Change Impact: Disruption and Loss of Productivity
A Model for Securing Price and Schedule Adjustment

Margins, Risk and Investment

EPC contractors’ margins in the E&C industrial plant sector are disproportional to the risk taken and the value added to Owners’ investments resulting from the projects delivered. Yet today Owners consider that industrial plants are not affordable. Conversely, a recent spate of profit warnings illustrate that Contractors’ trading results are far from satisfactory. Nobody is benefitting from the high cost of plants, especially not EPC Contractors.

A Fact of Contracting Life

Efficient, productive and economic work performance in conformity with thorough and effective planning is mandatory for there to be any opportunity for successful and profitable project delivery. Change is defined as “…any action, incidence or condition that makes differences to an original plan…” (Ibbs & Vaughan, 2014) and is a hindrance to productive and economic work performance and profitability. Consider some relevant statistics:

- **Expected Earnings**
  - Gross Margin: 10% - 15%
  - Net Profit: 2% - 5%

- **Changes**
  - 35% of ALL projects suffer major change
  - Increase in the EPC contract price: between 5% - 15%
  - Changes to baseline plans: high frequency impacting cost and schedule
  - Construction productivity loss: high frequency impacting cost and schedule

- **Acceleration / Recovery**
  - Always costly
  - Always reduces efficiency and productivity
  - Rarely properly planned
  - Rarely successful

- **Project Schedule**
  - 25% of ALL projects > 20% late: 36 month schedule – 31 weeks delay
  - Maximum LDs (10% of contract price): 12 weeks – 8% of 36 month schedule

A delay of 12 weeks to completion of an industrial plant on a 36 month schedule is not uncommon. However, securing a 12 weeks extension of time to avoid liquidated damages is a real challenge and often not achieved.

The impact of change has the potential to jeopardise project success, both in terms of time and cost targets, to such an extent as to fully erode anticipated margins and to cause organisational challenges relative to reputation and future project opportunities. It has both short-term and long-term ramifications to planned project delivery strategies, but is notoriously hard to predict, especially with regard to effect of cumulative changes and their disruptive consequences.
Since change has the potential to result in significant loss because gross margin fragility cannot withstand the impact, a policy of ‘no change’ is preferable, though practically impossible. Invariably it is change impact on the project schedule that causes the greatest damage.

EPC Contractors are not alone in the contracting arrangement; Owners have a significant part to play too. Where the Owner bears responsibility for change then they carry liability for the impact and have a duty to adequately compensate and relieve the EPC Contractor. In today’s market of significantly reduced CAPEX, Owners often do not have the funds available or the mandate to pay more to the EPC Contractor for the plant and, conversely, are constantly looking for savings; delay liquidated damages are an easy option in this respect. Securing price and schedule adjustment has just become very much more difficult for EPC Contractors.

The challenge is for EPC Contractors to dominate change. Primarily, the aim must be to avoid change, but where this is not possible EPC Contractors must ensure that price and schedule adjustment is secured. In this context disruption is a significant issue.

Change invariably causes disruptive working leading to performance shortfalls;

The typical response to inefficient and unproductive working is deployment of more resources, but this merely attempts to treat the symptom, not the cause. More resource deployment into an inefficient work regime does not eliminate or reduce the inefficiency caused by change and rarely overcomes the performance shortfall. Time and cost impacts can be very significant. Therefore EPC Contractors can be faced with exposure to delay liquidated damages, an overrun of their own engineering man-hours and loss of productivity claims from their construction Subcontractors. These circumstances often lead to complex scenarios that ultimately erode slim project margins.
The Cost of Disruption

Disruption translates into very significant additional costs; engineering man-hour overspend, prolonged retention of home office resources and exposure to construction Subcontractors’ claims for loss of productivity. Each collectively may result in costs that are often greater than any exposure to liquidated damages. EPC Contractors face a dilemma; assuring the veracity of the Subcontractors’ claims so that these are not over-compensated, whilst also identifying claim components, which in addition to the demonstration of their own additional costs, can be passed onto the Owner. No amount of CPA will be helpful in these respects.

Critical Path Analysis: Flawed Thinking

A 12 week delay, in the absence of being able to demonstrate entitlement to a corresponding extension of time, can often eliminate or substantially erode gross margin by the imposition of liquidated damages. It has been a long-held belief that Critical Path Analysis (CPA) is the analysis of choice to secure an extension of time. Where there are specific delay events affecting the critical path(s) this may be valid; in any other circumstances it is flawed thinking.

CPA - Only 20% of the Story

Considerable time, money, resources and effort are often devoted to CPA in order to demonstrate entitlement to extensions of time. This is an interesting phenomenon, given that around only 20% of schedule activities are typically on or close to the critical path(s), whereas disruption can affect 100% of schedule activities - including the 80% that are not on the critical path(s). There is therefore little wonder that so often CPA falls well short of producing a credible demonstration of the full effects of change schedule impact, including entitlement to extensions of time in circumstances where disruption is a dominant factor.

