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Innovate – Now!

Introduction

Trying to innovate or wanting to? Making a start is the most difficult step on any journey. Whether trying to innovate for the first time, or seeking improvements on current performance, organisations are confronted with a plethora of options. *Innovate – Now!* makes action easier by presenting some of the key considerations for improving innovation performance. This guide has been based on the outcomes of a survey and case studies conducted between 2003 and 2005 in the Australian property and construction industry and therefore contains unique and up-to-date information, examples and suggestions tailored specifically to your industry needs.

The large-scale industry survey and 12 innovation case studies on which this guide are based were carried out by The BRITE (**B**uilding **R**esearch, **I**nnovation, **T**echnology and **E**nvironment) Project as part of research for the Cooperative Research Centre for *Construction Innovation*. The stakeholders volunteering to take part in BRITE research included 400 hundred businesses, 14 government organisations, 8 industry associations and 4 universities.

The case studies are listed below and will be referred to by number throughout the guide.

- 1 Energy Cost Savings in 5-star office building
- 2 Clever Planks at Sports Stadium
- 3 Port of Brisbane Motorway Alliance
- 4 Fire Engineering at National Gallery of Victoria
- 5 Fibre-Reinforced Polymer Bridge Deck
- 6 Ground Penetrating Radar and Defective Bridge Beams
- 7 Managing Stormwater with Storage Gutters and infiltration
- 8 Saving On-Site Remediation Costs
- 9 Post-tensioned Steel Trusses for Long Span Roofs
- 10 Twin-Coil Air Conditioning at the Art Gallery of South Australia
- 11 Better Project Outcomes with Relationship Management and 3D CAD
- 12 Using Recycled Tyres to Construct an Access Road over Saturated Terrain

A summary of the BRITE project, including the case studies and the national survey, is provided in Appendix A and the full research results can be downloaded at www.brite.crcci.info.

This guide explores the notion of innovation in the next section, and then presents a series of steps that can be employed by businesses to develop an innovation program and grow innovation activities in pursuit of improved profitability. An innovation program is an ordered sequence of actions developed as a formal plan, designed to stimulate innovation in your business.

Demystifying innovation

Businesses find themselves under increasing pressure to innovate; yet many remain uncertain as to where to begin. This is partly because 'innovation' describes a broad range of activities packaged together. To confront the innovation challenge, businesses need to unpack the concept before they can proceed and develop an innovation program for their organisation.

In its simplest terms, innovation can be thought of in the following way:

Chart 1 Defining innovation

<i>Innovation</i>	<i>Involves <u>technological</u> or <u>organisational</u> change</i>	<i>By <u>improving</u> existing arrangements or developing <u>new</u> arrangements</i>
<i>In <u>products</u>, In <u>processes</u>, or In <u>methods</u></i>	<i>Which may represent an <u>incremental</u> or <u>radical</u> departure from existing arrangements</i>	<i>In either case, <u>driving</u> business <u>growth</u></i>

The international body that has driven the collection of innovation data over the past 20 years, the Organisation of Economic Cooperation and Development, defines innovation in more detail as the implementation of new or significantly improved:

- **products** (good or services) with respect to characteristics or intended uses (e.g. technical specifications, incorporated software, user friendliness, scope of offering, components, materials)
- **processes** with respect to production and delivery methods (e.g. techniques, equipment or software)
- **marketing methods** with respect to design, packaging, placement, promotion or pricing
- **organisational methods** with respect to business practices, workplace organisation or external relations.

The examples below help make these ideas more concrete, and might help you think about the changes your business could make:

- **product innovation** – e.g. investing in research to develop new materials or equipment on the basis of feedback from a customer focus group
- **process innovation** – e.g. changing the way you offer your goods or services to add greater value to users by adopting a more cooperative approach on projects
- **organisational innovation** – e.g. finding a new way to organise employees which better streamlines your systems, perhaps by offering employees incentives to put forward time-saving ideas
- **marketing innovation** – e.g. introducing your goods or services to new groups who do not currently know about them, firstly exploring government programs aimed at assisting business entry into overseas markets

Innovation is often categorised along a continuum ranging from incremental to radical change. Even innovation that leads to incremental change may have a significant impact on industry practice and business growth. To be innovative, it is not necessary to launch an untried idea or even to invest in research and development (R&D), although more radical innovations may require such strategies. An innovation program, therefore, need not take the form of a radical and high-risk 'leap in the dark'. An individual business only needs to implement an idea that is new to it to reap benefits. Although innovations that are new to the world may pay greater rewards, the risk profile of such innovations makes them unsuitable for many small businesses.

