INDUSTRY
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BUILDING FOR GROWTH

An Analysis of the Australian Building and Construction Industries

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Contents

1.0 Introduction

This report has been prepared for the National Building and Construction Committee (NatBACC) by the Department of Industry, Science and Resources (ISR) to analyse the current state of the Australian building and construction industry and identify those areas in which the industry needs to strengthen its capabilities. This report forms part of an Action Agenda process to develop key sectors of the Australian industry over the long term.

The report acts as a warning against complacency and a "business as usual" mindset. It asserts that some current attitudes and policies within the industry will lead, over time, to the Australian industry losing ground to its international competitors. To overcome this, the Government seeks the cooperation and support of individual firms and industry associations to work together to lift industry performance.

The objective for the industry should be to build on its existing strengths to move forward and become an international leader in construction and a supplier of world-class building and construction services, products and materials. The Action Agenda process aims to do this by providing joint Government and industry leadership to increase productivity, flexibility, efficiency, research, innovation and exports.

This report outlines a role for Government: to lead the way in strategic research, refine policy, reform regulations and assist industry to better understand its performance and the implications of the changing nature of the industry. It also recommends actions that will galvanise the industry into adopting a reform agenda. Such actions should consider factors emerging internationally and aim at increasing productivity, competitiveness and long-term sustainability.

The pivotal role for industry is to restructure the way it operates and to commit itself to building a better industry. To do this, the various sectors, sub-sectors and firms must strive for new capabilities and competencies. The Government believes it can help by acting as a facilitator to encourage consensus on the strategic direction the industry must take to be competitive in the new millennium.

This is the basis of the Action Agenda process. Action Agendas are a key element in the Government's industry policy framework. They are designed to be a partnership between industry and government to develop a specific program of action aimed at creating sustainable long-term competitive advantages for Australian firms.

The Government established NatBACC in September 1997 to foster a partnership between Government and industry and to advise on the development of an Action Agenda for the industry. The Committee included representatives from all major industry, commercial and professional groups in the building and construction sector. NatBACC presented a series of recommendations to the Minister for Industry, Science and Resources in April 1999 for consideration and this report both underpins the basis for NatBACC's recommendations and the subsequent Building for Growth Action Agenda.

To assist NatBACC to study and determine the issues to be addressed by the Action Agenda, the Department of Industry, Science and Resources commissioned a series of research projects which investigated emerging influences on the industry. This report draws heavily from the work of these research projects and places them in an appropriate policy framework. It explores in greater depth the issues and themes NatBACC considered in framing its advice to the Government.

The report analyses the relationships between firms in the industry, the framework of regulations and the industry's technical support infrastructure. The report is based on cluster analysis. Cluster analysis leads to a number of important insights into the dynamics which shape the competitiveness of industries and firms. While the internal operations of the firm remain the dominant factor in determining competitiveness, cluster analysis also provides insights into the factors outside the firm which shape firm and industry performance. The way in which firms interact between themselves and with the institutional environment impacts on the development of knowledge and the flow of information. While price-based competition remains important, these other factors shape the capacity of the firm and sectors to innovate and so move beyond competitive strategies based on price alone.

Cluster analysis also demonstrates that others, including government departments and agencies and public instrumentalities, are involved in shaping industry performance. The report acknowledges that the firms most likely to drive change are the leading ones, particularly those operating in international markets. Exposure to working and operating in the international sphere gives these firms a better understanding of the drivers of change and the associated strategies they need to employ to be successful in the global arena.

This report is in two parts. Part A, "The Industry Today", describes the current state of the industry. Part B, "The Industry Tomorrow", is a challenge to the industry to change its culture – and to survive and prosper.

Part A begins with a short statement on the importance of the industry to the entire Australian economy. It then utilises cluster analysis to obtain a deeper understanding of the industry and its dynamics. It looks at the entire cluster that makes up the building and construction industry, defining it beyond the traditional view that confines the industry to contractors and sub-contractors. The cluster analysis asserts the scope of the industry is much broader and gives a clearer insight into the industry's workings, performance and potential.

The analysis divides firms in the industry into three key sectors. The first is the "*supply network*" which includes the traditional construction trades, the manufacturers of building materials and the suppliers of machinery, equipment and tools. This sector has the most firms, employs the most people and makes the largest contribution to Gross Domestic Product (GDP). Firms in the construction trades are mainly small, with few employees. On the other hand, building materials manufacturers are often large enterprises employing very significant numbers of people, and many operate internationally. Perhaps surprisingly, construction trades typically are more profitable measured as a proportion of firm turnover. The business cycle is and remains a major determinant of profitability in this sector.

The second sector is made up of "*project-based firms*". These are the designers, engineers, project managers, builders and contractors. There are fewer project-based firms than supply network firms, but the number is still substantial. So, too, are the number they employ and their contribution to GDP. Project-based firms operate in three market segments – residential building, non-residential building and engineering construction. Some firms operate in more than one market segment.

The third sector is the "*property sector*". It includes firms, individuals and organisations which develop, commission, own, manage and lease buildings and other infrastructure. This report concentrates on the investment side of the property sector as it is the most relevant to the study and the sheer size of the sector makes complete analysis impractical. Even with this restriction, reliable data is lacking. It is clear that the property sector is driving many of the most important changes in the building and construction industry. This is because property forms the core of the portfolios of major investors such as superannuation funds, insurance companies and collective investment vehicles such as property trusts. The priorities for this sector are based on maximising the return on capital which represents a major change from the pattern where most construction was commissioned and occupied by the owners.

Following on from the cluster analysis, the underlying performance and competitiveness of the Australian industry is compared with that in a number of other countries. This section of the report finds that, on a strict cost comparison, the Australian industry currently performs well against other advanced economies. When other factors and measures of performance are considered, however, Australia's industry performance is not as strong and its position slips behind that of the advanced economies studied. Significantly, there appears to be no single area of the industry's performance that can account for such a turnaround, rather it will require incremental improvement across a range of factors to improve Australia's underlying performance.

A discussion of the policy context follows, summarising the policy response and prescriptions of Australian governments over the past two decades and providing a contemporary snapshot of current activities. The policy context examines the role of industry associations and argues that governments and the peak associations need to develop strong relationships in order to address long-term industry development.

Part B takes this analysis and projects it as a challenge to the industry. It sets out what must done in order to survive and compete successfully in a global economy, where only a few large global firms may come to dominate the major projects end of the industry. Firms operating successfully in such an environment are moving to a more integrated mass production model of building, often with good strategic links with suppliers of capital. Building and construction is likely to follow the example of the automotive and pharmaceutical industries and compete for large scale projects on the basis of economies of scale and multiple distribution channels. To compete or position themselves within such supply chains, firms in Australia will have to move quickly from a craft base to a structure more akin to that of an advanced manufacturing industry. The industry will need to integrate its supply chains, benchmark its performance and adopt new methods to deliver projects.

The industry needs to improve its performance in the use of information technology, innovation and research and development. Additionally, environmental issues will increasingly have a bearing on the design, engineering and construction practices of the industry. The role of regulation, not only in relation to environmental issues, but more generally, is also examined in this part of the report. Finally, an examination of the opportunities and challenges for the industry in 'going global' is covered in the section that deals with market access.

The Action Agenda process for the building and construction industry does not, however, end with the release of the Building for Growth Action Agenda. The process requires both government and industry to commit themselves to a partnership to continue to jointly examine and overcome any impediments to the long-term development of the industry's competitiveness.

Part A

THE INDUSTRY TODAY

2.0 The Industry's Importance: Vital to Australia's Economy

The building and construction industry is a vital part of the Australian economy. As well as its own output it has a significant impact on the efficiency and productivity of other industries. It promotes investment through its own activities and generates further investment in the broader economy.

The output of the industry has an impact on all of us. It provides both the physical infrastructure that underpins the economy and the built environment that more directly influences the quality of our lives. Some 95 per cent of people work in the built environment and 90 per cent of Australia's Gross Domestic Product (GDP)[1] is generated there.

The building and construction industry is a key element of national competitiveness. If the industry uses its resources better and raises its efficiency by reducing construction costs and time, Australian industry as a whole will be more competitive.

Based on a cluster analysis of the building and construction industry, the industry in 1996-97 contributed 14.4 per cent of Australia's GDP and employed a total of 729,400 people[2].

This is significantly greater than the contribution normally attributed to the industry based on traditional, narrower definitions. On these definitions, the contribution of the industry to GDP and employment in 1996-97 are estimated to be at about 6 per cent and 586,000 people respectively[3]. These latter and widely used figures nonetheless still indicate the importance of the industry to the Australian economy, but largely understate the magnitude of that contribution.

This is because of the common narrow definition of the industry. Traditionally, this has been seen in four broad segments:

- residential buildings (houses, flats etc);
- non-residential building (offices, shops, hotels etc);
- engineering construction (roads, bridges, water, sewerage etc); and
- construction trades (site preparation services, building structure services, plumbing, electrical etc).

However, the industry is integrated with many other segments. These include:

- client services, such as commercial property operators, developers and financiers;
- suppliers and producers of building products and materials; and
- machinery and equipment sectors providing such items as construction equipment and commercial heating and cooling equipment.

These segments contribute to building and construction activity and should be included in the analysis. Table 2.1 represents the industry expanded to its full scope. The sectors of "*supply network*", "*project-based firms*" and "*property*" are explained and developed in the following Section which shows why the traditional definition of the industry should be broadened to provide a more complete appraisal.

Looking at the industry in this light underlines its

[1] Newton PW (1999) Built Environment Sector Outlook (CSIRO - Division of Building, Construction and Engineering) Melbourne

[2] Data concerning the residential building, non-residential building, engineering construction and construction trades is based on information contained within the Australian Bureau of Statistics (ABS) Catalogue No. 8772.0 - "1996-97 Private Sector Construction Industry". (1998) Additional information concerning the remainder of the building and construction cluster is derived from IBIS Business Information Service (excludes machinery, equipment and tools).

[3] ABS Catalogue No. 8772.0 - "1996-97 Private Sector Construction Industry" (1998).

Table 2.1 The Building and Construction Industry, 1996–97

	Number of firms ('000)	Number employed ('000)	Contribution to GDP (%)
Supply Network	165.3	452.9	6.8
Project-based firms	46.6	182.4	3.6
Property	16.5	94.1	4.0
TOTAL	**228.4**	**729.4**	**14.4**

importance as a focus of economic activity and as a generator of wealth. It is, unquestionably, one of the most significant industry contributors to the Australian economy, both in terms of GDP and employment.

The Australian building and construction industry is extremely diverse. The size of firms varies markedly. So do the types of activity they undertake, the skills they employ, the intensity of their capital and their attitude to export. The industry has many firms that have a high knowledge base and many deal with vast quantities of information, particularly technical data. Yet, paradoxically, the industry has yet to fully maximise the use of information technology to manage such information flows to remove information bottlenecks, drive productivity and reap consequent commercial gains.

The building and construction industry is facing other pressures. Globalisation, advances in technology, environmental factors and changes in the structure of the Australian economy are presenting new challenges. Increasingly, the activities of various sectors of the industry will link more effectively as both private and public clients seek single source solutions to meet their requirements. Next to agriculture, however, the industry is the most fragmented in Australia.

To increase its contribution to Australia's well-being and to capture new opportunities, the industry must respond positively to these challenges. There are potential structural impediments that the industry must overcome including a focus on short-term business cycles and a project-to-project culture. It will have to re-engineer the supply chains and business systems within the industry to be more strategic, long-term and enduring. This may include developing a better understanding of input variables such as increasingly complex financial arrangements and the linkages with materials and product manufacturers and providers of construction services.

3.0 The structure of the industry: the need for cultural change

The traditional definition of the building and construction industry is narrow and based on its most obvious parts – mainly the building and contracting firms immediately involved in constructing buildings and infrastructure. Much of the available data is based on this framework.

3.1 A critique of the traditional framework

The traditional framework for analysing this industry has concentrated on dividing it into segments of residential building, non-residential building and engineering construction. This segmentation has had the effect of emphasising:

- the head contractor as the core of the industry (with the dynamics around the head contractor seen as driving the industry);
- the role of the non-unionised subcontracting system which is prevalent within the residential sub-sector; and
- productivity and workplace relations issues on major commercial and engineering projects, mainly in metropolitan areas.

This approach has a number of weaknesses. These include:

- The scope of the industry being limited to the firms directly involved in the construction process and the interaction between them. This does not recognise the significance of the professional and consulting services sector and the building materials sector.
- Not enough attention being given to the institutional arrangements that shape the industry. This particularly applies to the complex regulatory framework and to the institutions which educate and train the participants and undertake research and development.
- Seeing the industry as static and not taking its changing structure into account. For instance, fewer users of commercial buildings now procure their buildings directly. It is much more likely they were procured by investment capital. The industry is now driven by flows of investment capital from organisations such as property trusts. These non-user investors have different objectives and requirements than the traditional owner-occupier.
- Many promoters of major projects looking to head contractors to take an equity stake in the project as a risk management tool. The equity may not be high as a proportion of overall cost, but it can be quite large as a capital requirement within the contractor sector.

3.2 The building and construction industry cluster

The advantage of cluster analysis is that it not only acknowledges the importance of what goes on within a firm, it also analyses the complete context in which a firm operates. Cluster analysis typically includes a geographical dimension, but clusters more broadly represent a new way of thinking about an industry. This challenges much of the conventional wisdom about how to structure a firm and how institutions can contribute to competitive success.

In particular, clusters represent all the industries and entities that impact on firm competitiveness. It means that in addition to the head contractor, vital contributors such as the suppliers of specialised components, materials and services take their place. This broadens the context to give a much better insight into the performance of the industry.

