**Technical Rationality andReflective Practice in Handling Intricate Construction Claims; A Case Study**

**Abstract** :
Evidences supporting the increase in the number of court cases, theory verses practice gaps and the intricacy associated with theconstruction claims tend to pose messy, indeterminate situations where the traditional instrumental approaches are criticised for sub-optimal outcomes. This essentially warrants some kind of areflection in action merged with technical rationality in making professional judgments. This study therefore explores the potential of implementing reflective practice into construction claim analysis by using a case study. The project selected was a 12 km bypass in Doha Qatar consisting of a 10-lane section which provided qualitative data related to 19contractual headsthat are recognized as being effectively and amicably sorted out. The literature shows 17 characteristics of each domain. The study emphasized that the two paradigms (technical rationality and reflective practice) are not remote, but concomitant through severaldiscrete relationships. Recommendations were given for constructionpractitioners to use reflective practice, along with technical rationality to submit sensible claims and frame out solutions for future applications. Finally, future studies are suggested to empirically determine the right mix of the two paradigms in the domain of construction claims.

**Keywords:**construction claims, claims process, reflective practice; technical rationality

## Introduction

Construction projects tend to pose messy, indeterminate situations. The growth of claims has shown that the real-life scenarios are complexthan they are seen in outlook. Quantity surveyors and plannersfind it hard to provide effective solutions because of the intricacy involved in construction claims (Jayalath, 2012). The schedule delays for example often escalate into claims, undermine commercial aspirations,and involve lengthy negotiations and juridical cases (Pier L and Giovanni S, 2019). There is no industry consensus as to a specific technique that each party should use when assessing time-related claims, for example (Abou Orban, Hoda et al 2018).Meanwhile, Schon (2001) states that a crisis of knowledge exists. Dias and Blockley (1995) contend that only theoretical formulations have been attempting to offer solutions to physical phenomenon. This is a startlingnote for construction practitioners to revisit the contemporary approaches to claims analysis, because of evidences supporting the increase in the number of construction claims, court cases and theory vs practice gaps, etc (Wong and Ng 2010).It is difficult to get intuitive decisions accepted by others, particularly because decision maker is unable to justify it with a technical rationality.

Bartlett (1990) points out that becoming a reflective professional involves moving beyond instructional techniques. Schon (1992) categorizes theories, techniques and tools that are dominant in mathematics and science under Technical Rationality (TR) paradigm. Dijksterhuis and Nordgren (2006) argue that intuition is influentially the ideal tool to make decisions.Cioffi (1997) endorses intuition as a function of decision making. Altogether creatinga paradigm of Reflective Practice (which is alternative to Technical Rationality), RP encourages practitioners to solve problems in a heuristic manner by being a part of the problem (Kinsella 2007). Hence this alternative paradigm is both practitioner- and context-dependent.Dias and Blockley (1995) explain that RP encourages practitioners to diagnose problems in a more holistic manner. Reflective practice helps reduce individual idiosyncrasy of stereo type practitioners, who simply repeat old

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practices. However, many professional bodies today expect that their members engage in reflective practice. This study focuses on claimsmanagement processwith the aim to determine the suitability of a RP-based approach. It provides a deeper understanding of successfully claimed applications seeking a reasonable recompense by asking the basic question of what constitutes sensible claims. Furthermore, it explores the possibility of integrating strategies that makes sense into traditional claims. With this aim, the objectives of this study are as follows:

(1) Tooffer an overview on technical rationality and reflective practice in relation to professionalpractice in general and construction practitioners in particular.

(2) To investigate the applicability of both TR and RP paradigms in the context of construction claims.

(3) To suggest best practice approaches that reflects the right combination of RP and TR to strategically settle construction claims.

**Literature survey**

Technical rationality is premised upon the notion that the practitioners are instrumental problem solvers whomerely select technical means to solve the problems (Schön, 1987). Radziszewska-Zielina et al (2018) contend that the process in selecting technical means itself is difficult andin most of the times,unforeseeable. The technical-rational approach is still normativeattire in professional life in the Western society (Polkinghorne, 2004). Various fields such as education, health etc have a record of previous attempts to legitimate and professionalize their status using objective conduct and scientific method as their modus operandi (Natter *et al.*, 1995). However, Schön (1992) is challenging inflated views of its practical significance. He argues that a technical mentality is likely to lead to stereotyping, fitting someone to the theory rather than using the theory to inform the situation. , Schön (1992) contends that technical approaches give dominance to theory and facts than opinions and feelings. Shon further stressed that this 'rationality' is no longer valid in the modern dynamic industries, where the 'change' is fundamental.When practitioners apply esoteric knowledge, they tend to alienate themselves from their own understandings, engendering a loss of their sense of competence and control (Schön, 1992).