Whether incremental or radical, innovation in the construction industry typically takes the form of design changes, and technical changes to materials, components, equipment or construction processes. Technical changes are often based on R&D undertaken by manufacturers. However, recent years have seen the rise of organisational changes driving growth. This type of innovation is often associated with the steady refinement of established organisational methods, involving the roles of people and the organisation of work. Such refinements have been found to play a key role in business growth.

BRITE research shows that much innovation in the construction industry, from the most modest to the most dramatic, involves the following steps:

- Step 1 Identify opportunities for innovation
- Step 2 Build effective relationships
- Step 3 Know where to find ideas for innovation
- Step 4 Anticipate obstacles and challenges
- Step 5 Take action for innovation
- Step 6 Share your success

Step 1 Identify opportunities for innovation

Client-driven innovation

Businesses should seek to work with 'leading edge' clients who often provide significant opportunities for innovation. Leading-edge clients are those with high levels of technical competence, with challenging needs and with extensive experience. The innovation opportunities of a business are influenced by the level of sophistication of the clients for which it works — the more demanding, technically competent and experienced the client, the more likely it is to stimulate innovation in projects, by demanding outcomes that exceed business-as-usual. Businesses that are slow to innovate may need to find the courage to expose themselves to this kind of pressure, if they want to improve business performance. This might seem easier if one considers that advanced clients are also more likely to rely on value-based rather than lowest cost tendering.

BRITE survey results show that Australian repeat public-sector clients can play a significant role in promoting innovation, by providing favourable project conditions. Sixty percent of the 383 survey respondents nominated repeat public-sector clients as 'encouragers' of innovation in the industry. The survey also found that, compared to other industry groups, such clients had the highest rate of investment in research and development, the highest rate of adoption of advanced practices and technologies, the best return on innovation and they were ranked fifth among 14 sources on ideas listed in the survey. Hence, an effective innovation program should focus, where possible, on cultivating deeper and broader relationships with repeat public-sector clients.

The BRITE case studies identified specific roles played by leading-edge public and private-sector clients in driving industry innovation, including:

- setting challenging energy targets
- designing new forms of contract
- undertaking research and development
- networking with specialist experts
- organising demonstrator projects.

In the case studies, such requirements were the main drivers for proactive innovation, as shown in Chart 2. These opportunities created by client requirements were exploited mainly by small- and medium-sized enterprises. This highlights the importance of building and maintaining relationships with key clients.

Chart 2 Drivers of innovation on case study projects

Case study 1	Case study 2	Case study 3	Case study 4	Case study 5	Case study 6
Client wanted to minimise whole-of-life costs	Client's contract provided innovation incentives	Client wanted improved time/cost/ quality outcomes	During the project, time and cost started to blow-out and needed containment	Client attracted by the weight and corrosion benefits of a new material	During bridge repair faults were found in new concrete beams
Case study 7	Case study 8	Case study 9	Case study 10	Case study 11	Case study 12
Client (local council) wanted to educate community re water saving technologies	During site remediation highly toxic materials were unexpectedly found	Client had tight time-line; needed to keep stadium operating during construction	Client needed to gain better control of fluctuating humidity and temperature levels	Client had tight time-line; wanted better than usual time/cost/ quality outcomes	Client was constrained by restrictive community and environmental requirements and needed new solution

Crisis-driven innovation

In the three cases above (4, 6, 8)¹ where client behaviour was not driving innovation, crises during projects were responsible. Where a cooperative team approach dominates in the face of crises, innovative solutions can be found. The blame-shifting that is often characteristic of the traditional adversarial approach can be avoided and more creative 'best-for-project' responses can be generated. For businesses wishing to improve their innovation performance, this suggests the importance of maintaining robust industry relationships and the flexibility to respond to changing project circumstances.

