Tinus Maritz & Hendrik Prinsloo

Prof. Marthinus Johannes Maritz, Department of Construction Economics, University of Pretoria, Pretoria, 0002, South Africa. Phone: +27 12 420 2581, Email: <tinus.maritz@up.ac.za>

Dr Hendrik Frederik Prinsloo, Department of Construction Economics, University of Pretoria, Pretoria, 0002, South Africa. Phone: +27 12 420 2584, Email: <hendrik.prinsloo@up.ac.za>

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A decision support framework for extension of time claims for the JBCC Principal Building Agreement

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Abstract

Delays to contractors' progress, often resulting in time and cost overruns, are a major source of claims and disputes in the construction industry. The assessment of extension of time (EOT) claims as part of a construction project can have far-reaching consequences for the financial success of the project. The proper and transparent assessment of EOT claims is, therefore, an essential component in the success of any project. In this article, an action-research approach, a very specific qualitative approach, was followed to develop a user-friendly guideline to help practitioners navigate this potential minefield of complexities in the process of the assessment of EOT claims. Focus groups, consisting of industry practitioners, with specialist knowledge in construction contracts, contributed to the development of the decision-support frameworks, and ultimately to the findings. The iterative process followed assisted in producing a tool that can be used in practice as a guideline for the analysis of EOT claims when using the Principal Building Agreement of the Joint Building Contracts Committee (JBCC).

Keywords: Construction delays, decision-trees, EOT, JBCC

Abstrak

Die vertraging van die aannemer se vordering het dikwels 'n negatiewe impak op tyd en koste en is 'n groot bron van eise en geskille in die konstruksiebedryf. Die evaluering van eise vir die verlenging van tyd (VVT) kan tot verreikende nagevolge lei in verband met die finansiële sukses van 'n projek. Die behoorlike en deursigtige evaluering van VVT-eise is dus 'n noodsaaklike komponent in die sukses van enige projek. 'n

Aksie-navorsing benadering, 'n baie spesifieke kwalitatiewe benadering, word gevolg in die artikel om 'n gebruiker-vriendelike riglyn te ontwikkel om praktisyns te help om hierdie potensiële mynveld van kompleksiteit te navigeer in die proses van die evaluering van VVT-eise. Fokusgroepe, bestaande uit industrie-praktisyns wat oor spesialiskennis in konstruksiekontrakte beskik, het bygedra tot die ontwikkeling van die besluit-ondersteuningsraamwerke en die bevindings. Die iteratiewe proses wat gevolg is het bygedra tot die ontwikkeling van 'n instrument wat in die praktyk gebruik kan word om VVT-eise te ontleed wanneer gebruik gemaak word van die Hoofbouooreenkoms van die Gesamentlike Boukontraktekomitee (GBK).

Sleutelwoorde: Besluitnemingsboom, GBK, konstruksievertraging, VVT

1. Introduction

It is often said that the owner of a building or construction project aims to achieve three objectives, namely cost, quality and time. Any project faces delays and disruptions, especially with the complex projects nowadays. These frequently entail many interfaces between the installations and any overlapping activities (Eizakshiri, Chan & Emsley, 2011: 839-848).

Delays where the contractor is not at fault would normally constitute a valid claim for extension of time (EOT). If the delay affects the critical path of the project, it would normally result in the revision of the contractual-completion date of the project. However, confirming a delay and/or disruption is not an easy task; it is a time-consuming process, especially in multifaceted projects with thousands of activities, a lot of details, as well as the involvement of many stakeholders (Alnaas, Khalil & Nassar, 2014: 308-316).

In any construction contract, the contractor has a legal obligation to complete a project by a stipulated date. However, various delays almost always disrupt the performance of the contractor's work (Danuri, Othman & Lim, 2006: 15; Abd El-Razek, Bassioni & Mobarak, 2008: 831-841; Braimah, 2008: 5-6).

During the EOT process, many problems are normally encountered in the application and preparation of the claim for EOT. Many studies have been conducted on the topic of delays and EOT assessment. The majority of the previous studies have focused on identifying the sources as well as the causes and effects of delays, whereas others discuss delay-analytical methods, or the delay-claim procedures. In practice, delays and disruption to the contractors' progress constitute a major source of claims and disputes in the construction industry (Cheung & Yeung, 1998: 367-374; Braimah, 2008: 5-6; Croeser, 2010: 4).

However, according to Yang and Kao (2012: 385-397), none of the existing delay-analytical methods are perfect, because they all include an element of assumptions, subjective assessment and theoretical projection.

1.1 Problem statement

Delays and disruptions to contractors' progress, often resulting in time and cost overruns, are a major source of claims and disputes in the construction industry. At the heart of construction-delay disputes lies the question as to what extent each contracting party is responsible for the delayed project completion, and for the extra cost incurred. Various analytical methodologies have been developed over the years as aids to determine the extent of the delay, but there is limited information on the extent of use of these methodologies in practice, and their impact on the construction process (Braimah, 2008: 5-6).

In addition, hardly any information is available in terms of an overall framework or procedure to guide practitioners in the assessment of EOT claims. Previous research in terms of the various issues to be considered is fragmentary in nature and it would typically investigate one of the aspects in isolation of the others.

Many problems are encountered in practice in the application, preparation and assessment of EOT claims. In many cases, these problems might result in disputes. The lack of clear guidance on how to assess EOT claims can be viewed as a major contributing factor to disputes (Danuri *et al.*, 2006: 15).

The delay in dispute settlement has various negative effects on the project (Iyer, Chaphalkar & Joshi, 2008: 174-184):

- It hampers the project's progress when disputes arise during the execution stage;
- It is detrimental to the relationship between the owner and the contractor, and
- It contributes to cost-and-time overruns.

1.2 Objective

The main objective of this study is to develop a framework with the use of a decision-tree analysis to provide guidance for the assessment of delay claims. The framework would assist in providing a platform to standardise the assessment of delay claims when making use of the JBCC agreement. This approach will contribute to expediting the evaluation process and limit the negative impacts associated with any prolonged process for concluding delay claims. As a result of the standardisation, it would also contribute to an improved perception of fairness in the evaluation of delay claims, which would, in turn, it is hoped, lead to the reduction in claims being subjected to dispute resolution.

2. Literature review

At the heart of any claim for extension of the contract period is the presence of an event that would cause a delay. Therefore, an in-depth understanding of this primary building block of the claim-evaluation process is essential.

2.1 Types of delays

The evaluation of construction EOT claims is, to a large extent, influenced by the type of delay. A number of studies have attempted to categorise delays in terms of the impact, risk and cause of the delay. Figure 1 provides an overview of different types of delays and the impact each has on time and extra cost.

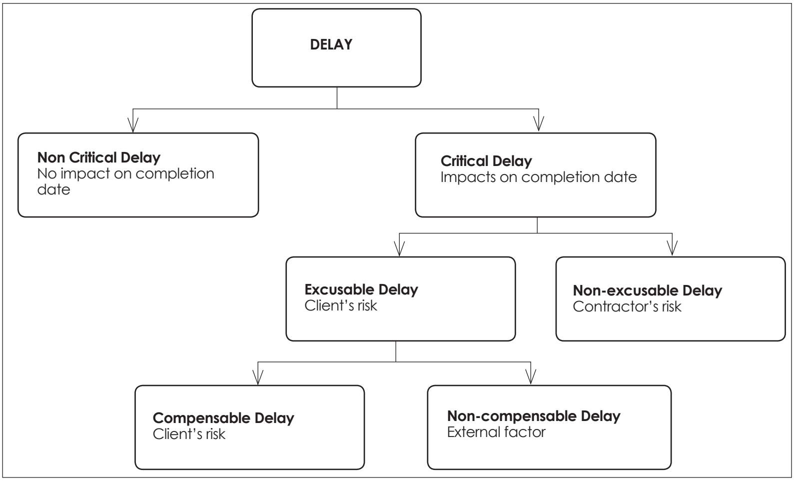

Figure 1: Types of delays

An in-depth understanding of the different types of delays is essential for the successful execution of delay-claim analysis.