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Wenger (1998) highlights the pragmatic value as a theory makes sense of the world. The theory of reflective practice suggests that science and technology alone could not answer all of the problems of practice. Instead, the theory of reflective practice assistsin'reframing' the issues beyond the emphasis on scientific discourse. Accordingly, reflective practitioners arethosewho act as experimenters in situations which are unique and uncertain. The sense he makes of the situation includes his own contribution to it. Yet he recognizes that the situation, having a life of its own distinct from his intentions, may foil his projects and reveal new meanings (Kinsella, 2007).Donald Shon who suggested that the capacity to reflect in action so as to engage in a process of continuous learning is one of defining characteristics of professional practice. The reflection in action should take place in the action-present, which is the period of time in which action can still make a difference to an outcome. Here, the focus is on gaining a new perspective, rather than just solving the problem. Claims are a day to day phenomenon in construction projects and each case is unique and to be evaluated on its own merit. As it happens on the spot, this type of reflection often appears very intuitive. It often is a skill associated with the development of expert practice.

TR has a limitation in its problem identification process, which makes it able to provide solutions only to issues that can be described through theoretical formulations. RP, on the other hand, encourages practitioners to use their tacit knowledge, coupled with explicit knowledge, to diagnose and solve any problem through a learning process where a high level of thoughtfulness is required (Schon 1992). This ability makes reflective practice more suitable for issues within the ambit of construction claims which are unique by nature. As such, the construction practitioners are expected to solve claims by dividing the whole into parts where the relationships could in most cases be found to be inextricably intertwined. In the ambit of construction claims, the causes, breach, effect or loss can be considered as sub-holons that make the whole, namely 'claim'. If one considers only a dimension of cause separately, construction practitioners may not be able to achieve desired outcomes in other dimensions.

Hesham A. Abdel-Khalek et al, (2019)hasgiven a particular emphasis to a series of widely used analysis algorithms in the domain of construction claims. Kraiem(1987) presented a tool to aid in analysis of delay claims. Erin et al. (2016) provided a comparative overview of how concurrent delay is treated across a number of court cases. Christopher (2017) compared the traditional offsetting penalties approach with the more modern apportionment of responsibility approach. Marrin (2002) contended that the dominant cause approach is less than wholly persuasive. Morris (2000) and Nash (2002) expressed reservations regarding Malmaison approach in the case of concurrent delays. Knowles (2000) supported the "first in line approach". The logic behind this approach is somewhat a technical view on the basis that who caused first will take the whole liability. Furst et al. (2006) opine that the law is imprecise in the contractual context. Bristow (1986), FitzPatrick (2001), Burrows (2004) and Burr (2005) confirm that the current position in law does not render justice to the parties in circumstances where concurrent liability exists. Dering (2007), Knowles (2000), Marrin (2002) and Silver (2005) once again disagree with dominant cause approach. In a nutshell, the key message is that there is no consensus as to which method that best serves the purpose under consideration. Table 1 offers an illustration on the realm of technical rationality and reflective form of practice in the context of construction claims.