Other drivers of innovation

At a broader level, construction innovation opportunities can also be driven by:

- **user needs** — e.g. the increasing requirement from building tenants for reduced whole-of-life costs, which is reflected in changing demands from building owners and design innovation (case studies 1, 7, 10)
- **regulatory regimes** — e.g. performance-based building codes which offer greater opportunity for innovation (case study 4)
- **trade conditions** — e.g. growing internationalisation, which offers opportunities for Australian construction businesses to expand their markets globally (case studies 6, 10)
- **social values** — e.g. concern about the environment reflected in government energy targets (case studies 1, 7, 10)

In summary, innovation in the property and construction industry is typically either sponsored by client needs — in which case businesses can *proactively* suggest innovations — or it is driven by crises during projects — in which case creativity in the context of harmonious project relations is required for effective *reactive* innovation.

¹ Numbers in brackets refer to BRITE case studies most clearly demonstrating the point being made.

Think construction innovation: seek work with leading-edge clients and view crises on projects as opportunities

Step 2 Build effective relationships

Agents of innovation

It is important for a business to maintain active personal contacts with related businesses, industry associations and research centres for driving innovation. Businesses may wish to think about relationships in four dimensions:

1. on individual construction projects, particularly with the client
2. along the supply chain, especially with manufacturers and consultants
3. with technical support providers, especially universities and industry associations
4. at different organisational levels, including within a particular organisation or industry, or across related industries, and interstate or overseas.

The BRITE case studies and survey highlighted the importance of relationships in these areas for driving innovation. For example, two case studies (3, 11) involved innovative forms of contract driven by the clients, the intention of which was to provide incentives for cooperative behaviour between team members on the projects. The impressive outcomes on those two projects (see Appendix, Figures A2 and A3) are based on innovation driven by the high quality and durable relationships that ensued. These projects employed, in one case, an Alliance Contract, and in the other, a modified 'C21' contract combined with relationship workshops.

Within the supply chain, the case studies suggest that manufacturers (2, 5, 10, 12) and consultants (1, 2, 4, 6, 8, 9, 11) were the most innovative groups. Manufacturers have a more consistent stream of work compared to construction businesses which typically face discontinuities arising from project-based production. Manufacturers are therefore better able to maintain ongoing R&D programs, and R&D is a key input to effective innovation. On the other hand, consultants are the practical problem solvers in the industry, using their creativity to develop design innovations. The findings related to manufacturers and consultants therefore suggest that businesses look to consistency of work and creativity to improve their innovation outcomes.

The survey findings highlight the same industry groups as 'encouragers' of innovation, as shown in Chart 3.

Chart 3 Industry group by per cent of survey respondents perceiving them to encourage innovation — Australian construction industry, 2004

Encouragers of innovation	%
Large/repeat clients	59
Architects	55
Engineers	51
Manufacturers	46
Building designers	44
Main contractors	43
Developers	38
Project managers	38
One-off clients	27

Trade contractors	27
Other suppliers	26
Organisations that set industry standards	26
Quantity surveyors	19
Funders	15
Government regulators	11
Letting agents	7
Insurers	5

Clients play the lead role in encouraging innovation, having been nominated by nearly 60% of the industry, while over 50% of industry participants nominated consultants, particularly architects and engineers. Manufacturers also emerge as playing a critical role, with nearly 50% of the industry nominating them.

The key role of clients, consultants and manufacturers in encouraging innovation highlights the significance of strategic relationships with them, particularly for access to their innovation assets, which are 'demanding requirements', 'creativity' and 'R&D' respectively. Such assets will assist businesses seeking to build a successful innovation program.

Furthermore, the role of technical support providers in driving innovation, particularly through testing and validation activities, was also reflected in the case studies (1, 2, 5, 7, 9, 10, 12), suggesting the value of relationships with universities and other research centres.

In summary, clients, manufacturers, consultants and technical support providers are key agents of innovation. Hence, businesses wishing to improve their innovation performance are advised to focus on building and maintaining relationships with these groups.

Levels of relationships

Another way to think about relationships is to look at their operation at various levels. Industry-level relationships have been covered above, while the importance of relationships *within an organisation* was highlighted in all the case studies. As an example, Case Study 8 showed that employees are a key source of innovation ideas, particularly when:

- they have a direct and secure employment relationship with the organisation
- the organisational climate is one in which failure is tolerated as an acceptable means of advancing creativity and innovation
- there are organisational incentive programs to encourage employees to share ideas.

Finally, businesses might also focus on relationships beyond their own industry, state and country, if they want to maximise innovation opportunities, as was demonstrated in most of case studies (1, 2, 3, 4, 5, 6, 7, 9, 12).

