



Application of Technical Rationality and Reflective Practice in Managing Intricate Construction Claims: A Case Study in Qatar

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ABSTRACT

The propensity towards the increased number of court cases, gaps between theory and practice and the intricacy associated with construction claims tend to pose messy and indeterminate situations where the traditional instrumental approaches are criticised for sub-optimal outcomes. This essentially warrants some kind of a reflection in action merged with technical rationality in making professional judgments. There is little to no literature on how construction practitioners synthesize both paradigms within a single project, reinforcing the apparent divide between them. 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 19 contractual heads that are recognized as being effectively and amicably settled. The literature shows 17 characteristics of each domain. The study emphasized that two paradigms (technical rationality and reflective practice) are not remote, but concomitant with several discrete

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relationships. Recommendations were given for construction practitioners to use reflective practice, along with technical rationality to submit sensible claims and frame out solutions for future applications. It is apparent that the use of algorithms, industrial knowhow and thumb rules provide stimuli in claims analysis combining both the paradigms fostering a culture of sensible claims.

Keywords: Construction claims; claims process; reflective practice; technical rationality.

1. INTRODUCTION

The growth of claims has shown that real-life scenarios are complex than they are seen in outlook. Quantity surveyors and planners find it hard to provide effective solutions because of the intricacy involved in construction claims [1]. Claims are an assertion of a right that requires either more time or/and payment by either party of the contract [1]. Schedule delays escalate into claims, undermine commercial aspirations, and involve lengthy negotiations and judicial cases [2]. There is no industry consensus as to a specific technique that each party should use when assessing time-related claims [3]. Meanwhile, [4] states that a crisis of knowledge exists. [5] contend that only theoretical formulations have been attempting to offer solutions to physical phenomena. This is a startling note 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, among others. It is difficult to get intuitive decisions accepted by others, particularly because decision maker is unable to justify it with a technical rationality.

[6] points out that becoming a reflective professional involves moving beyond instructional techniques [7] categorizes theories, techniques and tools that are dominant in mathematics and science under Technical Rationality (TR) paradigm [8] argue that intuition is influentially the ideal tool to make decisions [9] endorses intuition as a function of decision making. Altogether creating a 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 [10]. Hence this alternative paradigm is both practitioner- and context-dependent [5] explain that RP encourages practitioners to diagnose problems in a more holistic manner. Reflective practice helps reduce individual idiosyncrasy (personal mannerism) of stereo type

practitioners, who simply repeat old practices. However, many professional bodies today expect that their members engage in reflective practice. This study focuses on claims management process with 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 were as follows:

- (1) To offer an overview on technical rationality and reflective practice in relation to professional practice 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.

2. LITERATURE SURVEY

Technical rationality is premised upon the notion that the practitioners are instrumental problem solvers who merely select technical means to solve the problems [4,11] contend that the process in selecting technical means itself is difficult and in most of the times, unforeseeable. The technical-rational approach is still normative attire in professional life in the western society [12]. Various fields such as education, health, among others have a record of previous attempts to legitimize their status using objective conduct and scientific method as their *modus operandi* (Natter *et al.*, 1995). However, [7] challenged 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 theory to inform situation [7] contends that technical approaches give dominance to theory and facts than opinions and feelings [7] further stressed that this 'rationality

Table 1. Characteristics in technical rationality and professional artistry

Realm of Technical Rationality	Author(s)	Case based Illustration	Reflective Form of Practice	Author(s)	Case based Illustration
Problem solving	[7]	The process by which we define the decision to be made, the ends to be achieved, the means which may be chosen.	Problem setting	[7]	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/technical means	[7,11]	Test reports, meteorological records, quality reports, compliance certificates, financial and legal instruments	Screening hidden metaphors	[30]	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	[7,14]	Chronology of events leading to claimable situation, application of contra proferentum rule in patent ambiguities	Relational approach	[31]	Argumentation backed by reasons--and modifying or defending positions accordingly.
Methodical approach	[26]	Following steps in order; establishing causal relationship, relative causative potency, proof of loss	Artistic approach	[32]	Reframing and converting the situation into solvable problems
Reductionism	[27]	Isolating and treating basis, eligibility and quantum in discrete components; incremental approach	Holism	[33]	Taking a holistic view on the overall claim cumulative approach
Seeking lesser level of anxiety	[28]	Discrete costing, tender price leveling in varied works, prorating, use of first principles	Coping with anxiety	[34]	Applying fair rates in varied works, risk margin, contingency applications
Selective inattention	[29]	data that is not immediately relevant/not submitted immaterial; only those claimed will be considered;	Transcending limits	[35]	Unclaimed financial commitment on time extension, avoid double dipping/repetition
Logical Deduction and hands-on experience	[36]	Relies on facts and rules flowing from general to specific; arriving at confirmation	Logical induction, observation, fact-	[42]	relies on patterns and trends flowing from specific to general; arriving at a theory

