EVOLVING ROLES OF PROCUREMENT INTELLIGENCE AND PUBLIC PROCUREMENT FACILITATE THE SUCCESSFUL DELIVERY OF A NATURAL DISASTER RESTORATION INFRASTRUCTURE PROGRAM

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ABSTRACT. In Australia, Queensland's natural disasters caused severe damage to the Queensland Department of Transport and Main Roads' infrastructure asset in 2010-11. Planning and delivery of the resulting $4.5 billion Transport Network Reconstruction Program alongside the $21 billion five years Program of Works presented unprecedented procurement challenges to the Agency.

Program Procurement Branch (PPB), Program Development and Management Division coordinated with the 12 regional offices to identify declared areas requiring restoration, treatments, associated agency demand for all materials and services. PPB's analytical function utilised its custom Cost Escalation Road Input index based procurement intelligence to monitor the potential impact on market costs caused by the challenge of delivering a disaster recovery augmented $21 billion Program of Works.

Program Procurement proactively helped achieve deliverables and value for money with evidence based procurement intelligence.

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REVIEW OF ISSUES

Early procurement intelligence helps achieve program procurement efficiencies and value for money

A key procurement proponent advocates early involvement of procurement in the public sector capital works planning and management activities to help explore and choose 'options and alternatives…estimates, product specifications, make or buy decisions and outsourcing opportunities' (Matthews, 2005, p. 394). Central to such early involvement is the role of procurement intelligence.

For the purposes of this paper the term procurement intelligence is defined as procurement oriented macro and micro economic scans and market research (Cretton, 2010) that utilise a varied toolkit of qualitative reporting and quantitative methods, including forecasts, simulations and advanced statistical modeling. These in turn inform matters like key categories or critical resource demand, supplier capability and capacity, supply chain and market volatility analysis, risk indexing and an all compassing program and project input cost escalation, to help formulate short to mid term procurement strategy planning and program delivery decisions. As such, procurement intelligence is the term being proposed for what was in practice at a leading Queensland public sector agency, initially procurement research and then procurement analysis. The function and its outputs have steadily evolved from a reactive and conceptual role to a more hands on analytical one. In more recent times, it has ground theory in practice and established public program procurement business credibility to the point of being a proactive function – and in this journey and evolved context, is being referred to as procurement intelligence.

Given the Global Financial Crisis (GFC), and the ensuing economic uncertainty, some constraints on public procurement has been removed (Peters et al, 2011). There is now an increasing need for procurement intelligence gathering (Atkinson, 2007), analysis and research including forecasting trends to inform effective, and as best as possible future proof procurement decision making exercises for chief executives in large organisations (Murray, 2002). Any public sector agency that makes huge capital infrastructure investments, that in turn typically recover costs over several years, requires to undertake procurement intelligence work to inform first and final estimates of how much a program or projects will cost to plan, manage, build and deliver. While such intelligence is often only an option when economic conditions are stable, it is imperative when more turbulent times arrive. In recent years, procurement has had to cope with such volatility and the pattern seems to remain iin Queensland (Rutherven, 2012). This is exactly where procurement intelligence unquestionably arms agencies with invaluable evidence based insight into the past, present and the future to achieve efficiencies and value for money.

By the very nature of delivery, engineering construction and civil works like road and bridge programs and projects are complex and uncertain (Cristobal, 2012; Saynisch, 2010; Hassanein, 2006 & Carillo, 2005). From a purely metaphoric perspective, public infrastructure procurement now functions in more volatile economic times post GFC in organisations that bear semblance to complex systems, that are dynamical, non linear, in chaotic modes and far from equilibrium (Burnes, 2005; Fitzgerald & van Eijnatten, 2001). Procurement intelligence takes on a fundamental role in serving as feedback loops between the market and the agency continuously in times of volatility to inform procurement decision makers of risks or opportunities – reporting on the matters like Adam Smith's invisible hand and the structure of markets (Sterman, 2003). Queensland's engineering construction market conditions indicate that the need for intelligence is crucial in light of extraordinary growth of civil works in current times, running in long cycles of 8.5 years. The most recent ended in 2010 and a new cycle has started without the normal 18-month slump between cycles and is expected to grow through ups and downs till 2018-19 (Ruthven, 2012).

