmatic.

Quantitative methods, mixed qualitative and quantitative methods, and multiple methods can all be acceptable techniques to use in realist designs state Pawson and Tilley (1997). This is demonstrated by the authors in an exploratory case study.

Pawson and Tilley (1997) attempt to define the realism concept within five components that may help to explicate the operation of any social system. These are namely embeddedness, mechanisms, contexts, regularities and change.

Embeddedness, refers to how a social system is contained within a wider set of rules or institutions. Thinking about social systems, one must adopt a layered approach where the system can be studied in isolation, but should also be understood in terms of a wider set of systems. Mechanisms as described by, Pawson and Tilley (1997), is the method of formalising the matter of a social system. The authors use a clock as a useful example. Trying to explain how the clock is working one cannot determine this by merely looking at the clock surface. One must open the clock and understand the mechanisms inside to be able to explain how the clock works. In this sense one can define the mechanism in three components; to reflect the embeddedness of a programme within a layered reality; to

consider both micro and macro processes and thirdly to determine how programme outcomes follow from stakeholders' decisions and their ability to put these into practice. A mechanism is a theory that predicts the potential output of human resource and reasoning. (ibid pg. 68). Social interventions or programmes work through the action of mechanisms. Pawson and Tilley (1997) categorise different types of mechanisms, such as direct types which cause a direct outcome; secondly, there are mechanisms that may also produce several different outcomes. Thirdly, there are mechanisms that work indirectly and lastly there are mechanisms that are responsible of the whole event.

The next consideration in a realist study is the notion of context. Pawson and Tilley (1997) refer the notion of contexts as a companion to mechanisms. This is because of the idea that a mechanism can causes effect under certain conditions, and these conditions are the context. The authors highlight the importance of context in explaining the success or failure of a social programmes. These pre-existing interrelationships are crucial in the success of social programmes note Pawson and Tilley (1997).

When context and mechanism cause an outcome, Pawson and Tilley (1997) refer to this as regularity. The authors follow a realist logic; social inquiry attempts to explain significant regularities by defining underlying mechanisms, which under a specific context, will produce an outcome with regularity.

Pawson and Tilley (1997) refer to the interview candidates as stakeholders and categorise the stakeholders into subjects, practitioners and evaluators.

Subjects are more likely to provide information on mechanisms (M), without too much emphasis on contextual (C) or outcome (O) factors. Practitioners are much more valuable on all three fronts, mechanisms, contexts, and outcomes. Evaluators are useful in extracting information on CMO configurations.

Pawson and Tilley (1997) summarise the key components in realistic evaluations as a general set of rules. The first of which is *generative causation*, whereby the evaluator must seek to find the how and why a change takes place, focusing on the internal power of individuals and inquire as to how and why they make the decisions they make. In addition, understanding the circumstances surrounding the individual that trigger those decisions.

The second point the authors make is *ontological depth* where they stress the importance of penetrating beneath the observable surface and try to understand the underlying drivers that manifest in the decisions people make.

Thus, in my study, I would be exploring a problem in the context of a mechanism causing a certain outcome within a specific setting. Furthermore, I would explore the underlying drivers that motivate specific persons that make specific decisions within the interview setting.

The next three rules highlighted by Pawson and Tilley (1997) is CMO – context, mechanisms, and outcomes. *CMO configurations* is the route to developing middle range theories which provide analytic frameworks to help understand how and why things perform in a particular way.

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The CMO elements can be collated for each individual risk identified for example manual handling or working at height risks. Following this, a forming of CMO combinations may help this research in developing middle range theories which may be proposed and refined within the interview process. This is captured with the seventh rule as the *teacher-learner process* by Pawson and Tilley (1997), whereby the evaluator extracts the detailed information from the interviewee and relays it back to the candidate to help formalise the theory or adjust it.

Finally, the authors emphasise that the realist evaluation is an *open system* which makes any change programme a subject of further change, as time can shift the context or mechanisms.

To complete this paper, I have attempted to apply some of these principles below in a real-life setting to explore how it could be exercised in reality.

A realistic evaluation application example of CMO configurations and possible theory formation for my study

Example of the TFL Manual handling problem

Context:

- within escalator environments that are within underground railway stations
- TFL project teams and individuals manage the project to upgrade/modify the system to an agreed time and cost, thus administer the contract
- installers are under contract to meet specific targets in time and cost

- installation brings in revenue, so financial benefit is realised as soon as installation is completed and commissioned
- TfL under financial pressure to generate secondary revenue streams

Mechanism:

- use specialist plant to transport materials (especially using escalator stairs as access route)
- risk identified through safety leadership team (SLT)
- Risks vetted by Programme leadership forum (PLF)
- Action Teams target identified risks

Outcomes:

- Specialist plant used for D12 (98" screen) when escalator access is required
- Specialist plant is not used for smaller screens (75")
- Specialist plant is sometimes used for D6 (86") screens – when escalator access is required
- Manual handling is sometimes more time effective than specialist plant
- Manual handling is not totally eliminated by specialist plant
- Manual handling is reduced through the use of the specialist plant

Possible contrasting CMO configurations

Context	Mechanism	Outcome
Railway station, escalator and stairs environment with D12	Application of specialist	Manual handling highly reduced

asset	plant	
Railway station, escalator and stairs environment with D6 asset	Application of specialist plant	Manual handling moderately reduced
Railway station, escalator and stairs environment with 75” asset	Application of specialist plant	Manual handling not reduced and manual method preferred over specialist plant
Railway station, stair environment but NO escalator access required with D12, D6, and 75” assets	Application of specialist plant	Manual handling not reduced and manual method preferred over specialist plant

Implicit organisational theory

Context	Mechanism	Outcome
<ul style="list-style-type: none"> Railway station environment Construction Projects 	<ul style="list-style-type: none"> Using SLT to identify key risks Using PLF to 	<ul style="list-style-type: none"> Reduction of risk Reduction in incidents /

- Stair access required
- Escalator access required
- vet risks
- Using action groups to tackle problems
- accidents

Specific programme theories to test and explore through interview process

Theory ref.	Context	Mechanism	Outcome
1	<ul style="list-style-type: none"> • Railway station environment • Involves Manual handling • Stair and/or escalator access required 	<ul style="list-style-type: none"> • Application of action research (AR) method 	<ul style="list-style-type: none"> • Reduction in incidents / accidents relating to musculoskeletal issues • Reduction in manual handling • Effect on team attitudes is positive
2	<ul style="list-style-type: none"> • Railway station 	<ul style="list-style-type: none"> • Exploration and 	<ul style="list-style-type: none"> • Reduction in incidents /

environment		accidents relating to musculoskeletal issues
• Involves Manual handling	application of alternative risk-reducing strategy	• Reduction in manual handling
• Stair and/or escalator access required		• Positive effect on team attitudes

I would propose/create theories based on the CMO configurations above and these would be discussed in the interview process. These discussions may lead to refinement of the theory. In addition, I could validate/test the CMO configurations as I have listed above with interview candidates. This may modify some of the configurations listed to alternative newfound combinations.

References

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