Realm of Technical Rationality	Author(s)	Case based Illustration	Reflective Form of Practice	Author(s)	Case based Illustration
Idiosyncrasy (personal mannerism)	[7]	Measurement of work according to individuality of the measurer when no measurement rule is available	finding, Toiling with irrelevancies	[7]	Being influenced by technically unconnected circumstances
Dogmatism	[37]	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	Pragmatism	[13,14]	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	[38]	BIM, Big Data, Artificial Intelligence and Machine Learning, parametric estimating	Intuition	[8]	Idiosyncrasy of individual measurers, gut feelings on previous hands-on experience
Adherence to Formula methods	[39]	Formula methods to compute unabsorbed overheads, price escalation, productivity losses, Three-point estimating	Industry accepted norms / continuous learning	[7]	the average by which the practitioners govern themselves; the ordinary manner of doing things; RICS practice standards
Observing Protocols	[40]	SCL protocol, pre-action protocol	Portfolio	[43]	Firm and project level analysis, Vendor Scope-Budget Matrix
Adhering to Standards	[41]	Standard method of measurement, standard phraseology, New rules of measurement, standard specifications	Industry best practice	[44]	Benchmarking & Metrics, Change Management, Constructability, mitigating impacts, Front End Planning, Lessons Learned, Modularization, Zero Accidents Techniques
Use of Theories	[7]	ways that make sense of what is observed in the natural world; structures of ideas that explain and interpret facts;	Tacit knowledge	[46]	acquired from one's own experience, which cannot be expressed easily through words or pictures
Case law/ Precedents	[45]	pre-existing rules from binding	Intellectual	[47]	educated guess based on prior

Realm of Technical Rationality	Author(s)	Case based Illustration	Reflective Form of Practice	Author(s)	Case based Illustration
Method studies and work measurement	[11]	decisions in past cases; case law in concurrent delays, delay impact analysis Analytical estimating, Direct time study Synthesis method Analytical estimating Predetermined motion time system Work sampling or ratio delay method.	hypothesis Industrial knowhow	[48]	knowledge and observation; no predetermined outcome; Guestimate, rough order of magnitude, ballpark, analogous estimating, rules of thumb

is no longer valid in the modern dynamic industries, where 'change' is fundamental. When practitioners apply esoteric knowledge, they tend to alienate themselves from their own understandings, causing a loss of their sense of competence and control [7].

[13] 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 assists in 'reframing' the issues beyond the emphasis on scientific discourse. Accordingly, reflective practitioners are those who 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 [10,7] suggested that the capacity to reflect in action so as to engage in a process of continuous learning must be 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 [7]. Blending theoretical opposites is not always trivial [14]. This 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.

[15] has given a particular emphasis to a series of widely used analysis algorithms in the domain of construction claims. [16] presented a tool to aid in analysis of delay claims. [17] provided a comparative overview of how concurrent delay is treated across a number of court cases [18] compared the traditional offsetting penalties approach with the more modern apportionment of responsibility approach. [19] contended that the dominant cause approach is less than wholly persuasive. [20] expressed reservations regarding Malmaison approach in the case of concurrent delays [21] 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 [22] opine that the law is imprecise in the contractual context. [23,24 and 25] confirm that the current position in law does not render justice to the parties in circumstances where concurrent liability exists. [19 and 21] disagree with dominant cause approach.

In nutshell, the key message is that there is no consensus as to which method that best serves the purpose under consideration. Hence, this study examines the characteristics of issues related to claims analysis with respect to two paradigms, TR and RP. It is an exploratory study the findings of which could be used to showcase a future direction in managing claims. Table 1 offers an illustration on the realm of technical rationality and reflective form of practice in the context of construction claims.