The need for early procurement intelligence engagement is additionally necessitated by recent trends that indicate ‘cost overruns have been commonplace’ (Sarker, et al, 2012, p.130) in the delivery of large infrastructure projects and programs. Exponents in planning for the construction industry strongly advise a need to budget for cost escalation as a major risk management issue. As such, they recommend consideration and application of probabilistic risk assessment through the study of changes in construction costs by analysing the movements and forecasts of a cost index (Sarker et al, 2012; Shane et al, 2009 & Flyvbjerg et al, 2002). Theorists identify (Shane et al, 2009; Tookey et al, 2001; Kenley et al, 2000 & Egan, 1998) that infrastructure capital construction projects need the coordination of a multitude of human, organisational, technical and natural resources.

Early engagement of procurement intelligence whether economic, market, contract or supplier based can inform procurement planning and management activities to serve these very needs. The lack of any engagement here can cause cost disruptions to programs and downstream projects by way of delay or indefinite postponement to accommodate higher construction cost of a single earlier project (Shane, et al, 2009), if not a complete program of works. At its worst, such budget overruns can lead to significant or partial non-delivery of a capital program of works. Public sector agencies must avoid such risks at all costs or face-embarrassing scrutiny on counts of transparency, due diligence, governance and accountability to stakeholders, ministers, media, whistleblowers, members of the public and extended community.

The above procurement challenges are further exacerbated by unpredictable natural disasters impacting program or project delivery. ‘Bad or inclement weather due to heavy rains and the resulting floods’ is ‘the number one cause for cost escalation… is followed by scope changes, environmental protection and mitigation costs’ (Kaliba et al, 2008, p. 528). The most immediate issues in the wake of recent major natural disaster that leads to increases in the cost of construction are ‘increases in material cost, bid market disruptions, the high volume of construction work…global economy, an ever growing demand for construction work, and a shortage of labour…' (Morris and Willson, 2006, p.1).

Literature indicates remedial procurement measures to absorb such risk, among others, as follows: pre- purchasing materials to limit the impact of price fluctuations, accommodating for scheduling delays, reduction of the bid award period, delaying the bidding of non-essential packages of work, negotiating contracts and using cost plus incentive contracts (Morris and Willson, 2006).

Disaster recovery programs elevate the need for timely procurement intelligence to inform a procurement planning process 'that works in tandem with operational planning to identify resource requirements' (Duncombe and Searcy, 2007, p. 68) and helps shape a quality procurement strategy (Donnelly, 1999) to meet key objectives and an agenda (Matthews, D, 2005, p. 394). Ducombe and Searcy (2007, p. 71) clearly indicate the potential benefits of improved operations as being 'reduced units costs, reduced administrative costs of managing procurement, greater user satisfaction with product quality and timeliness of delivery'.

A series of significant public sector procurement strategies have been identified that will benefit from early procurement intelligence to help deliver capital programs of work efficiently. These include an understanding of government's impact as a buyer on markets, supply market structure, commercial behaviour, all of which culminate in the development of a high performance supply arrangement, supplier relationship development, strategic sourcing, negotiation and contract management (Jeliffe, 2011, p.15), ensuring procurement as the crucial basis for cooperation between clients and contractors (Pesamaa et al, 2009).

The adoption of a performance based contract management approach (Rose et al, 2010, Loftus, 2006, Tudor, 2005) is highlighted as being particularly beneficial for achieving procurement efficiency and value (Walraven et al, 2009).