2.2 Excusable delays

A non-excusable delay is defined as a delay caused by the contractor, or any aspect that is within the contractor's sphere of control. The contractor would not be entitled to any additional time or compensation for this type of delay (Tumi, Omran & Pakir, 2009: 14-15).

An excusable delay, on the other hand, can be described as a delay caused by either of the following two factors:

- Third parties or incidents beyond the control of the client and the contractor, and
- The client or the client's agents (Alaghbari, Kadir & Salim, 2007; Hamzah, Khoiry, Arshad, Tawil & Che Ani, 2011: 490-495; Tumi *et al.*, 2009: 192-206).

2.3 Critical delays

According to Pickavance (2000: 218-271), a delay in progress is not the same as a delay in completion. A delay in progress is a significant shift in the planned timing of a specific activity or activities that could occur at any time. Although the start and/or finish of the activity might differ from the original intent, it is irrelevant, unless it ultimately impacts on the completion date. On the other hand, a delay in the completion date occurs only when the completion date has passed; this can only be caused by a delay to the progress of an activity, which is in the critical path to completion.

The criticality of a delay can be defined as follows in terms of the ultimate impact on completion:

- Critical delay – a delay on the critical path of the project, resulting in the final completion date of the project being delayed, and
- Non-critical delay – a delay that is not on the critical path and that would, therefore, not impact on the overall completion date (Ndekugri, Braimah & Gameson, 2008: 692-700).

2.3.1 Determining criticality

Braimah (2008: 93-125) states that various methodologies have been developed over the years as aids to evaluate any delay claims. These methods would test delays in terms of the criticality, and attempt to quantify the extent of the delay. These methodologies can be divided into different categories (non-critical-path method-based techniques and critical-path method-based techniques) and different types, as are encountered in projects.

The methodologies for analysing delay are summarised and categorised in Table 1.

Table 1: Existing delay analysis methodologies

	Common name	*Description*	*Literature*
Non-CPM-based techniques	S-curve	Develop time/cost S-curve baseline and compare with actual S-curve	Rubin, Fairweather & Guy (1999)
	Global impact technique	Show all delays on bar chart Total delay = sum of all delays	Leary & Bramble (1988); Alkass, Mazerolle & Harris (1995; 1996: 375-394); Pinnell (1998)
	Net impact	Show all delays on bar chart Eliminate concurrence Total delay = sum of net delays	Leary & Bramble (1988); Alkass *et al.* (1995, 1996: 375-394)
CPM-based techniques	As-planned vs. as-built	Compare baseline programme with as-built programme to determine overall delay	Stumpf (2000: 32-32); Lucas (2002: 30-36); Lovejoy (2004: 27-30); Pickavance (2005: 218-271)
	As-planned but for	Take the actual as-built schedule and take out the duration of all the excusable delays	Alkass *et al.* (1996: 375-394); Pinnell (1998)
	Impacted as-planned	Incorporate delays into as-planned (baseline) programme	Trauner (1990); Pinnell (1998); Lucas (2002: 30-36); Lovejoy (2004: 27-30) Pickavance (2005: 218-271)
	Collapsed as-built	Eliminate delays from as-built programme	Pinnell (1998); Stumpf (2000: 32-32); Wickwire & Groff (2004: 3-9); Lovejoy (2004: 27-30)
	Window analysis	Divide the programme in a number time periods Update each window with delays in that period	Galloway & Nielsen (1990); Bordoli & Baldwin (1998: 327-337.); Finke (1999: 96-100); Lovejoy (2004: 27-30); Pickavance (2005: 218-271)
	Time impact analysis	Establish effect of individual delays on baseline programme Evaluate delays chronologically	Leary & Bramble (1988); Alkass *et al.* (1996: 375-394); Pickavance (2005: 218-271).

Source: Braimah (2008: 93-125)

2.3.2 General deficiencies of delay-claim analysis methodology

In general, the existing methods of evaluating delays and formulating claims are "inaccurate, time-consuming and costly". Preparing the claims involves scrupulous digging up information through piles of project documents to arrange and ascertain the relevant delays encountered throughout the project lifecycle (Alkass *et al.*, 1996: 375-394).

In addition to the diverse outcomes that existing methods produce, when applied to the same set of delay claims data, other significant matters that can possibly influence the outcomes are frequently not even considered when applying these techniques. These matters comprise the functionality of the programming software employed; resource loading and levelling requirements; resolving concurrent delays, and delays in pacing the strategies (Braimah, 2013: 506-531).

2.4 Compensable delays

Compensation will have to be considered if a delay is found to be excusable, and it should be established whether the delay can be defined as follows:

- Non-compensable delay – an excusable delay caused by factors beyond the control of the client and the contractor. Although most forms of contract make provision for the extension of the contract-completion date, the contractor will not receive compensation from the client; and
- Compensable delay – an excusable delay caused by the client or the client's agents. The contractual completion date will be extended, and the contractor will receive compensation from the client (Tumi *et al.*, 2009: 192-206).

The JBCC agreement clearly differentiates between delays that would attract compensation and delays that are not compensable. Clause 23.1 provides a list of delay-causing events, which would not result in an adjustment of the contract value (compensation). On the other hand, clause 23.2 makes provision for delaying events, which would attract compensation. Clause 23.3 also makes provision for circumstances, not specifically mentioned in clause 23.1, while clause 23.2 makes provision for circumstances beyond the contractor's reasonable control.

2.5 Contractual compliance in terms of delay claims

In order to assist contracting parties in dealing with claims that might arise during the execution of the construction contract, the majority of the standard construction contracts contain provisions, under which the contractor can recover compensation from the employer for various losses suffered – where the project is prolonged or disrupted by certain specified causes (Croeser, 2010: 20).

However, the majority of contractual regimes, and even general conditions of contract, do not provide details of the principles governing the assessment of claims for EOT; this is left to the professionals involved in each project (Yogeswaran, Kumaraswamy & Miller, 1998: 283-293).

Delay-claim clauses in the majority of the standard construction contracts can be classified into the following two main categories:

- Clauses dealing with the notification of a possible delay, and
- Clauses dealing with the claim itself.

Compliance with all contract provisions in regard to claims is a prerequisite for the claim to be considered for approval.

3. Research methodology

3.1 Research design

In considering the choice of the research design, one should bear in mind that the research is undertaken in the built environment. Built-environment disciplines are primarily applied sciences, focusing on the application more than on the mere generation of knowledge (Klosterman, 1983: 216-225; Knight & Ruddock, 2009:1-12, 14-27). Given this background, the research design should be able to deliver results that can be applied in practice. Upon further investigation, it became evident that action research, a very specific qualitative approach, would be the most appropriate choice for the research design.

Action research can be defined as a participatory, democratic process, concerned with developing practical knowledge in the pursuit of worthwhile human purposes, grounded in a participatory worldview. It seeks to bring together actions and reflection, theory and practice, in participation with others, in the pursuit of practical solutions, in order to address issues of pressing concern to people. Reason and Bradbury (2001: 1-19) and Huang (2010: 93-109) simplified it further by stating that action research is an approach to knowledge creation that results from a context of practice; it requires researchers to work with practitioners.

3.2 Methodology

The action research process required to develop a decision-tree support framework for the assessment of EOT claims was executed, as depicted in Figure 2.

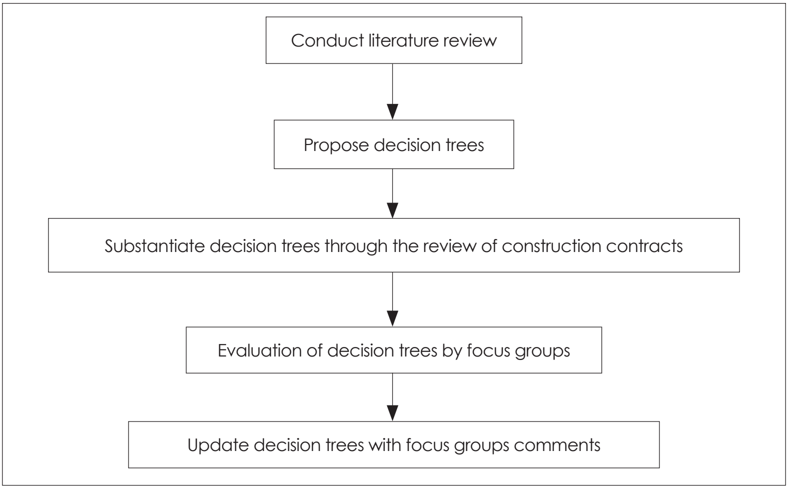

Figure 2: Action research process to develop a decision-tree support framework

The first step in the action-research process was to conduct a literature review. The main objective of the literature review was to identify the key decisions required in the assessment of construction-delay claims. For a decision tree to be functional, the decisions to be considered in order to reach a conclusion should be known. Therefore, key decisions are an essential requirement when developing a decision tree.