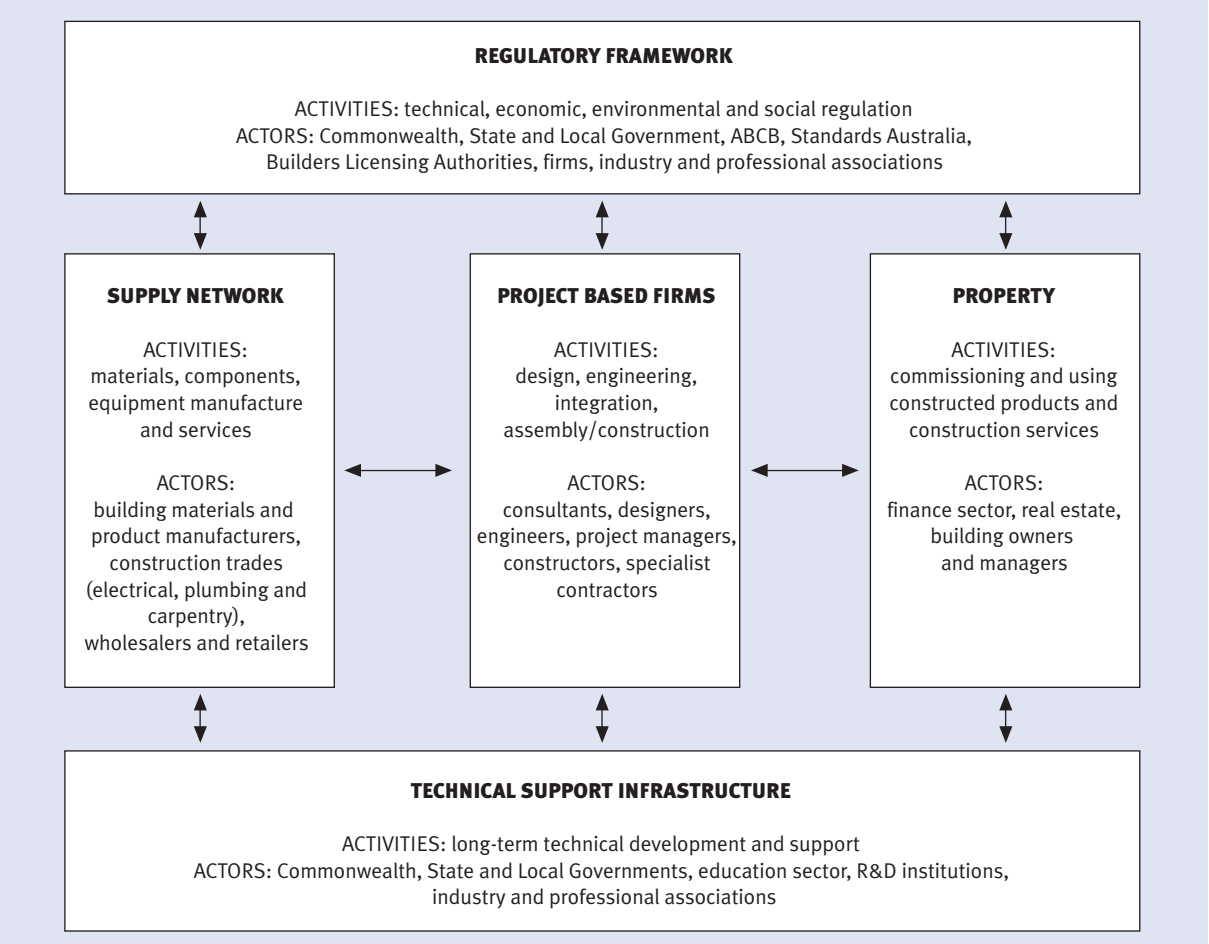
The building and construction industry cluster also includes government and other institutions – the tertiary institutions, the agencies that set standards, the providers of vocational training, the regulators and the industry associations. These all help shape the industry by providing specialised research, information, technical support and training.

The cluster framework[4] for the industry is illustrated schematically in Figure 3.1. It sets out the major participants, the activities and flows of information and knowledge. It also includes the regulatory, institutional and governance structures in which they interact. This cluster map has six analytical dimensions. They are:

- the regulatory environment
- supply networks
- project-based firms
- property sector
- technology support infrastructure, and
- information and knowledge flow.

Using this model as a base it is possible to map the industry to reflect the major participants and activities involved in its main sub-sectors. Cluster analysis, however, rarely conforms to standard industrial classification systems and these systems, in turn, also fail to capture many important factors and relationships that either induce or inhibit competitiveness. This has made the economic performance of the industry difficult to quantify.

Figure 3.1 The Building and Construction Industry cluster map



[4] The cluster framework utilised in this report is based on a framework developed by the Australian Expert Group in Industry Studies (AEGIS) - a research centre of the University of Western Sydney. AEGIS are undertaking a number of studies on the building and construction industry on behalf of the Department of Industry, Science and Resources. The framework is drawn from a forthcoming report "Mapping the Building and Construction Product System" (1999).

For instance, on the cluster map, only partial contemporary data is available for the supply network and elements of the project-based firms category – and this is due to the traditional segmentation of the industry. Despite this serious limitation, later in this section there is an attempt to quantify the scope of the industry. It is based on available Australian Bureau of Statistics (ABS) data and augmented by data from the IBIS Business Information Service (IBIS).

First, however, the six analytical dimensions on the cluster map are explained.

3.3 The regulatory environment

The map of the industry cluster gives some prominence to the regulatory environment in which the industry operates. The influence of government is strong, ranging from setting the general macro-economic conditions through to quite specific requirements such as building regulations (the latter are discussed in Part B of this report).

The building and construction industry is highly sensitive to general economic conditions and factors. Here the Commonwealth plays a role through using macro-economic levers to establish the underlying economic conditions that influence industry generally. Most recently this has seen a series of favourable economic fundamentals such as strong domestic growth, low inflation and low interest rates. The prevailing interest rates and taxation arrangements for major projects and the property investment sector, in particular, are linked closely with activity in the industry. This means the effect on the industry of the Government's reform process, including the proposed new taxation system, the treatment of collective investment vehicles and the future of the accelerated depreciation provisions, all impact on industry performance. The Commonwealth is also an active player in setting policies such as workplace relations, environmental and other standards, education and training, trade-related matters and financial and corporations law.

State and Territory governments have responsibility for building regulation and the planning approvals system, although elements of the system are delegated to local government. This level of government is also responsible for the registration of builders and some trades, and accrediting and registering professionals. Many industry bodies, particularly within the professions, also have a high level of influence in training and recognition of qualifications.

Industry argues that the regulatory environment is complex and confusing, and often fails to provide a reasonable level of certainty. Regulatory reform should continue with the objective of limiting the cost, time and resource burdens placed on firms in the industry.

The following diagram, Figure 3.2, summarises the main elements of the regulatory environment.

Figure 3.2 The Regulatory Framework

REGULATORY FRAMEWORK

ACTIVITIES:	Building control and planning, standard setting and accreditation, technical, economic, environmental and social regulation.
KEY ACTORS:	Australian Building Codes Board Standards Australia Joint Accreditation System of Australia and New Zealand National Association of Testing Authorities Australia Australian Building Systems Appraisals Council Industry Associations: Australasian Fire Authorities Council Housing Industry Association Master Builders Association Australian Institute of Building Cement and Concrete Association of Australia National Association of Forest Industries Clay and Brick Paver Institute Concrete Masonry Association of Australia Australian Institute of Steel Construction Australian Procurement and Construction Council Local Councils Builders Licensing Authorities Various Commonwealth, State and Territory portfolios covering: education and training; workplace relations; corporate and consumer affairs; trade competition policy; industry development; public works. Other professional and trade accreditation bodies

3.4 The Core Structure – supply network, project-based firms and the property sector

The cluster map divides the industry's firms and businesses into three distinct, but closely related sectors – the supply network, project-based firms and property. The previously shown Table 2.1 summarises the contribution to the economy of each sector with the total representing the whole industry's contribution. As explained earlier, the data quantifying the industry's contribution is incomplete particularly for statistics in the property and construction machinery sectors. However, the information based on 1996-97 data does illustrate the importance of the industry to the economy.

The industry in Australia is extremely diverse in size of firms, numbers employed, activities undertaken, range of skills employed, capital intensity, industry concentration and attitude to export. These differences show up when each sub-sector is analysed.

3.4.1 The supply network

The supply network has three sub-sectors that have strong inputs into construction. They are construction trades, building materials and products and machinery and tools. Each is different in make-up, but are closely linked as the product and materials produced by one sub-sector are subsequently used and installed by the other. This analysis is confined to the first two sub-sectors as comparable data for machinery and tools was unavailable.

3.4.1.1 Construction trades

Construction trades[5] are part of the traditional segmentation of the industry. They include services such as bricklaying, roofing, erecting structural steel, plumbing and electrical services, plastering, air conditioning and heating services, carpentry, tiling and carpeting, painting and decorating, glazing, landscaping and similar trade work.

Employment

Construction trades dominate the employment profile of the building and construction industry cluster. In 1996-97, they employed 356,000 people, or 48 per cent[6] of the cluster's total. The skill levels vary significantly depending on the nature of construction services and their input into the building process.

Number and size of firms

There are some 158,000 firms in the construction trades sub-sector. The overwhelming majority are micro-businesses, employing an average of 2.3 people. Altogether 94 per cent of the businesses in the sub-sector employ fewer than five people. Only 800 firms – or less than 1 per cent - employ more than 20 people. Most construction trades firms operate in the residential building sector, resulting in a geographically dispersed sub-sector.

Industry concentration

The level of industry concentration is extremely low.

Profitability

The latest data from the ABS shows that 15.5 per cent is the average profit margin for all firms in the sub-sector. Businesses with fewer than five employees had a higher profit margin – an average of 23.1 per cent. Generally, profit margins become lower as the size of the businesses increases with businesses with between five and 19 employees averaging a profit margin of 6.4 per cent and those with 20 or more averaging 4.9 per cent.

[5] Data obtained from ABS Catalogue No. 8772.0 - "1996-97 Private Sector Construction Industry" (1998)

[6] Calculation based on data contained in ABS Catalogue No. 8772.0 - "1996-97 Private Sector Construction Industry" (1998) and IBIS Business Information Service (excludes machinery, equipment and tools).

3.4.1.2 Building materials and products

The building materials and products[7] sub-sector of the supply network consists mainly of large-scale manufacturers. They include manufacturers of cement and concrete, paint, timber products, ceramics and tiles, windows, bricks, steel, plasterboard, pipes, prefabricated buildings and other products. These account for approximately 25 per cent of all inputs to the building and construction industry[8] as measured under the traditional industry model using input/output analysis. It is clear it is an important component of the overall industry.

Employment

Building materials and products contribute significantly less than construction trades to the employment profile of the industry cluster. In 1996-97 the sub-sector employed 96,000 people, or 13 per cent[9] of the cluster total.

Number and size of firms

The sub-sector has only 7310 firms. Most are large even by Australian all-industry standards. Many, such as Boral, CSR and Pioneer, are among Australia's largest companies in both employment and turnover. The major market share in each manufacturing area is split between a handful of companies, most operating nationally. In some areas, such as cement, foreign ownership is strong.

Industry concentration

Industry concentration is extremely high. It has become more concentrated in the past five years with building materials being among the top five industries for mergers and acquisitions.[10]

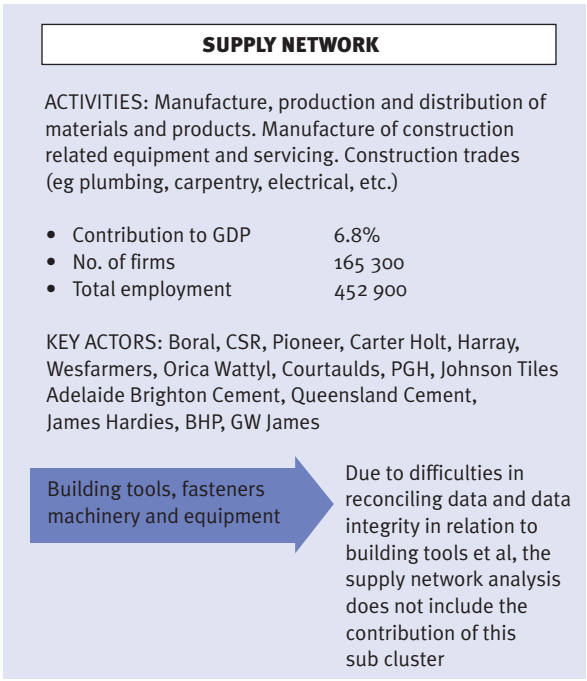
Profitability

Profitability of the sub-sector depends greatly on the general health of the building and construction industry in the domestic market. It is reasonable to summarise that profitability is patchy with some areas declining over the past two years. Over-capacity further erodes profitability in some areas.

With building and construction activity starting to ease, profitability will be expected to weaken correspondingly. As many companies operate overseas, profitability will be affected depending on the markets they are in and the state of construction cycles in these countries.

The following diagram, Figure 3.3, summarises the main elements of the supply network.

Figure 3.3 The supply network sector



3.4.2 Project-based firms

Project-based firms[11] more closely resemble those which dominate in the traditional view of the industry. They are the contracting firms involved in the residential building, non-residential building and engineering construction sub-sectors. It also includes a range of professional services including architectural and consultant engineering services. Again the size and range of the firms in these sub-sectors differ widely.

[7] Data derived from IBIS Business Information Service and ABS Catalogue 8221.0 and Department of Foreign Affairs and Trade (DFAT) STARS Database.

[8] Data is based on ABS Catalogue No. 5209.0 - "1994-95 Input-Output Tables" and DFAT STARS Database.

[9] Calculation based on data contained in ABS Catalogue No. 8772.0 - "1996-97 Private Sector Construction Industry" (1998) and IBIS Business Information Service (excludes machinery, equipment and tools).

[10] Ernst and Young (1998) - "Mergers and Acquisition Index"

[11] Data obtained from ABS Catalogue No. 8772.0 - "1996-97 Private Sector Construction Industry" (1998)

3.4.2.1 Residential building

The residential building market segment is made up of many firms and is highly cyclical in nature. The segment is characterised by sub-contracting of non-unionised labour. It covers construction of new houses, alterations, additions, improvements, renovations and general house repairs and organising or managing these activities as the head contractor. It also covers firms engaged in constructing flats, apartments and condominiums, although multi-unit construction often involves different construction methods and many contractors specialise in either detached or multi-unit.

Employment

The residential building sub-sector accounts for 9.6 per cent[12] of the total employed in the cluster, employing 70,300 people.

Number and size of firms

The market segment has approximately 31,000 firms. The overwhelming majority are micro-businesses employing an average of 2.3 people. This is a similar profile to the construction trades market segment in the supply network sector. Altogether 93 per cent of businesses employ fewer than five people and only 100 firms employ more than 20 people. The firms are geographically dispersed and only a few firms operate in more than one State.

Industry concentration

The level of industry concentration is low to moderate. Figures released recently reveal that small firms in the market segment are continuing to be squeezed out by larger corporate builders which are becoming more significant. In 1997-98, the top 10 house and apartment builders in Australia accounted for 15 per cent[13] of all construction in what has traditionally been a fragmented market segment.

Profitability

The average profit for all residential building firms is 8.1 per cent. Businesses operating in the multi-unit area had a higher average profit of 16 per cent while firms mainly constructing houses averaged 6.4 per cent. It appears that the growing strategy of large corporate builders to insulate themselves from market fluctuations and changes in demand is to diversify into the "in-fill" multi-unit market in existing areas rather than take on traditional new subdivision work.

3.4.2.2 Non-residential building

The non-residential building[14] market segment covers construction of shops, offices, hotels, factories, hospitals, schools and other buildings. The key markets are business, retail, industrial and tourism. The segment is characterised by unionised labour, particularly on CBD and major project sites. Economic conditions affecting these sectors determine the level of construction activity in this segment.

Employment

The non-residential building market segment accounts for 2.9 per cent[15] of total employment in the cluster, employing 21,300 people.

Number and size of firms

There are approximately 2100 firms in this market segment. Overwhelmingly, most are significantly larger than those in both the residential building and construction trades market segments with each firm employing an average of 10 people.

Industry concentration

The level of industry concentration is greater than the residential building market segment, but is still low to moderate. In 1997-98, the top five companies accounted for approximately 15.9 per cent of all construction[16].