Think construction innovation: build relationships with agents of innovation, such as manufacturers and universities

Step 3 Know where to find ideas for innovation

BRITE also collected data on the industry groups that provide new ideas for innovation. This data reinforces the importance of relationships with the types of industry participants emphasised in Step 2.

Industry groups providing ideas for innovation

The case studies show that consultants, clients and manufacturers are prominent sources of innovation ideas for the industry, as shown in Chart 4.

Chart 4 Industry group providing ideas for innovation on the case study projects

Study 1	Study 2	Study 3	Study 4	Study 5	Study 6
Mechanical/ electrical consultant	Structural engineering consultant and plank manufacturer	Client	Fire engineering consultant and architect	Pre-existing research group comprising clients and manufacturers	GPR consultant who had pre-existing relationship with client
Study 7	Study 8	Study 9	Study 10	Study 11	Study 12
Manufacturer	Environment consultant and main contractor	Steel design consultant/ specialist sub-contractor	Manufacturer	Client, architectural and engineering consultants	Manufacturer

The role of consultants in providing ideas is highlighted in seven of the above studies (1, 2, 4, 6, 8, 9, 11), manufacturers were a key source in five (2, 5, 7, 10, 12) and clients in four (3, 5, 6, 11). These case study findings highlight the same three groups as the survey findings about innovation 'encouragers'.

Other sources of ideas for innovation

In addition to the central role played by particular industry groups in providing ideas for innovation, businesses should bear in mind the importance of idea generation through in-house staff, industry associations, conferences and previous projects. These sources were highlighted in the BRITE survey, with nearly 70% of industry participants nominating in-house staff as a prominent source.

Further, the most decisive factor in determining the extent of innovation in an organisation identified by the survey was whether they focused on recruiting new graduates. The value of such employees is likely to be in their propensity to bring new ideas to the business through their recent exposure to university knowledge and best practice ideas.

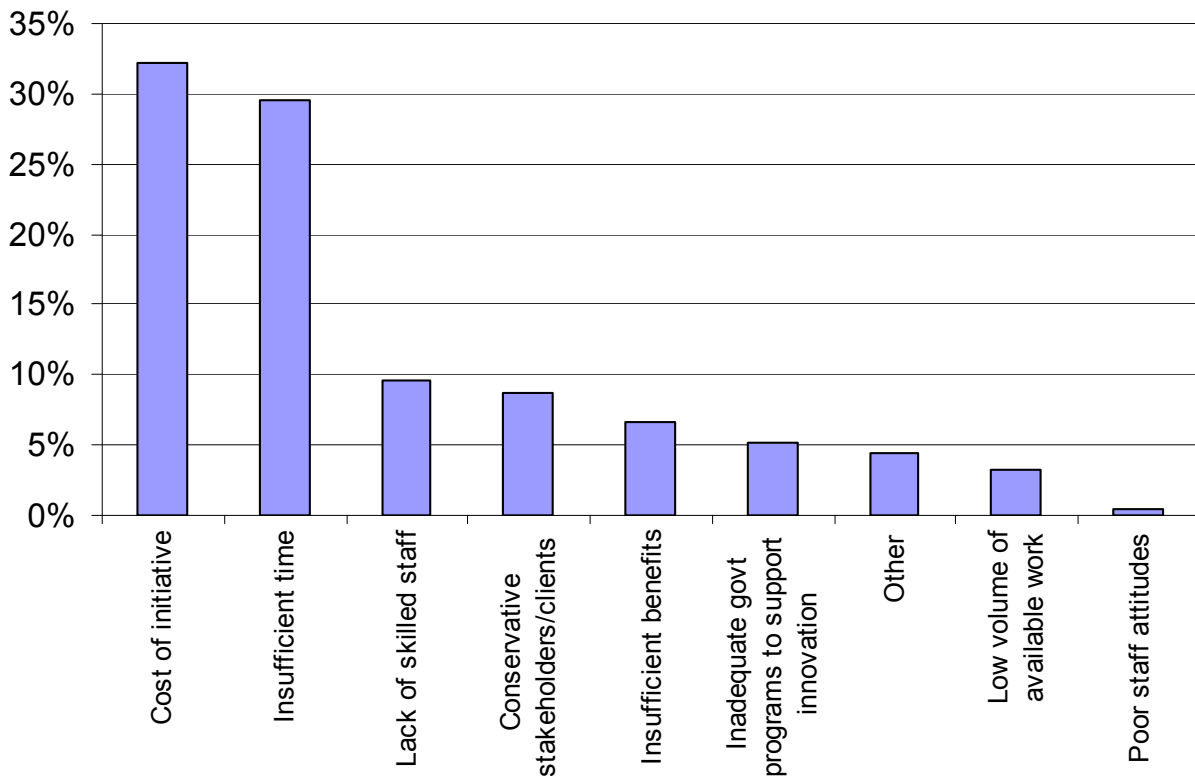
Think construction innovation: key sources of innovation ideas are clients, consultants, manufacturers, employees and new graduates