The literature was of great assistance, not only when identifying critical decisions in the assessment of EOT claims, but also to further investigate important considerations associated with the key decisions.

The information, in terms of critical decisions identified during the literature-review process, was utilised as the input to develop a decision tree for the assessment of EOT claims.

3.3 Research instrument

A research instrument is a tool utilised to gather the data for analysis (Hofstee, 2006: 107-119). The research tool should be considered in the context of the action-research design followed in the study. The focus-groups process was viewed as the most appropriate approach, as "focus groups explicitly use group interaction as a part of the method" (Kitzinger, 1995: 299). To further supplement the focus-group process, selected interviews were also held with industry specialists.

3.4 Data

The absence of a specific grouping structure of construction industry specialists knowledgeable and experienced in EOT claims necessitated the use of non-probability sampling. Purposive sampling, one of the most common non-probability sampling strategies, was deemed to be the most appropriate approach. Purposive sampling calls for the participants to be selected on the merits of their specific involvement and the experiences central to the phenomenon being studied (Greig, Taylor & MacKay, 2012: 81-200).

The level of knowledge required excluded some possible participants, who would only have a basic knowledge of contract clauses – as a result of the utilisation of the specific contract in a project. Consequently, it was decided to target those members serving on the technical committee of the organisation responsible for the compilation of the construction contract. To ensure that meaningful participation of all the group members was possible, it was decided to keep the number of participants as low as possible. As a result of the small number of possible participants with the sufficient degree of expertise in this specialised subject, larger focus groups were not possible.

Table 2: Focus-group participants

	Designation	*Years of experience*
1.	Architect; CEO JBCC technical committee	Over 40 years
2.	Contractor; Construction contract specialist	Over 30 years
3.	Contractor, Construction contract specialist	Over 30 years
4.	Construction contract consultant	Over 30 years

	Designation	*Years of experience*
5.	Quantity Surveyor; Construction Contract specialist	Over 40 years
6.	Architect; attorney; Construction Contract specialist	Over 40 years

The data gathered by means of the focus group and interview process were extremely valuable, and led to a number of amendments to the original proposed decision trees developed.

3.5 Limitations

The main objective was to provide a holistic guideline to assist in the assessment of EOT claims. The EOT assessment process addresses a large number of different aspects. It was not possible to do an in-depth analysis of each of the different aspects, partly because of time and practical constraints, and partly because too much detail would detract from the aim to provide an overall guideline with an emphasis on ease-of-use.

4. Findings

4.1 Universal decision tree framework

To be able to apply decision tree principles to EOT analysis, it was necessary to identify the decisions taken as part of the evaluation process. The literature, focus groups and interviews identified the following essential decisions required when an EOT claim is to be analysed:

- Was the delay critical?
- Was the delay excusable?
- Were the contractual provisions complied with?
- Was the delay compensable?

Decision trees address decisions in a sequential manner. As a result, it is necessary to determine the sequence in which the above decisions should be made.

The decision on whether the delay is compensable can only be made once all the other decisions have had a positive outcome and it is established that EOT should be awarded. Therefore, this decision should be considered last. A logical approach would be to sequence decisions in terms of the consequence of the outcome of the decision. If a specific decision would lead to the rejection of the EOT, it would make sense to consider this decision first. However, it is not possible to decide which of the three remaining decisions should be addressed first, by merely examining the outcome of the decision, because a negative response to any of the first three decisions would result in the EOT not being awarded. The degree of effort required in making a decision in each of the three questions differs. In practical terms, it would make sense to consider the decision that would require the least amount of effort first. Should this first decision result in the claim not being awarded, time would not unnecessarily be spent on decisions that require more effort to consider.

To determine whether a delay is critical is normally the most complex and time-consuming part of an EOT claim analysis. A practitioner would not want to embark on this cumbersome process without knowing that the contract provisions were complied with and the delay is indeed excusable. For this reason, it is proposed that criticality should only be considered after contractual compliance was assessed and the question as to whether the delay is excusable has been addressed. To determine whether a delay is excusable (beyond the contractor's reasonable control) can sometimes be complex and time consuming. It is reliant on evidence presented by the contractor and the verification by the person responsible for the EOT claim analysis.

To determine whether the general contract clauses were complied with would normally not be a very involved process, as the facts presented in the EOT claim submission would be evaluated in terms of the relevant contract clauses. It is, therefore, proposed that the compliance with contract clauses should be considered before a determination is made on whether the delay is excusable. The following sequence of decision-making is, therefore, proposed:

- Decision 1 – Were the contractual provisions complied with?
- Decision 2 – Was the delay excusable?
- Decision 3 – Was the delay critical?
- Decision 4 – Was the delay compensable?

If the decisions required in the EOT claim analysis process are translated into a decision tree, the decision tree can be formulated as follows (refer to Figure 3):

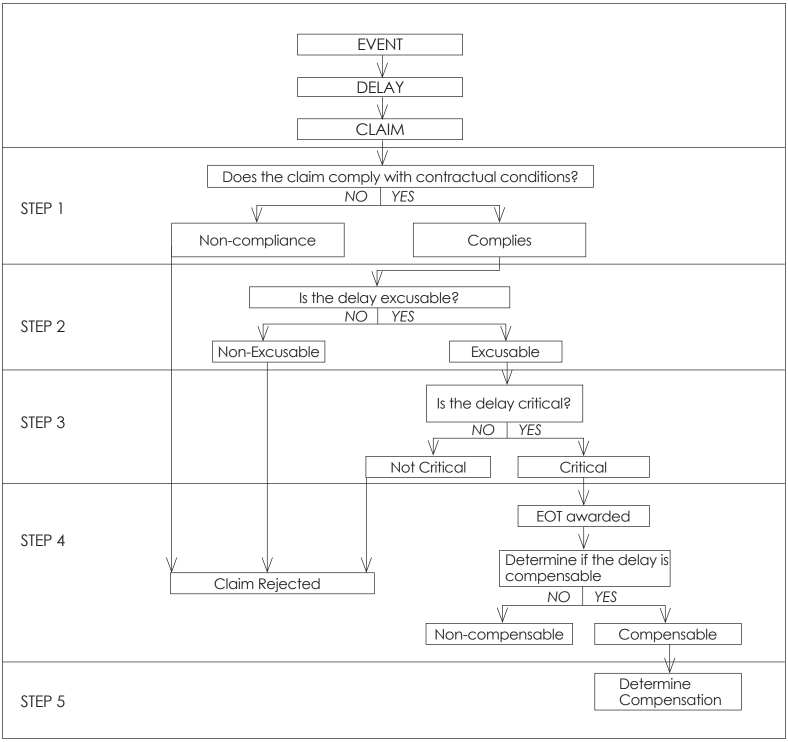

Figure 3: Universal decision-tree framework

The principles defined as part of the universal decision-tree framework can be applied in the process of assessing EOT claims when utilising the JBCC agreement.