To summarise, early and timely procurement intelligence achieves value for money outcomes through a series of evidence informed actions. In this context, 'value for money' is best defined as the core principle governing public procurement to help achieve '…efficiency and effectiveness, competition, accountability and transparency, ethics and industry development' (Raymond, 2008, p. 783). The potential for reactive procurement research and analysis to evolve into proactive intelligence to inform procurement strategies and plans for the delivery of a natural disaster program will be a significant contribution to the field. In practice, this would help achieve a much-required higher level of intellectual respect from all stakeholders and acceptance of government procurement achieving maturity (Thai & Grimm, 2009). If this theoretical contribution is validated by practice, public procurement will merit its acceptance as a professional force and an influential link between public activities, the private sector and civil society (Callender & Matthews, 2000).

BACKGROUND –THE AGENCY

In context of the above procurement literature review and key issues identified, the paper now presents a case to explain how in practice the program procurement branch of the largest procurement spend based public sector infrastructure Agency in Queensland Government, Australia harnessed procurement intelligence to achieve cost efficiencies and value for money while facilitating the rollout of a natural disaster restoration Program of Works.

The Agency in this context is the Department of Transport and Main Roads (TMR). TMR is a department of the Queensland Government responsible for planning, managing and delivering Queensland's integrated transport environment to achieve sustainable transport solutions for road, rail, air and sea. Program Development and Management (PD&M) is a division of TMR. PD&M develops and manages the statewide policies, systems and processes for Program and project management. Program Procurement Branch (PPB), within PD&M, identifies sources, procures and manages the key products and services TMR needs to deliver the Queensland Transport and Roads Investment Program (QTRIP).

Natural disasters devastated the road and bridge network of Queensland

The state of Queensland dealt with the impacts of an unprecedented number of natural disasters from 2010 and 2011, which have caused extensive damage to communities and key road, rail, ports and waterways infrastructure. Significant cyclones Olga, Ului and Tasha struck Queensland in January, March and December 2011, respectively, followed by Anthony and Yasi in January 2011. Additionally massive storms impacted Toowoomba, Grantham and Brisbane in January 2011. The effects of the cyclones and flooding damaged one quarter of TMR's asset network, with over 9,000 kilometers of state-controlled roads in need of repair.

This unprecedented scale of damage called for a statewide response to develop an additional Program of road works, established as the Transport Network Reconstruction Program (TNRP). The Australian Federal Government has provided financial support to the Queensland Department of Transport and Main Roads (QDTMR) through the Natural Disaster Relief and Recovery Arrangements (NDRRA) fund to help deliver a $4.5 billion Transport Network Reconstruction Program (TNRP).

The Procurement Problem

The TNRP was set up to fund and manage the reconstruction of Queensland's integrated transport system in order to reconnect Queensland communities and economies following the natural disasters and achieve value for money.

TMR faced a unique challenge, in that it had to augment its regular Program of Works to include a natural disaster recovery program. Program Procurement Branch (PPB) helped PD&M manage the procurement challenge associated with the concurrent rollout of the $4.5 billion TNRP component as well as the main $21 billion 5 year Queensland Transport Roads Implementation Program (QTRIP).

Specifically, the Agency experienced an unprecedented demand for road making materials and services and had to vie against intense competition from other industries that required procurement of the same materials. Competing industries were largely rail and mining construction sectors. Both these had suffered extensive flood and natural disasters. Yet again, another challenge was for the Agency and for PPB was to be able to deliver the augmented program in a timely manner to satisfy community needs in the wake of a series of natural disaster aftermaths and budget limitations.

Early procurement engagement

As part of this unique, large scope and demanding procurement exercise PPB undertook an early scoping of the demand for labour, plant, equipment, key materials and services generated by the rollout of the programs. PPB coordinated with the 12 regional offices to identify declared areas requiring asset network restoration, treatments, associated agency demand for all materials and services broken down by kilometers, geographic location and dollar value equivalent.

The requirements were compiled by the analytical function of the branch noting in particular data quality issues. The evidential outputs were examined by the delivery function against demand competition intelligence from mining and local industries, supplier market competition, upstream, at level and downstream supply chain risks, potential procurement delivery models, risk and mitigation strategies.