Step 4 Anticipate obstacles and challenges

Obstacles to innovation

Obstacles are regarded here as largely insurmountable problems. Chart 5 shows the key obstacles to innovation in our industry.

Chart 5 Obstacles to innovation identified by survey respondents from the Australian construction industry, 2004



Fifty-eight percent of industry participants reported cost and insufficient time as the main obstacles to innovation, pointing to the need to prioritise current efforts aimed at improving industry profitability. In the short term, organisations are encouraged to look at joint approaches to innovation in order to spread the potential risks. This once again highlights the value of developing robust relationships with key organisations to advance innovation.

Manufacturers are least affected by the obstacles in Chart 5, in part due to their ability to spread cost, time and staff over a large number of production units, compared to the restrictions facing project-based organisations. Among project-based organisations, consultants were most likely to be obstructed by ‘cost’, main contractors by ‘conservative stakeholders/clients’, and trade contractors by ‘time’.

Interestingly, although the survey showed that cost and time pressures on individual project team members are an obstacle to innovation, the case studies showed that such pressures on the *client* act as a driver of innovation (2, 4, 6, 8, 9, 11). Therefore, businesses are encouraged to seek work with ‘demanding’ clients. Tight project constraints are a source of innovation, rather than merely an unwanted stress!

Challenges to innovation

Challenges are problems that are more likely to be overcome than obstacles. The 12 case studies provide a picture of the challenges encountered during project innovation, as shown below.

Chart 6 Main challenge encountered during innovation on case study projects

Study 1	Study 2	Study 3	Study 4	Study 5	Study 6
Controlling up-front costs,	Managing product testing within	Ensuring a supportive culture	Addressing lingering safety	Managing tensions between	Managing the risk of a highly novel

managing client risk aversion	the time available	across a large client organisation	concerns of the client	parties in the research group	approach
Study 7	Study 8	Study 9	Study 10	Study 11	Study 12
Adjusting technical specifications to match building requirements	Managing bureaucratic approval processes to ensure timeliness	Ensuring the precision of technical elements on-site	Managing relationships across many stakeholders	Adjustment of team to a more cooperative way of working	Optimising organisation of site-work to reap maximum efficiency

Only cases 7, 9 and 12 encountered ‘main challenges’ that were technical in nature. In all other cases the ‘main challenge’ was non-technical, involving cost, time, risk, conservatism, culture and relationships. The non-technical nature of typical innovation challenges highlights the importance for businesses of appropriate training for managers and employees, particularly in the areas of value-management, planning and social skills.

Think construction innovation: value-management, planning and social skills may provide the key to overcoming many project challenges

Step 5 Take action for innovation

Now that you better understand the forces that drive and hinder innovation in our industry, you are ready to take action for innovation. The following three checklists are designed to assist businesses wishing to develop or improve an Innovation Program. The checklists will help you:

- assess current innovation readiness
- assess the value of existing staff-related practices
- develop and use relationships to achieve innovation goals.

Each question in the checklists is based on an element of ‘best practice’ as revealed by BRITE research.

Checklist 1 Assessing current innovation readiness

	I haven't thought about it	I am thinking of doing something	Yes	Yes, and we are constantly improving	Yes, we represent best practice
1. Do you have robust relationships with key industry participants (e.g. clients, manufacturers, consultants and technical support providers)?					
2. Do you actively monitor international best practice in your field?					
3. Do you actively monitor advances in related industries that might be applicable to your business?					
4. Do you have a formal system for transferring project learnings into your continuous business processes?					

5. Do you view problems or failures as opportunities for learning and growth?					
6. When you make changes, do you measure how well the changes have worked?					
7. Do you seek to win projects with 'demanding' clients?					
8. Do you allow sufficient time for value management, planning and review activities?					
9. Do you invest in R&D?					
Sub-totals	Level 1	Level 2	Level 3	Level 4	Level 5
Final score					

Checklist rating system based on work by the Construction Excellence in the UK in 2001 (<http://www.constructingexcellence.org.uk/>).

