AUSTRALIAN CONSTRUCTORS ASSOCIATION

Changing the game

How Australia can achieve success in the new world of Mega-projects

"The ACA recognised the need to change the way we think about the projects of the future. We pride ourselves on engineering excellence but we have also recognised that our world is changing. Both the private and public sector are searching for long-term viable economic solutions. We recognise we need to develop the capabilities to better understand and support the diverse sets of stakeholders that are engaged in this process. Our traditional project management processes need to evolve to provide far more predictable outcomes for the future. This research explores our new world and identifies some of the changes we will need to undertake to be successful. We are looking forward to engaging with the industry stakeholders in a robust discussion so we can all make the changes required to ensure our investment dollars achieve their maximum impact."

David Saxelby
President
ACA

"We have reached an inflection point in the way we think about and manage the delivery of services projects in Australia. As with many step changes, we seldom solve them with the same mindsets that created them. This research has identified the need to take a much broader perspective on the nature of what we are trying to achieve and then adopt a far more reflective and adaptive model that can deliver a different outcome that meets the expectations of the diverse stakeholder groups involved."

Malcolm Dunn
Lead Researcher and Learning Integrator
Agilience

In the media today

We have a mega problem that is threatening our economic growth

Headlines

"Global mega project* spending to hit US$6 - 9 trillion per annum or 8% of global GDP. The Australian infrastructure pipeline is greater than A$300 billion for the resources and infrastructure sectors (approximately 100 mega projects are underway at any time)."

"The nature of projects is changing from engineering success to delivery of sustainable services and economic outcomes. Accordingly, projects are becoming increasingly larger, longer and more complex (compounding at 2.5% p.a.)."

"The complication is that these complex projects have low success rates (international estimates are in the order of 1/1000 for economic success, with Australia's experience less than 50%, based on budget and schedule)."

"The iron law of mega-projects has become 'over-time, over-budget and over again'."

"The value at risk for Australia is in the order of 20% or greater than A$60 billion based on conservative estimates of pipeline and success rates. So the imperative to better manage these projects is high."

Traditional models are failing us and we need to understand why and adopt a new approach: 'the conventional way of running mega-projects has reached a tension point where tradition is being challenged and reform is emerging'.

Our challenge

"We have a nation-shaping pipeline of infrastructure projects and need to create ways to share experiences."

John Fitzgerald Infrastructure Australia

This research has been commissioned by the Australian Constructors Association to explore the nature of this next generation of complex mega-projects

The challenge

Despite recent cutbacks in the Resources sector, Australia's investment pipeline still includes greater than $300 billion of Resources and Infrastructure projects over the next decade.

Unfortunately, there is a very low success rate (measured by achieving budget, schedule and economic business case) for complex mega-projects both globally (less than 15 %) and in Australia (40 – 50 %). If we apply even the most optimistic assessment, this implies an overrun of approximately $60 billion (20 % of $300 billion), which corresponds to many roads ($1 – 5 billion), LNG plants ($10 -20 billion), mines ($1 billion), schools ($1 billion) and hospitals ($1- 2 billion).

So our challenge is to really understand the evolving nature of these projects in our increasingly sophisticated and socialised economy, and explore why existing approaches are proving insufficient or inconsistent. From this understanding, we can develop the next generation of approaches and create a supporting environment to ensure mega-project success and maximise social, political and economic investment returns.

Changing the game

We require a completely new perspective for the next generation of complex mega-projects.

Flyvbjerg (2014) defines mega-projects as "large-scale complex ventures that typically cost $1 billion or more, take many years to develop and build, involve multiple public and private stakeholders, are transformational, and impact millions of people. They are not just magnified versions of smaller projects, they are a completely different breed in terms of their aspiration, lead times, complexity and stakeholder involvement."

Australian mega-projects of the past have been complex engineering achievements, such as the Sydney Harbour Tunnel, the Victorian Desalination Plant and the Snowy Mountains Scheme.

However, there is an emerging view that not only is the nature of projects changing, but also the social environment in which these projects occur. Accordingly, these mega-projects require a completely different perspective, level of stakeholder engagement, cultural environment and project leadership than that practiced at the moment, which is based on up-scaled large project management disciplines.

We will explore the nature of this mega-project world in several ways, including:

- Identifying the challenges
- Studying key research insights
- Taking a different perspective
- Exploring new solutions to change the game

Critical research question

Most importantly, we will filter our research through the following question: "What do we need to do differently to improve our project success rate in this new environment?"

Research/Discovery Approach

We wanted to understand the changed social, political and technological environment for mega-projects and, based on this, consider what new perspectives and approaches are required. We reflected that there were also successful projects in Australia that we could learn from. We purposefully explored the views of a range of new stakeholders who are now intimately involved in this next generation of projects to understand their views of what is required for a successful outcome. Our research approach involved three key elements:

Quantitative

Assess the performance gap in Australia through a survey of successful and challenged projects from the perspective of Owners Teams, Delivery Teams, Engineering Procurement & Construction Management (EPCM) Contractors and Constructors.

Qualitative

Understand the root causes of success and failure, and identify potential solutions through success case/appreciative enquiry interviews with > 30 stakeholders (Policy-makers, Government and Private Sector Owners and Delivery Teams, EPCM Contractors, Constructors, Lawyers and Infrastructure Investors.

Action forums

Engage key stakeholders in discussing the research insights to help identify solutions able to change the game.

Doomed to failure?

From an international perspective there is a high rate of mega-project failure, with less than 1 in 1,000 projects achieving their promised business cases

Current mega-project performance

Source	Evans & Peck	Flyvbjerg	IPA	Accenture *
# Projects	16	258	> 1000	31
% on budget	-	10%	-	17%
Overrun (% budget)	10-20%	26.7%	25%	-
Overrun Schedule	-10 - +10	90%	60%	< 20%
Achieve Business Case	-	5%	-	17%

* Accenture (2012), 'Achieving Superior Delivery of Capital Projects', Global survey of the metals and mining industries

* Accenture (2012), 'Developing Strategies for the Effective Delivery of Capital projects', Global survey of the energy industry

Break Fix Model

"Generally mega-project planners and managers do not know how to deliver successful mega-projects and therefore they tend to break sooner or later. The fix often takes place at great and unexpected cost to stakeholders. The cure is to get projects right from the outset through proper front end management".

Faulty decision-making

"With the consistent errors and biases of forecasts that form the basis for business cases, cost benefit analysis and social and environmental impact assessments, such analysis will with a high degree of certainty be misleading".