CPA – An Ineffective Tool for Assessing Disruption

CPA alone is unlikely to provide a realistic basis for assessing and evaluating disruption and its associated schedule impacts. While CPA might reveal some effects of disruption to critical path activities (the 20%), it is not capable of conclusively demonstrating the full impact of change.

Disruption to non-critical path activities (the 80%) translates into revised and late activity execution, as well as leading to the erosion of float, which ultimately results in critical delay. However, the use of CPA is misguided and is unreliable when assessing the full scale of schedule disruption.
Productivity and Disruption Research

There is a substantial amount of research available to illustrate the significant impact that change has on productivity. There are a range of established techniques too that seek to quantify the effects of change, and in particular the cumulative effects of change. However, most, if not all, are focused on unravelling the effects on efficiency and costs. None, it seems, appear to consider the potential causes of disruption and their effects on the schedule.

The findings from recent research undertaken by the Construction Industry Institute (CII) in the preparation of its ‘Four-casting for Early and Accurate Predictability’ identifies ten ‘Change Types’ and thirty six ‘Change Reason’s that hinder predictability’, each of which is prioritised by frequency of occurrence in terms of impact on cost and schedule. The top seven in each case are listed below:

<table>
<thead>
<tr>
<th>Rank</th>
<th>Change Type</th>
<th>Frequency</th>
<th>Rank</th>
<th>Change Type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design / Engineering Errors / Omission, inclusive of Constructability Issues</td>
<td>46%</td>
<td>1</td>
<td>Construction Productivity</td>
<td>32%</td>
</tr>
<tr>
<td>2</td>
<td>Construction Productivity</td>
<td>41%</td>
<td>2</td>
<td>Plan Change</td>
<td>29%</td>
</tr>
<tr>
<td>3</td>
<td>Plan Change</td>
<td>34%</td>
<td>3</td>
<td>Commissioning &amp; Start-up Issues</td>
<td>24%</td>
</tr>
<tr>
<td>4</td>
<td>Scope Error / Omission</td>
<td>33%</td>
<td>4</td>
<td>Supplier / Subcontractor</td>
<td>23%</td>
</tr>
<tr>
<td>5</td>
<td>Supplier / Subcontractor</td>
<td>29%</td>
<td>5</td>
<td>Scope Error / Omission</td>
<td>19%</td>
</tr>
<tr>
<td>6</td>
<td>Engineering Productivity</td>
<td>23%</td>
<td>6</td>
<td>Design / Engineering Errors / Omission, inclusive of Constructability Issues</td>
<td>15%</td>
</tr>
<tr>
<td>7</td>
<td>Cost Estimating</td>
<td>22%</td>
<td>7</td>
<td>Engineering Productivity</td>
<td>13%</td>
</tr>
</tbody>
</table>

Clearly, the issues hindering predictability also similarly affect work performance in terms of cost and schedule.

Thus far the real effect of disruption and loss of productivity on schedule has not been considered. Yet, loss of productivity is frequently a cause of delay as the recent CII research shows.

KP Approach to Analysis of Disruption and Delay

Building upon the considerable body of research, KP has developed an approach to the analysis of disruption and delay. Our approach provides a key component to a claim submission or expert opinion in the demonstration and substantiation of entitlement to extensions of time and reimbursement of additional costs resulting from disruption and delay.
The KP methodology is not constrained to the development of a defined ‘answer’, but instead to the exploration of disruption against a model that reflects the constraints, challenges and dynamics of the project, in order that scenarios may be tested and any observations challenged.

Our approach utilises, builds upon and adopts recognised schedule analysis practices to provide a holistic examination of the changes that give rise to disruption and delay and their impact upon cost and completion dates, to justify entitlement to adjustments to price and schedule.

Demonstration and substantiation of entitlement to extension of time and reimbursement of additional costs requires analysis of the relevant project records to identify deviation from the baseline plan caused by changes that are not under the control and responsibility of the EPC Contractor. The better the records, the greater the potential for demonstrating entitlement to justified schedule and price adjustment.
Kingsfield Planning provides fully integrated solutions that are focused on minimising our client’s schedule risk.

We can help you:
- develop effective delay and disruption claims
- proactively manage your schedule risk
- produce credible recovery strategies
- strategically align project planning and controls across your full project supply-chain
- provide expert witness support for arbitration
- develop your people with training in planning, delay and disruption

The KP approach takes into account crucial factors that have the potential to detract the output from schedule analysis unless they are properly considered in overall context of the project and the actual events and circumstances affecting work performance.

The KP disruption model presents EPC Contractors with a real opportunity to substantiate the cumulative effect of unproductivity working borne as a consequence of Owner imposed changes. Ultimately, securing entitlement to price and schedule adjustment is a bottom line issue that simply cannot be ignored.

CII (2013) Four-casting for Early and Accurate Predictability (Implementation Resource 291-2)