Score '1' for each 'Level 1' response, through to '5' for each 'Level 5' response. Add the sub-totals for each level to calculate your final score.

Final score	Innovation readiness
36 or more	Your business has excellent innovation practices compared to best practice
18–35	Your business is demonstrating average performance against best practice
17 or less	Your business is currently underperforming compared to best practice

Any business achieving a score of 35 or less can use their results to guide improvement strategies, while higher scoring businesses can seek to capitalise on their experiences.

Checklist 2 Assessing the value of existing staff-related practices

	I haven't thought about it	I am thinking of doing something	Yes	Yes, and we are constantly improving	Yes, we represent best practice
1. Are staff rewarded for maintaining networking linkages with other industry participants with complementary skills?					
2. Are staff rewarded for sharing ideas with management?					
3. Are staff rewarded for using organisational knowledge bases?					
4. Do you have a plan to retain key staff?					
5. Do you employ university graduates?					
6. Are you providing staff training to develop new skills and competencies to support organisational innovation?					
7. Do you directly employ staff, on an ongoing					

basis, to capture the benefits of staff loyalty?						
Sub-totals		Level 1	Level 2	Level 3	Level 4	Level 5
Final score						

Checklist rating system based on work by the Construction Excellence in the UK in 2001 (<http://www.constructingexcellence.org.uk/>).

Score '1' for each 'Level 1' response, through to '5' for each 'Level 5' response. Add the sub-totals for each level to calculate your final score.

Final score	Value of existing staff-related strategies
28 or more	Your business has excellent innovation practices, compared to best practice
14–27	Your business is demonstrating average performance against best practice
13 or less	Your business currently underperforming compared to best practice

Any business achieving a score of 27 or less can use their results to guide improvement strategies, while higher scoring businesses can seek to capitalise on their experiences.

Having rated your current practices between levels 1 and 5, you can use the associated questions below to plan future action:

- Level 1: Is it in our interests to ignore these activities?
- Level 2: Am I putting in the effort or resources needed to support these activities?
- Level 3: Which of these activities should I make even better?
- Level 4: How can I identify the strengths on which to build and improve even more?
- Level 5: How can I capitalise on these successes?

Checklists 1 and 2 highlight the value of cooperative relationships in achieving innovative products, processes and methods. Although important, building and maintaining such relationships is a time- and resource-consuming exercise and should be done purposefully. Clearly not all connections between firms and sectors have equal value, and not all relations need strengthening.

The aim of Checklist 3 below is to identify the relationships you require with other organisations, including their nature and strength. The types of relationships you need will be guided by your innovation goals, which may be shaped in conjunction with Checklists 1 and 2 above. It is important to consider linkages with all types of organisations, including other businesses (e.g. clients, manufacturers and consultants), research centres, government organisations and industry associations. You will also need to consider linkages that are within your industry, as well as in related industries, in your state, as well as in Australia and/or overseas.

Checklist 3 Developing and using relationships to achieve innovation goals

Action	Response
Identify those organisations with which your business currently has a strong relationship.	List:

Will these relationships be sufficient to achieve your innovation goals?	Yes/No
If not, do you need a stronger or different type of relationship with any of the organisations listed to achieve your innovation goals?	Circle those organisations listed above with which work is needed.
Identify new organisations with which your business needs to have a cooperative relationship to achieve your innovation goals.	List:
For relationships that currently need work, or new relationships, identify possible strengthening or creation strategies.	<p>Possible strategies:</p> <ul style="list-style-type: none"> • create formal or informal links • include management and/or employee participation • examine possible channels: phone, email or personal meeting • consider frequency: daily, weekly, monthly, quarterly • explore examples of specialised arrangements: facilitated workshops, working groups, reference groups, memorandums of understanding, partnerships or alliances, joint testing, research or development, joint publication in newsletters, magazines or journals, joint presentations, and joint patenting.
It might even be necessary to weaken some relationships to secure your innovation goals.	<p>Possible strategies:</p> <ul style="list-style-type: none"> • decrease frequency of contact • decrease seniority of contact • shift from formal to informal arrangements • shift from personal to phone or email contact.