There is a big prize at stake

The Australian projects performance gap identified by the research is significant and presents a valuable prize

Australian Mega-projects Survey Results

This study	Total	Successful Projects Average	Challenged Projects Average	Overall Performance Gap ($M)	Private Sector Gap ($M)	Public Sector Gap ($M)
# Projects	44	23	21	-	21	23
Budget ($M)	43,809	1,074	910	-	-	-
Budget overrun ($M)	6,021	83	196	3,629	-	-
Budget overrun (%)	13.74%	8.4%	27.4%	19%	19.1%	20.2%
Schedule overrun (%)	-	(.3)%	20.3%	20.6%	27.9%	27.6%

This is the most comprehensive set of survey data on Australian mega-projects completed to date. The survey covered 44 mega-projects (> $1 billion each) worth nearly $44 billion

- The total budget overrun across the portfolio was $6 billion or 13.7%, with both successful and challenged projects having budget overruns. This is good by international standards.
- Schedule overruns ranged between 0 – 20%, which is fair by international standards.
- However, there was still a significant gap (> 20%) between successful and challenged projects from both budget and schedule perspectives.
- There was little difference between private and public sector performance from a budget or schedule point of view.
- Closing the gap from average challenged to average successful (19%) would save over $3.5 billion on this project portfolio. This would be even greater if we could shift to the best-practice level of performance.

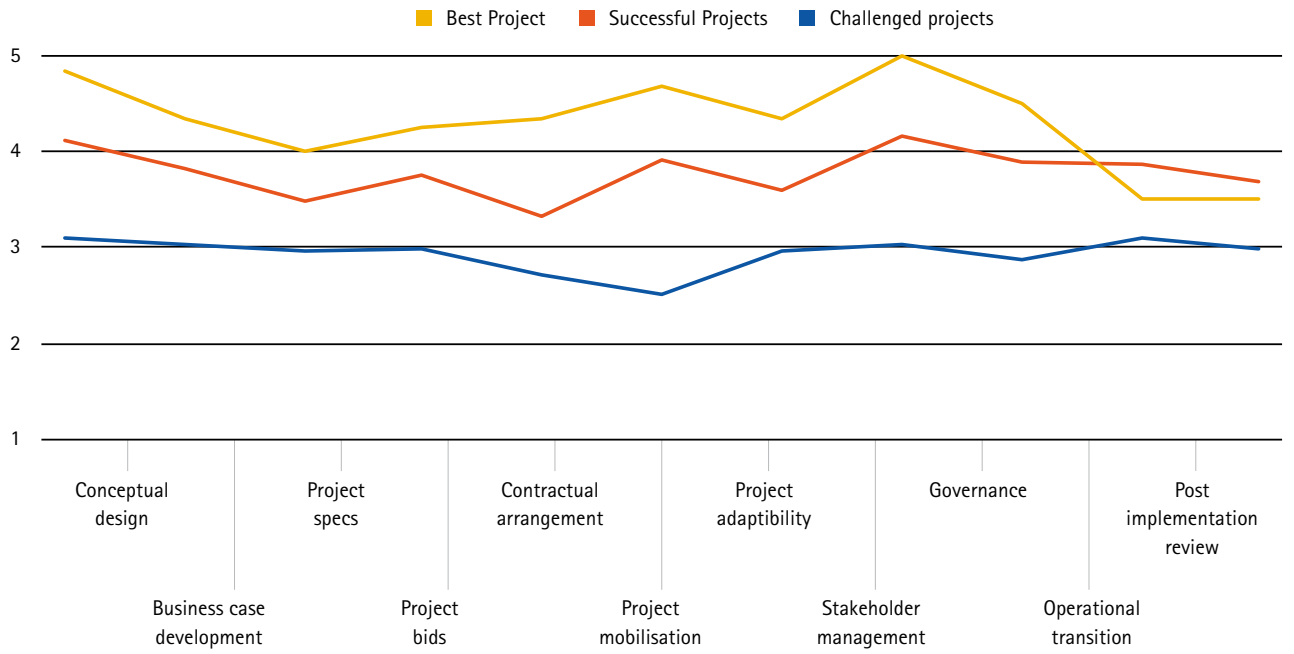
Understanding the root cause of future success

There was a significant difference in performance at all stages between successful and challenged projects

There were projects that were set up for success by the way those involved approached the early stages. Equally, the challenged projects started badly due to time pressures, inadequate stakeholder engagement, loosely specified requirements and aspirational businesses cases. Project managers then tended to compensate for this with risk-oriented contracts and overly strong project management and governance.

This chart records the average survey results by project stage for successful and challenged projects in comparison to the best project.

Project Stage Performance



The performance gap was clear

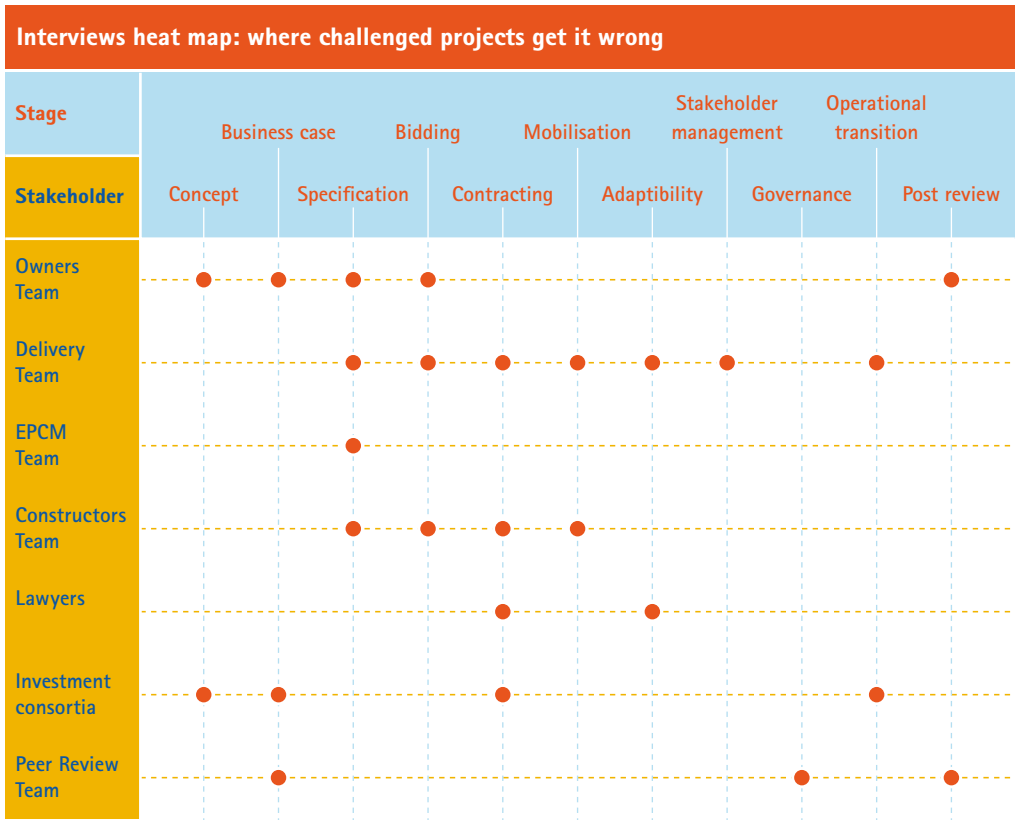
We identified a number of critical differences between successful and unsuccessful projects at all stages.