| Realm of Technical Rationality | Illustration | Reflective Form of Practice | Illustration |
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| Problem solving | The process by which we define the decision to be made, the ends to be achieved, the means which may be chosen. | Problem setting | Process in which, interactively, we name the things to which we will attend and frame the context in which we will attend to them. |
| Using instruments | Test reports, meteorological records, quality reports, compliance certificates, financial and legal instruments | Screening hidden metaphors | Apportion the blame into two accounts, loss lies where it falls. Claims are a form of blackmail, concurrency is a shield for contractors and sword for employers |
| Rational approach | Chronology of events leading to claimable situation, application of contra proferentum rule in patent ambiguities | Non rational | Argumentation backed by reasons--and modifying or defending positions accordingly. |
| Methodical approach | Following steps in order; establishing causal relationship, relative causative potency, proof of loss | Artistic approach | Reframing and converting the situation into solvable problems |
| Reductionism | Isolating and treating basis, eligibility and quantum in discrete components; incremental approach | Holism | Taking a holistic view on the overall claim cumulative approach |
| Seeking lesser level of anxiety | Discrete costing, tender price leveling in varied works, prorating, first principles | Coping with anxiety | Applying fair rates in varied works, risk margin, contingency applications |
| Selective inattention | data that is not immediately relevant/not submitted immaterial; only those claimed will be considered; | Transcending limits | Unclaimed financial commitment on time extension, avoid double dipping/repetition |
| Logical Deduction and hands-on experience | relies on facts and rules flowing from general to specific; arriving at confirmation | Logical induction, observation, fact-finding, | relies on patterns and trends flowing from specific to general; arriving at a theory |
| Idiosyncratic (personal mannerism) | Measurement of work according to individuality of the measurer when no measurement rule is available | Toiling with irrelevancies | Being influenced by technically unconnected circumstances |
| Dogmatism; | Vigor in defending its believed truths; assumptive; mutually exclusive unitary frames assuming a win/lose (zero-sum) relationship; upfront denial and return claims unevaluated on the wrong format itself, no prior notice, no damages for delay, paid when paid only, etc | Pragmatism | Persistence in search for truth; investigatory; .open up the inquiry" by examining the data to see what concepts best fit the data, without a preconceived explanation or framework |
| Use of Algorithms | BIM, Big Data, Artificial Intelligence and Machine Learning, parametric estimating | Intuition | Idiosyncrasy of individual measurers, gut feelings on previous hands-on experience |
| Adherence to Formula methods | Formula methods to compute unabsorbed overheads, price escalation, productivity losses, Three-point estimating | Industry accepted norms | the average by which the practitioners govern themselves; the ordinary manner of doing things; RICS practice standards |
| Observing Protocols | SCL protocol, pre-action protocol | Portfolio | Firm and project level analysis, Vendor Scope-Budget Matrix |
| Adhering to Standards | Standard method of measurement, standard phraseology, New rules of measurement, standard specifications | Industry best practice | Benchmarking & Metrics, Change Management, Constructability, mitigating impacts, Front End |

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| | | | Planning, Lessons Learned, Modularization, Zero Accidents Techniques |
| Use of Theories | ways that make sense of what is observed in the natural world; structures of ideas that explain and interpret facts; | Tacit knowledge | acquired from one's own experience, which cannot be expressed easily through words or pictures |
| Case law/ Precedents | pre- existing rules from binding decisions in past cases; case law in concurrent delays, delay impact analysis | Intellectual hypothesis | educated guess based on prior knowledge and observation; no predetermined outcome; |
| Method studies and work measurement | Analytical estimating, Direct time study<br>Synthesis method<br>Analytical estimating<br>Predetermined motion time system<br>Work sampling or ratio delay method. | Industrial knowhow | Guestimate, rough order of magnitude, ballpark, analogous estimating, thumb rules |

**Table 1: Characteristics in technical rationality and professional artistry in claims handling**

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Considering these circumstances, this study investigates the characteristics of problems and solutions of construction claims analysis with respect to two paradigms, TR and RP. It is an exploratory study, with a hope that the findings could be used to evaluate future directions for developing algorithms for claims analysis.

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## Design of the study

To meet the second and third objectives of this study, a case studyapproach was taken. Case study method is progressively popular among researchers (Thomas, 2011; Hyett, Kenny & Dickson-Swift, 2014). In investigating complex situations, such as construction projects, case study approach has been proven reliable to capture rich information (Saunders et al, 2009). Yakubu N. Sanda (2021) contends that case study as a tool of research contributes widely in the discipline of construction management. In order for the research outcome to be reliable, the four fold test (Table 2) was adopted as suggested by Wedawatta et al (2013).

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| Test | Purpose | Case study | Phase |
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| Construct validity | Identify operational measures | Use multiple sources of evidence<br>Review case study reports<br>Review of monthly commercial report<br>Review of claims documents<br>Adopt an interview protocol | Data collection |
| Internal validity | Establish truism of relationship between research variables | Isolate converging/divergent opinion<br>Pattern matching | Data analysis |
| External validity | Define appropriate domain to which the findings can be generalized | Use theory in single case study | Data analysis |
| Reliability | Test possibility of repeating the study and obtaining the same results | Use case study protocol<br>Define limitations | Data analysis |

Table 2: Four fold test of case study

As such, this paper shall attempt toinvestigate archival information on how the parties settled their claims amicably using TR and RP approaches.The key themes through which the qualitative information collated in the case study as filtered were the difference of opinion that cropped up to a level of a formal claim, technical tools used and the processes adapted, limitations, reservations and hypothesis encountered in the settlement process, refection on action during the unilateral analysis, reflection in action during negotiations and reflection on experience which will help reframing out the solutions for future application. For data sorting, NVIVO 9, a qualitative research tool for data sorting and analysis, was used. In the software, different nodes were created to systematically facilitate data sorting. Using archival analysis on the claims submitted, it was possible for the authors to investigate 19issues, which could be somewhat difficult to achieve if archival of information and interview within the case study were selected as the research strategy.