4.1.1 Assess contractual compliance (step 1)

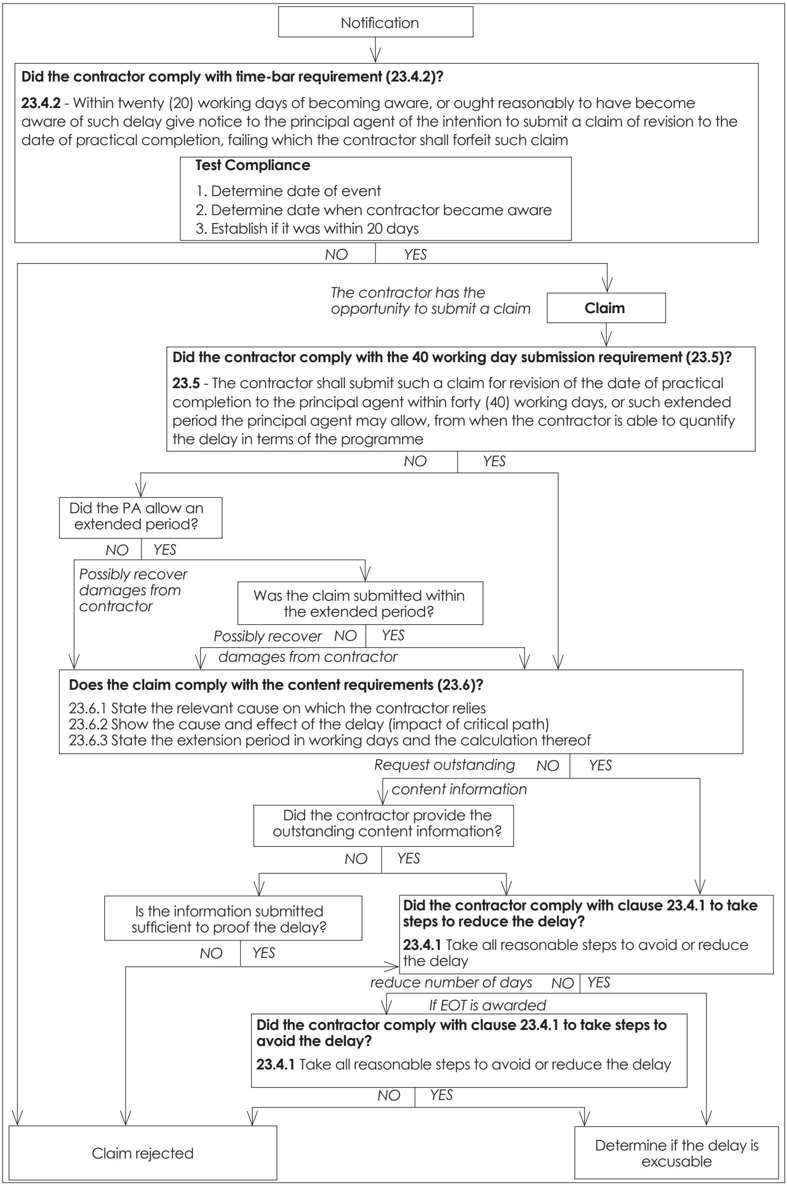

Figure 4: Decision tree: JBCC contract compliance

The test for contractual compliance in the JBCC agreement is twofold. First, criteria in terms of the notification of delay should be complied with and, secondly, certain requirements in terms of the claim should be met.

The main focus of the notification clause is to determine if the contractor complied with the time-bar requirements set in clause 23.4.2. According to the clause, the contractor should provide a notice within 20 working days of becoming aware of the delay. The clause is clear that, should this time bar not being adhered to, the claim will be forfeited. Therefore, the first decision as part of the decision-tree framework should be to test compliance with the time-bar requirements.

If the provision in clause 23.4.2 is strictly applied to a situation where the contractor has not met the 20 working-day notification requirement, then the claim can be rejected. However, from a common-law and a case-law perspective, the decision to reject the claim is perhaps not so simplistic. In case law, it is clear that, if a client, by his own act, delays performance, he is not entitled to take advantage of his own wrong. One example can be found in *Kelly and Hingle's Trustees vs Union Government (Minister of Public Works) 1928 TPD 272,* a case dealing specifically with delay and the right of the employer to impose liquidated damages on the contractor, as a result of delayed completion of the work. Feetham J. quoted the English case of *Holme vs Guppy*, in which case it was held that "if a man by his own act prevents the performance of what another has been stipulated to perform, he cannot take advantage of his own wrong." And further "… and there are clear authorities that if the party be prevented, by the refusal of the other contracting party, from completing the contract within the time limited, he (the contractor) is not liable in law for the default. It is clear, therefore, that the plaintiffs (the contractor) were excused from performing the agreement contained in the original contract. The plaintiffs were, therefore, left at large, and are not to forfeit anything for the delay.

If this principle is applied to the time-bar provision in clause 23.4.2, it is perhaps not advisable to immediately reject a claim if the 20 working-day notification provision was not adhered to. It should first be considered whether the delay was not as a result of the actions of the client. If this was the case, the contractor might have a remedy in law if the claim is outright rejected – due to non-compliance with the time bar.

Should it be found that the time bar required was adhered to, the next step would be to assess compliance in terms of the claim-admission requirements.

According to clause 23.5, the submission of the claim is also governed by a requirement to submit the claim within a stipulated period of time. The contractor should submit the claim within 40 working days from the time when the contractor is able to quantify the delay in terms of the programme. Provision is also made for the principal agent to allow an extended period for claim submission.

The second decision, as part of the decision-tree framework, would therefore be to establish if the claim was submitted within the stipulated period of time. It should be borne in mind that the principal agent would only be in a position to verify adherence to the deadline once the claim is submitted, as the relevant information to determine when the contractor was able to quantify the delay in terms of the programme (in accordance with clause 23.5) will only be submitted with the claim. In contrast to the notification clause (clause 23.4.2), the clause dealing with the submission of the claim is silent on the consequence of non-adherence to the 40 working-day submission requirement. Without a specific provision in the clause that the claim will be forfeited if the 40 working-day submission requirement was not adhered to, it is not advisable to reject the claim on this basis.

The first consideration would be to determine if the principal agent granted an extended period for the claim to be submitted. If an extended period was agreed to, it should then be determined whether the contractor complied with the deadline in terms of the extended period. Late submission in both scenarios, non-adherence to the original 40 working-day submission requirement, or to the extended deadline, would not lead to the rejection of the claim. It is in the contractor's interest to submit the claim as soon as possible, because, without an approved EOT claim, the practical completion date would not be adjusted. In a case where the claim was submitted late, the contractual remedy for the client is damages. It should be determined whether the client suffered any damages as a result of the late submission of the claim. The JBCC agreement does not provide specific guidance on how damages, as a result of the late submission of an EOT claim, should be dealt with. It is assumed that, if damages can be proven, it would be possible for the client to recover the cost in terms of clause 27.0 (recovery of expense and/or loss).

If the claim was submitted within the 40 working-day deadline, or if it was submitted late, the next decision required will be to establish if the claim complies with the content requirements stipulated in clause 23.6:

- *23.6.1 State the relevant clause on which the contractor relies.*
- *23.6.2 Show the cause and effect of the delay (impact of critical path).*
- *23.6.3 State the extension period in working days and the calculation thereof.*

No specific consequence is mentioned if the claim does not comply with the content requirements. In practice, the principal agent would normally request the contractor to submit additional information if sufficient information to comply with the content requirements was not provided, even though the JBCC agreement does not specifically deal with a request for additional information. If no information is forthcoming after a request for additional information by the principal agent, the claim would be evaluated on the basis of the original information provided. The lack of information could influence the outcome of the claim. At this stage, the principal agent would have to review the information submitted, and make a decision on whether the information was sufficient to confirm the delay. If the information is not sufficient – even after a request for additional information – it is probable that the claim would be rejected.

Should the content be acceptable, there still remains one requirement to consider – if all reasonable steps to avoid or reduce the delay were taken according to clause 23.4.1. The JBCC agreement is silent on the issue of non-compliance with this clause. The question that the principal agent should consider is whether any reasonable action from the contractor could have reduced the delay or even resulted in the avoidance of the delay. If it is clear that the action – or it may very well be the lack of action – by the contractor resulted in the delay persisting longer than necessary, the remedy might be to reduce the number of days awarded. It would only be possible to effect this reduction in step 3 of the universal decision tree, when it is being considered whether the delay is critical. The number of days awarded would only be determined in this step.

If it is found that the contractor could have taken reasonable steps to avoid the delay but the steps were not taken, this may lead to the rejection of the claim. If the contractor did take all the reasonable steps to reduce or avoid the delay, the next step in the decision-tree process would be to determine whether the delay is excusable (see Figure 5).