Procurement intelligence assesses impacts – the Cost Escalation Road Input Index (CERI)

PPB used evidence-based procurement intelligence to advice potential procurement cost impacts and actions to plan the delivery of the expanded Program of Works. A key issue addressed was the potential impact on market costs by the challenge of delivering a disaster recovery augmented Program of Works.

PPB's analytical function used its custom produced Cost Escalation Road Input (CERI) index to track, update, and forecast procurement relevant Program delivery cost impacts.

In detail, the Cost Escalation Road Input (CERI) index is a department specific index that measures the changing cost of inputs used in the construction of roads and bridges. It is the measurement of Transport and Main Roads (TMR) road and bridge input costs for labour, wages and material. The CERI forecast is representative of project inputs only and does not include changes in design, scope, land acquisition or company/contractor profits, as TMR project estimators capture these factors since they may contain non-procurement elements. The CERI index is based on Australian Bureau of Statistics (ABS) economic data but is informed by departmental data to produce a more robust and accurate measure of cost escalation. A Principal Component Analysis (PCA) is used to reduce multidimensional data sets to lower dimensions for analysis. Procurement Analysis Team has used PCA as a tool to identify influential variables within the Queensland macro and micro economies. Eighty-seven Australian Bureau of Statistics (ABS) indices or variables were identified as a broad representation of Queensland's macro and micro economies. The primary component of interest is Component 1 as it accounts for 67% of variance within the data set; Component 2 accounts for 15% and Component 3 accounts for 8%. The market monitoring ability of PCA comes from the consistent grouping of like variables capturing different economic phenomena into components. For analytical purposes, the CERI forecast uses the Trends module of Statistical Package for the Social Sciences (SPSS) Base 20. The CERI has been forecast for four quarters after the most recently released CERI index figure. The forecasts are determined using an Auto-Regressive, Integrated, Moving Average (ARIMA) model.

Appendix A Graph 1 indicates the CERI trend from September 2003 to September 2011 in context of significant global and Australian events, like the inception of the mining boom, the GFC, loss of AAA rating by Queensland Treasury Corporation, economic stimulus packages, Reserve Bank of Australia's lowest cash rate and a flurry of natural disasters in Queensland. Appendix A Graph 2 and Table 1 indicate the reliability and the accuracy of the CERI being calculated as an average difference of about –0.04% (or 0.13% absolute) between forecast figures and actual figures for the period December 2007 to December 2011. The variance is minimal and reiterates the dependability of this program procurement cost index.

Finally, Appendix A Figure 3 indicates that the CERI index offered evidence based procurement intelligence that an increase in the department's gross expenditure will lead to market conditions escalating the total cost of rolling out a larger Program of Works. Based on the CERI's historic data, trends and evidence PPB advised all TMR Program and project managers to consider spreading out the reconstruction component of the Program of Works to avoid a cost blow out of $155 million. The figure is the relevant cost escalation rate that would have impacted $4.5 billion of the TNRP had it been rolled out to market for delivery in a compressed 1-year timeframe. Procurement intelligence helped program procurement curb a massive risk and save costs by staggering delivery of the augmented program of works. As such, value for money was the staggered delivery approach to prevent over heating of the local and extended markets, key commodity prices and supply market capacities.

Program procurement harnessed early procurement intelligence for planning and strategies to help deliver an augmented program

The procurement exercise thus centered on the ability to deliver the expanded Program of Works. Leveraging on procurement intelligence supplied, PPB achieved success in terms of overcoming delivery challenges as follows:

- PPB coordinated with 12 regional offices to identify declared areas requiring asset network restoration, treatments, associated agency demand for all materials and services broken down by kilometers, geographic location and dollar value equivalent; the procurement intelligence outputs were compiled by the Procurement Analysis Team.