[12] Calculation based on data contained in ABS Catalogue No. 8772.0 - "1996-97 Private Sector Construction Industry" (1998) and IBIS Business Information Service (excludes machinery, equipment and tools).

[13] Housing Industry Association (1998) - "Housing 100 1997/98"

[14] Data obtained from ABS Catalogue No. 8772.0 - "1996-97 Private Sector Construction Industry" (1998)

[15] Calculation based on data contained in ABS Catalogue No. 8772.0 - "1996-97 Private Sector Construction Industry" (1998) and IBIS Business Information Service (excludes machinery, equipment and tools).

[16] IBIS Business Information Service

Profitability
The average profit margin for all firms in the market segment is very low at 0.7 per cent. Barriers to entering non-residential building are low and this maintains strong competition based on price. Residential builders who diversify by moving into the commercial building market provide fierce competition.

3.4.2.3 Engineering construction

The engineering construction[17] market segment is mainly engaged in engineering or infrastructure projects such as railways, dams, roads and bridges, major pipelines and electricity and other utilities' infrastructure. While barriers to entry to the industry are not onerous, competition is restricted to established firms which demonstrate a proven track record of consistency and quality and can complete large-scale projects on time and within budget. The successful operators tend to be large firms which have sufficient economy of scale to bid for major projects. The public sector, which mainly purchases the infrastructure, plays a vital role in determining the level of demand in this market segment. This applies particularly to transport-related infrastructure such as road, rail and bridges.

Employment
The engineering construction market segment accounts for 4.8 per cent[18] of the total for the cluster, employing 35,600 people.

Number and size of firms
Approximately 3100 firms are in this market segment, which is similar to the size of the non-residential building market segment. The size of firms is similar, too, with an average employment of 11.3 people.

Industry concentration
There is growing evidence of both increasing concentration and foreign investment in the larger end of the market. The level of industry concentration is high, with the four largest firms accounting for 25 per cent of the output. The 100 largest firms provide 70 per cent of the output.

Profitability
The latest ABS data, 1996-97 Private Sector Construction Industry Catalogue, shows that the average profit margin for all firms in the market segment is 4.3 per cent. Increasingly, in order to remain relevant, firms in this market segment must have the ability and capacity to develop viable privatised infrastructure agreements. Some of the large contractors are also involved in international markets and the state of these markets and the extent of opportunities in the future, will also have a bearing on profitability.

3.4.2.4 Architectural services

The main markets for building design services[19] are commercial buildings such as shopping complexes, office buildings and hospitals, residential and industrial developments. The demand for services follows the overall trend for residential and non-residential building construction in new work, alterations and additions. Significantly, about 73 per cent of architects state that they work on projects ranging in value between $100,000 and $249,000[20].

Employment
The architectural services sub-sector accounts for 2.9 per cent[21] of total employment in the cluster, employing 21,200 people.

Number and size of firms
The sub-sector has approximately 4600 firms. According to the Royal Australian Institute of Architects' latest profile of the profession, the typical architectural practice employs five people,

[17] Data obtained from ABS Catalogue No. 8772.0 - "1996-97 Private Sector Construction Industry" (1998)

[18] Calculation based on data contained in ABS Catalogue No. 8772.0 - "1996-97 Private Sector Construction Industry" (1998) and IBIS Business Information Service (excludes machinery, equipment and tools).

[19] Data from IBIS Business Information Service

[20] Royal Australian Institute of Architects (RAIA) (1998) - "1998 Profile of the Architectural Profession"

[21] Calculation based on data contained in ABS Catalogue No. 8772.0 - "1996-97 Private Sector Construction Industry" (1998) and IBIS Business Information Service (excludes machinery, equipment and tools).

including partners, with almost exactly half employing five or fewer people. Only 9.3 per cent are employed by firms of 50 or more people. A recent *World Architecture* survey[22] shows that six Australian firms are now among the 50 largest in the world, with the largest Australian firm employing 320. Most practices are in the capital cities.

Industry concentration

The level of industry concentration is low with the top five firms accounting for 7.3 per cent of activity.

Profitability

Profitability for architectural services has been buoyant for several years. This reflects the general health of the building and construction industry. However, this profitability is expected to decline. Some of this decline will be felt by some of the major practices which have some exposure and business in Asia where a significant number of projects have been cancelled or postponed by domestic and international investors.

3.4.2.5 Consulting engineering services

The firms engaged in the consulting engineering service[23] sub-sector predominantly provide engineering services, but also quantity surveying, inspections and construction project management. Their key markets are residential building construction (23 per cent), non-residential building construction (35 per cent) and engineering construction (42 per cent).

Employment

The consulting engineering service sub-sector accounts for 3.5 per cent[24] of total employment in the cluster, employing 25,600 people.

Number and size of firms

Approximately 4600 firms are in this sub-sector, many of them multi-disciplinary in nature. The sector has some quite large firms, with the top five together employing some 7000 people, or 27 per cent of the total.

Industry concentration

The level of industry concentration is moderate to high with the top five firms accounting for 31 per cent of activity.

Profitability

For most firms, profitability grew in the 1993-96 period reflecting the steady growth in non-residential building and engineering projects. Since then, profitability has grown in line with turnover. For individual firms, the key contributors to profitability are good management skills, diversifying operations or establishing niche markets and developing exports.

The following diagram, Figure 3.4, summarises the major elements of the project-based firms sector.

Figure 3.4 The Project-based firms sector

PROJECT-BASED FIRMS

ACTIVITIES: Involved in the design and engineering of buildings and major projects; the integration and project management of assembling and construction.

- Contribution to GDP 3.6%
- No. of firms 46 600
- Total employment 182 400

KEY ACTORS:

Residential building
A V Jennings, Devine, Heley Properties, Mirvac Group
Meriton Apartments, Clarendon Housing Group
Alcock/Brown Neaves Group, Multiplex Constructions
J-Corp, BGC (Australia)

Non-residential and engineering construction
Leighton Holdings, Clough Limited Evans Deakin,
Transfield, Concrete Construction ABB Engineering,
John Holland Group, Barclay Mowlen,
Baulderstone Hornibrook, Multiplex Constructions,
Lend Lease/Civil & Civic

Engineers
CMPS, Gutteridge Haskins & Davy, Connell Wagner,
Sinclair Knight Merz, Ove Arup

Architects
Woodhead, PeddleThorp, DC International, DEOY Ltd,
Woods Bagot

[22] Summarised in "Australian Architects Best in the World", Australian Financial Review 18 January 1999, p32.

[23] Data from IBIS Business Information Service

[24] Calculation based on data contained in ABS Catalogue No. 8772.0 - "1996-97 Private Sector Construction Industry" (1998) and IBIS Business Information Service (excludes machinery, equipment and tools).

3.4.3 Property Sector

The property sector is another key part of the core structure of the building and construction industry. Earlier in this report, the increasing interaction between the property and finance sector, particularly in large-scale projects has been discussed. Adding to that analysis, many and varied mechanisms now exist to finance commercial property investment with equity financing available through share and venture capital, unit trusts, property trusts and other institutional funds. Traditional construction firms are also being drawn into a number of hybrid debt/equity arrangements.

Government, particularly State and Territory Governments, also fall into this sector both as property managers and commissioners of construction work such as major infrastructure projects. Governments around the world, however, are moving away from providing infrastructure directly and this will increase the opportunities for the private sector to build, own and operate these assets. In this environment, it may be required for construction firms to contribute equity in these projects. Project-based firms who do this will find it essential to develop strong ties with investors.

Commercial offices, industrial, tourism and retail are the key segments for commercial property operators and developers. The proliferation of property trusts as a form of collective investment vehicle is spurring new investment and activity in various sectors of the building and construction industry.

This sector is highly sensitive to general economic conditions such as the level of interest rates and inflation, growth in the value of assets held by superannuation funds which invest in property and the availability of finance for existing properties and new projects.

While this brief summary focuses on the commercial property sub-sector, the sector also includes those involved in leasing or renting residential properties and the real estate sector. However, the sector generally lacks reliable data which means Figure 3.5 should be considered as an estimate only.

Figure 3.5 The Property Sector

PROPERTY SECTOR

ACTIVITIES: Investing in and commissing new buildings and projects, building and facilities management, property and real estate development.

- Contribution to GDP 4.0%
- No. of firms 16 500
- Total employment 94 100

KEY ACTORS:
Property Trusts, Superannuation Funds, Finance and Banking institutions, Real Estate Agencies: eg Westfield, AMP, Jones Lang Wooton, Colliers Jandine, Knight Frank, CB Richard Ellis, Stockland Trust, P&O Services, Langton Nominees, Lend Lease.

3.5 Technical support infrastructure

The technical support infrastructure and its flows of information and knowledge to other sectors within the cluster are critical to the well-being and competitiveness of the industry. A system that functions well enables specialised information to flow across and upwards within the model. This improves the competitive baseline of all firms operating in the cluster.

Investments by public institutions such as publicly funded research and development and education and training can enhance the industry's productivity and competitiveness. This occurs if the information is widely diffused and tailored to meet the needs of industry. Governments play a strong part in the regulatory environment and the technical support infrastructure. In turn, this emphasises the importance of all levels of government being coordinated effectively to promote the most supportive framework for the firms operating in the cluster.

However, more than government activity is required to enhance productivity. Investments by private companies, either individually or collectively through trade and industry associations, in training programs and research centres also contribute to improving industry standards. The key industry associations within the cluster carry out a limited role and are established along the narrow lines of segmentation that characterised the traditional view

of the industry. There are peak associations to cover each of the separate construction trades areas, the different professional groups and the various players in the residential, non-residential and engineering construction sub-sectors.

The challenge for industry associations will be to adopt a more strategic role. At present there are few who do, although the Australian Construction Industry Forum (ACIF) is taking a broader view of both the industry and the policy framework that surrounds it – a view not too dissimilar to the cluster model used in this analysis. ACIF should be encouraged to take more of a leadership role within the industry.

Industry associations have an important role in education and training and research and development.

3.5.1 Education and Training

The education and training area of the building and construction industry cluster has a multitude of connections between users, research and training institutions and regulators. Some of these connections are highly intense and others are relatively weak. Apart from the multitude of players, perhaps the main feature is the increasing overlap of functions across accreditation, training and industry representation. The major players are the Australian National Training Authority (ANTA), Construction Training Australia (CTA), the State Industry Training Advisory Boards, various State and Territory Government boards and agencies and professional registration authorities. Then there are semi-private regulators led by the professional bodies. Employers' associations and industry development bodies play a less crucial role – seeking to influence rather than control. The vast number of organisations involved in collaboration, instruction and accreditation processes is further complicated by the multiple roles assumed by some organisations. For example, some are both training providers and users. The result is a complicated pattern of information flows that is difficult for both insiders and outsiders to unravel.

The plethora of players at the trade end of the spectrum is especially striking. So, too, is the complexity of relationships between sets of players and similar players in the different States and Territories. The complexity at the trade end contrasts sharply with the clear organisation of the professional end of the training spectrum. Here there are few players and most of them have been established for a long time both in training and accrediting trainers and training graduates.

There is a highly volatile situation at the technical and knowledge-intensive trades level, with some groups pushing strongly for professional status.

In total, the training arena is filled with a multitude of players. These include major private trainers and the long established TAFE/VET providers, which are officially still in the public sector, but are becoming increasingly "private" in many of their approaches and functions. They are being joined by new players moving into the arena as a result of the deregulation of vocational training over the past few years. Their entry is blurring many traditional distinctions.

There is frequent comment in the media and elsewhere about how little investment the industry makes in education and training. This comment should be directed at individual firms in the industry. The private sector in the traditional building and construction industry spends well below the all-industry average on training. In 1996, the building and construction industry spent just over $100 per employee on training compared with the all-industry average of $185[25]. Training expenditure across Australia has declined in recent years. The private sector expenditure in the industry fell by 11 per cent over the period 1993-97[26]. Expenditure per employee and the amount of training provided per employee vary substantially with the size of firms, with smaller firms providing less training per employee than larger firms.

This decline in expenditure and general lack of attention to training arise, in part, from the tradition of subcontracting functions within the cluster. The major project-based firms, for

[25] Construction Training Australia (1998) - "Building and Construction Workforce 1998-2005: Strategic Initiatives Draft Discussion Paper".

[26] ibid.

example, are coordinators of activity rather than long-term employers. Technological changes in the industry over a long period have also contributed to this situation. Now, however, as will be discussed in detail in Section 6, the industry is facing a significant change in both the physical technologies it uses and the ways it organises its activities.

Some of the drivers of this shift flow from changes in the regulations governing much of the activity in the industry. Others are due to the reduction of public sector dominance in major projects. This forces new responsibilities on to project firms . In any case, the shift has major implications for training and regenerating the knowledge base of the cluster. It is not clear how well the training arena, as organised at present, can cope with these changes.

Industry leaders and governments have to come to grips with this shift and its ramifications. At present, there appears to be little appreciation of the implications for training. Major firms should be encouraged to do more as they will lead the sector through the early stages of the shift. Policymakers could usefully give thought on how to bring attention to training needs at the firm level.

From this new perspective, the training system for the building and construction industry cluster needs urgent attention.

3.5.2 Research and development

The industry does not have a particularly good track record for formal expenditure on research and development (R&D). This is particularly evident in the private sector. The latest *R&D Scoreboard* '98 indicates that only one building and construction firm is among the top 20 private sector research performers, although another diversified company in the top 20 has some operations in the industry. Of the 325 companies listed by the *R&D Scoreboard*, only 21 (or 6.4 per cent of the total) are in the building and construction industry cluster.

It is important to note, however, that these results probably understate the broader commitment to R&D and innovation in the industry. This applies particularly to the anecdotal evidence that improvements to processes and products, as inputs to the construction process from the manufacturing and services industries, are a major source of productivity growth.

Interim results from a study[27] commissioned by the Department of Industry, Science and Resources suggest that this bleak picture, may need some amendment. The study focused on the funding by the private sector on research conducted in the public sector, including both the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and universities.

The study indicates a quite complex picture. The amount of money spent overall in the form of grants by the private sector to public sector performers of research is not large. This is based both on the standards of what is needed at a time of paradigm shift in the industry and the proportion of turnover the firms have spent in this way. However, it does go some way towards generating new and viable knowledge. By the standards of the public sector, the number of grants of $200,000 or more from the private sector is quite substantial and represents a significant commitment by the companies concerned. This is also bolstered by in-kind support.

Perhaps most importantly, the companies investing in R&D are not only buying particular pieces of new knowledge, but are building relationships with knowledge generators who can be an ongoing source of advice and expertise. This greatly multiplies the value of particular investments and strengthens the knowledge flows between key players. These links are demonstrated by some firms becoming repeat buyers of research.

The relatively few firms investing in R&D when compared with the large number of potential investors suggests that much needs to be done to bring more players into the knowledge generation arena. It also points to the need to develop systems to transmit the results of research so more players can benefit. The private funding of research can have major spillover effects on others without

[27] AEGIS; from a forthcoming report "Building and Construction Product System: Public Sector R&D and the Education and Training Infrastructure".

compromising the value of the investment to those who commission the original projects. Mechanisms to capture the benefits of these spillovers could be a useful subject for policymakers.