4.1.2 Determine whether the delay is excusable (step 2)

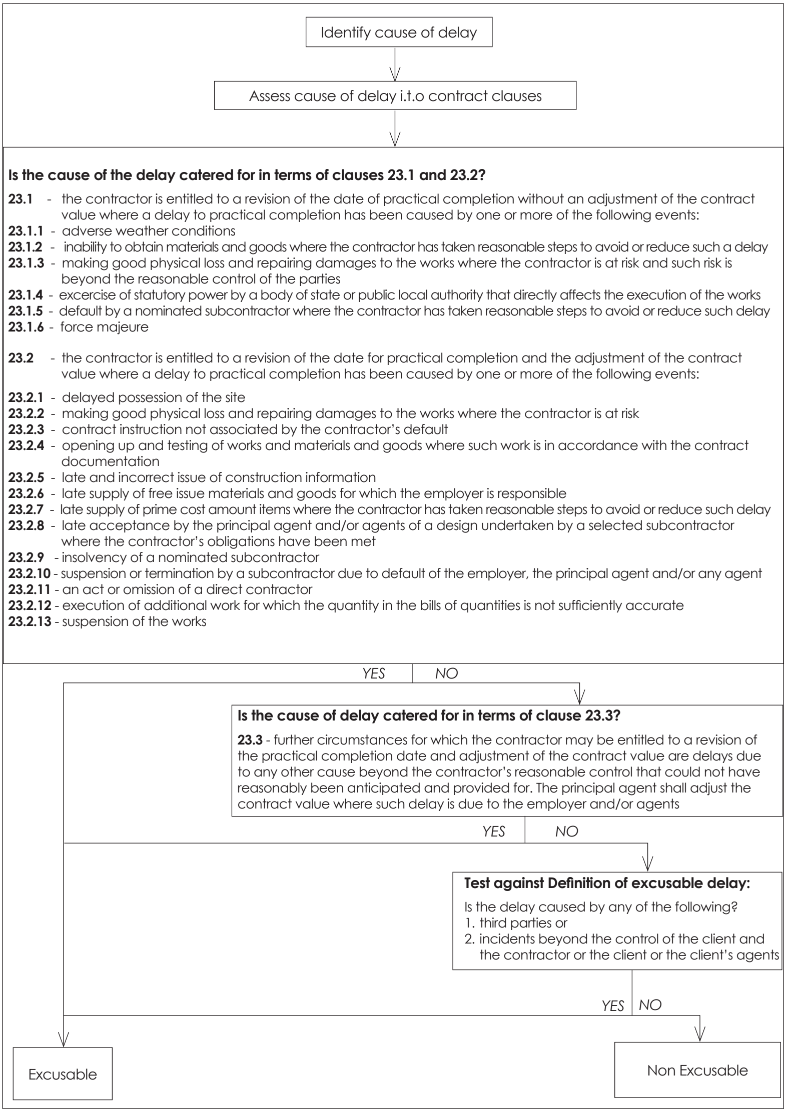

Figure 5: Decision tree: JBCC excusable delay or not

The first decision required would be to assess whether the cause of the delay is specifically mentioned in the lists of possible delays provided in clauses 23.1 and 23.2. Should this be the case, the delay would then be viewed as excusable. If the delay is not specifically mentioned in any of the two clauses, it should then be considered in terms of clause 23.3. Clause 23.3 provides for the following criteria to test the cause of the delay:

- Is the cause of the delay beyond the contractor's reasonable control?
- Could the cause of the delay not have been reasonably anticipated and provided for?

To establish whether the delay is beyond the contractor's reasonable control and whether the cause of the delay could have been anticipated or provided for, it would be necessary to consult the tender documents. By assessing the tender documents, one should be able to establish the information available to the contractor in terms of the delay in question. This information would assist in answering the question as to whether the cause of the delay could have been anticipated or reasonably provided for. If the delay could not have been anticipated and provided for, this would qualify as an excusable delay. If the contrary is evident, the claim would be rejected on the basis that the contractor was responsible for the risk associated with the cause of the delay.

It is possible that the tender document might be silent on the cause of the delay in question. In such a case, it is proposed that the definition of an excusable delay be utilised to determine the outcome of the decision.

A final decision can now be made to determine if the cause of the delay was excusable. Should the assessment show that the delay is indeed excusable, and therefore not as the contractor's risk, the next consideration in the decision-tree framework is to determine whether the delay is critical.

4.1.3 Determine whether the delay is critical (step 3)

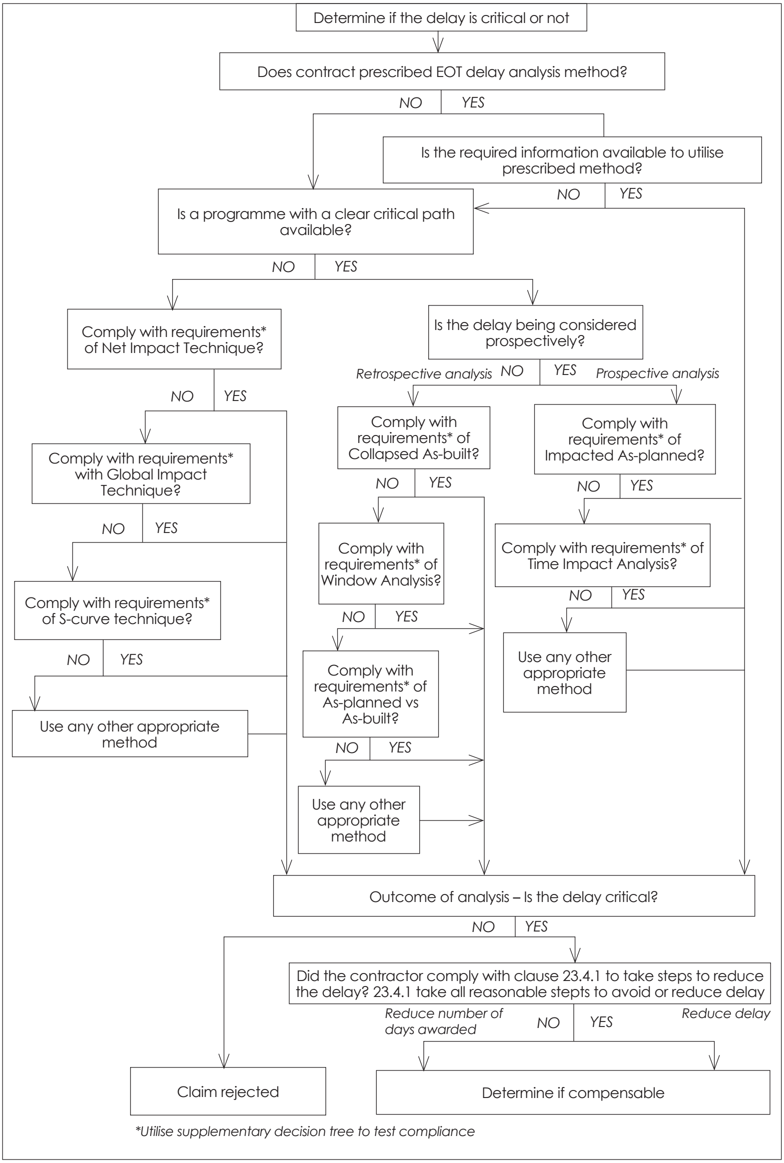

Figure 6: JBCC: Decision tree to determine if delay is critical

To determine whether the delay is critical, the first decision required as part of the decision tree would be to establish which of the EOT delay analysis methods (DAM) should be utilised. The JBCC agreement does not prescribe the type of DAM to be utilised, therefore leaving the choice open to the principal agent.

EOT DAMs can be divided into two main categories: non-critical path methods and critical path methods. It would be preferable to utilise a critical path method. As this outcome would be conclusive as to whether the delay was critical or not. Unfortunately, in some instances, a programme with a clear critical path may not be available, and a decision would have to be made with the limited information available. In such cases, the only alternative would be to utilise one of the non-critical path methods. The second consideration in the decision tree would be to determine whether a programme with a clear critical path is available. If the response is positive, the next consideration would be to decide on the most appropriate critical path method to utilise.