- PPB's function groups also rigorously coordinated with critical item industries' peak bodies and suppliers to communicate demand for critical items.
- The evidential outputs were examined by the delivery function against demand competition intelligence from mining and local industries, supplier market competition, upstream, at level and downstream supply chain risks, potential procurement delivery models, and risk and mitigation strategies.
- Specifically, in light of timely procurement intelligence PPB achieved the following:
    - Established panels of suppliers for works based on a range of values (<$30 to >$30 million)
    - Placed Forward Orders in particular for quarry products
    - Established relational type contracts like the Performance Incentive Cost Reimbursable Contract
    - Set up Supply Arrangements for critical materials; in particular a first in Australia to help deliver more than $200 million of capital expenditure into bitumen facilities in Queensland
    - Conducted Category Management and Supply Chain Analysis for all critical infrastructure spend items
    - Provided expertise in acquisition strategies for all Program of Works related commodity-supply chain-industry configurations

PROCUREMENT BENEFITS ACHIEVED

Procurement excellence was achieved by efficiencies driven through timely intelligence based advice to all program delivery arms of TMR. A key outcome was the decision to spread the $4.2 billion reconstruction Program of Works beyond 2011-12 to outer years based on CERI Index modelling and forecasts indicating potential cost overruns. Program procurement advice to the General Manager (PD&M), based on procurement intelligence saved TMR a potential cost blowout of $ 155 million, in the first year alone. This was achieved by a decision to stagger the restoration work over a couple of years to prevent overheating of the local supplier markets. Also, the State's 12 regions benefitted active cost savings of $200 from intelligence driven program procurement review of supplier arrangements for bitumen.

PPB helped PD&M and QDTMR to deliver the challenge a natural disaster recovery triggered augmented program and achieve value for money with evidence based procurement intelligence. The case demonstrates Program Procurement's success in proactively managing cost overruns and achieving value for money for program development strategy, funding, management and delivery activities, based on early engagement and leveraging off procurement intelligence.

Findings: grounding procurement theory in public procurement benchmark practice

Program procurement excellence was achieved by efficiencies driven through timely delivery of the natural disaster recovery augmented Program of Works. Proponents' theoretical constructs on early procurement engagements (Matthews, 2005 & Sarkar, et al, 2012) and the harnessing of procurement intelligence to inform decision making in the wake of turbulent, uncertain or unplanned events (Peters et al, 2011, Atkinson, 2007 & Murray, 2002) have been grounded in benchmark public procurement practice that facilitated the delivery of an augmented, complex road and bridge construction program (Cristobal, 2012; Saynisch, 2010; Hassanein, 2006 & Carillo, 2005) soon after state-wide natural disasters.

The CERI index served as a yardstick in validating theories by international exponents on measuring and containing natural disaster affected program cost overruns (Kaliba et al, 2008 & Sarkar et al, 2001) in an engineering construction agency that resembles a complex system (Fitzgerad & van Eijnatten, 2001). The CERI index also confirmed the need to undertake probabilistic risk assessments by analysing the movements of infrastructure program cost (Shane et al, 2009 & Flyvbjerg et al, 2002). Similarly, studies by leading theorists on the need for a coordination function to bring together a multitude of human, organisational, technical and natural resources for infrastructure capital construction projects (Tookey et al, 2001;

Kenley et al, 2000 & Egan, 1998) in a value for money and cost effective manner has been founded by program procurement's role in this case.

Early procurement engagement with the augmented program's rollout and CERI index's contribution towards risk and impact assessment has validated program procurement planning strategy (Jeliffe, 2011; Duncombe and Searcy, 2007; Matthews, D, 2005 & Donnelly, 1999) and procurement risk management measures (Morris and Willson, 2006) based premises.

The case's unique performance based contract to manage supply arrangements for the procurement of critical items like bitumen, highlight the benefits of a value added (Walraven et al, 2009, Raymond, 2008), cooperative and yet value for money approach shared by clients and contractors (Rose et al, 2010; Pesamaa et al, 2009; Loftus, 2006 & Tudor, 2005).

Finally, the benchmark government procurement practice that harnessed early procurement intelligence is a hallmark indicating firstly, evolution of the profession to a higher level of intellectual respect and maturity (Thai & Grimm, 2009) and secondly, an increasingly influential link between public, private and civil societies (Callender & Matthews, 2000).