A policy is also needed to find mechanisms to increase the amount of 'public good' research funded and carried out by the building and construction industry. Public investment in R&D is critical. The present level is probably too low for the size and importance of the building and construction industry. The bulk of this investment goes to CSIRO and should result in CSIRO Sector for the Built Environment being a major driver of innovation and R&D within the sector. This, however, does not appear to be the case. It is important for CSIRO to develop mechanisms that create a better alignment between the needs of industry and its capacity to absorb knowledge and CSIRO's work focus and outputs.

3.5.2.1 R&D in the public sector

The bulk of research is carried out by the public sector as shown in Table 3.1 that follows.

A recent survey of public sector research institutions[28] active in the area of construction shows there has been some degree of stability. The results draw on data provided by various sources such as universities, departments of public works and CSIRO. The sample represents approximately 85 per cent of the total number of public sector research organisations with a significant presence in this area. Overall, not many projects are involved. Eighty three percent of respondent organisations had begun fewer than 15 construction-related projects between 1996 and 1998.

Also significant are the linkages between the industry and the public sector research organisations involved in the survey. Seventy five percent of respondent organisations had commenced at least one project between 1996 and 1998 that was funded either in part or in full by industry. It is not clear, however, whether potential users are adopting the results of the research and it is not clear whether this funding has actually increased or decreased over the period.

The sources of generating ideas for R&D organisations provides a good indicator of how close they are to the industry and also how proactive industry is in putting forward its research ideas.

Of the projects cited in the survey, just over half arose from ideas generated within the R&D organisation; 18 per cent arose from outside the organisation and 29 per cent were a joint effort by players internal and external to the R&D organisation. So, almost half the ideas were developed jointly or came from industry. Projects based on ideas formed externally, and especially those formed jointly with external partners, indicate that the research organisations do interact with industry and other external players. This demonstrates the potential to gain networking benefits.

Funding is one of the major concerns for the performance of R&D, not only the volume, but also the source, the relationship with funding providers and the difficulties that arise in getting it.

Table 3.1 The Public sector research activities

R&D Expenditure on Construction ($ millions)							
	Business	**Commonwealth**	**State**	**Higher Education**	**Private Non-profit**	**Total Construction**	**Construction R&D as a % of total R&D**
1992-93	25.7	28.5	10.2	38.5	0.325	103.3	1.63
1994-95	34	24.3	6.8	27.7	1.3	94	1.28
1996-97	45.1	28.9	6.96	32.25	0.701	113.9	1.32

[28] AEGIS; from a forthcoming report "Building and Construction Product System: Public Sector R&D and the Education and Training Infrastructure".

In this key area of the level of project funding, the study found that expenditure on individual R&D projects diverged widely, ranging from less than $20,000 to more than $200,000. Overall, 75 per cent of nominated projects were funded partially or fully by external sources. The actual rate of external funding varied with the size of the project, with bigger projects being more likely to involve external funds.

Sources of external funding are varied and include private companies, the Australian Research Council (ARC), government departments and industry associations. The level of funding provided by government departments and the ARC appears to be substantially higher than that provided by companies and industry associations.

The relationships formed between research organisations and funding providers appears to be of great importance in establishing the necessary funds to perform R&D. In more than half the cases where a research agency sought a new source of funds, the funding provider was found from contacts and relationships already established. The importance of relationships also extends to those agencies with pre-existing arrangements, and the survey results illustrate this. It found that 86 per cent of agencies which responded to the survey rated pre-existing relationships were important in attaining funding for new projects. This clearly shows the importance of the relationship between research agencies, industry and government for R&D agencies.

Getting the results of R&D out to the wider industry is crucial. For the nominated projects in the survey, publication in journals was the most common method to spread the R&D results. Sixty six percent of nominated projects resulted in at least one journal publication. The journals in which these articles were published were fairly evenly spread among Australian and overseas-based journals. Some 64 per cent resulted in at least one workshop or conference paper being produced, again evenly distributed between Australian and overseas conferences. Other methods were used to a lesser extent. These included holding workshops and conferences and the applying for patents and copyright.

The following diagram, Figure 3.6 , summarises the major elements in the technical support infrastructure sector.

Figure 3.6 Technical support infrastructure

TECHNICAL SUPPORT INFRASTRUCTURE

ACTIVITIES: Long-term technical development and support

KEY ACTORS:

Various Commonwealth/State/Territory portfolios

Research and Scientific	CSIRO, Universities, Scientific Services Laboratory, Australian Research Council
Education and Training	Australian National Training Authority, Construction Training Authority State Industry Training Advisory Bodies, Private training providers
Industry and Professional Associations	Air Conditional and Mechanical Contractors Association of Australia Association of Consulting Engineers of Australia Australian Construction Industry Forum Australian Constructors Association Australian Council of Building Design Professions Australian Industry Group Housing Industry Association Master Builders Australia National Electrical Contractors Association Property Council of Australia Royal Australian Institute of Architects + many other sectoral and sub-sectoral and specialist associations (120 plus)

3.6 Information Technology (IT)

Research[29] conducted on behalf of the Department of Industry, Science and Resources suggests that IT penetration of the Australian building and construction industry is low. Most of the industry has taken the easy gains from automation, but this has not given any sustained advantage for the firms who made these gains. With most competitors doing the same, they have merely survived. The few firms that have continued to bring innovation to their organisations and technologies have gained a more enduring advantage. Even these, however, have rarely innovated outside the boundaries of their own organisation.

While some industry leaders have moved beyond automation, the building and construction industry, compared with other industries such as retail and financial services, has been late in adopting IT. A number of factors may explain this.

- First, individual firms have benefited substantially from automation and many may have believed this was enough.
- Second, automation on its own is attractive to this highly cost-conscious industry because it mainly involves reducing costs.
- Third, some may have been cautious about the risk in technology and changing the organisation.
- Fourth, industry profit margins are generally so tight that many firms feel they cannot afford to invest in substantial change.
- Fifth, many firms believe that IT is a one-off investment rather than a continuing development of a crucial business competence and, having reaped the benefits of automation, do not expect IT to give them a new generation of change.

It is clear the industry must overcome the perception that the benefits gained through automation are sufficient. It must not see IT as a one-off investment that does not require a change in culture. Benefits from automation may be substantial, but on their own, they do not produce a sustainable competitive advantage.

3.7 Exports

The competitive position of the Australian building and construction industry depends on relevant sections of the industry aggressively embracing an export culture over the next decade. Strong opportunities exist for increased exports, especially in the areas of professional construction services, such as architectural and consulting engineering services, particularly in Asia. Prefabricated housing in Japan is another strong export prospect. Many Australian firms already have a presence in the Asia-Pacific region through export activity or by setting up offices, strategic alliances, plants and joint ventures. In the mid-1990s, the Asia-Pacific region accounted for about 85 per cent of Australia's building and construction exports[30].

Australian firms have had some significant success in exporting their products and services. Most exports have been building materials from the supply network and mainly architectural and consulting engineering services from the project-based firms sector. In 1996-97 these exports were worth $346 million and $400 million respectively. The same sectors imported goods and services worth $816 million and $331 million respectively, leaving a large trade deficit of $470 million in building materials but a moderate trade surplus of $69 million in architectural and consulting engineering services[31]. Imports of timber, ceramics, tiles and pipes accounted for most of the trade deficit in the supply network. The trade balance for timber should improve as increased supplies of Australian timber come on stream.

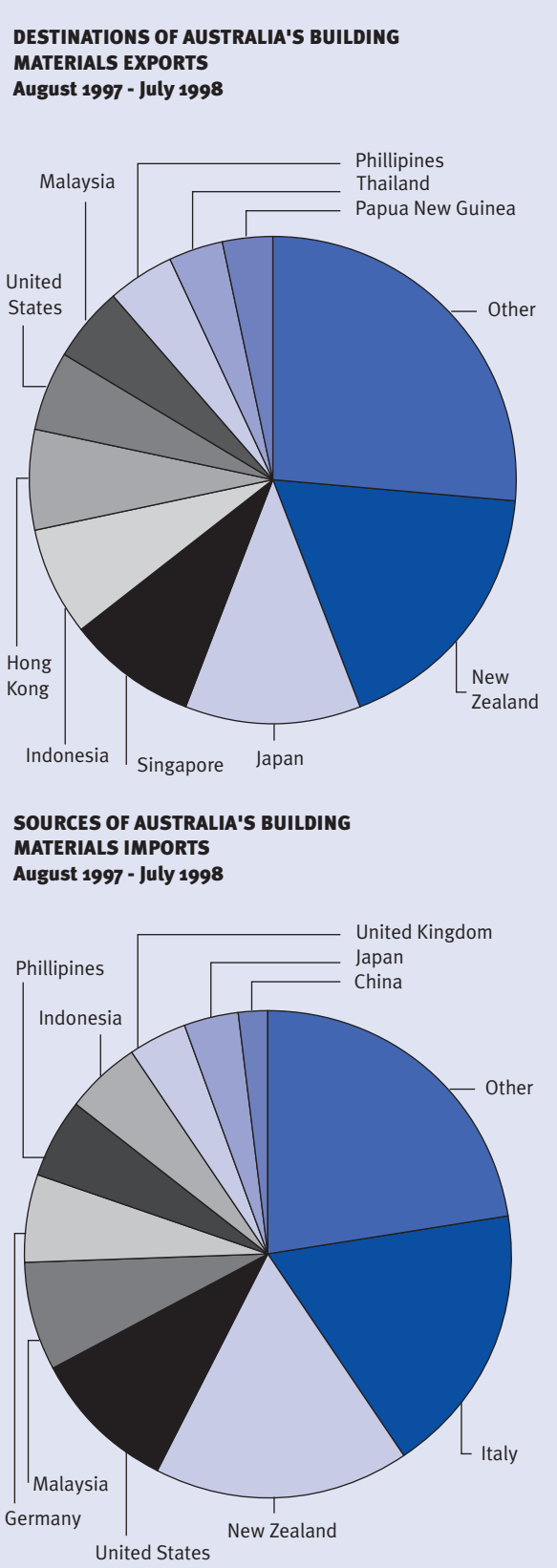
Figure 3.7 gives a geographical representation of Australia's trade in building materials.

[29] Australian Graduate School of Management and the Building Research Centre, Faculty of the Built Environment, University of New South Wales (1998) - "Information Technology in the Building and Construction Industry: Current Status and Future Directions".

[30] DFAT STARS Database

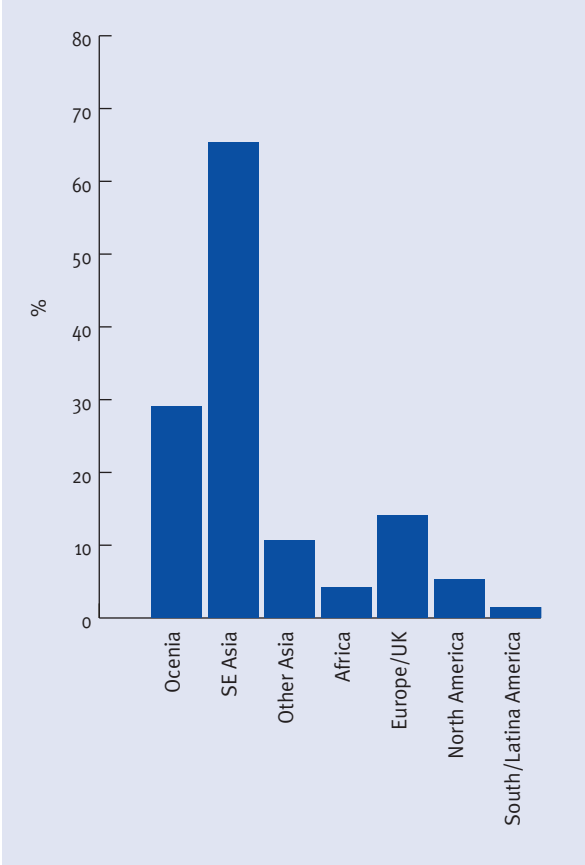
[31] DFAT STARS Database

Figure 3.7 Australian trade in building materials



Although there is no consolidated data for the destination of construction services, a recent survey[32] by the Royal Australian Institute of Architects provides some insights into the destination of architectural services exports, as defined in Figure 3.8.

Figure 3.8 Australian architectural services exports



South-East Asia receives by far the biggest exports of Australian architectural services, with 65 per cent. Oceania, other Asia, and Europe/UK are other common export destinations.

The Asia-Pacific region is the favoured destination for export activity in both the materials and services sectors. Despite the Asian financial crisis, the region has a continuing demand for infrastructure development.

Most firms in the cluster are unlikely to enter export markets because of their small size and the unspecialised nature of their products and services. The large to medium sized firms are better placed to exploit opportunities, although size does not

[32] Royal Australian Institute of Architects (RAIA) (1998) - "1998 Profile of the Architectural Profession"

necessarily constrain niche professional services providers such as architectural services. It is also clear that export strategies still appear to be firm-based, with the industry not promoting its capabilities well.

While elements of the output of the industry are not traded internationally, some large firms have substantial international interests. For instance, many of the multi-domestic firms, such as the large-scale materials manufacturers, invest significantly in developing overseas plants and derive revenue from them. Also, some construction firms and firms in the property sector are either active in overseas markets or invest there. However, the flow back to Australia from these investments is difficult to quantify.

A series of non-tariff barriers that impede export opportunities needs to be addressed. They include regulatory frameworks, product certification and approval and recognition of professional qualifications. Individual firms cannot do this by themselves and will require support from the regulatory environment and other elements of the cluster.

3.8 Cyclical outlook

As discussed earlier, the performance of the cluster is strongly tied to the state of the general economy and is subject to cyclical fluctuations. Recently, the industry has been strongest in residential building where a degree of resilience has deferred the extent and timing of an anticipated downturn.

Dwelling investment – spending on new housing and housing renovations – fell by 2.2 per cent in the September 1998 quarter after rises in the previous seven quarters. In its latest *Economic Roundup*[33], Treasury states that while the outlook is for a slightly weaker dwelling sector over the coming quarters, some factors should mitigate the extent of any decline in housing activity. They include housing being highly affordable with interest rates remaining low, where previous downturns have been associated with rising interest rates. In addition, people are building bigger and more expensive dwellings and spending heavily on renovations. This explains why, although starts are some 18 per cent below their previous peak, dwelling investment is at record levels. The current level of 150,000 housing starts a year is likely to fall, but not significantly over the next 15 months because of high affordability and consumer confidence. From all available forecasts, there will be a more protracted downturn in the second half of 2000.

Non-residential construction activity in 1997-98 rose by 6 per cent in real terms to $30.4 billion. This places the level of activity above the previous high recorded during the office building boom of 1989-90[34].