The timing of when the analysis is taking place would have an impact on the choice of DAM. Prospective analyses seek to determine the likely impact of the delay on the project completion date. Retrospective analyses seek to determine the actual impact of the delay on the completion date. Therefore, before the decision tree considers the choice of DAM, it requires that it should first be determined whether the delay is being considered prospectively or retrospectively.

Braimah and Ndekugri (2008) did a study on the factors that influence analysts' selection from these methodologies. Eighteen factors were identified with the help of the literature review and pilot surveys, and then ranked on their relative importance, based on data collected in a nationwide survey of United Kingdom construction organisations (Table 3).

Table 3: Factors influencing the selection of DAM

Factor	*Source literature*						
	Leary & Bramble (1988)	*Conlin & Retik (1997)*	*Finke (1997)*	*Bubshait & Cunningham (1998)*	*Bramble & Callahan (2000)*	*SCL (2002)*	*Pickavance (2005)*
Records availability	✓	✓	✓	✓	✓	✓	✓
Baseline programme availability	✓			✓		✓	✓
Nature of baseline programme				✓	✓	✓	✓
Updated programme availability				✓	✓	✓	✓
Reason for the delay analysis	✓	✓				✓	✓
Applicable legislation		✓					
The form of contract		✓	✓			✓	✓
Cost of using the technique	✓			✓		✓	✓
Nature of the delaying events	✓				✓	✓	
Skills of the analyst	✓				✓	✓	
The amount in dispute	✓				✓	✓	
The number of delaying events			✓		✓		

Source: Adapted from Braimah & Ndekugri (2008)

The construction industry-wide survey yielded the following results (summarised in Table 4) in terms of the relevant importance of the factors influencing the selection of the DAM.

Table 4: Relevant importance of DAM selection factors

Selection factor	*Overall*	
	Importance index	*Rank*
Records availability	97.5	1
Baseline programme availability	84.1	2

Selection factor	*Overall*	
	Importance index	*Rank*
The amount in dispute	73.1	3
Nature of baseline programme	71.5	4
Updated programme availability	69.8	5
The number of delaying events	66.1	6
Complexity of the project	65.8	7
Skills of the analyst	65.3	8
Nature of the delaying events	64.6	9
Reason for the delay analysis	61.8	10
Type of contract	59.2	11
Cost of using the technique	58.0	12
Dispute resolution forum	54.4	13
Time of the delay	62.0	14
Size of project	50.9	15
Duration of the project	45.1	16
The other party to the claim	44.7	17
Applicable legislation	36.5	18

Source: Adapted from Braimah & Ndekugri (2008)

The industry-wide survey also determined the extent of use of different DAMs. The survey ranked the DAMs in terms of the extent of use for both critical path methods and non-critical path methods. Table 5 provides information on the overall ranking of different methods.

Table 5: Extent of use of DAMs

DAM	*Usage index*	*Rank*
As-planned vs as-built	65.7	1
Impacted as-planned	59.4	2
Collapsed as-built	54.8	3

DAM	*Usage index*	*Rank*
Time impact analysis	48.2	4
Net impact	45.7	5
Global	45.5	6
Window analysis	40.2	7
S-curve	33.8	8

Source: Adapted from Braimah & Ndekugri (2008)

In the absence of any guidance from the contract, a decision on the most appropriate DAM should be made. In order to make this decision, it is proposed that the five most significant factors influencing the selection of DAMs should be utilised in the decision tree, in order to identify the most appropriate method (Table 4).

1. Records availability.
2. Baseline programme availability.
3. The amount in dispute.
4. Nature of baseline programme.
5. Updated programme availability.

Table 6 highlights the information required for the following criteria for selection:

- Records availability.
- Baseline programme availability.
- Nature of baseline programme.
- Updated programme availability.

Table 6 can be utilised as a tool to support decision-making when considering the selection of the appropriate DAM as part of the decision tree.

Table 6: Requirements to utilise DAMs

Record	*As-planned vs as-built*	*Impacted as-planned*	*Collapsed as-built*	*Window analysis*	*Time impact analysis*
Important project information required for the application of DAMs					
Outline of delay events	✓	✓	✓	✓	✓
Start dates of delay events	✓	✓	✓	✓	✓
Finish dates of delay events	✓	✓	✓	✓	✓
Activities affected by delays			✓	✓	✓
Duration of delay events	✓	✓	✓	✓	✓
Original planned completion date (or as extended)	✓	✓		✓	✓
Actual completion date	✓		✓	✓	✓
As-planned critical path(s)	✓	✓		✓	✓
As-built critical path	✓		✓		
Updates critical or near critical path(s)				✓	✓
Update or schedule revision dates				✓	✓
Activity list with logic and lag	✓	✓	✓	✓	✓
Main programming requirements of DAMs					
Baseline programme available	✓	✓		✓	✓
Nature of baseline programme					
Available in CPM	✓	✓		✓	✓
Includes all relevant activities	✓	✓		✓	✓
Reasonable activity durations	✓	✓		✓	✓
Reasonable activity relationships	✓	✓		✓	✓
Activities defined in appropriate detail	✓	✓		✓	✓

Record	*As-planned vs as-built*	*Impacted as-planned*	*Collapsed as-built*	*Window analysis*	*Time impact analysis*
Relevant programmes updates for DAMs application					
Intermediate regular programme updates available				✓	✓
Final updated programme available (as-built programme)	✓		✓	✓	✓
TOTAL	16	13	9	19	19

Source: Adapted from Braimah (2008)

A specific DAM can only be utilised if it was established that the required information to execute that particular DAM is available. The supplementary decision trees provided below (Figures 7 to 14) in conjunction with Table 6 would be of assistance in this regard. The contract administrator should verify whether the information required to successfully utilise the DAM provided in Table 6 is available. This would be the first decision required in the decision trees. Should the information be available, the decision trees would then consider the adherence to the other important selection criteria. Should the decisions required in terms of the other selection criteria yield positive responses, the specific DAM can be utilised. Should any of the decisions required in terms of the selection criteria be negative, an alternative DAM should be considered by repeating the process.

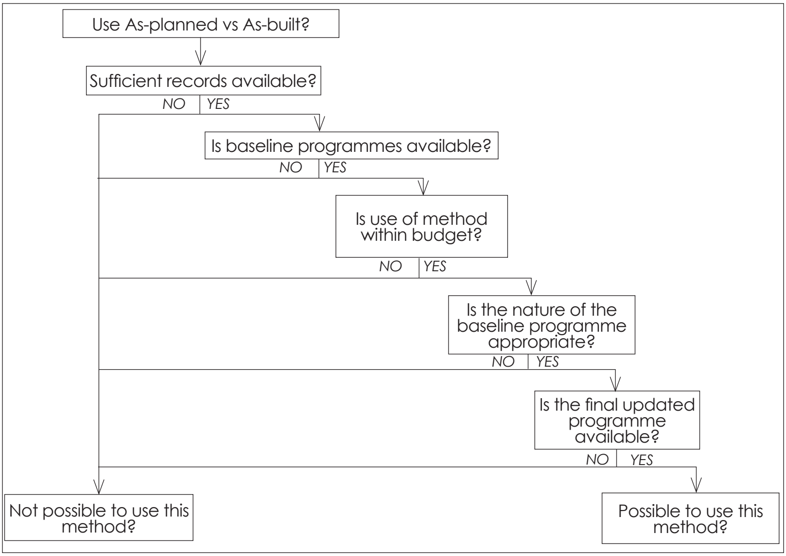

Figure 7: Decision tree: Use As-planned vs As-built?

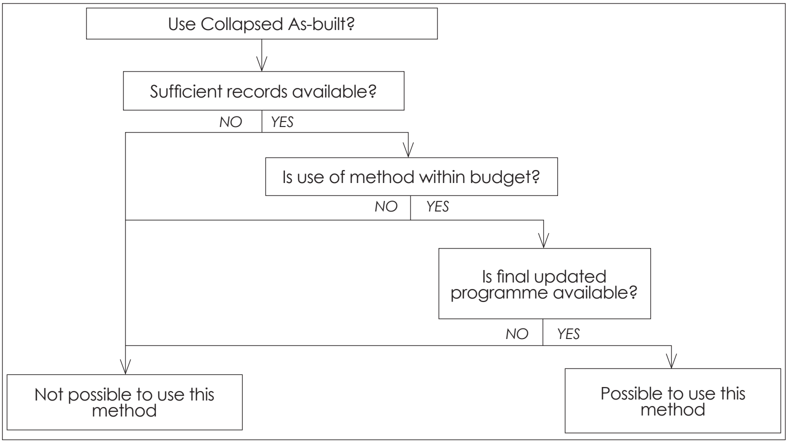

Figure 8: Decision tree: Use Collapsed As-built?