Project stage	Successful Projects	Challenged Projects
Concept Design	Wide support/time-staged/stakeholder engagement	Fast-tracked, aspirational, too high-level
Business Case Development	Alternate scenarios/sensitivities/staged	Reverse-engineered/optimism bias/no reference benchmarking
Project Specifications	Outcomes focused with flexibility for innovative input	Either light on or too much detail that stifled innovation and added cost
Bidding process	Set the stage for formation of collaboration and problem-solving	Excessive focus on competitive tension and risk management
Contracting	Different strategies based on flexibility and alignment	Focused on task details and risk transfer
Mobilisation of team	Whole of extended team including external stakeholders	Driven by strong project management and schedule
Stakeholder Management	Good upfront and continuous engagement through process	Transactional when needed and too late
Governance	Self-managed and accountable team	Strong project management and schedule-driven
Operational Transition	Early and continuous engagement of owners' teams in process	Lack of engagement and disconnected process with blame
Post review	Genuine opportunity to learn	Firing of Project Manager

There are diverse views of success

The research also identified a number of different risk hot spots for the various stakeholders on projects that are not necessarily aligned and can cause contention

Stakeholder hot buttons



Observations

1. Owners teams are subject to significant political pressure in both the private and public sectors. Long-term failure is discounted in favour of short-term drivers such as press announcements.

2. Delivery team are often handed a 'poisoned chalice' of an undeliverable project. They then try too hard to achieve an impossible outcome without having "stop" as an option.

3. EPCM Teams want to ensure there is a great design but potentially over-engineer for the desired economic outcome.

4. Consortium teams are looking primarily for expected financial outcomes. Bids are costly (> $15 million) and the cost of losing is high, which leads to underbidding and the 'winner's curse'.

5. Lawyers are seeking to protect their clients' interests (even against the group's). They often shape project culture through the contract model.

6. Delivery teams focus too much on the technological aspects of complex projects and negate the socio-political aspects in dealing with diverse unengaged stakeholders.

7. Peer reviews are regarded as annoying, rather than as sources of insight from experienced practitioners.

Adopting a fresh approach

From the research, we recognise that we need to start thinking about mega-projects from a different perspective

Key insights and implications

1. The nature of projects is changing

The nature of projects is changing to match changes in our society. Projects are becoming increasingly sophisticated and involve an ever-greater number of diverse stakeholders with different requirements, who need to be engaged to ensure a successful outcome. The failure to recognise this leads to poorly specified designs, continuous scope creep and major budget and schedule overruns.

2. Projects have become increasingly complex

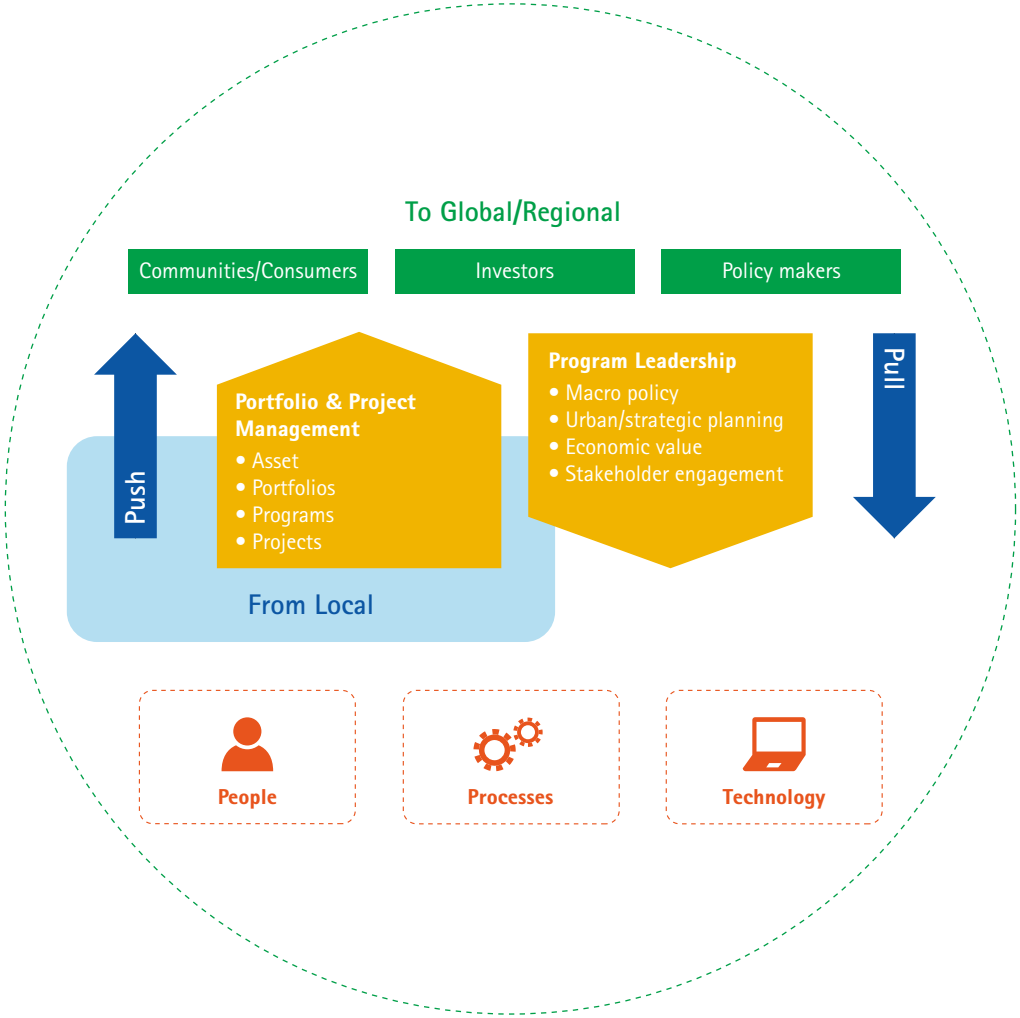
Projects have become increasingly complex and are exposed to many more human variables and environmental and political uncertainties; they are no longer just engineering projects. We need to change our approaches to recognise these factors and be able to more rapidly adapt to emergent knowledge or external changes. Our new business models and governance processes need to be able to flex to allow change while still ensuring transparency, accountability and safety. We need a new form of more inclusive and pervasive agile project leadership.

3. Changing mindset and models

Changing mindset and models are required for these new age mega-projects. The engineering mindset is critical but not sufficient. We need not only to broaden the inclusion of other stakeholders' perspectives, but also to build a new culture of collaboration across corporate and political boundaries.

4. Next generation distributed and pervasive leadership

Next generation distributed and pervasive leadership is required that enables flexible decision-making at the distributed point of need.