## Case study

The project was a 12 km bypass in the city of Doha consisting of a 10-lane section (5 lanes in each direction) with a provision for a future addition of two more lanes in each direction. In addition, there is one major road crossing over the mainline and two pedestrian/bicycle overpasses.The scope of work includes Design and Construction of a new freeway, including four different grades-separate interchanges with cross roads, collectors-distributors, overpass and underpass

structures, retaining walls, pedestrian and bicycle paths, traffic signs, signals and ITS, landscape and hardscape and arts cape, street lighting, and all related infrastructure.The Contractor has been experiencing delays, disruption and abortive works. In spite of the entitlement for changed circumstances, the Contractor's cost proposal has been either challenged or disputed on the notion that all these impacts are mere outcome in the process of design development falling within the ambit of D&B lump sum price. However, the Contractor claims that he should receive a fair and reasonable cost reimbursement related to design changes and other technical reasons fallen beyond control of the Contractor and for which the Contractor is not contractually liable. The subject changes that are claimed in the claim document have been shortlisted and given in a tabulated format offering a snapshot of the entire chronicle (Table 1). Accordingly, there are 19 claim items (heads) qualifying a reasonable Contract Price Adjustment under the Contract. The Contractor in doing so intends that this claim will be treated by the Employer and the Engineer as a formal request to be put in the same position as the Contractor would have had the actual conditions not differed from those described in the Contract.

**Findings**

The findings from the research investigation are presented in Table 3 in line with the key themes that emanated from the archival analysis.

| Claim Head | Narrative of the Claim | Difference of Opinion | Technical tools/Process used/adapted | Limitations and Hypothesis | Refection on Action (Analysis) | Reflection in Action (Negotiation) | Reflection on Experience (Evaluation) |
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| Sleeves for Foul Water Rising Main | design and construction of 270 m long, 500 mm dia, sleeve in GRP in accordance with the Specification, which is a newly added scope evaluated on the agreed Sub Contractors rates | Engineer's recommendation was based on the rates applicable for TSE | Priced bill of quantities/ tender price leveling maintained | Conditions in which the works carried out are dissimilar | BOQ rates provided basis of evaluation | subject additional works warranted a completely different technical approach, hence BOQ rates are not desirable | Ascertain the true value of the subject work based on labour, materials, transport and plant with a reasonable profit margin. |
| Procurement of Wrapping | Changes taken place by the differences between 2005 and 2015 specifications. | Wrapping of the pipes where the overlapping will increase high as 11% to 55%not considered as a major technical variance | Employer Particular Requirements General Specification of Main Laying Materials for Works – July 2015 | Migrating to new spec is a quality than a contractual issue | Quality will be judged against the new spec at no additional cost to contract | Contractor has to abide by utility authority directives | Migrating to new shall be treated as a varied work the cost of which has to be reimbursed |
| Removal of Dead Cables | As was evident in given information, two cables were supposed to be dead but the reality was far from being provided given that one cable out of two is still live whilst being connected to the substation. | Getting live cable deactivated, to avoid diverting of the cable will constitute redesigning of the whole scheme and working out a new route for diverting. | Concept drawings | Underground utility lines shown in service drawings in archive are not reliable | Dealing with dead services is within the Contract | Artificial obstructions unforeseeable | Additional labour involvement could be reimbursed |
| Additional VCB in Tunnel S/S (Outside ROW) | Contractor was instructed to supply and install, connect and energize, test and commission, an additional VCB in the | This change, enforced after the project Base Date is, the Contractor contends, a | Employer's Requirements | Not all the end user requirements could be articulated and documented at | ROW is strictly considered as the payment line | mechanism to absorb changes or enhancement to project requirements is available | Employer's Requirements cannot range from a very simple specification to a change that is |