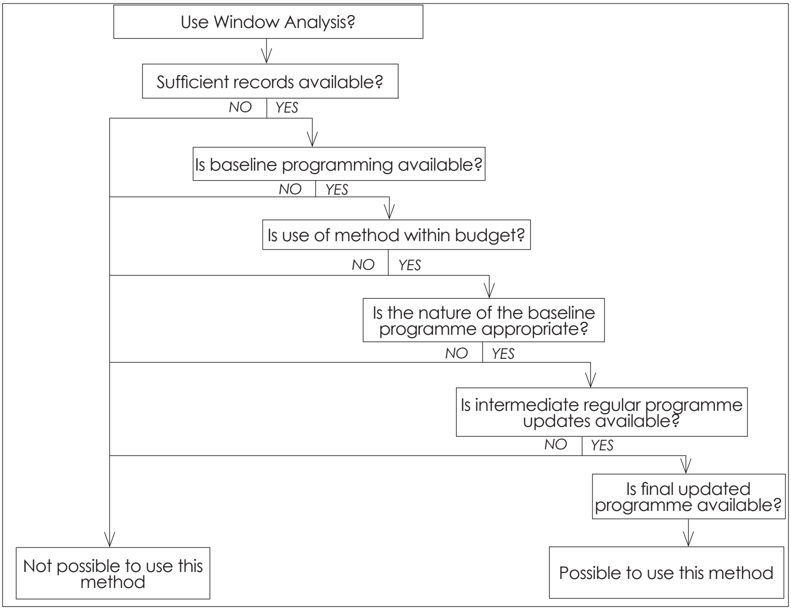

Figure 9: Decision tree: Use Window analysis?

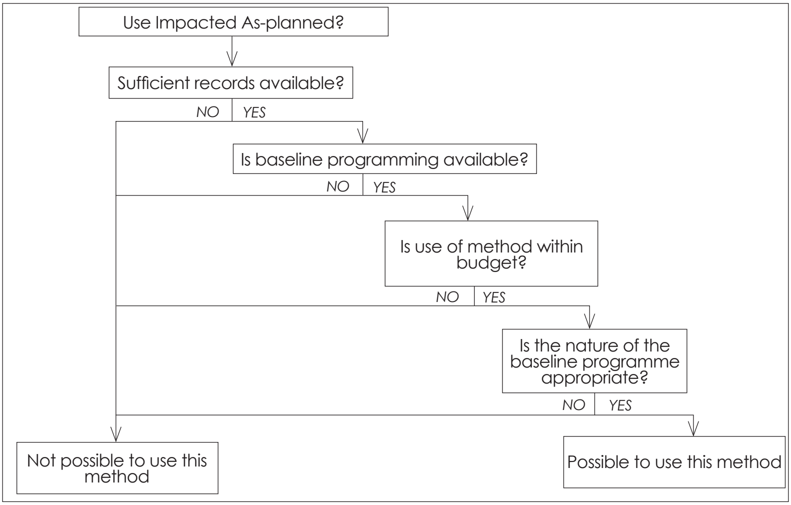

Figure 10: Decision tree: Use Impacted As-planned?

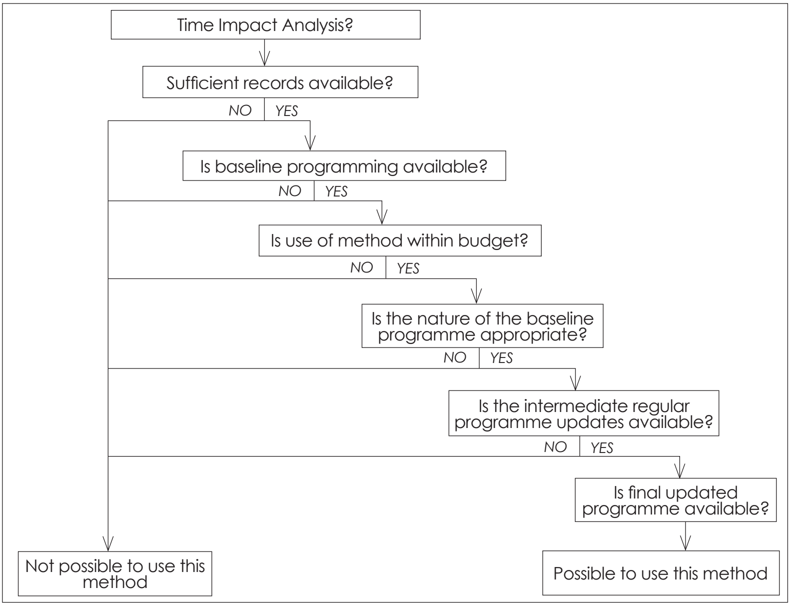

Figure 11: Decision tree: Use Time impact analysis?

If a programme with a clear critical path is not available, one of the non-critical path methods should be considered. The project-related information available would be the most significant deciding factor utilised in the decision tree to choose the most appropriate non-critical path DAM. One of the following decision trees can be utilised to decide on the most appropriate non-critical path method (Figures 14-15).

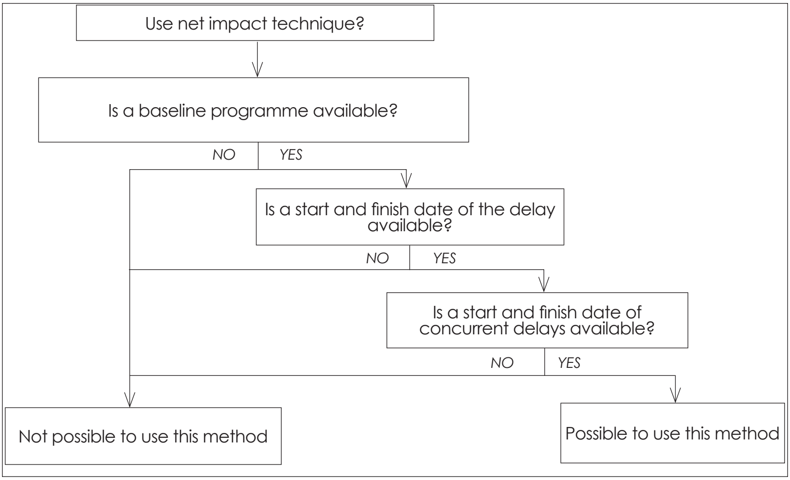

Figure 12: Decision tree: Net impact technique?

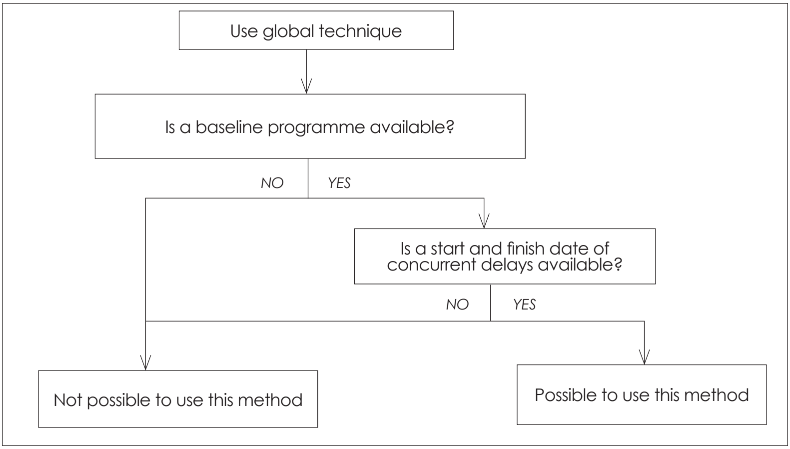

Figure 13: Decision tree: Use Global impact technique?