(Adapted from Keast and Brown, (2005) Understanding, Building and Leveraging Relationships for Maximum Outcomes: A Practice Workbook, School of Management, Faculty of Business, QUT.)

The results of these checklists can be used to develop an Innovation Program tailored to meet your specific needs. In addition to the ideas that have been provided here, you will need to consider the structure of your business and the industry you operate in. How will your competitive environment and the current status of economic cycles mould your response to the challenges presented here? Are you familiar with all the government programs that may support your efforts? Additional resources to help businesses structure an Innovation Program are available from the Australian Government (<http://www.ausindustry.gov.au>), (www.industry.gov.au); the BRITE Project (www.brite.crci.info); the Cooperative Research Centre for *Construction Innovation*, Australia (www.construction-innovation.info); and the Construction Excellence program in the UK (<http://www.constructingexcellence.org.uk/>).

Think construction innovation: review your current business practices in the light of information presented here to develop an active Innovation Program – *Innovate Now!*

Step 6 Share your Success

Successful applications of innovation should be widely broadcast throughout the industry. The sharing of successes helps speed the diffusion of new ideas and benefits the reputation of the innovating business. However, this needs to be done within the constraints imposed by market positioning, commercial-in-confidence and intellectual property protection.

Historically in our industry, there has been a tendency to hoard successful ideas and innovations. This reluctance to share was fueled by the desire to maintain competitive advantage. However, new research shows that sharing in the current economic circumstances benefits all involved in the learning process. This is the final step in capitalising on your experience. Confining innovation within a single project or business represents a missed opportunity for growth. Make sure you have systems in place to collect the things learnt on projects and integrate them into your ongoing business processes, and share your successes with others. Industry associations are well placed to assist in spreading information about innovations.

Think construction innovation: ensure you capture project-based learnings and share your successes with the broader construction community

Appendix A – Overview of the BRITE Project

Between 2003 and 2005, the BRITE Project of the CRC for *Construction Innovation* conducted a large-scale innovation survey of the Australian construction industry and undertook 12 in-depth innovation case studies.

BRITE Innovation Survey

The purpose of the survey conducted in 2004 was to examine innovation levels, types, strategies, drivers, obstacles and impacts. It covered the non-residential building and civil sectors, in New South Wales, Victoria and Queensland. The industry was defined broadly to include five groups — main contractors, trade contractors, consultants, suppliers, and clients from the public sector who regularly commission work.

Overall, 1317 questionnaires were distributed and 383 useable responses were returned, equating to a response rate of 29%, which can be considered a good response for a voluntary mail survey. The survey covered 'key' organisations, which were defined as government clients, members of eight selected industry associations, and consultants and contractors appearing on the pre-qualification lists of the clients. The industry associations chosen for surveying were identified through an industry workshop in Brisbane, Australia in 2004 as those that made the most significant contribution to construction projects.

The survey was distributed through the post to the contact person on the industry association membership lists and government agency pre-qualification lists. These people were mainly managers. For the government clients, forms were sent to managers in the civil and building agencies of the three states. Chart A1 summarises key survey data.

Chart A1 Key survey data

Industry sector	No. sent	Useable no. back	Response rate	Population size	Population definition	Percent sampled	Sampling method
All sectors	1317	383	29%	3476	See below	38%	See below
MAIN CONTRACTORS: non-residential building and civil	300	93	31%	1122	Pre-qualified firms	32%	Random
CONSULTANTS: non-residential building and civil	409	130	32%	1549	Pre-qualified firms/assoc. members	26%	Random
TRADE CONTRACTORS: electrical, communication, airconditioning, mechanical	236	74	31%	346	Major association members	68%	Census
SUPPLIERS: glass, plaster, asphalt, steel	328	63	19%	415	Association members/yellow pages	79%	Various
PUBLIC SECTOR CLIENTS: non-residential building and civil	44	23	52%	44	Agency managers	100%	Census

One of the most important findings of the survey is that non-technical innovation is a key source of growth. Most analysts recommend research and development (R&D) to drive technical 'engineered' innovations to improve business performance. However, the survey results support a new perspective which is emerging in the literature, that organisational innovation has an equal role to play in driving growth. Organisational innovation involves the way in which work is managed and puts considerable emphasis on the role of people, especially employees as innovation initiators, managers and diffusers. Organisational innovation accordingly requires effective social skills and an inclusive style of management.