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| | existing Kahramaa substation # 21347 which is clearly outside the ROW. | Variation under the Contract. | | the outset | | | entirely a scope creep to the concept design (for what the parties have bargained for). |
| New Traffic Diversion (Temporary Road to Permanent Road Conversion) | Contractor redesigned the permanent route so as to maintain one way access to the Main line | Not considered as a part of the permanent works | Temporary Traffic Management (TTM) plan | TTM specifies temporary diversions only | Contractor provided the alternative temporary diversion access covered under preliminaries | access road was not covered in the Scope of WorkThe local authority was to provide suitable means of exit/entry from this area via an upgrade to their local roads | Any deviation from what was envisaged at the time of tender shall be considered a variation |
| Beneficial Road Opening | If the Employer does use any part of the Works before the Taking Over Certificate is issued, the part which is used shall be deemed to have been taken over at date on which it is used. | Engineer's failure to follow the taking over procedure stipulated in the Contract whereas, the Engineer has allowed the Employer to use the parts of the works | As Built Drawing s, Operation and Maintenance Manual | scarcity of the asphalt due to implementation QCS 2014 asphalt mix design | Engineer rejected the Contractor's request for issuing Taking Over Certificates. | Contractor have excelled his best effort to achieve the opening of the sections of the works as agreed/committed with the Employer upon the Employer request/instruction amid several obstructions | Opening road to public in sections are a norm |
| Roads Tunnel – Sprinkler System Tunnel MEP+FPS | There is no design reports or drawings in relation to mechanical works for structures and the contractor be held responsible for the complete design and construction of the works. | Selection is far in excess of actual requirement given that tunnel lengths are not long. | Tender Queries, preliminary design reports and drawings for fire protection, fire and safety requirements | both ER and Preliminary concept design requirement is silent for the firefighting system in tunnels | The employer has all the liberty to pick up the option put forward by the contractor | Compliant Design' will be the minimum requirements to be met. | Best international practice employed by D&B contractors is sufficient |
| Increase Tunnel Height due to | overall height of the tunnel needed to be increased by 1000 mm (1600 mm clearance | Leaving aside of the Contractor's initial proposal based on the | Preliminary Design, Detailed Design, IFC | Tunnel ventilation fans were deemed to be placed inside | This forms part of the design obliged by the contractor | Increasing tunnel height in a structure of this magnitude for accommodating | It is imperative to recap the fitness for purpose obligation |

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| Ventilation Fans | required instead of 600 mm in tender) constituting a structural change particularly in concrete and rebar quantities | Concept drawings , the latest design is indeed an additional and to be considered as a Variation to the Contract | | the Tunnel (i.e. above the walkways – away from the tunnel envelope | | fans is clearly a deviation from the requirements inferred in the Contract | |
| Changes in the Scope of Work – Extra Cost for Supply of Material | Works carried out under provisional sums | Tender Circulars take priority over the contents of the Schedules and seeking the Contractors inputs in order to Supply ducts is clearly a varied works that must be dealt with the Clause 14.4 of the Conditions of Contract | Conditions of Contract | Employer's approval is needed to expend monies under provisional sums | Provisional Sums allowed for local government authorities are for the supply of materials only. | works are to be paid directly by the Employer | A provisional sum is an allowance (or best guess), usually estimated by a cost consultant, that is inserted into tender documents for a specific element of the works that is not yet defined in enough detail for tenderers to accurately price. |
| Increase in the number of Traffic Signs | A total of 1622 sign posts appeared in the detailed design whereas the Concept design shows 742 Nos | A quantity deviation of more than 200% is a magnitude where an experienced designer and contractor cannot reasonably unforesee. | Concept design Detail design | This is a D&B contract for which quantity variances are not a matter to adjust the contract price. | Contract is a non-measured lump sum and has no provision to pay for quantities | This is a considerable shift of the initial scope, a cardinal change | A fair recompense is possible for the additional cost incurred on the supply and installation of the additional traffic signs. |
| Abortive Work in Street Lighting Bases at | A request is made to alter the maintenance factor and the luminaire changes that had been already | Cost for demolition of the previous constructed footings re- | Preliminary Design report | Maximum interval between poles.Where there is no high | Abortive works are incidental by nature | Abortive works are owing to subsequent employer imposed changes to the | Employer intervention to alter the maintenance factor is not |