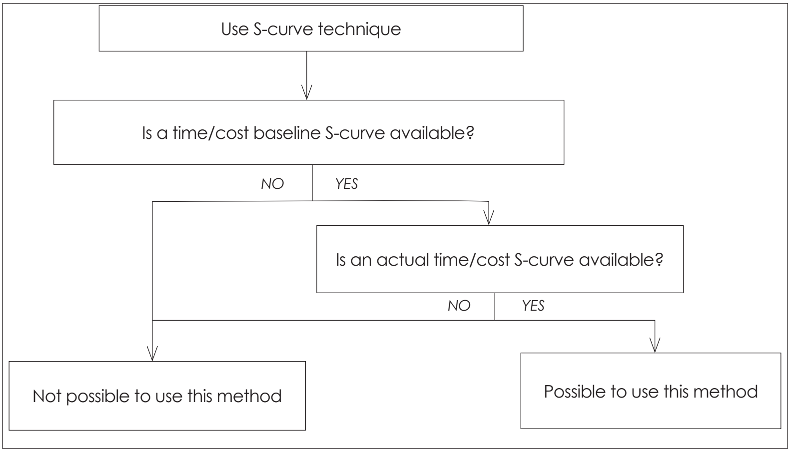

Figure 14: Decision tree: Use S-curve technique?

Once the DAM has been decided upon, the delay would be analysed. The main outcome of the delay-analytical process would be to determine whether the delay is critical or not. The DAM should also give an indication of the number of days that the event delayed practical completion. At this stage, the decision tree would consider the impact of clause 23.4.1 of the JBCC agreement. Clause 23.4.1 calls for the contractor to take reasonable steps to avoid or reduce the delay. Should it be established that the contractor did not take reasonable steps to address the delay, the impact should be considered. If, as a result of the contractor not taking action, the delay persisted for a prolonged period of time, the number of days awarded may be reduced, in order to take this into account. If, taking reasonable steps to address the delay, the contractor could have avoided it, the outcome of the assessment process may very well be that no EOT is awarded to the contractor.

If the delay is not critical, the delay would be rejected. If the delay is critical, the next step in the decision-tree process would be to investigate whether the delay is compensable.

4.1.4 Determine whether the delay is compensable (step 4)

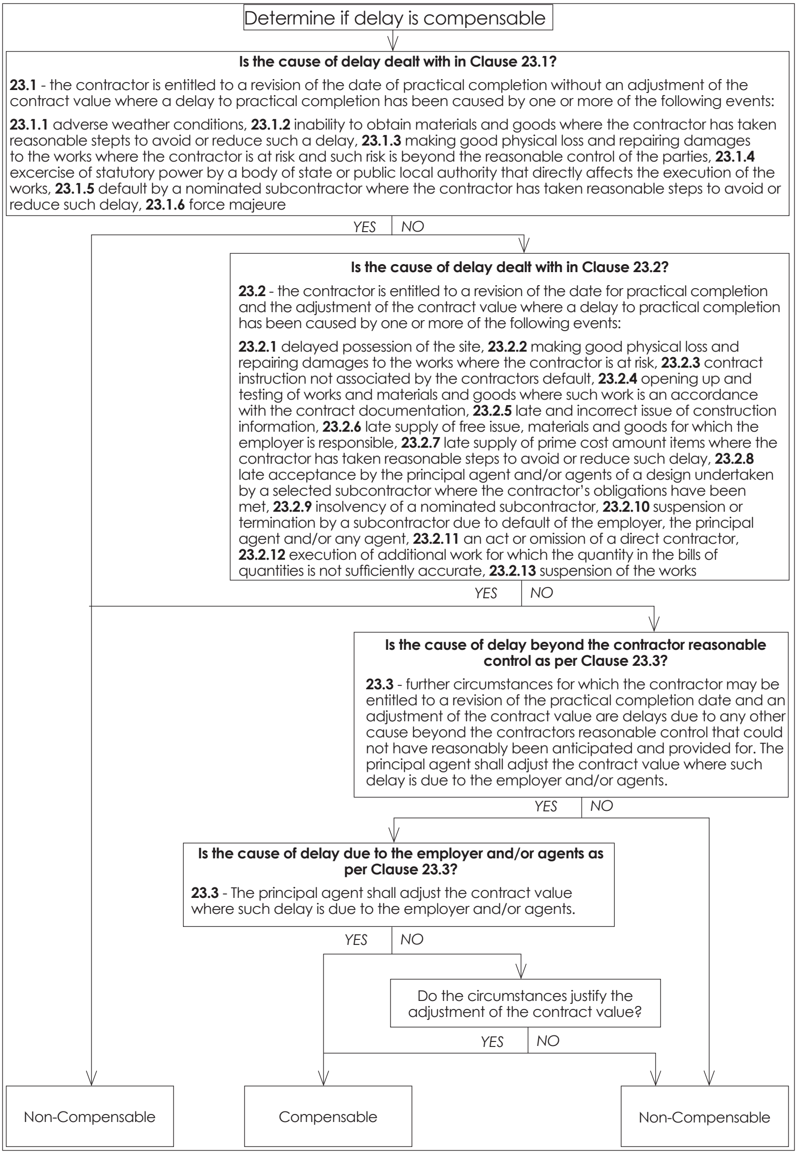

Figure 15: Decision tree JBCC: to determine if delay is compensable

In this case, the decision tree is fairly simplistic. The first consideration would be whether the cause of the delay is specifically mentioned in clauses 23.1 or 23.2. If the cause of the delay can be identified in clause 23.1, then the claim would not be compensable; if clause 23.2 makes provision for the cause, the delay would be compensable. It is possible that the cause of the delay is not catered for in either clause 23.1 or clause 23.2. Under these circumstances, clause 23.3 can be utilised to determine whether the delay is compensable.

According to clause 23.3, the contractor may be entitled to a revision of the contract value (compensation) for delays due to any other cause beyond the contractor's reasonable control that could not have reasonably been anticipated and provided for. The consideration of the decision tree at this point would be to determine whether the cause of the delay was beyond the reasonable control of the contractor and could not have been reasonably anticipated. The clause further states that the contract value should be adjusted where such a delay is due to the employer and/or his agents. The next consideration in the decision tree would be to determine whether the employer or his/her agents caused the delay. If this was found to be the case, compensation would be due. If the delay was not due to the employer or his/her agents, the principal agent should decide whether the circumstances justify any adjustment of the contract value.

5. Conclusion

One of the main contributions of the study to original knowledge was the development of a universal decision-tree framework for the assessment of EOT. The decision-tree framework is unique in that it would assist practitioners holistically in terms of all considerations in the assessment process. Other forms of guidance produced to date are mostly focused on assessment of the criticality of the delay.

Decision trees have been developed for the JBCC agreement. A number of decision trees is utilised to investigate the issues relating to contract compliance, in order to determine whether the delay is excusable, and to establish whether the delay was critical, as well as to address the issue of compensation.

The decision trees would assist in eliminating uncertainty in the assessment process of EOT claims by providing clear guidelines.

It is possible that the decision trees could, to some extent, assist in the standardisation of the assessment of EOT claims. Standardisation would have a number of benefits. One of the significant benefits would be that this could possibly reduce the number of disputes in EOT claims.

The main benefit of the decision-support framework is that it would provide a guideline with clear and easy-to-follow steps to assess any EOT claims. This could be of assistance to practitioners who are responsible for the assessment of EOT claims on projects.

The decision-support framework would also provide insight for contractors into the process of the assessment of EOT claims. This would lead to a better understanding of what is required to substantiate EOT claims, and to better quality claims being submitted.

The following possibilities for further research exist:

- The decision trees for EOT claims can be developed for other forms of contract.
- The decision trees can be developed to simplify other contractual processes, for example, dispute resolution processes in different forms of contract.
- It can be investigated how decision trees could be utilised as a tool to assist in the analysis of disruption claims.
- It could be investigated how regression decision trees could be utilised to predict the outcome of EOT claims.
- It can be investigated how regression decision trees could be utilised to predict the possible occurrence of different types of delay in projects.
- The comparison of projects, where the decision-tree support framework has been implemented with other projects, without making use of such a framework to determine the benefits of the decision-support framework.

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