"The psychological commitment to projects happens early, from then on we just backsolve"

Insight 1.

The nature of projects is changing and this requires a different response

The focus of projects is changing in many aspects, as the construction of components develops into the provision of sustainable, high-quality operational services.

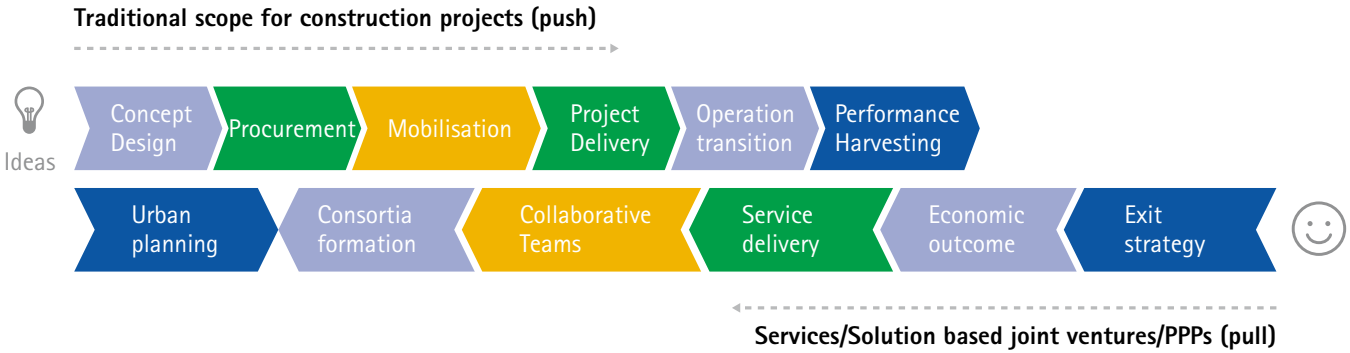
This shift involves different stakeholders throughout the process and requires early involvement of the ultimate operators. There are now global sources of funding for projects, with international companies included in development consortia. This applies especially to infrastructure projects such as airports, ports, hospitals, prisons, toll roads and light rail, but it is also applicable to next-generation mining and gas projects with significant local community and regional consumer market involvement.

In addition to these global sources of capital, there are global views on risk (project and sovereign) that shape project expectations and have consequences for follow-on projects.

Environmental expectations and international labour mobility (457/FIFO/DIDO) are also part of the ever-changing dynamic of projects. Because of their nature, the size and duration of mega-projects is also increasing, with some projects involving over 20,000 staff (many from offshore) for durations of more than 5 – 10 years, as well as up to 100 sub-contractor businesses. This implies a shift from the somewhat transactional nature of traditional project teams to the formation of high-performing project communities with a shared sense of purpose.

"The structure is only there to keep the rain off the services"
Anthony Manning, NSW Health, Northern Beaches Health PPP

"We need to run projects backwards with the ultimate owners involved from day one
Brett Himbury, IFM Investors



Insight 2.

Increasing project complexity requires more adaptive processes

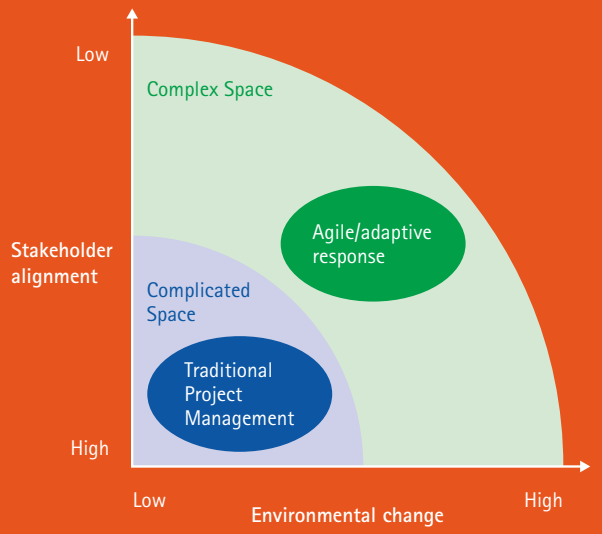
There has been limited improvement in the performance of mega-projects over the last few decades and projects will only become increasingly complex and human-centric in the future. There is much research underway on how to improve our performance on mega-projects. Areas of focus include better modelling of risk, the development of more accurate estimate classes and improved institutional design for accountability. However, it may be useful to apply a different set of lenses to the whole phenomenon of mega-projects. By using some of the thinking from the complexity sciences and organisational behavior, we can better understand the issues at play in this environment and seek novel solutions.

We have learned that a different set of leadership capabilities are required to manage complex systems. They allow us to gain a better sense of the environment, shape an identity that can drive self-management, rapidly adapt to emerging trends and regularly seek agile pathways in order to achieve better outcomes.

"Complex projects have been characterised as embodying uncertainty, ambiguity, dynamic interfaces and significant external influences"
IBM

"Humans are central to the creation of complexity, the people involved, the ways they communicate and the relationships they develop constitute the behaviour and combined culture of the organisation or project"
Complex Project Management Task Force Report

"Traditional project management approaches, tools and techniques are inadequate for managing the increasing complexity and ambiguity in our rapidly changing business environment"
Complex Project Management Task Force Report



Insight 3.

We need change mindsets to build a new culture of collaboration across corporate and political boundaries

We know that for the complex eco-systems that we call mega-projects we need a different culture and type of leadership (everywhere) that can rapidly adapt – within agreed boundaries – to meet emerging challenges.

From organisational behaviour, we have learned that shaping such a performance culture takes time. It requires trust and authenticity, the freedom to adopt alternate views, emotional engagement with a sense of purpose, an environment of coaching not blaming and a sense of shared accountability.

In this environment, the incremental discretionary effort is high and the ability to collaborate to solve problems or deal with emergence is prevalent. This culture works best when it is supported by an appropriate business model, but can also transcend one.

Another key notion here is that of boundary-spanning leadership, as on complex mega-projects we are working across organisations and even across different layers of Government. We need to manage using influencing techniques, as we may not have recourse to direct line authority. Alpha project managers often struggle in this space and can cause collateral damage in the name of project progress.

These lenses of complexity and behavioural science will be used to frame a set of responses to the challenge of mega-projects.

Our next generation service oriented projects are complex not complicated. They require a different approach to being guided rather than managed. Traditional project management approaches used in the Simple (routine) or Complicated space are useful for engineering projects but are not able to deal with the ambiguity and emergence of complex social service delivery projects.

Insight 4.

Changing mindsets and models

Inside out to outside in

We are changing from an inside out to an outside in approach to how we think, sense and architect the way we look at and drive projects. We need to be aware of the business and service impact of decisions at all times and optimise outcomes to deliver value to all stakeholders. This requires the business model to flex as we move through the project stages and requires delivery agencies to collaborate and align their contributions to achieve the best outcomes. In this complex eco-system, the people best able to take decisions make them because there is trust, transparency and shared accountability. The role of the leader is to create the flourishing environment that enables distributed leadership.