3. METHODOLOGY

This research utilized a case study approach followed by the literature survey as described below. In investigating complex situations, such as construction projects, case study approach has been proven reliable to capture rich information [49,50] contends that case study as a tool of research contributes widely in the discipline of construction management.

3.1 Design of the Study

Case study method is progressively popular among researchers [51]. In order for the research outcome to be reliable, the four fold test (Table 2) was adopted as suggested by [52].

Table 2. Four fold test of case study

Test	Purpose	Case study	Phase
Construct validity	Identify operational measures	Use multiple sources of evidence Review case study reports Review of monthly commercial report Review of claims documents Adopt an interview protocol	Data collection
Internal validity	Establish truism of relationship between research variables	Isolate converging/divergent opinion 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 Define limitations	Data analysis

As such, this paper attempted to investigate 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, reflection 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 made possible for the authors to investigate 19 issues, which could be somewhat difficult to achieve if archival of information and interview within the case study were only selected as the research strategy.

3.2 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 grade separated interchanges with cross roads, collectors-distributors, overpass and underpass structures, retaining walls, pedestrian

and bicycle paths, traffic signs, signals and ITS (Intelligent Transport Systems are to improve flow efficiency, reduce congestion on driveways, prevent accidents, and provide drivers with actual information on road conditions), 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 (Design and Build) 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 intended that this claim would 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.

4. RESULTS AND DISCUSSION

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

Table 3. Archival analysis of the case study

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)
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	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	Getting live cable deactivated, to avoid diverting of the cable will constitute redesigning of the whole scheme and working out a new route for	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

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)
Additional VCB in Tunnel S/S (Outside ROW)	connected to the substation. Contractor was instructed to supply and install, connect and energize, test and commission, an additional VCB in the existing Kahramaa substation # 21347 which is clearly outside the ROW.	diverting. Change, enforced after the project Base Date is, the Contractor contends, a Variation under the Contract.	Employer's Requirements	Not all the end user requirements could be articulated and documented at the outset	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 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 Work The 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	Engineer's failure to follow the taking over procedure stipulated in the Contract whereas, the	As Built Drawings, 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	Opening road to public in sections are a norm

Claim Head	Narrative of the Claim	Difference of Opinion	Technical tools/Process used/adapted	Limitations and Hypothesis	Reflection on Action (Analysis)	Reflection in Action (Negotiation)	Reflection on Experience (Evaluation)
	be deemed to have been taken over at date on which it is used.	Engineer has allowed the Employer to use the parts of the works				with the Employer upon the Employer request/instruction amid several obstructions	
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 Ventilation Fans	Overall height of the tunnel needed to be increased by 1000 mm (1600 mm clearance required instead of 600 mm in tender) constituting a structural change particularly in concrete and rebar quantities	Leaving aside of the Contractor's initial proposal based on the Concept drawings, the latest design is indeed an additional and to be considered as a Variation to the Contract	Preliminary Design, Detailed Design, IFC	Tunnel ventilation fans were deemed to be placed inside the Tunnel (i.e. above the walkways – away from the tunnel envelope	This forms part of the design obliged by the contractor	Increasing tunnel height in a structure of this magnitude for accommodating fans is clearly a deviation from the requirements inferred in the Contract	It is imperative to recap the fitness for purpose obligation
Changes in the Scope of	Works carried out under provisional	Tender Circulars take priority over	Conditions of Contract	Employer's approval is	Provisional Sums allowed for local	Works are to be paid directly by	A provisional sum is an

Claim Head	Narrative of the Claim	Difference of Opinion	Technical tools/Process used/adapted	Limitations and Hypothesis	Reflection on Action (Analysis)	Reflection in Action (Negotiation)	Reflection on Experience (Evaluation)
Work – Extra Cost for Supply of Material	sums	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		needed to expend monies under provisional sums	government authorities are for the supply of materials only.	the Employer	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 foresee.	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 Bridges and MSE Walls	A request is made to alter the maintenance factor and the luminaire changes that had been already implemented	Cost for demolition of the previous constructed footings re-erecting MSE wall barriers not paid.	Preliminary Design report	Maximum interval between poles. Where there is no high masts (14m and lower) a maintenance factor of 0.7	Abortive works are incidental by nature	Abortive works are owing to subsequent employer imposed changes to the design	Employer intervention to alter the maintenance factor is not envisaged at the time