Engineering construction activity rose by 11 per cent to $17.1 billion in 1997-98. Activity was driven by a 26 per cent rise to $7.2 billion in private activity, mainly from mining and resource developments and private infrastructure projects. Non-residential building activity rose by 1 per cent to $13.3 billion in 1997-98. Private activity decreased slightly to $9.7 billion. Public sector work rose by 7 per cent to $3.6 billion due mainly to entertainment and recreation construction associated with the Olympic Games, and to construction of buildings in the health sector. In its July 1998 report, the Construction Forecasting Committee forecast further growth in non-residential construction activity over the next two years, but at a diminishing rate as current work is completed.

The value of construction activity in recent years and the forecast for the next are illustrated in Table 3.2.

Despite this relatively up-beat analysis, a number of signs warn that levels of domestic activity within the cluster can be expected to fall.

First, while the industry makes a sizeable contribution to GDP, it displays the hallmarks and characteristics of a mature and low-growth industry. Based on traditional industry profiles, the percentage of growth in the industry over the period 1975-1997 (in constant 1989-90 dollars)

[33] Commonwealth Treasury (1999) - "Economic Roundup (Summer)"

[34] Construction Forecasting Committee (CFC) (1998) - "Non-residential Construction Forecasts: Short-term Prospects July 1998".

Table 3.2 Value of construction activity

VALUE OF CONSTRUCTION ACTIVITY						
Type of Activity	**1994-95**	**1995-96**	**1996-97**	**1997-98**	**1998-99**	**1999-00**
(1996-97 prices)			**$bn**			
Building (a)	10.11	11.49	12.8	13.0	13.7	14.0
Engineering Construction (b)	13.44	14.72	15.2	16.5	17.3	17.7
Total	23.55	26.2	27.9	29.5	31.0	31.7
(Change, real terms)			**%**			
Building (a)	12	14	11	2	5	2
Engineering Construction (b)	3	10	3	9	5	3
Total	6	11	7	6	5	2

was 59.8 per cent, the third lowest of all industry sectors[35]. This is illustrated in Figure 3.9. In addition, the long-run contribution of the industry, as traditionally defined, to GDP has been in steady decline since the mid-1980s when it was at 7 per cent.

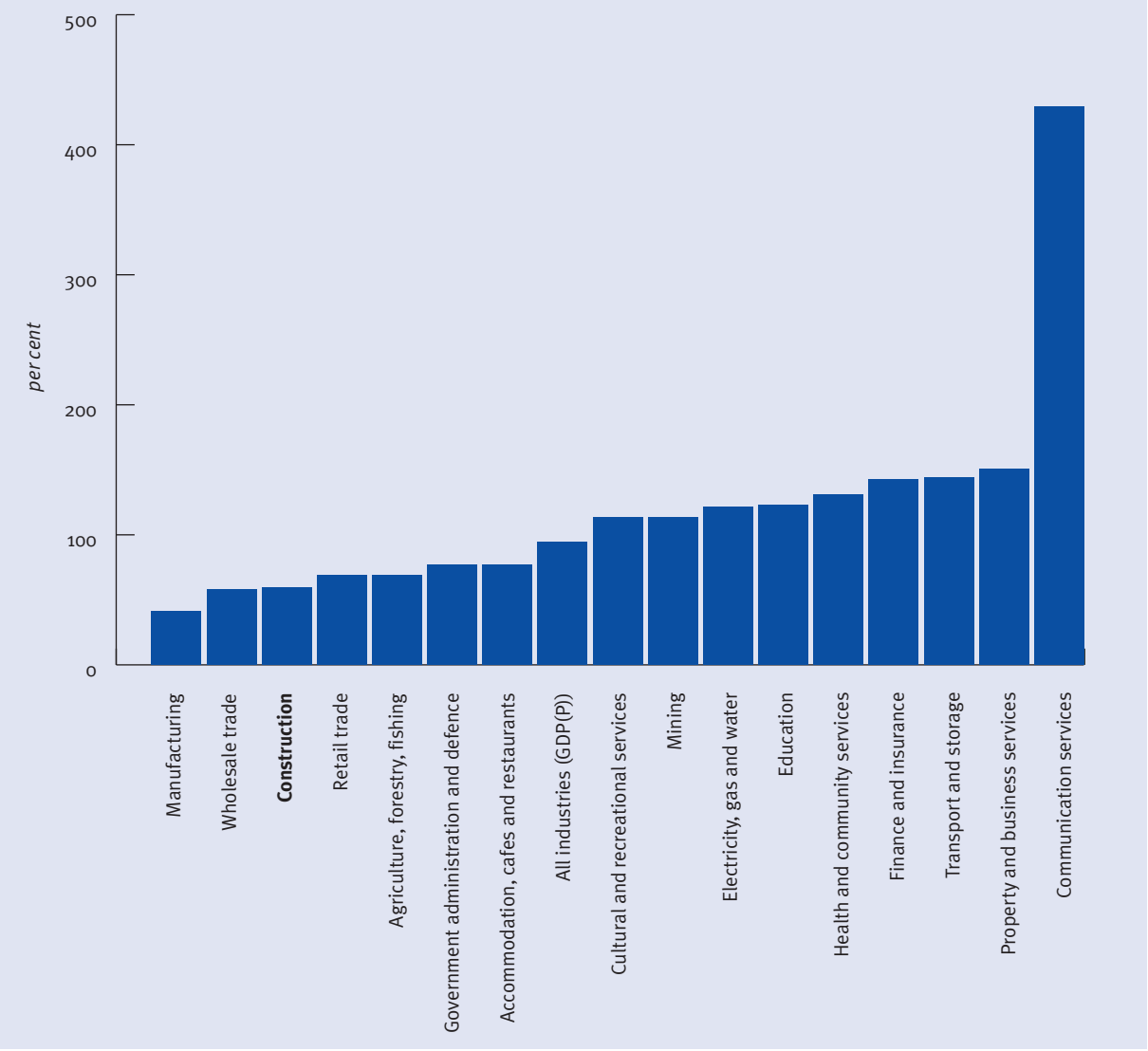
Second, the cyclical nature of the industry means that activity is nearing its peak and will be followed by a downturn. The level of activity in the industry reflects short-term business cycles, particularly the level of investment, capital expenditure and interest rates. Demand is also determined by demographic trends, the available stock of housing and commercial office space, and public sector investment in infrastructure.

The momentum for additional construction activity from the 2000 Olympics has waned and it is expected that construction will slow distinctly in the years 2000 and 2001. The Australian Procurement and Construction Council (APCC) has forecast that total construction will peak at $50.9 billion this financial year and decline to $43.9 billion in 2001-02 before peaking again at $53.9 billion in 2005-06[36].

[35] ABS Catalogue No. 5204.0 - "National Accounts"

[36] Australian Procurement and Construction Council (APCC) (1998) - "Construct Australia - Forecast of Construction Industry Activity: Australia and all States and Territories".

Figure 3.9 Industry growth by sectors, 1975–1997



3.9 Summary

The cluster framework that has been used to analyse the industry has broadened its definition and scope to better represent the various players within the building and construction industry. It is a complex system, with varying levels of interaction between the elements of the schematic model that has been presented. A well-functioning cluster would have strong flows of information and knowledge between the various participants, encouraging and stimulating them to pursue common objectives to increase the overall performance of the cluster. However, the flows of information and knowledge are not yet at an advanced level.

The industry faces ongoing challenges to improve competitiveness, given that it is mature in nature and activity is cyclical. As most firms are micro-businesses and focused on the domestic market, initiating substantial improvement will be extremely difficult. However, the cluster framework has identified many firms, associations and government agencies which have sufficient influence within the industry to act as agents of change. The interaction of these players with the remainder of the cluster appears to be the key to raising competitiveness within the industry. This is particularly true when considering the future trends that will impact on the industry.

4.0 The International Cost of Construction Study: Where Australia Stands

With the important exceptions of professional services and building products and materials, there is little international trade in the building and construction sector. This makes international comparisons difficult.

Nevertheless, many major players within the industry, including those that operate internationally, believe the Australian industry compares favourably. However, few comparative studies have been undertaken on the performance and cost of construction in Australia relative to the rest of the world. The two most useful studies are reports by the Industry Commission in 1991[37] and McKinsey and Company Australia in 1995[38]. The results of these two studies, however, are inconclusive and are now quite dated.

To try and definitively gauge the extent of Australia's international competitiveness, new research was commissioned by the Department of Industry, Science, and Resources. The following information summarises the findings of this research. The key conclusions to be drawn from the study are that the Australian industry must be vigilant in seeking to continually improve its performance. While on current exchange rates, Australia is a reasonably cost-competitive location to build, there is reason to believe that the underlying performance of the industry as a whole is below that of OECD-type economies. There does not appear to be any single area that warrants special attention, but improvement must be pursued across a range of areas. In short, there is no "king hit" for success - all practices and processes should be reviewed and improved.

4.1 The New Study: The International Cost of Construction

The study identified seven countries for the basis of comparison and generated estimates for constructing seven identical projects in each country. The countries selected were:

- Australia
- Singapore
- Indonesia
- Germany
- United Kingdom (UK)
- Peoples Republic of China (China)
- United States (US) - West Coast.

The study was conducted in two stages. The first, undertaken by the Page Kirkland Partnership, outlined the criteria for the identical projects and established the project cost in each country. The second stage, completed by the Construction Economics Program at the University of Technology in Sydney, attempted to 'normalise' the data by incorporating Purchasing Power Parity (PPP) and a range of contextual factors into the results of Stage 1. This provides a better overview of the 'true' underlying performance of the industry in each country.

The seven construction projects selected for the study were:

- an integrated hotel and tourism resort;
- a commercial office building;
- a factory shell;
- a major multi-purpose sporting stadium;

[37] Industry Commission, (1991), Construction Costs of Major Projects, AGPS, Canberra

[38] McKinsey and Company Australia, (1995), Growth Platforms for a Competitive Australia

- a multi-lane highway/freeway;
- an underground commuter railway; and
- an ethylene production plant.

Greater details of the scope of each of these projects are outlined in Appendix A.

4.2 Stage 1

Stage 1 adopted the process and methodology of preparing a series of quantitative documents (cost plans) in either trade or elemental form and having these costed in each individual country in the study.

To obtain an accurate picture of relative costs, an elemental bill of quantities was obtained for each project in each country and converted to Australian dollars at exchange rates prevailing as at 29 January 1999. The results on average were:

RELATIVE COSTS COMPARISON

Country	Stage 1 Ranking (lowest costs)
Indonesia	1
China	2
Singapore	3
Australia	4
UK	5
US	6
Germany	7

Table 4.1 provides a summary of costs for all projects in each country.

This information is based on primary data from research in each country. This has been compared with secondary data collected by others to make it more accurate. The analysis, which compares Australia's cost performance in key labour and material aggregates (namely excavation, concrete, structural steel, timber, services, preliminaries and overall production) places Australia close to the mean for most factors, with an advantage in the services area (in this case, electrical work for the purposes of this study) and a disadvantage in preliminaries. The overall production factor was quite high for Australia, however this was influenced by the petrochemical project which had a higher proportion of imports than the other projects.

The Stage 1 analysis leads to the conclusion that generally Australia is close to the average for construction cost compared with the nominated countries, but is cheaper than the highly industrialised countries - primarily due to the prevailing currency exchange rates at the time.

The results of this stage of the study, while accurate at the time of exchange rate calculation, could alter significantly with any subsequent fluctuations in exchange rates - making a true comparison of costs difficult. This has been confirmed by many researchers who have commented on the

Table 4.1 Comparison summary (Australian dollars)

COMPARISON SUMMARY

Project Type	Australia	Singapore	PR China	Indonesia	UK	Germany	US	Average
Exchange Rate		1.055	5.231	6500	0.378	1.069	0.624	
Hotel	44 239 108	45 024 828*	32 698 977	25 881 069**	56 663 917	52 706 602	64 459 469	45 953 424
Office	156 118 593	138 928 815	107 032 587	86 299 538**	185 400 471	191 313 246	173 532 449	148 375 100
Factory	4 317 283	3 973 884	2 602 552	2 410 300**	5 410 463	5 340 850	5 485 995	4 220 190
Stadium	187 908 624	163 019 372	115 107 965	114 838 154**	220 512 820	223 443 529	226 908 855	178 819 903
Highway	42 500 694	35 877 607	27 195 349	19 238 289**	47 769 249	51 876 822	50 011 734	39 209 963
Railway	57 353 072	49 895 442	32 605 482	37 724 207**	74 624 175	77 758 661	69 219 647	56 597 241
Petrochemical	595 150 000	497 522 000	479 842 000	459 626 000	587 735 000	575 030 000	538 100 000	533 286 429
Total	1 087 587 374	934 241 948	797 084 912	743 017 558	1 178 116 095	1 177 469 710	1 127 718 149	1 006 462 250
% Difference		-14.10%	-26.71%	-31.68%	8.32%	8.26%	3.69%	-7.46%

Source:
Detailed Stage 1 cost estimate prepared by Page Kirkland Group

Notes:
* *recalculated from stage 1 based on 1.055 exchange rate*
** *recalculated from stage 1 based on 6500 exchange rate*

shortcomings of cost comparisons where domestic prices are converted into a base currency at current exchange rates. In an attempt to 'normalise' data and consider factors other than basic price, a second stage of analysis was required.

4.3 Stage 2

The "true" cost of construction comparison between countries is much more complex than comparing a simple dollar value. It involves such factors as differing site locations and conditions, the regulatory standards to be met, the quality of work, the levels of safety, the maturity of the industry and the position within the building cycle, among others. Stage 2 of the study analysed the effect of these factors to gain a more realistic assessment of Australia's position.

The first step of this analysis enabled the costs of construction to be expressed in terms of a modified price parity. This is a method used to make international comparisons of living costs and standards. It is a rate of currency conversion that eliminates differences in price levels between countries. PPP attempts to value domestic production (GDP) by using international prices. There are some difficulties in this method, so a variation using the "Big Mac" index was adopted. Finally, to gain the best possible comparison, Stage 2 was extended by a weighted evaluation matrix that incorporated all relevant factors.

4.3.1 PPP – The "Big Mac" Index

The "Big Mac" index is an alternative to the strict PPP analysis. It was devised as a guide to whether currencies are at a correct PPP level, and as a measure of value. The "Big Mac" index illustrates the under or over valuation of currencies by translating the normal price of a "Big Mac" hamburger into US dollars. Countries where the adjusted price is greater than the US have an overvalued currency, and vice versa. Although presented as a price parity, the "Big Mac" index can be used to denominate real product.

PPP can also be criticised on similar grounds to those applying to the international comparison of construction costs in used in Stage 1. To overcome this factor, an innovative methodology was used to augment the "Big Mac" index. Under this approach the local currency estimate for each project is divided by the local unit price of a "Big Mac" hamburger to calculate the number of units (hamburgers) to construct each project. The unit price includes all taxes that are levied, such as GST or sales tax, and is based on data collected by in-country research in March 1999. The "Big Mac" index was chosen as the best available measure of PPP applying to the seven selected countries.

Table 4.2 lists the results of the adjustment.