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| Bridges and MSE Walls | implemented | erecting MSE wall barriers not paid. | | masts (14m and lower) a maintenance factor of 0.7 | | design | envisaged at the time |
| Abortive Design | Contractor has incurred an abortive design cost due to the implementation of Specification and Stakeholders' requirement after the Base Date and more over in the later stage of the project. | Contractor had to extend the services of the Design Consultant | Detail design | Design parameters | Design changes could be made at no cost to D&B contract | Where a change has been instructed by the Employer, that might result in abortive work, it gives rise to additions to the contract sum, | Except in the circumstances where the D&B Contractor has carried out unauthorised or non-compliant work, or has accepted the risk of unknown items it may bear the cost of abortive work. |
| Asphalt Mix Design | New requirements to all manufacturers of asphalt to update their plant to meet the Spec: 2014. | the Contractor could not have anticipated the issues that would have arisen with its proposed Subcontractor renewing its mix design certificates from the LSA | Construction Specification 2010, Design Submissions Review Process, Certification Procedure,Quality Management Systems | Laboratories and Standardization Affairs (LSA) parametres | Conformity Certificates (Ministry of Environment (MOE) for both BC-Type 1 and SC-Type 1 mixes, | Implementation of the Spec 2014 for Asphalt Mix design and Asphalt Plant compatibility to this project after the Base Date is clear departure from the Contract | Technical standards or regulations that come into force after Base Date is a valid source of claim |
| Price escalation | price fluctuation formula should be used for those contracts where duration is more than three months | the payment for fluctuation caused by increase or decrease in the prices of certain materials may be made at a time when such materials were not used at all. | Formula to compute price escalation Conditions of contract | availability of reliable indices, accurately calculated input proportions, local and foreign components, | The fluctuated component is ascertained on the difference between the indices of costs of construction labour and materials at the time of bidding and the current values of those | . The choice of those inputs largely depends on the principle of cost significance in the overall share for the quoted tender price. | There can be over or under recovery in some extreme cases. One instance is where the contractor will have to expend more money for the whole quantity of input with the fluctuated amount earlier than what |

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| | | | | | indices during the construction stage in accordance with a predetermined relative proportion for each cost index | | was envisaged in the original sequence. |
| Productivity loss | Disruption led to a loss of productivity included access restrictions, changes in the work, late information arriving, delay in testing/inspections, client and third party interference. | The disruptive scenario does not ideally fit in for the adoption of measured mile method as the disruptive events fell throughout the project and no impact period is isolatable for the efficiency comparison. | AACE International Recommended Practice No. 25R-03 | Once lost productivity is calculated, it is still difficult to establish causation, thus apportioning into employer and contractor. | Measured mile technique | An actual, post-construction productivity baseline is more reliable than a projected baseline because it is based on jobsite records. | When establishing the Measured Mile, it is important that work performance represents reasonable, attainable levels of productivity and that this productivity was maintained at the baseline level during the Measured Mile period. |
| Under-Absorbed Head Office Overhead (HOOH) | Failure of the project to contribute to office overheads whilst still tying down overhead resources owing to employer decisions | Calculation is derived from a number which already contains an element of head office overheads and profits, causing double counting, | Hudson formula | Head office overhead percentage is taken from the contract. | disallowed certain time periods while HOOH $ is arbitrarily decided | Head office overhead bears little or no relation to the actual head office costs of the contractor. | It is important to prove that contractor avoided loss of overheads by taking on other work, mitigated damage by ensuring that staff are re-located from work on the delayed contract to other work. |
| Negation of Penalty Imposition | Failure to give access to site and delay in approving drawings prevented meeting. contractual deadline | the Contractor is only required to complete the works within a reasonable | Conditions of contract<br>EOT claim<br>SCL Delay and Disruption | Float has been fully exhausted and no float to absorb delays | Retrospective delay analysis | Whoever the first used the float has got the benefit of available float. | Applications for an EOT should be made and dealt with as close in time as possible to |

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| | and time became 'at large' | period of time. | protocol | | | | the delay event that gives rise to the application. A 'wait and see' approach is not conducive. |
| Extended Preliminaries | Contractor is to be reimbursed the additional cost which results from Employer delays. | the Claim should take the mode of a loss and expense claim instead of a typical prolongation claim where the time related preliminaries are prorated with the period extended | Prolongation claim<br>SCP protocol | Preliminary bill items to maintain tender pricing level | Time related preliminary items on pro rata basis | Time related costs will, unless there is a full suspension of the site for instance, continue through any period of delay and can be claimed 'at cost'. | Evaluation should relate to the period when the effect of the delay occurs and not to the overrun period at the end of the contract. |
| Unsuitable materials off the site | Struggling with the cost control due to far excessive materials declared unsuitable for embankment that became a drain on the client's budget. | The contractor was in a dilemma how fast track completion could be achieved, apart from this windfall. | Priced bill of quantities<br>Variation procedure | Budget<br>Milestone completion<br>Contingency allocation | Using bill rates and new rates exceeding 20% of contract sum | Revisited the specification and came out with a value engineering proposal of rock fill. The question of slow progress was framed to ask how rapidly this in-situ mechanical process could be executed to expedite the progress. | structurally sound embankment could be built with dry rock fill dam with adequate compaction. |