"Alliances change the focus of what adds value and become a catalyst for behavioural change and collaboration"

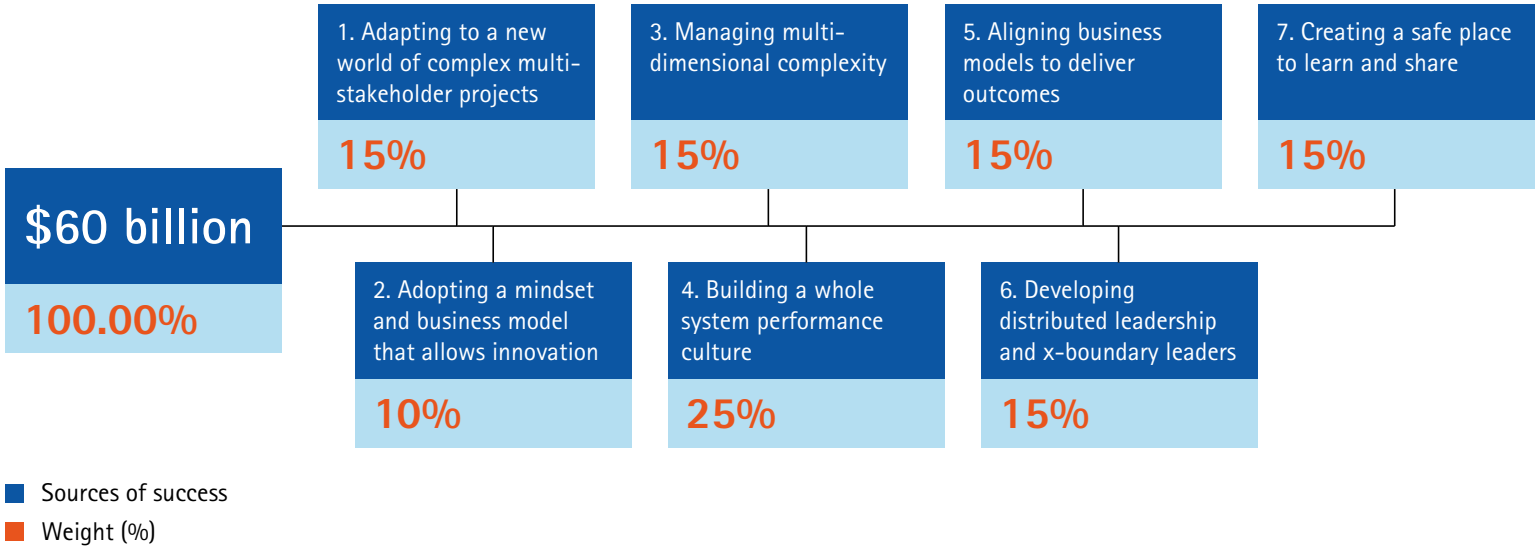
	Traditional Project Management	Next generation Project eco-system leadership
Aspect	**From**	**To**
Outcomes	Engineering and budget success	Business case and operational performance success
Primary Stakeholders	Owners and Contractor teams	Customers, Service providers, Investors, Owners and Constructors
Timescale	Construction project	Operating asset use lifecycle
Locus of attention	Project resources	Service consumers, delivery agents and shareholders
Leadership	Hierarchical and centralised	Distributed leadership at point of events
Vision and engagement	Top-down and siloed	System-wide and engaged
Decision-making	Centralised	At point of need
Business model	Protecting interests	Agile creation of value for all
Risk	Tightly controlled	Managed as emerges
Governance	Adherence to plan, variation-oriented	Achievement of outcomes, value-oriented

"Psychology is prime and will override any business model"

Emerging Solutions

From over 30 interviews we identified the following root cause of future success

From the research process, we have focused on what we can do differently from a behavioural perspective to achieve better outcomes for the next generation of mega-projects. These are additive to the well-known Prince 2 approaches, processes and systems that we use for traditional engineering-oriented projects. The degree of impact will depend on the nature and complexity of the new project. The clear areas for improvement identified below come from the domains of leadership, social, behavioural and organisational sciences. We use many of them in steady-state organisations but now have the challenge of using them adaptively for complex projects in a dynamic environment. The goal is to select from well-known bodies of engineering/ financial knowledge, while building an adaptive, performance-focused organisation that spans many diverse stakeholders and engages them in an emergent process.



Tackling complexity

Based on these insights we have developed a new behavioural-based model for the world of complex mega-projects

Model elements

1. Engaging the Eco-systems: Mega-projects need to address many diverse stakeholder communities and we need to shift our project focus to people and social needs that pull through supporting processes and technology.

2. Enabling innovative solutions: Our engineering and contracting models need to allow for continuous innovation, rather than being too rigidly specified upfront in an ineffective attempt to reduce risk.

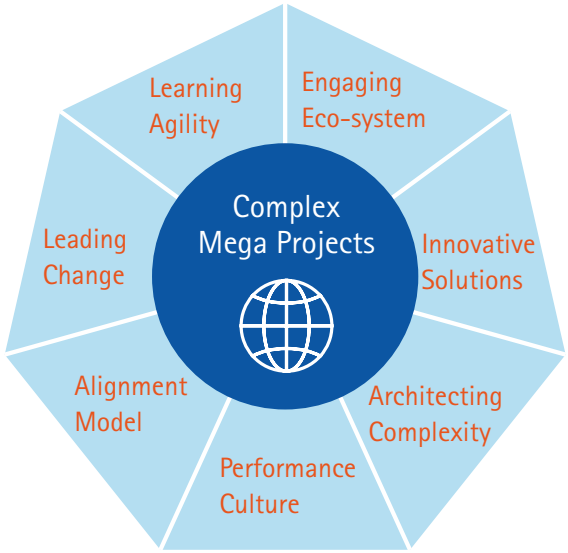
3. Architecting complex change: We need to look at how we best break down these complex solutions into viable related component parts. This will be as much about managing human change as about structural engineering.

4. Building a performance culture: We need to develop a culture of collaboration across all the diverse delivery agents on mega-projects so that they can make continuous optimisation decisions at the point of need, rather than relying on centralised control.

5. Aligning business models: New projects need contract models that align outcomes across diverse stakeholders, and can flex with the dynamic environment.

6. Changing leaders: We need to change the capability and focus of mega-project leaders and leadership from task management to achieving political, social and economic outcomes.

7. Learning agility: We need to embrace learning and rapid adaptation during and between projects so we can develop new processes based on a different form of project outcome.



1. Engaging eco-systems

What needs to change?

- Stakeholder engagement: We need to recognise that in the new world of solutions-focused projects, there is a large and diverse set of stakeholders with different views of success. These views can be political, social and economic. We will need to develop a new market-facing and inclusive project eco-system that engages and aligns these stakeholders.