Table 4.2 Commodity adjustment (McDonalds "Big Mac" Index)

COMMODITY ADJUSTMENT (McDonald's "Big Mac" Index)

Project Type	Australia	Singapore	PR China	Indonesia	UK	Germany	US	Average
Hamburger Price*	A$2.75	S$3.20	8 RMB	Rp17 598.90	£1.90	4.95 DM	US$2.60	n/a
Hotel	16 086 948	14 844 123	21 381 044	9 558 947	11 273 137	11 382 496	15 470 273	14 285 281
Office	56 770 397	45 803 094	69 985 933	31 873 981	36 884 936	41 315 931	41 647 788	46 326 009
Factory	1 569 921	1 310 140	1 701 744	890 223	1 076 397	1 153 408	1 316 639	1 288 353
Stadium	68 330 409	53 745 449	75 266 221	42 414 469	43 870 445	48 254 774	54 458 125	55 191 413
Highway	15 454 798	11 828 399	17 782 359	7 105 494	9 503 566	11 203 298	12 002 816	12 125 818
Railway	20 855 663	16 449 904	21 319 910	12 825 083	14 846 283	16 792 729	16 612 715	17 100 327
Petrochemical	216 418 182	164 026 784	313 756 688	169 758 849	116 928 332	124 183 246	129 144 000	176 316 583
Total	395 486 318	308 007 892	521 193 897	274 427 045	234 383 097	254 285 883	270 652 356	322 633 784
% Difference	0.00%	-22.12%	31.79%	-30.61%	-40.74%	-35.70%	-31.56%	-18.42%

Source:
Detailed Stage 1 cost estimate prepared by Page Kirkland Group, adjusted fro hamburger price in-country

Notes:
* *normal (regular) price inclusive of government taxes where applicable, obtained from city branches 01.03.99*

Under this methodology Australia is shown as being above the international average cost. This contrasts with the simpler Stage 1 analysis where Australia was almost equal to the international average. The following table summarises Australia's performance by project type:

Project Type	Australia (Index)	International Average (Index)	% above
Hotel	16 086 948	14 285 281	12.61
Office	56 770 397	46 326 009	22.55
Factory	1 569 921	1 288 353	21.85
Stadium	68 330 409	55 191 413	23.81
Highway	15 454 798	12 125 818	27.45
Railway	20 855 663	17 100 327	21.96
Petrochemical	216 418 182	176 316 583	22.74
TOTAL	395 486 318	322 633 784	22.58

Taking this into consideration, the ranking of the countries changed quite significantly as follows:

Country	Stage 1 ranking (lowest costs)	Rankings adjusted via modified PPP
Indonesia	1	4
China	2	7
Singapore	3	5
Australia	4	6
UK	5	1
US	6	3
Germany	7	2

The analysis chronicled so far has been based purely on cost and while it appears that Australia may be paying more for its projects than most, other factors need to be considered before arriving at a final conclusion. Stage 2 was subsequently extended to examine a range of contextual factors and their impact on determining ranking of underlying performance.

4.4 Stage 2 Contextual Factors

While it is true that PPP and the "Big Mac" methodology give a 'truer' picture than simply establishing the costs of similar projects in different countries and converting those costs to a nominated base currency, a more accurate and useful analysis would include factors such as quality, productivity, site location and the general performance of the built project.

The extended Stage 2 of the study introduces such contextual factors to the analysis and recognises the importance of non-monetary elements in the performance of the respective building and construction industries. To set the framework, it is necessary first to analyse the general performance of the industry in each of the countries and specific components. A more detailed analysis is contained in Appendix A. The following is a summary.

4.4.1 Construction Industry Performance

It has already been stated that the building and construction industry plays an important role in economic development. The countries in the study, especially the advanced economies of Germany, Australia, the US, UK and Singapore, are working to increase construction productivity through human resource development, technical guidance, mechanisation and support for research and development. These countries see competitiveness in the industry as crucial and are pursuing policies with this objective. Also, they are promoting partnerships between the public and private sectors in the industry.

With the exception of Germany, all selected countries are using Build-Own-Transfer (BOT) projects or other forms of private sector involvement to develop power plants and other types of infrastructure. They are hoping that private sector involvement in domestic infrastructure projects will attract direct investments from abroad. Involving the private sector is expected to bring about efficient infrastructure development.

4.4.1.1 General issues

Procurement

The UK and the US use a wide range of procurement systems in both the private and public sectors. The German industry is more conservative and few projects have used alternative procurement systems. The Asian countries use several different bidding systems, such as public bidding, selective bidding and negotiations. In recent years, there has been an emphasis on liberalisation and fairness and a trend towards more transparent systems.

Discrimination against others
The trend is towards a 'borderless' world. The US and European building and construction markets are relatively open to outsiders. Asian countries are beginning to open their markets to attract foreign investment. Japan, South Korea and Singapore are opening their markets. Vietnam and the Philippines are relaxing restrictions on capital inflows. India is deregulating. Foreign firms are increasing their presence in China, Indonesia and Malaysia.

4.4.1.2 Specific issues

The following sixteen specific issues were identified as potentially affecting the performance of the industry in each of the seven countries and seven projects in the study.

- Site location
- Site conditions
- Climatic variations
- Regulatory standards
- Government controls
- Coercion/ethics
- Imported resources
- Industry maturity
- Innovation
- Building cycle
- Labour productivity
- The environment
- Site safety
- Level of industrial disputes
- Research and development (R&D)
- Taxation

4.4.2 Assessing the factors

These 16 factors were then assessed with commodities being adjusted to view all costs in the context of national living standards. This removed exchange rates as a key part of the methodology, countering common criticism of international comparisons.

A weighted evaluation matrix was developed to adjust the cost comparisons for the 16 factors. Each factor was weighted on a scale of one to five, with one meaning the factor had little importance and five meaning it was significant. Factors were then assessed using Australia as a base, again on a one-to-five basis, with one being judged a significant problem/disadvantage and five a significant benefit/advantage. Each country was then assessed on whether it was better or worse than the Australian base. Higher scores, therefore, represent an advantage over Australia.

The matrix multiplies the criteria weighting by the country assessment to arrive at a total 'value score'. This is divided by the commodity-adjusted cost index to arrive at an overall assessment. Given that high value scores and low cost indices are preferred, dividing value score by cost index produces a workable 'value for money' index that can be used for comparisons. The higher this index the better the performance of the industry.

This methodology is a form of multi-criteria analysis (MCA). Figure 4.3 summarises the adopted process.

The matrix produces a final ranking taking into account both cost and context. While the initial findings showed that Australia was mid-range and the commodity-adjusted calculations showed that Australia was ranked sixth, the inclusion of contextual factors has caused some minor adjustments to the relative position of the seven nominated countries.

The difference between the top three countries is not significant, and the performance of Singapore and Australia is also quite close, although behind the leading countries. Indonesia and China fared poorly, despite their low face-value construction costs.

Figure 4.3 Comparison assessment matrix

	weight 1 - 5	AUS base	SIN	PRC	IND	UK	GER	US
Site Location (distance from major centres)	1	3 / 3	5 / 5	4 / 4	5 / 5	5 / 5	5 / 5	4 / 4
Site Conditions (foundation quality)	1	3 / 3	2 / 2	3 / 3	1 / 1	3 / 3	3 / 3	3 / 3
Climatic Variations (adverse conditions)	2	3 / 6	2 / 4	3 / 6	2 / 4	2 / 4	3 / 6	4 / 8
Regulatory Standards (workmanship quality)	5	4 / 20	3 / 15	1 / 5	2 / 10	4 / 20	5 / 25	4 / 20
Government Controls (political intervention)	2	4 / 8	3 / 6	1 / 2	1 / 2	4 / 8	4 / 8	4 / 8
Coercion (unofficial payments)	2	5 / 10	5 / 10	1 / 2	1 / 2	5 / 10	5 / 10	5 / 10
Imported Resources (reliance on imports)	1	3 / 3	1 / 1	3 / 3	3 / 3	4 / 4	4 / 4	5 / 5
Industry Maturity (system development)	3	4 / 12	3 / 9	1 / 3	1 / 3	5 / 15	5 / 15	5 / 15
Innovation (propensity for innovation)	2	3 / 6	4 / 8	1 / 2	1 / 2	4 / 8	5 / 10	4 / 8
Building Cycle (position in the cycle)	4	3 / 12	2 / 8	3 / 12	1 / 4	4 / 16	4 / 16	5 / 20
Labour Productivity (efficiency of workforce)	3	4 / 12	3 / 9	1 / 3	1 / 3	3 / 9	4 / 12	4 / 12
Environmental Considerations (environmental protection)	1	4 / 4	2 / 2	1 / 1	1 / 1	4 / 4	4 / 4	4 / 4
Site Safety (worker safety procedures)	4	4 / 16	3 / 12	1 / 4	1 / 4	5 / 20	4 / 16	4 / 16
Industry Disputes (time lost due to disputes)	2	2 / 4	5 / 10	5 / 10	5 / 10	2 / 4	4 / 8	3 / 6
Research and Development (investment in improvement)	1	1 / 1	1 / 1	1 / 1	1 / 1	3 / 3	4 / 4	3 / 3
Taxation (investment incentive)	2	3 / 6	5 / 10	5 / 10	5 / 10	2 / 4	2 / 4	3 / 6
TOTAL VALUE SCORE (A) (higher the better)	max. 180	126	112	71	65	137	150	148
COST INDEX (B) (lower the better)	av. 323	395	308	521	274	234	254	271
OVERALL ASSESSMENT (higher the better)	A/B	0.32	0.36	0.14	0.24	0.58	0.59	0.55

4.5 Conclusion

Stage 1 of the study demonstrated that Australia was relatively price competitive in the building and construction industry. However, using methodology outlined in Stage 2, which incorporated contextual factors into the analysis, Australia is ranked fifth with respect to the underlying performance of the industry, reasonably close to fourth placed Singapore, but behind Germany, UK and US. Indonesia and China fared poorly, despite their apparent low construction costs shown in Stage 1. The ranked order of performance for Stage 2 is as follows:

Country	Stage 1 ranking (lowest costs)	Rankings adjusted via modified PPP	Final Ranking
Germany	7	2	1
UK	5	1	2
US	6	3	3
Singapore	3	5	4
AUSTRALIA	4	6	5
Indonesia	1	4	6
China	2	7	7

The International Cost of Construction study concludes that Australia is at mid-range of the selected countries for overall costs within the industry, but below the highly industrialised countries. This conclusion is not restricted to projects of a particular type, although some advantage with tourism facilities over the other projects studied may exist. The capabilities of the firms involved in completing each project could also affect the outcome. This study has used an all-industry average in each country.

The industry in Australia will require a wide-ranging program of industry improvement, and closer examination of the factors that may have produced this result, to be internationally competitive.

It may be beneficial to repeat this type of study with additional data. That data should do more than comprehensively examine the factors that have produced the present results. It should examine such growing practices as integrated supply chain management, better use of information technology project management and procurement and project delivery mechanisms. This data could then be compared with a range of real case studies to verify translation of these outcomes into practice.

While Australia is currently behind countries such as Germany, the US and UK, the gap is not insurmountable and can be closed by embracing new construction practices and overcoming many inefficiencies in current construction practices and techniques in the industry. Importantly, those Australian firms that are, or are considering, operating in the international arena will need to keep abreast of developments that will improve their competitiveness. Our cluster analysis suggests that this must be done in concert with improvements to the regulatory environment and technical support infrastructure.

5.0 The policy context

Historically, governments in Australia have not clearly articulated an industry development vision for the building and construction industry, this is especially true for the non-residential construction segment.

From the 1970s through to the early 1990s the primary emphasis was on the public and private residential dwelling sector. Housing was seen as a 'social good' rather than an industry sector worthy of industry policy consideration. Commonwealth, State and Territory policies were concerned with the provision of public housing and its associated infrastructure. Government decision-makers concentrated on social issues such as accommodation for the aged, equity in access, and helping to house welfare recipients and low income earners. The ability to afford a house was a central part of the agenda, particularly when the Commonwealth regulated interest rates and so had a direct impact on housing activity. The Commonwealth also provided direct loan and rent subsidies to first home owners and tenants and welfare recipients. There is little evidence during this period that governments used their status as a developer or procurer of public housing as a significant lever to encourage industry development.

Similarly, in a broader policy context, the Commonwealth, States and Territories saw activity in the non-residential sectors of the industry as being outside the realm of concerted industry policy consideration. This is despite governments during the period 1977 to 1997 accounting for between 40 and 30 per cent of activity in the non-residential and engineering construction sub-sectors respectively, mainly through public works and infrastructure projects[39]. It was never seriously considered to use the government's market power to stimulate activity in any strategic or coherent way. Nor was it used to promote industry development. The major policy considerations for the non-residential sector were funding the provision of infrastructure and improving industrial relations, training and skill levels.

Some moves were made to develop industry in major private and public projects. These included mechanisms to attract investment, local content and offset programs. However, these were mainly project-specific and ad hoc rather than part of a targeted strategy to develop the industry. Not surprisingly, governments shared the traditional view of the industry and analysed it through the orthodox view of its sectors. This meant the industry was viewed as consisting solely of builders and contractors and their workforces. There was no broader understanding of linkages between these elements of the industry and the client services professions, products and suppliers, and machinery and equipment sub-sectors.

Within this environment, the Commonwealth's main involvement was limited to administrative and funding arrangements associated with the Commonwealth/State Housing Agreement (CSHA) and providing forecasting data for the building and construction sectors. These forecasts came through the Indicative Planning Council (IPC) established in 1973 and the Construction Forecasting Committee (CFC), established in 1979. Given the cyclical nature of the industry, the core function of these bodies was to assess short and medium-term prospects in the residential and construction sectors and provide this information to firms in the industry so they could plan accordingly. It is important to note that when IPC was established, the Commonwealth

[39] AEGIS are undertaking a number of studies on the building and construction industry on behalf of the Department of Industry, Science and Resources. This data is drawn from a forthcoming report "Mapping the Building and Construction Product System".

still regulated housing rates and so had a direct impact on housing activity. The CFC arose from concerns about possible resource constraints caused by the 'mining boom'.

The Commonwealth demonstrated little if any 'true' industry development inclination for the non-residential segment until the announcement of a Construction Industry Reform Strategy in December 1990. Although this focused mainly on workplace relations, the strategy was a precursor to establishing the Construction Industry Development Agency (CIDA) in December 1991. CIDA was established in part because of a host of economic and other problems in the late 1980s and early 1990s. These included high levels of industrial relations disputation, shortages of skills, falling property values and spiralling interest rates. It was a recognition of the importance of industry development to the reform process. While CIDA's scope was limited, it brought the focus of the industry to new issues such as business competitiveness, best practice and improving overall industry performance. Many of the issues that were identified as impeding growth are still topical, including innovation, procurement practices, skills development and training, and regulatory reform.

After CIDA was wound up in 1995, a series of industry advisory councils were established. These culminated in the formation of the National Building and Construction Committee (NatBACC) in 1997. NatBACC includes representatives from the residential and non-residential building sub-sectors, design professionals, specialist contractors, construction companies, property owners and developers, and public works authorities.

The current Government announced in its industry policy statement, *Investing for Growth*[40], a number of initiatives designed to strengthen the capacity of industry to contribute to a stronger and more prosperous Australia. Action Agendas are one of these initiatives. They play a key role within the Government's industry policy framework by addressing issues that impede specific industry sectors in realising their growth potential. Recognising its importance to the wider economy, an Action Agenda has been developed for the building and construction industry.