**Table 3: Archival analysis of the case study**

**TR and RP as nearly opposite paradigms**

The results obtained from the analyses of TR and RP established 17 near opposite characteristics when compared as a form of professional practice in relation to claims analysis. These characteristics exist in harmony in a varying scale and should be integrated in a manner to make the function of claims analysis more sensible and meaningful. However, TR and RP are not entirely opposite paradigms. To support the contention that construction claims analysis is a combination of RP and TR, it is seen that the use of algorithms, industrial knowhow and thumb rules provide stimuli in claims. For example, when the specification was revisited for performance criteria as to compaction, an uncertainty arose as to whether compaction can be achieved at the crest of the embankment. This required the original question to be further reframed to ask whether a structurally sound embankment could be built with dry rock fill dam. Further investigations revealed that it is technically viable and as such the engineer relaxed the specification yet enough to meet the basic performance criteria as stipulated in the standard specifications, making a huge saving on the contract. As Dias and Blockley (1995) explained dependent relationships exist among the two paradigms. TR becomes the context of RP, RP is a pre-condition for TR and RP is a constraint to TR. They illustrated the three relationships in the context of structural design. In this study, these three relationships were illustrated by examples related to construction project planning and implementation, as outlined in Table 4.

| **Claims Function by Key Milestones** | **Reflective interaction** | **RP procedure** | **Focus of Attention** | **TR approach** | **Relationship** |
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| Claims Avoidance | Reckon and seal out the sources of potential claims in advance | lesson learnt on similar projects, continuous education and training, document review | Harmonious relationship | Risk assessment | TR within RP |
| Claims Mitigation | mitigate claims from arising across all the stages of the project | Constructability Review, Request for information (RFI) procedure, Dispute Review Board (DRB) | Cost and time saving | Potential change notice (PCN) procedure | TR within RP |
| Claims identification (potential changes) | Foresee changes in initial design and technical parameters | Firsthand experience, site level information handling | High mark-up | Rough order of magnitude | RP to TR |
| Claims Identification (varied works) | Recognize the claimable situations, events and sources leading to varied works | Finding scope changes, scope creep, cardinal change, schedule impact, educated guess | Net resultant impact of variations on the scheduled completion | CPM, PERT, LOB, EVA | RP to TR |
| Decision to claim | Review documents, identify technical variances, cost and time implications | Data management, loophole engineering | Winning | Probability analysis | RP to TR |
| Claims | Duty owed, | Use contemporary | Contractual | Malmaison test | RP within TR |

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| articulation (Eligibility for time extension during concurrency) | breach of duty committed and as a result, a loss incurred, records, expertise | records, establish cause and effect relationship, detect relative causative potency | entitlement | | |
| Claims articulation (scope creep) | Identify uncontrolled growth in the project scope | Experience, thumb rules, visualization | Converting into cash | Artificial neural network | TR within RP |
| Quantum (choice of computational method) | Identify the limitations and hypothesis underlying the use of formula methods in calculating disruption costs | Experience, considering project context, fact finding, toiling with irrelevancies, case law precedents | Productivity lost | Measured mile technique | TR within RP |
| Negotiation and Defense | Identify constraints and exploit every minor opportunity during talks | Experience, industrial knowhow, thumb rules, fact finding, common sense | Safeguard the contractual stance and equitable solution | Mathematical approach such as multiplication to justify no loss | TR within RP |