- Adaptive concept-scoping: Many current projects are aspirational (strategic or social infrastructure projects) in both the private and public sectors. They are large, complex and hard to specify. Because of their nature, these projects are exposed to global and local economic, political and social volatility that does not allow for reliable estimates or promised outcomes. We need a new, more flexible project business model that can evolve as greater knowledge emerges or flex as the external environment changes.

- Human engineering: Our focus is often drawn to the now complicated world of technology and we ignore the complex human social-engineering aspects of projects at our peril. We need a shift in focus to include the far broader range of deliverables and processes that these future projects require. This implies a different governance and leadership model that incorporates the external and internal communities that are part of the project eco-system.

What can we change?

1. Engage the broader set of eco-system stakeholders in an inclusive and sustainable way: Former BCA Chairman Tony Shepherd spoke of the community engagement program for the Sydney Harbour Tunnel. By genuinely listening and creating an environment of openness and trust, the team enabled an easier resolution of the inevitable challenges that came later.

2. Change the way we manage iconic projects: From a psychological perspective we need to recognise the importance of iconic projects in both the private and public sectors, but make this recognition more transparent. If we deny our ambition for these projects we are left trying to reverse-engineer viable business cases. This will require changes to our project parameters that allow other factors to be included in place of unconscious bias or deception.

3. Adopting a new more holistic perspective: Using some of the approaches from complexity science such as sensing and sense making, we can ensure we can flesh out the concepts sufficiently so that we better understand their cost of construction/ service provision. This can involve structured creative processes that include multiple key stakeholders – such as scenario planning, design thinking and simulations – to allow for more robust tested concepts.

"The psychological commitment to projects happens early, from then on we just backsolve."

"We are trying to produce a recipe that ignores humans."

2. Enabling innovative solutions

What needs to change?

- Trapped in a cycle: Senior executives feel that they are subject to relentless BAU strategic planning cycles, market reporting cycles and election cycles which drive the pace and timing of new project announcements for publicity purposes, rather than allowing space for diverse or disruptive thinking.
- Trapped in probity: Many construction companies believe that they are asked for orchestrated, risk-averse answers and are not allowed to challenge or change the questions.
- Trapped in risk adversity: In seeking the fantasy of certainty, we specify the unspecifiable and wish risks away through rigid processes and registers. Innovation needs an environment of creativity and a willingness to fail and learn that is not present in most project environments.

What can we change?

1. Creative space for innovation: There is a need to create time and thinking space to allow for more mature stakeholder engagement, debate and co-creation of new/alternative solutions. Open innovation platforms or parallel task forces can uncover novel solutions.
2. Adopt a different procurement model that allows time and parallel processes: From NASA and many of the other great innovative projects, we see an environment of shared visions and value alignment, incentivising all parties to consider viable and sustainable operational outcomes rather than just the input costs of components.
3. Minding risk: "Creative approaches to risk management recognise the need to develop a shared interest in successful outcomes through identification of resultant mutual opportunity, rather than perceived protection against risk of failure and loss". **Complex Project Management Task Force Report**

"We sometimes see innovation in a crisis that cannot occur in a structured environment!"

"On many bids we are not allowed the time, space and attitude for innovation to occur."

3. Architecting complex change

What needs to change?

- Deconstruction of complex projects into component packages or parts is reductionist and primarily driven by technological drivers. It ignores both the complex intra- and inter-world of the project. Such packaging can create human interfaces that are a source of greater complexity, misunderstanding and friction with many different contractors.
- Drive for certainty: the attempt to eliminate change creates rigidity, and endless scope variations. When coupled with a risk-averse contracting strategy, it creates contention and disputes rather than an aligned problem-solving approach to novel issues.
- Negative feedback loops end up prioritising reporting and managing variances, when we know the original estimates were never accurate in a dynamic multi-stakeholder environment.

What can we change?

1. The project architecture needs the psychological and sociological knowledge on how to manage change. The construction engineering is often challenging, but the human engineering is far more complex and yet given such little attention by or within the project.
2. Complex Project Management: we must learn to observe and guide rather than constrain the forces involved. We can also build the abilities of the people at the primary interfaces by trusting them to make the myriad of optimising decisions they need to on a daily basis, without having to resort to a centralised command-and-control model.
3. Learning to tolerate uncertainty and ambiguity by building a culture of trust and results agility.

"We create our own complexity by the way we try to manage complexity – endless documents, risk logs, contracts."

"If it is bigger than $2 billion or has more than 3 interfaces it is too complex and will fail."

4. Building a performance culture

What needs to change?

- The new model involves a far broader range of people that need to be engaged, aligned and committed. This cannot be achieved by Gantt charts. There needs to be an environment across the many aspects of the project that promotes a sense of shared purpose, constructive engagement, collaborative problem-solving, trust, accountability and self-management.

- Decisions made at point of impact not at the centre: As a response to project complexity and consequent anxiety we try to centralise decision-making. This ends up as a bureaucratic logjam on complex projects where work often has to continue in spite of the governance.

- Shared accountability: Under the current model there is a run-for-cover shifting of blame or contracts when things go wrong. This needs to change to a sense of mutual achievement and learning how to work better in the future.

What can we change?

1. Build a performance culture upfront: We need to focus much more on the creation of sustainable project environments where we have a clear sense of "why" and aligned teams across boundaries. The formation of the partnership should come from organisations and people who have both the ability to deliver and the willingness to collaborate to achieve success.

2. Build trust and transparency in everyday actions: The challenge is for us to move beyond platitudes and to consciously develop a nurturing environment by the way we conduct ourselves in the many transactions and interfaces we have on a daily basis. Culture is emergent, not proclaimed. We need to call out non-values aligned behaviours immediately, at any level.

3. Conflict resolution: The fear of conflict or avoidance is just as problematic as uncontrolled conflict. Creating a safe place to offer alternative solutions and challenge status quo is healthy. This can be both a value and a process. Dispute Avoidance/ Resolution Boards can be useful safety nets but the stakeholders can learn how to have difficult conversations with positive outcomes by using a coaching mindset.

"We need experienced and collaborative people with just enough governance not technocrats and autocrats."

"Governance is more useful at head office than on the site, we need experienced people not paper."

5. Aligning business models

What needs to change?

- Moving beyond the contract: At present there is a view that the contract form needs to be the mechanism to ensure compliance and order on projects – assuming that bad behaviour will occur. We need to see that human collaboration is the key to success and ensure that the form of agreement (alliance, D&C, schedule of rates, lump sum) supports, not supplants this.

- Flexibility: In complex mega-projects, it is not possible to know all the 'right stuff' on day one, so we need to create a business model that reflects the emergent nature of these projects, aligns stakeholders around success and allocates a fair share of value and risk.

- Contracting in a complex world: There are numerous examples today where the legal document is driving significant contention, claims and disputes, or has been put aside to allow project progress. We need to develop a more accessible way of creating an agreement around outcomes that guides successful solutions and incentivises performance.