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)
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	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	The choice of those inputs largely depends on the principle of cost significance in the overall share for the quoted tender	There can be over or under recovery in some extreme cases. One instance is where the contractor will

Claim Head	Narrative of the Claim	Difference of Opinion	Technical tools/Process used/adapted	Limitations and Hypothesis	Reflection on Action (Analysis)	Reflection in Action (Negotiation)	Reflection on Experience (Evaluation)
		when such materials were not used at all.			materials at the time of bidding and the current values of those indices during the construction stage in accordance with a predetermined relative proportion for each cost index	price.	have to expend more money for the whole quantity of input with the fluctuated amount earlier than what 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	Failure of the project to contribute to office	Calculation is derived from a number which	Hudson formula	Head office overhead percentage is	Disallowed certain time periods while	Head office overhead bears little or no relation	It is important to prove that contractor

Claim Head	Narrative of the Claim	Difference of Opinion	Technical tools/Process used/adapted	Limitations and Hypothesis	Reflection on Action (Analysis)	Reflection in Action (Negotiation)	Reflection on Experience (Evaluation)
Overhead (HOOH)	overheads whilst still tying down overhead resources owing to employer decisions	already contains an element of head office overheads and profits, causing double counting,		taken from the contract.	HOOH \$ is arbitrarily decided	to the actual head office costs of the 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 and time became 'at large'	the Contractor is only required to complete the works within a reasonable period of time.	Conditions of contract EOT claim SCL Delay and Disruption protocol	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 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	Prolongation claim 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.

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)
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.	preliminaries are prorated with the period extended The contractor was in a dilemma how fast track completion could be achieved, apart from this windfall.	Priced bill of quantities Variation procedure	Budget Milestone completion 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 4. Relationship between RP and TR approach

Claims Function by Key Milestones	Reflective interaction	RP procedure	Focus of Attention	TR approach	Relationship
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 articulation (Eligibility for time extension during concurrency)	Duty owed, breach of duty committed and as a result, a loss incurred, records, expertise	Use contemporary records, establish cause and effect relationship, detect relative causative potency	Contractual entitlement	Malmaison test	RP within TR
Claims articulation (scope creep)	Identify uncontrolled growth in the project scope	Experience, rules of thumb, visualization	Converting into cash	Artificial neural network	TR within RP
Quantum (choice of computational method)	Identify the limitations and hypothesis underlying the use of	Experience, considering project context, fact finding, toiling with	Productivity lost	Measured mile technique	TR within RP

Claims Function by Key Milestones	Reflective interaction	RP procedure	Focus of Attention	TR approach	Relationship
Negotiation and Defense	formula methods in calculating disruption costs Identify constraints and exploit every minor opportunity during talks	irrelevancies, case law precedents 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

4.1 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 [5] 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 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 that 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 a 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. 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 malmaison 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.

5. CONCLUSIONS AND RECOMMENDATIONS

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 are unaware of benefits of reflective practice or they tend to feel it a threat to their conservative systems. [7] 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'. This is particularly important since the construction projects are quite often characterized by complexity, dynamism, uncertainty and uniqueness, which make traditional technical approaches inadequate. Construction practitioners can act in 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 RP in order to minimise 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.

6. RESEARCH IMPLICATIONS AND CONTRIBUTION

The discussion presents a knowledge gap of linking technical rationality and reflective practice in handling construction claims. Most of the contractors' claims have been initially disputed on the notion that the extra works are not necessarily extra but mere outcomes in the process of design development which should essentially fall within the ambit of Design and Build as a contractual modality. This was 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 is unique 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. In this paper, the author critically engaged with a number of claim heads, to show that the integration between these two epistemic stances can scaffold management of claims.

7. LIMITATIONS AND FUTURE RESEARCH

This was a single case study confined to a medium scale road project in Qatar. The project administered on design and build basis suffered from a number of claims. However, this research focused only on the application of technical rationality and reflective practice. Constraints inherent in single case studies were 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.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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