BRITE Innovation Case Studies

Of the 12 innovation case studies, six were carried out in 2003 and another six in 2005. The purpose was to demonstrate the benefits of innovation and highlight the nature of successful implementation strategies. The cases were nominated to the program through referrals from clients and through a public call for nominations. Approximately 100 cases were considered, all involving innovation on a specific construction project. The selection of the final 12 was based on the:

- existence of significant measured benefits, or the clear potential to assess such benefits
- likely usefulness of the study in highlighting innovation challenges
- likely level of cooperation from project stakeholders in completing the study
- likely industry interest in the type of innovation nominated
- desirability of a case studies from different Australian states
- desirability of a reasonable balance between civil and building studies

Charts A2 and A3 show the key features of the case studies.

Chart A2 Key Data, BRITE Case Studies 1–6

	Case study 1	Case study 2	Case study 3	Case study 4	Case study 5	Case study 6
Project name	William McCormack Place	Lang Park Sports Stadium	Port of Brisbane Motorway	National Gallery of Victoria – Australian Art Building	Coutts Crossing Bridge	Cattle Creek Bridge
Location	Cairns, Qld	Brisbane, Qld	Brisbane, Qld	Melbourne, Vic.	Coutts Crossing, NSW	Near Mackay, North Qld
Project description	4568 m ³ public building	52,500 seat world-class stadium	5 km, 4-lane motorway, with 12 major new bridges	Iconic public building, 11,000 m ³	Repair of 12 metre length of 90 metre long timber bridge deck	Identification and repair of faults in 200 new concrete bridge beams
Budget estimate	\$17.5m	\$280m	\$112m	\$65	\$1m	\$1m
Innovation summary	Chilled water thermal storage tank and moisture absorbing thermal wheel	Precast prestressed polystyrene voided concrete planks with formed rebates	Project delivered under an alliance contract	Fire engineering enabled use of unprotected steel	Fibre-reinforced polymer (FRP) bridge deck	Ground penetrating radar to find defects in bridge beams
Main benefit achieved	37% saving in energy costs	8% saving in cost of grandstand steelwork	10% project cost saved, 30% time saved	5% of project cost saved	75% saved in transport costs, 90% saved in traffic management costs	50% of project cost saved

Chart A3 Key Data, BRITE Case Studies 7–12

	Case study 7	Case study 8	Case study 9	Case study 10	Case study 11	Case study 12
Project name	Gladesville Road Community Centre	Imago Site	Stadium Australia	Art Gallery of South Australia	Adelaide Oval	Tomago All-Weather Access Road
Location	Hunters Hill, NSW	East Perth, WA	Sydney, NSW	Adelaide, SA	Adelaide, SA	Tomaree Peninsula, NSW
Project description	Stormwater management at a small community building, 400 m ³	Remediating 5800 m ³ contaminated land	Two 3500 m ³ roofs over sports stadium ends	Up-grading the air-conditioning system at an art gallery	Redeveloping the eastern grounds of a sports stadium	16 km road through saturated ground
Budget estimate	\$13,000	\$1.8m	\$10m	\$100,000	\$22m	\$4m
Innovation description	Managing stormwater with storage gutters and infiltration	Saving site-remediation costs through a new waste disposal method, sprinkler and wheel wash system	Post-tensioned steel trusses to create long span roofs	Twin-coil air-conditioning to improve energy efficiency	Relationship based contract and 3D CAD to efficiently deliver complex project	Using recycled tyres to create a permeable road pavement while meeting strict environmental and community requirements
Main benefits achieved	26% reduction in mains water demand	13% project cost saved	50% reduction in steel weight; 25% reduction in roof erection time	30% reduction in energy consumption	50% reduction in prefabrication time, 90% reduction in requests for information	15% of project cost saved

Of the 12 case studies documented, four were located in Queensland, four in New South Wales, two in South Australia and one each in Victoria and Western Australia. Three sporting stadiums were covered, along with two bridges, two art galleries, two commercial buildings, two very different roads – a motorway and an access track, and one case of contaminated land. The projects ranged in value from \$13,000 to \$112m, while in all cases the benefits achieved were significant. The case studies resulted in three prominent contributions to knowledge, by:

- calculating the benefits attributable to construction innovation
- revealing the key role played by organisational innovation, which is about the way in which work is organised
- documenting in detail the types of relationships that underpin successful innovation.

Readers interested in more detailed information about BRITE are directed to the Project's website www.brite.crcci.info.