What can we change?

1. Mutuality of interest is where the ultimate project results and the relative contribution of all parties (both resources and collaborative behaviours) can be agreed on and then captured in an appropriate form. The process needs to be shaped in the real world of projects using social, emotional and political skills to align the different stakeholders in achieving success.

2. Joint ventures to create value, not limit exposure: The model needs to be able to flex and adapt to external and internal changes as part of the core process, not as an exception.

3. Project issues should be resolved by people raising them early and seeking to solve them, not by resorting to at best historical records of an imprecise understanding of scope and costs from several years before. Otherwise, we may win the skirmish in a contract dispute, but then create a lose-lose cultural impact that ultimately undermines the sensitive collaborative culture of the project and the economic and social benefits it delivers.

"Hard money contracts can engender adversarial behaviours where ambiguities arise, as parties tend to protect their individual positions, each interpreting the contract in their own favour."

"We need to put the Partnership 'P' back in PPP!"

6. Changing leaders

What needs to change?

- New leadership model: The shift from managing complicated technological projects to leading complex social solutions needs a different form of leadership that is distributed through the project eco-system, not resident in a single person.
- New Leaders: The current form of centralised project leader who is a single point of responsibility is not viable in a large, complex project environment. There are just too many variables and interfaces. Their role needs to change to one of enabling leadership, rather than acting as the choke point for decisions.
- Leadership development: At the moment there is a limited cohort of jumbo project pilots. They tend to learn by surviving the school of hard knocks and often burn out or lose their edge. There is limited development of the next generation on an apprenticeship basis.

What can we change?

1. Develop a distributed leadership model: As the project eco-system is set up, it can be designed in such a way that it enables timely leadership decision-making close to the operational parts of the project. Leaders can collaborate as a team to review, assess and solve the myriad of daily issues that emerge. They can communicate and share performance outcomes and take joint accountability for success.
2. Identify the behavioural capacities required for your next generation leaders: The project leaders of the future will have to have a 360 degree leadership style and become orchestrators and integrators of distributed leadership. They will need to transcend boundaries (political, national and organisational) and unify disparate stakeholders into an aligned mega-project team.
3. Create a pipeline of project leaders: Develop an action-learning model for project managers as part of their everyday activities. They can have defined learning stretch goals, formal peer groups and experienced mentors.

"We need to use large projects as an environment to blood younger people, they bring energy and drive to the project."

"They appointed Alpha Project Managers to difficult contracts to contain the costs, but they ended up destroying the team."

"The perceived complexity of a situation or system is relative to the capacity of the responsible individual or group to comprehend it."

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7. Learning agility

What needs to change?

- Risk appetite limits learning: Typically the level of anxiety on complex projects does not allow learning or experimentation to occur. The emphasis is on risk minimisation and therefore tight governance and procedural adherence.
- Wrong approach: Research has found that the use of absence of governance frameworks and methodologies makes very little difference to project outcomes. People tend to rely on their own experience and that of those around them. Yet we spend a great deal of training and control effort on mechanisms that have limited impact. We need to shift approach and learn through experience and reflection.
- Limited learning appetite: Project post-implementation reviews seldom take place or have sufficient attention paid to them. There is limited appetite to explore failure and learn, and typically project managers end up as the immediate collateral damage.

What can we change?

1. Change the culture: The project needs to create a way to fail safely. This way we can genuinely explore what happened and what needs to change and avoid making the same mistake again. NASA created a safe space to be expected to "not know" and therefore be open to learning.
2. Adopt a new, embedded learning model: NASA also recognised the apprenticeship process of learning to deal with complexity and supported this with knowledge management, mentors and simulations to give real-life experiences.
3. Learn across projects: We can leverage great models of successful transfer of learning across projects through knowledge management. This can be a first port of call for novel project problems, allowing teams to explore others' experiences and even use new technology platforms for crowd solving and learning.

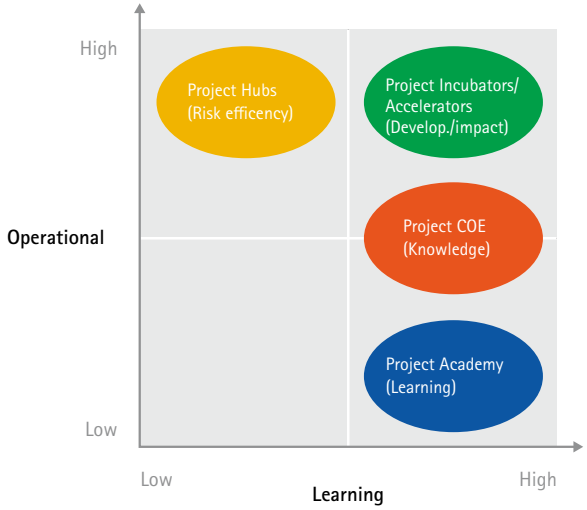
"We will make the same mistakes again, just with different people."

"I have been asking for lessons learned for 30 years but never get them."

Changing our approaches will be challenging

Changing the way people think, relate and operate is complex but we have some models to draw on

Model	Project HUBS	Centres of Expertise	Project Academy	Project Incubators/Accelerators
Approach	Centralise mega/major projects	Virtual or physical sharing of knowledge and methods	Specialised learning environments for developing project leaders	Built into mega-projects to develop leadership and culture
Benefits	Reduces risks if few very capable mega-project managers	Low-cost, low-touch, available 24x7, can be outsourced	Brings like-minded cohorts together and is a focused development activity	Real-time learning in the project environment with the real systems and project team
Limitations	Can alienate the owners and other site and eco-system stakeholders. Is also susceptible to economic cycles.	Relies on being kept up to date and relevant. Is optional and does not change behaviours	There is an abstraction from the real project environment that requires deliberate application of learning	Takes some upfront investment of time and a commitment to ongoing development as part of a sustainable practice
Examples	BHPB	Rio Tinto	NASA John Grill Centre Accenture	Telstra VC start-ups



A real concern unearthed by the research was the low rate of improvement over the years. We explored different ways that organisations had used to either try to ensure consistency through centralisation or share best practices through centres of expertise. Both approaches had their challenges. The Project Academy model used by NASA developed a good pipeline of experienced project leaders who leveraged knowledge supported by mentors. However, as with the Project Hubs this investment could not be sustained through the usual boom/bust cycles. Learning as an integrated part of the project itself and across and between projects using a leadership incubator approach appears to best create the culture that is required to break the cycle of repeated errors. This is regarded as normal practice in many U.K. projects.

Measuring success in the new world

We need to change the way we look at these projects and measure their outcomes. This will drive the behavioural changes required for success. This entails engaging with key external and internal stakeholders and really understanding the drivers of performance. We need to know we can measure success and then be able to use the performance data to help us all adapt our inputs and processes to focus on outcomes. We can no longer live in the world of engineering success and economic failure.