Future research: transferability of the procurement CERI Index to other industry sectors

The case also indicates that procurement intelligence indices like the CERI Index can be potentially custom fit and applied to inform procurement practice in other industry sectors, be it public or private. If successful, there are value add propositions that will inform early program procurement engagement across these sectors to achieve cost efficiencies and value for money. Potential target industry segments in Australia that can be studied are other engineering construction, oil, gas, mining, manufacturing, transport and warehousing. The key to such transferability is the relevant industry classification codes that serve as inputs into the creation of the CERI index or a custom fit one. The Australian Bureau of Statistics (ABS) publishes these as the Australian and New Zealand Standard Industrial Classification Structure (ANZSIC). This may well serve as a future applied research agenda for procurement intelligence, procurement strategy and planning practice.

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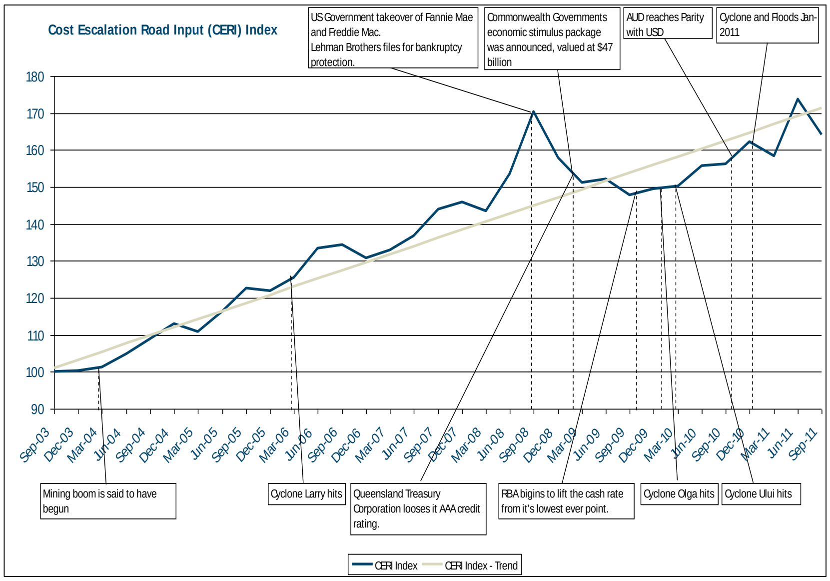
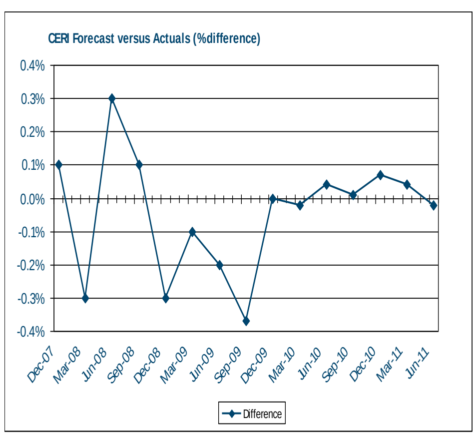
APPENDIX A GRATH 1



APPENDIX A, GRAPH 2



CERI Forecast versus Actuals (%difference)

	Actuals	Forecast	Difference
Dec-07	7.9%	7.8%	0.10%
Mar-08	7.7%	8.0%	-0.30%
Jun-08	7.9%	7.6%	0.30%
Sep-08	8.3%	8.2%	0.10%
Dec-08	8.2%	8.5%	-0.30%
Mar-09	7.8%	7.9%	-0.10%
Jun-09	7.4%	7.6%	-0.20%
Sep-09	7.0%	7.4%	-0.37%
Dec-09	6.7%	6.7%	0.00%
Mar-10	6.3%	6.4%	-0.02%
Jun-10	6.1%	6.1%	0.04%
Sep-10	5.9%	5.9%	0.01%
Dec-10	5.8%	5.7%	0.07%
Mar-11	5.6%	5.5%	0.04%
Jun-11	5.5%	5.4%	-0.02%
	Average Difference		-0.04%

APPENDIX A, GRAPH 3