**Table 4: Relationship between RP and TR approach**

Claims avoidance as a proactive function of claims illustrates a situation where TR falls within the context of RP. Actions such as document review are important to identify the sources of potential claims in advance. Technically, the construction practitioners may adopt a risk identification technique such as sensitivity analysis to locate any potential claims;however the spectrum of reflection is much larger in scale. Claims mitigation takes a similar vein confirming that it is a function falls with the context of RP.Identifying potential changes is a situation where RP becomes a precondition to TR. A rough order of magnitude can be arrived at a few RP approaches such as using one's own experience, brainstorm, as well as recouping site level information. Critical path method, Project evaluation review technique, Line of balance and Earned value analysis are few TR considerations widely applicable in computing the impact of scheduled completion owing to varied works.These algorithms have been used to estimate the amount of variation (TR consideration), but these calculations are only a few factors that determine the remedial actions necessary to minimise the influence of the variation. Finding causes of variations, scope creep and cardinal changes etc and use of different construction methods are some other salient concerns that the traditional planning tools cannot describe effectively. This essentially warrants some kind of RP skills for the construction practitioners. The example of concurrency describes the eligibility for time extension where RP becomes a constraint to TR. Construction practitioners use TR techniques such as malmaision test to find out the extent of apportionment of delays into employer. However, before malmaison test is carried out, the practitioner needs to filter viable methods of computing concurrency from all available means by considering whether the duty owed, breach of that duty committed and as a result, a loss incurred and availability of records and expertise. Therefore, considerations under RP become constraints for TR in this situation. Within the information provided in the case study, it was not however possible to ascertain the share of this combination, which is a limitation of this exploratory study. Thus, future studies are required to eliminate this limitation and achieve more fruitful results related to the applicability of RP and TR to the context of construction claims handling.

## Conclusion and Recommendation

In nutshell, the argument is that the practitioners cannot get to problem solving without first engaging in what is clearly a non-technical process. This means that the surrounding is susceptible to change and the only way to deal with is to learn and understand, and guide and influence these transformations. Thus, the practitioner allows himself to experience surprise or confusion in a situation which he finds uncertain and then he reflects on the phenomenon before him. Although reflective practice is not yet well known in the construction industry, construction professionals sometimes unconsciously engage themselves in reflective practice to some extent. Generally these professionals declare that what they are offering their clients is the technical expertise. Clients too expect only this technicality may be because they areunaware of benefits of reflective practice or they tend to feel it a threat to their conservative systems. Shon defined reflective practice as a process where a professional engages himself in a continuous dialogue with a situation and listens to its backtalk when dealing with uncertain or varying scenarios, in order to find appropriate solutions by modifying or reframing problems. Hence, the issue of reflective practice has a significant time value as well as a subject value as far as construction professionals are concerned.

When a practitioner makes sense of a situation he perceives to be unique, he sees it as something already present in his repertoire. It is, rather, to see the unfamiliar, unique situation as both similar to and different from the familiar one, without at first being able to say similar or different with respect to what. In this way we engage with situations without having a full understanding of things before we act, but, hopefully, we can avoid major problems while 'testing the waters'. When looking at a situation we are influenced by, and use, what has gone before, what might come, our repertoire, and our frame of reference. This is particularly important since the cconstruction projects are quite often characterized by complexity, dynamism, uncertainty and uniqueness, which make traditional technical approaches inadequate. Construction practitionerscan actin a proactive manner using RP skills with the integration of tacit and explicit knowledge in order to holistically understand claims. Reflecting in and on action, claims analysts are encouraged to embrace a paradigm shift in practice from the TR to RPin order tominimise the theory and practice gap as well.Professional bodies should per se add to the code of conduct to engage in reflective practice as it cannot be practiced in isolation. The consultants need to continuously converse with the contractors in framing problems, and in subsequently reframing them, as the dialogue and the back talks continue.

### Research Implications and Contribution

The discussion presents a knowledge gap of linking technical rationality and reflective practice in handling construction claims. Most of the contractor’s claim has been initially disputed on the notion that the extra work is not necessarily extra but they are mere outcome in the process of design development which should essentially fall within the ambit of Design and Build as a contractual modality and a project delivery method. This is found to be a misnomer in this research that challenged the widely held view of lesser number of claims in DB projects. The bottom line is that each case in unique and to be evaluated on its own merit. The findings underscore the significant challenges in road projects where the reflective practice has also a considerable stake. It is hoped that these strategies will be utilized by future project teams to effectively cope with such claims while guiding how to compile sensible claims.

### Limitations and Future Research

This is a single case study confined to a large scale road project in Qatar. The project administered on design and build basis has suffered from a number of claims however; the research has been focused only on the application of technical rationality and reflective practice. Constraints inherent in single case studies

are equally prevalent in this study. Findings of the research provide opportunities for further research and build up a model of claims management with the right mix of TR and RP.

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