Value	From (Challenged)	To (Successful)	Prize (based on $ 1 Bn project)	through...
Social Value Capture	Disconnected	Aligned with community needs	Multiplier effect	• Services outcomes specified • Early engagement of community • Service delivery lifecycle perspective
Political Value Capture	Aspirational	Inspirational	Multiplier effect	• Visionary • Planned • Policy enabled
Economic Value Capture	< 5 % Business case achievement	> 50 %	> $ 500 m	• Stakeholder alignment and engagement • Adoption of innovative techniques • Focus on value harvesting
Improved budget success	Overruns > 30 %	< 5 %	> $ 250 m	• Realistic estimates • Flexible outcomes based business model • Collaborative rapid problem solving
Meeting schedule	Overruns > 30 % LD Fees 5 %	< 5 % Early bonus 5 %	> $ 100 m	• Architecting bite sized and parallel chunks • Stakeholder alignment and engagement • Delivery teams work as one
Reducing Risk	Liquidated damages 5 %	0 %	$ 50 m	• Reduced risk through early intervention • Aligned business model

How do we know if our project is complex?

It is important that we apply the right mindsets to the nature of the project. Routine projects are predictable and low risk. They can be well managed using traditional project management approaches. Complicated projects have a higher risk profile from an engineering perspective. They need a disciplined framework and business model that can adapt us the unknown aspects become clearer. Complex projects are far more emergent. We don't understand the risks upfront and can constrain innovation and incur endless variations by being too rigid. They require a more adaptive approach and business model that can align the different stakeholders interests as they collaborate to deliver successful shared outcomes.

Complexity Factor	Routine Project	Complicated Project	Complex Project
System properties: Variety & domain knowledge	Stable, known & repeatable	Stable & linear Known & unknown but discoverable	Emergent & non-linear Unknown but knowable
Example	Highway, Mine	Desalination plant, Port	Health service, Space station
Nature of outcome	Clearly defined and know approach	Defined but approach to be refined	Conceptual and changing with adaptive approach
Stakeholder relationships	Limited, aligned and engaged	Known set, may be influenced	Wide variety and wicked (oppositional)
Impact intensity	Product-only failure	Impact beyond system	Broad social and political implications
Resources	Known, available and engaged	Known, scarce and sought after	Known/Unknown, rare and to be developed
Technology	Known & stable	Known/Unknown and evolutionary	Known/Unknown and revolutionary
Interfaces	Stand-alone	1 -3 modules	Many-to-many
Methodology	Known and repeatable	Discoverable and reductionist	Discernible but adaptive
Value capture	OTOBOS	Economic value captured	Social, political and economic value captured
Governance	Structured process, risk averse	Structured discovery, innovative, transparent, trust & communications	Shared purpose, distributed leadership, transparency and outcomes accountability

2020: In the media

We have experienced a portfolio of successful projects that have developed Australia's fundamental economic infrastructure for the next 30 years

Headlines

"These projects were complex and costly but they were well managed and met all of the performance hurdles in terms of social engagement and impact and economic success for venture partners, as well as sustainability and safety."

"We had many learning challenges and a number of mistakes along the way, but we learned from them and shared this knowledge with others to ensure we did not make the same mistakes again."

"We established project communities made up of many diverse stakeholders, unified by a shared sense of purpose and a fair economic model. The culture was collaborative and 'can do' outcomes-focused, where any issues were dealt with quickly in a generative manner."

"We now have an amazing generation of complex project leaders who are in demand by the rest of the world, and we are comfortable that our processes will continue to build both the leadership and the leaders we need for the ever-increasing complexity we face in the future."

Acknowledgements

The interview/ discovery process was conducted through 30 interviews with different stakeholders to get their perspectives of success and failure

Political leadership

- Former Premier of New South Wales

Infrastructure Agencies:

- Infrastructure Australia
- NSW Treasury
- Infrastructure NSW
- Infrastructure Partnerships Australia

Professional Peak bodies:

- Australian Constructors Association
- Project Management Institute
- Australian Institute of Project Managers

Business Leadership

- Former Chair of Business Council of Australia
- President of Australian Constructors Association

Owners team Mega-project Managers

- Resources
- Transport
- Health

Construction companies

Engineering Design organisations

Law firms

Infrastructure Investors

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As an Asia Pacific Industry Managing Partner in major international consulting firms (Booz & Co and Accenture) and Director of Business Schools (AGSM and MBS) he has executive teams plan and transform their organisations.

He has worked extensively in both the private and public sectors with large-scale Resources and Oil industry multinationals, as well as with the Federal and State Governments.

Malcolm has focused on adult learning/capability models and successfully used action-learning techniques to build cross-business unit/agency collaboration in both large organisations and Government. He conducts applied research in the application of complexity and behavioural sciences to organisations and mega-projects.

Malcolm has postgraduate degrees in Business, Science, and Psychotherapy.

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James is an internationally-accredited strategy & execution, portfolio project, programme, PMO, benefits and project management consultant. James is an approved trainer with an extensive proven history of uplifting the capability of over 1,000 executives, programme, project, PMO, benefit and change managers.

He has supported executives and teams to better understand their roles and responsibilities, increasing speed of delivery within the project/programme/portfolio environment.

Clients leverage James' deep experience as a Programme Director, PMO Manager, Organisational Change Manager and Portfolio Advisor to optimise organisational project delivery. He has delivered many of his clients' most challenging programmes while coaching clients to ensure ongoing delivery capability uplift.

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Craig focuses on Executive Development, Digital Marketing Strategy and Operational Excellence.

He has been a long-standing Program Director and Faculty member on AGSM's MBA, MBT and Executive Education Programs. He has consulted to major telecommunications, consumer products and resources companies. In addition, he led a boutique management consulting firm for over six years and accumulated over 15 years' experience as a director on boards.

Craig's career includes more than 25 years' experience at senior levels in the corporate and public sectors in both Australia and the United Kingdom, including senior sales, marketing and executive roles in major Australian and international companies.

Craig brings a breadth of functional expertise coupled with genuine adult learning experience to help organisations change. He understands how to engage the participants of change in the process.

He has an undergraduate degree and postgraduate degrees in economics, industrial relations, marketing and an MBA. He is a Fellow of the Australian Institute of Company Directors and a Senior Fellow of Finsia as well as being a Certified Practising Marketer.

About Australian Constructors Association (ACA)

The Australian Constructors Association represents leading construction and infrastructure contracting companies. ACA members operate globally, with member companies operating in Australasia, Europe, Asia, North and South America and the Middle East. Collectively ACA member companies have combined annual revenues in excess of $A50 billion and employ over 100,000 workers in their Australian and international operations.

About Agilience

Agilience is engaged in action based research, execution impact and learning. We have studied the heart and science of agility, and from this position we seek to become a catalyst in your process of outcomes driven strategic change. This applies to strategy and project execution in a complex world."