The Government has also recognised new economic research and literatures that highlight the importance of innovation to industrial sectors and the overall national economy. It is particularly aware that strategies to be developed should enmesh the industry into what the OECD calls the "learning economy": one that is knowledge intensive, innovative, flexible and adaptive and characterised by the fast and effective diffusion of information; characteristics which, in the past, have not been evident in the building and construction industry.

As part of this process, NatBACC's task was to communicate to both industry and the Government the trends that would impact on the industry in future and identify appropriate actions to improve the performance of the industry. A draft strategy for the industry, *Building for Growth*[41], was released in February 1998.

The draft strategy, *Building for Growth*, identified several key issues facing the industry and circulated them widely for public comment and discussion. The result of these discussions reaffirmed the view that this multi-billion dollar industry needs to adapt rapidly and embrace change if it is to fulfil its potential and take advantage of new and emerging opportunities. The policy initiatives contained in the Action Agenda set out a series of medium-term actions that the industry and Government need to take to better fulfil the industry's potential.

5.1 International policy responses

As part of developing the Action Agenda, an analysis of the international and strategic policy directions of other governments was undertaken. This analysis showed that the issues that face the industry and present policy dilemmas for governments are surprisingly similar, although policy approaches vary. The core issues confronting policymakers internationally are:

[40] Commonwealth of Australia, (1997), Investing for Growth, AGPS

[41] Commonwealth of Australia, (1998), Building for Growth: A Draft Strategy for the Building and Construction Industry, AGPS

- improving industry competitiveness;
- enhancing skills;
- the impact on the sector of information technology;
- environmental factors; and
- advances in materials technology and application.

Government responses to these issues are varied, however, they use both generic and specific sectoral policies. To improve the industry's output, most of the countries analysed tended to use a mix of research (both technical and trends), best practice projects and dissemination activities. The strategies and policies being developed were also influenced by the nature and history of the construction industry in each country and the government's approach and philosophy to industry policy.

For example, Finland, like most other Scandinavian countries, appears to have a stronger cultural appreciation of the importance of innovation and design. When this is coupled with the local geographic and climatic conditions, it is not surprising that Finland is committing a great deal of research to issues associated with energy efficiency and its application in buildings. A stronger tradition of economic intervention and social welfarism has resulted in a stronger focus on urban design and the use of the public housing sector to promote industry development. Most recently, this has been through new energy-efficient building prototypes.

In the UK, on the other hand, where the cultural attitude to the industry is similar to Australia, the Government has created a Construction Industry Advisory Board which acts as the focus for best practice and business process re-engineering activities. Integrating information technology in the construction process is a significant interest. In July 1998, the UK released a report called *Rethinking Construction*[42]. It provides a framework for the industry to do things differently, rather than simply better. The report makes recommendations and develops specific sectoral programs across such areas as supply chains, partnering, product development, customer focus, processes, management skills, quality and developing long-term relationships.

More generally in Europe, the construction industry is being increasingly scrutinised through the European Union (EU). The EU is releasing an Action Plan designed to lift the performance and competitiveness of the industry in Europe. It will set out to overcome the fragmented nature of the industry and its vulnerability to economic cycles by making a series of recommendations in relation to quality, an improved regulatory environment, education and training and research and development. In addition, the European Construction Institute brings clients, contractors and consultants together to improve efficiency by establishing taskforces into benchmarking, regulations, partnering and information technology.

Japan, through its Ministry of Construction, has perhaps the most integrated governmental response to the industry. The Ministry of Construction is in charge of maintaining public infrastructure, land preservation, city planning, building standards, promoting the construction industries and other relevant activities. It is also responsible for a large research program though the Public Works Research Institute and the Buildings Research Institute. It should be remembered that the building and construction industry in Japan is made of a small number of large companies.

Korea is similar to Japan, placing a range of building and construction-related agencies within one portfolio, the Ministry of Construction and Transport. Activities and policy drivers are as integrated as they are in Japan and cover national development planning, housing, city planning, land policy, water resources policy, construction and administration of roads and airports and all other matters involving construction and transport safety.

In Singapore, the Construction Industry Development Board examines ways to support infrastructure development and make the

[42] UK Department of the Environment, Transport and the Regions (1998) - "Rethinking Construction"

Singaporean industry more competitive. Policies and programs are in place to improve the development of skills, productivity and a number of information and dissemination services.

The approach in the United States, however, is more generic, with innovation and technology policy and programs being handled through the Department of Commerce or its associated agencies. An example is the Department of Housing and Urban Development which, despite its title, is primarily concerned with providing public and welfare housing and does not have a strong industry development bent.

Canada has adopted an approach to assist the industry through Industry Canada, which has made a rigorous sub-sectoral analysis of its construction, architectural and engineering sectors (CAES). Industry Canada also supplies comprehensive resources to developing suppliers, promoting exports, and innovation and research and development. It has established a CAES National Sector Team, comprising federal and provincial governments, industry associations and companies to coordinate federal programs to ensure that government resources support the international development interest of firms.

While governments around the world are taking different approaches to improving the performance of their construction industries, the issues they face are similar. In most of the countries analysed, a series of common issues are being tackled and government has a role in assisting industry to meet its potential. The problems facing the Australian industry are the same as those facing the industry internationally. The Australian industry will remain competitive if it takes concerted action and commits itself to world's best practice.

5.2 The policy response in Australia

As Australian policymakers face the same central issues, it is important to assess how the various policy actors within Australia are responding. It is also important to assess their strengths and weaknesses so the policy environment that is the most conducive to assisting the industry can be promoted. The best way to understand the intra-national and inter-industry variances is probably to concentrate on the key policy actors. This is in line with international experience where the dynamics of industry policy can best be understood within a framework of comparative sectoral or cluster analysis. This enables the identification of the various players, including policy networks and institutional arrangements, which can either assist or hinder an industry sector in fulfilling its potential.

A successful framework is one where a number of firms within a sector cooperate with each other and with other agencies to ensure they commit themselves to long-term infrastructure development that underpins the needs of the industry. The competition and rivalry between firms ensures that they maintain the innovation and motivation they need to respond to new opportunities. This is the model of the new policy framework outlined earlier. It is the role of the agencies to facilitate inter-firm cooperation and promote the long-term development and competitiveness of the sector by shaping and driving supporting public policy.

In Australia, the main players in the construction industry network are the Commonwealth Government, several Commonwealth/State bodies such as the Australian Building Codes Board (ABCB) and the Australian Procurement and Construction Council (APCC), State and Territory Governments and industry associations. These are not all the actors, but they are the ones which appear to have the greatest influence on policy.

5.2.1 Commonwealth Government

The Commonwealth Government defines the overall national economic environment through its policy setting mechanisms at the macro-economic level and its micro-economic reform program. Along with its industry policy, which was articulated in *Investing for Growth*[43], it has a considerable bearing on the economic forces that impact on the industry. With particular regard to

[43] Commonwealth of Australia, (1997), Investing for Growth, AGPS

industry policy, it has developed a framework to encourage innovation, boost investment and improve Australia's trade performance.

The Commonwealth is also able to bring a national and international perspective to formulating industry policy. Through the Action Agenda process, it has announced that it has a role to play in assisting the building and construction industry to improve its performance. Importantly, it understands the interactions between industry sectors and how these elements contribute to the wider economy.

The Commonwealth provides significant funding for research and development and leads the way in advocating that Australian industry should make a more concerted effort to embrace the benefits arising from innovation.

The Commonwealth is the primary conduit for industry/government relations internationally. This will become more important to the well-being of the Australian industry as it becomes more internationalised. The Government has the capacity to facilitate export and market activities, encourage the harmonisation of international regulations and standards that affect the industry and develop national environmental policies.

Additionally, the micro-economic reforms it is pursuing will help determine the future shape of the industry. These reforms include creating a more flexible industrial relations framework that will result in improved workplace relations and introducing a more relevant and comprehensive education and training structure to improve competencies and levels of skill. These reforms will help underpin the industry's improved competitiveness.

However, it is valid to argue that in the past the Commonwealth has not been particularly adept in coordinating its various policy arms in delivering policy to the industry. The Action Agenda process tries to achieve this by taking a whole-of-government approach.

5.2.2 Commonwealth-State Forums

Two joint Commonwealth-State institutional arrangements impact significantly on the building and construction sector.

The first is the Australian Building Codes Board (ABCB) which was established in 1994 and is responsible for developing and managing a national approach to technical building requirements. These are embodied in the Building Code of Australia. The ABCB is a vital link between building practice and regulatory policy. It has produced national consistency and has successfully achieved community expectations of health and safety and amenity in the design and construction of buildings. Importantly, the building code it has produced is based on performance rather than being prescriptive. This makes it a driver for cost-effective and innovative building solutions.

The second is the Australian Procurement and Construction Council (APCC) which is the peak council for Commonwealth, State and Territory departments responsible for procurement and public works construction. The APCC is responsible for developing nationally consistent approaches to broader procurement policies, practices and processes as well as using a public works function to promote industry development. As 30 per cent of expenditure in the non-residential and engineering construction sub-sectors is in the public sector (almost all from State and Territory Governments), APCC's role in industry reform should not be underestimated.

In 1997, the APCC released *Construct Australia*[44], a strategy to drive industry development through its role as a major client of industry. *Construct Australia* outlined initiatives to improve the industry in areas of providing strategic information, mechanisms for rewards and incentives in the procurement process and education and training activities.

Over time, the privatisation of government utilities and infrastructure providers in the States and Territories could dilute the influence of APCC on the industry. Also, the main effect of APCC reforms is on the firms who supply to

[44] Australian Procurement and Construction Council, (1997), Construct Australia — Building a Better Construction Industry in Australia

government. The momentum for reform could again diminish unless governments also commit themselves to develop complementary strategies through their departments responsible for industry development, building regulatory reform, and planning.

State and Territory Governments

The States and Territories are also significant players in their own right, especially in determining the shape of regional development and the provision of infrastructure. The States have a significant impact on regulations, through builders' licensing, approvals regimes, some aspects of education and training and, in some jurisdictions, responsibility for workplace relations. They also set the guidelines under which local government authorities operate.

Various State and Territory Government portfolios, as noted, are implementing some of the initiatives set out in *Construct Australia*. It is critical that all jurisdictions develop strategies in a whole-of-government response.

As yet, not all States and Territories have taken up the challenge of developing and implementing integrated and coordinated policies for the building and construction industry. But there are recent positive signs of progress, in particular the approach being adopted by New South Wales.

5.2.3 Industry Associations

Industry associations are also key policy actors. They have roles within the regulatory environment and are part of the technical support infrastructure of the industry in communicating advice on policy to both government and their members. They also provide a range of business services to firms.

A feature of successful industries is for a highly mobilised business sector to act in concert with government to provide the ideal environment to advance the interests of the industry. Independent thinking is facilitated in sectors where government and industry interact strongly. It provides a broader perspective which in turn encourages longer term

Case study — New South Wales response

In New South Wales, the Construction Policy Steering Committee (CPSC) was established in 1992 to develop, promote and implement new policies, standards and procedures in government contracting and consulting, and to ensure a whole-of-government approach.

As the largest construction industry client in the state, the NSW Government is using its considerable buying power as a lever to facilitate change. The purchasing power is being focused by adopting consistent capital investment, building construction, and contractual policies across all agencies and establishing requirements industry must meet to do business with the government.

The CPSC is providing the leadership to ensure these objectives are met. It has developed policies and other initiatives in a number of areas, including a set of guidelines for the construction industry aimed at improving the environmental performance of contractors on government projects. From May 1999, all projects will require an appropriate site-specific environmental management plan to be prepared before the commencement of relevant site works. In addition, anyone seeking to work on major projects will need an environmental management system accredited by a NSW Government construction agency. Implementation of the *Environmental Management Systems Guidelines*[45] will be coordinated and monitored by the CPSC on a whole-of-government basis.

Construct New South Wales[46], launched in July 1998, provides a framework for the comprehensive development of the NSW construction industry in the years to 2005. It contains a series of initiatives designed to foster a seamless, efficient, profitable, innovative and environmentally responsible industry that is competitive in Australia and internationally.

[45] NSW Department of Public Works and Services, (1998), Environmental Management Systems Guildlines.

[46] NSW Government, (1998), Construct New Souith Wales.

planning. On the other hand, weak structures see a range of policy actors emerge, all claiming some jurisdiction. This results in competing priorities and diminishes the capacity to develop strategic policy resulting in incremental short-term planning that is vulnerable to political manipulation.

A framework has been developed by researchers[47] to consider the effectiveness of industry associations and their ability to steer industry. This framework is particularly concerned with the relationships between governments and sectoral organisations, arguing that the stronger the relationship the greater the chance of developing favourable or 'anticipatory' policy approaches. Anticipatory industry policy emphasises instruments of policy that are integrated with one another and aimed at successfully transforming the structure. For the weaker relationships, patterns of reactive policy are more likely to emerge. Reactive industry policy refers to policy that is organised around the immediate needs of specific firms, such as in the too frequent occurrence of distress financing. It is policy that is ad hoc, uncoordinated and short term.

The framework shows that favourable industry development is possible if a number of inherent characteristics combine to form a highly mobilised business. Six specific pre-conditions have been identified. They are:

- The associational system will be divided horizontally with separate associations or divisions representing different products, service groups or products.
- One – and only one – association will speak for the sector as a whole, with sub-sectoral organisations belonging to the peak sector-wide associations, or individual firms will associate directly.
- Both sectoral and sub-sectoral associations will have a high density; that is, there will be a high proportion of firms in a given sector.
- In sectors characterised by limited competition involving a small number of firms and where these major firms enjoy the option of direct contact with the government, the same firms will also be highly active in the association.
- Firms and associations will have a considerable in-house capacity to generate both technical and political information.
- Associations will have the capacity to bind member firms to agreements negotiated with government and to be able to assure that individual firms will comply with policy decisions.

It can be argued that there is a direct correlation between the proportion of pre-conditions an industry association displays and its capacity to develop an input to constructive industry policy.

A quick stocktake of the Australian building and construction industry reveals that there are some 15 to 20 peak associations, and an additional 50 relatively important associations covering the industry. A more comprehensive analysis would uncover at least twice as many. These associations range from those with memberships in the tens of thousands to those with hardly more than a handful – and the size of membership does not necessarily have any bearing on the influence of the association. To compound matters, membership of some of these associations overlap and cover the same constituency. Others are purely sub-sectoral organisations. Some are truly national organisations and others are based on federation models. And it is not uncommon for various industry associations with similar and at times shared constituencies to take different positions on policy. This occurs at both the broad sectoral level and the sub-sectoral level.

In short, the multitude and varying structure of the industry associations is not the most conducive to implementing and driving reform. This may reflect the fragmentation within the industry. It may also reinforce the fragmentation.

When the industry cannot agree about its future directions and strategy, this lack of consensus makes it extremely difficult for the Commonwealth, State and Territory Governments to respond. Certainly, if the industry is to fulfil its potential, industry associations will have to work together more cooperatively and present a more coherent voice to government.

[47] Atkinson MM and Coleman WD (1989) - "Strong States and Weak States: Sectoral Policy Networks in Advanced Capitalist Economies" in British Journal of Political Science, No 19, January, pp47-67.

Only in recent times has a degree of common sense and maturity emerged in the way industry associations in the building and construction industry put forward a coherent position to government. And then it has usually been around a single issue, most recently through the creation of Australian Building Energy Council (ABEC) to deal with energy efficiency in buildings. Similarly, as noted in Part A of this report a reinvigorated Australian Construction Industry Forum (ACIF) could also play a major role in driving reform within the industry.

Part B

THE INDUSTRY TOMORROW

6.0 Challenges for the future

The most advanced industries in the world have moved to an integrated mass production model. Mega-mergers in the automotive and pharmaceutical industries demonstrate this new corporate approach to operating in a global market. The building and construction industry is set to follow the same path.

Already construction is becoming an increasingly global business, characterised by a trend towards large firms through growth, merger or alliance. The industry is in the first stage of a global industrial formation that, by 2010 will see it dominated by perhaps 10 large firms[48].

This trend will be reinforced by many projects themselves becoming larger and more complex. Only large companies with greater efficiencies and economies of scale and the appropriate technological and financial underpinning will be able to bid for and successfully complete mega-projects. As globalisation intensifies so will the international competition for business. This will result in multinational clients and constructors having a greater influence on the development of the industry.

The message to Australian firms is clear. To compete internationally, they will have to attain new levels of technical and financial capacity.

In Australia, the building and construction industry is moving in this direction, although different parts of the industry are at different stages in the transition from a craft-based industry to an advanced manufacturing industry. This transition will have a major effect on the industry.

Firms must respond through:

- integrating their supply chains;
- increasing their knowledge base;
- benchmarking; and
- adopting new project delivery mechanisms.

6.1 Integrating the supply chain

The process of integrating the supply chain has already begun. It is developing from the needs of construction to require a number of different firms to work together in a series of both long and short-term arrangements.

These networks are widening. Increasingly, construction services include structuring financial deals, planning, designing, coordinating the supply chain and managing risk as well as managing all the other firms and interests involved in the actual operations of the project. These interests include legal, environmental and regulatory authorities.

To understand what is happening – and how to take the right actions for the future - it is necessary first to break the construction down into its five main phases: initiation (need/opportunity), planning, design, construction/renovation, and maintenance.

Traditionally, separate independent firms undertook each of these phases with the building and construction industry being identified only with carrying out the actual construction and renovations. Contracting firms competed on price for a given level of construction quality. This is changing.

The changes, as well as reacting to the increasing globalisation of the construction market, are being driven by the need for more creative project financing in a climate of privatisation and declining public funding. Broad management

[48] The Global Construction Market and International Contracting - presentation by the University of Reading and Skanska to the Construct IT forum held in Cambridge, UK, 19 and 20 November 1998.

services are now being demanded earlier in the building process and construction firms are becoming involved right at the start of the process in the development of new projects as well as providing traditional construction services. To cope with this, construction firms are developing their technical and integrative management capabilities and shifting from a production-oriented culture towards an attitude of providing professional services. This trend must be strengthened.

Figure 6.1 shows a breakdown of the construction process[49].

The result of this change in culture is that the building and construction industry now places greater emphasis on the entire chain – from concept to whole-of-life maintenance. This is a key part of the transition to a global industry.

6.1.1 Client focus and single source solutions

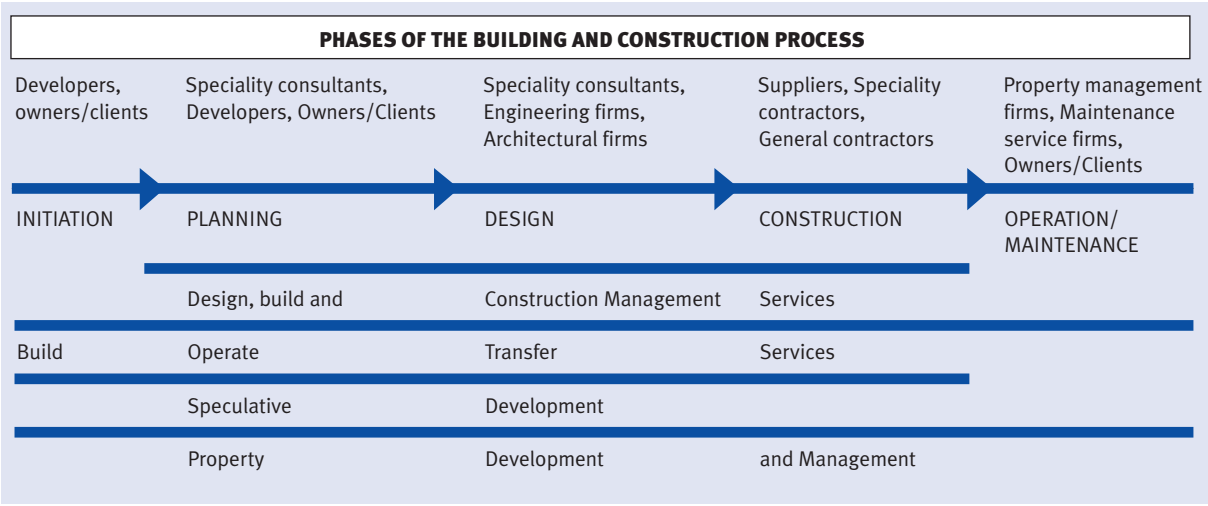
Clients are increasingly seeking complete packages of building services, often including financing arrangements. The trend is changing the way companies do business and it enables property owners and other clients to deal with fewer participants in the building process. As well as forming these new relationships, the single-source solution model also incorporates new legal and contractual forms. Clients and users of builders are gaining a new feeling of individualism and will demand that their communications with building and other professions improve. This will be more pronounced as clients demand greater flexibility in their buildings and investments.

Along with these changes, construction firms must alter the way they manage the design, production, distribution and service components of the supply chain. In this new operating environment, construction firms must demonstrate they have the capacity to continue to build better. They will do this by clearly defining tasks to form the basis of establishing risks, responsibilities and liabilities of the participants in the process, no matter which procurement method is chosen. Building and construction firms will develop long-term relationships with suppliers, which will lead to general contractors, specialised contractors, and suppliers in the building process coming closer together.

6.2 Industrialisation and increasing the knowledge base

Globalisation will increase the industrialisation of the building process and this will affect the structure of firms competing in the industry. Australia must speed up the gradual evolution of the industry from a craft-based model to an advanced industrial model.

Figure 6.1 Phases of the building and construction process



[49] Pietroforte R (1997) - "Building International Construction Alliances: Successful Partnering for Construction Firms"

Construction will become part of a sophisticated industrial process assembling manufactured and standardised products from the manufacturing sector. To do this, successful firms will have to use the newest technologies and management processes. These will include increasing automation, advanced logistical systems, long-term strategic planning, supply chain development, quality management systems covering all phases of the building process, and just-in-time techniques.

Construction firms will need the knowledge and expertise to operate in this new environment. Increasingly, workers in the industry will be recognised as 'knowledge workers'. They will be required to capture construction project knowledge and information and integrate it into an up-to-date standardised knowledge base. From this base ways will be found to build quicker, better and cheaper – right from the planning phase through to building completion.

6.3 Benchmarking

Benchmarking is a way to establish how the industry and individual firms compare with the rest of the world. Benchmarking is a systematic and continuous process that lets management and policymakers measure how well they are doing compared with leading companies. It can help a firm create competitive advantages and give impetus to the process of improvement. Benchmarking also identifies industry-wide trends. A number of individual firms may be benchmarking, but the industry as a whole, apart from some anecdotal evidence and opinion, does not know accurately how it rates internationally.

The Commonwealth Government believes benchmarking within the industry should be promoted. It would provide Australian industry with a knowledge base to help both to become more competitive internationally and to identify opportunities for continuous improvement. In another crucial benefit, benchmarking data and further analysis of the industry would help the Government set the most effective policies to encourage best practice.

6.4 Project delivery mechanisms

A key theme of this report is that Australian firms in the industry must change their culture if they are to face the future with confidence. That future is not some far-away threat. Large global firms are likely to emerge in the next decade. Advances in communication and production technologies will enable these global firms to enter small domestic markets, such as Australia, at lower levels than they could in the past. To respond, Australian firms will need to build strategic and cooperative alliances with clients and suppliers. This will allow them to compete against large global firms, not only in Australia but also overseas.

The domestic industry will have to take advantage of other important trends. As well as the increased focus on what clients require, contracts based on outcomes are being developed. Noting this, the performance-based building code implemented by the Commonwealth, State and Territory Governments through the Australian Building Codes Board (ABCB) allows greater scope for innovation. The code provides a regulatory framework for the building and construction industry to produce better results for clients. The industry has to respond by adopting new approaches to project delivery that shift the focus from individual goals to project goals.

The project alliance is one approach. It was pioneered by British Petroleum in the development of North Sea oilfields and has been used successfully on a wide range of resource projects in Australia and overseas. More recently, project alliances have been adopted in Australia for major engineering construction works including the Northside Storage Tunnel being constructed in Sydney for Sydney Water Corporation and a new wastewater treatment plant at Woodman Point, south of Perth.

A project alliance sets out to achieve the best possible outcome for the project with all participants in the alliance sharing both risks and rewards. All participants must adopt an "open-book" approach on costs and the alliance is built on mutual trust and respect with all committing themselves to achieve common objectives and outcomes. Experience to date suggests project

Case Study — The Wandoo B Offshore Oil Platform

"Services can be bought - but alliances must be built on trust," according to Dr Robert Care, State Manager NSW, for consulting engineers Ove Arup and Partners. He was commenting on alliance partnering as the project delivery mechanism for major construction and engineering projects.

"Clients must willingly be part of the process if this method of project delivery is to be a success," he said. "In regard to the Wandoo project, the thrust came from the client, Ampolex, which demanded an innovative solution, and Ove Arup became part of the group that delivered the whole project."

The Wandoo B project was the construction of an offshore oil platform for the Wandoo Oil Field on the North West Shelf of Australia, some 70 kilometres offshore from Dampier. The platform consists of an 81,000 tonne concrete gravity substructure, 400,000-barrel oil storage capacity, 10 producing wells, one gas injection well (and one spare) and accommodation for up to 20 people.

"The alliance approach to the project has been different from traditional - and confrontational - ways of doing projects. The project was put out for expression of interest to 19 different organisations, asking them to tell Ampolex what they thought was possible," Dr Care said.

Ultimately, an alliance of Ampolex (now owned by Mobil Exploration and Production Australia), Ove Arup, Leighton Contractors, Brown and Root and Keppel FELS of Singapore was formed to deliver the $480 million project on a "gain share/pain share" basis. The parties agreed to work together for a three-month period to establish the project and work out the target price on an "open book" basis.

"The whole idea was to take the initial project objectives and align these with the benefit to project participants. We formed an alliance involving all participants and demanded that all board decisions were to be unanimous. This is a great motivator to reach decisions quickly, as any costs incurred by delays in the decision-making process come out of the common profit pool.

"The project wasn't tendered on price. That's a key element because once you've tendered on price, already you've eliminated a large element of the ability to trust each other. To work together in a spirit of openness and cooperation, to use innovative methods etc, [the alliance partners] have got to be open and honest with each other.

"Person to person communication is the key," Dr Care said. "When you've had people working in a confrontational working environment, you have to invest in some effort to move people out of the particular mindsets that creates."

The alliance brought in JMW Consultants to help with the process. One feature of the alliance was the "no blame" clause in the alliance contract. On 29 April 1995 the seawall separating the rig construction area from the sea was breached and flooded to a depth of seven metres. By 11 May the breach in the dyke was sealed and within four weeks all water had been removed, resulting in a delay of only one week in the concrete pour for the platform base.

"Traditionally, recovery from an incident like this would have taken months," Dr Care said. "There'd be covering up, people blaming each other, lawyers, litigation. There was no blame assigned - I've never seen anything like it."

The approach was successful. The project was delivered in 26 months, as opposed to three years for similar projects using traditional delivery methods, and it was delivered 4 per cent under budget.

"Alliance partnering is a process you have to go through, it's not a blueprint. The most important part is the process you use to get that contract. Each part of the alliance must give to the alliance the people, or groups of people, within those organisations who are willing to take on alliance partnering as an opportunity, to be open minded about their trust and have the same level of commitment to the project," he said.

alliances foster innovation and eliminate the adversarial culture that characterises much of the building and construction industry. They also encourage flexibility as the alliance requires firms to move away from fixed roles within the project and to deploy expertise where it can get the best results.

Alliances, however, may not be appropriate for all projects. The focus on the outcomes of projects, the needs of clients and value for money for the client will become more important throughout the industry, fuelled by the pace of technological change and the globalisation of markets. This means it is likely that the principles of project alliances will become more widespread as firms develop closer and more cooperative relationships with customers and suppliers.

The industry and individual firms must explore the possibilities of alliances. The Wandoo B Offshore Oil Platform project in Western Australia provides a useful insight. It is the way of the future.

6.4.1 National Museum Project

Australia has pioneered what may be the first use of project alliances for a building project anywhere in the world. On Acton Peninsula in Canberra, the Commonwealth and ACT Governments have agreed to establish new facilities for the National Museum of Australia, the Australian Institute of Aboriginal and Torres Strait Islander Studies and the ACT Aboriginal and Torres Strait Islander Cultural Centre. The project alliance has brought together Civil & Civic Pty Ltd, Tyco International Pty Ltd and Honeywell Ltd with architects Ashton Raggatt McDougall and Robert Peck von Hartel Trethowan.

This development is an important step for the industry. The Commonwealth and ACT Governments expect the project will be an important Australian architectural and construction achievement. The application of project alliancing to this building project has already generated considerable interest within the Australian industry. There could well be valuable lessons learned along the path to project completion, and powerful insights gained as to the wider applicability of this project delivery mechanism to other projects. It is for these reasons that the Acton Peninsula development should be used as a national case study for the industry. This would be in keeping with the national significance of the project. The opening of the new facilities in March 2001 will be a highlight of Australia's Centenary of Federation Celebrations.

7.0 Innovation and R&D

To grow and compete, the building and construction industry must quickly and thoroughly involve itself in the design, development, commercialisation and effective diffusion of new building products, systems and services.

It must innovate in project delivery systems and develop relationships within the supply chain to assist in procuring and financing projects in addition to innovating in management and marketing. This must include the legal arrangements as relationships reflect the new delivery systems.

To deliver high quality outcomes for clients, the building and construction industry will need to recognise the importance of innovation and R&D within the building process. As the industry becomes more industrialised and has a 'product' to sell, it will constantly need to refine and distinguish its product in the marketplace. It can only do this through a strong commitment to innovation. To improve construction systems, innovation will be both based on technology and process.

For innovation based on technology, the industry must concentrate on material technologies that are increasingly recognised as having major economic importance. It will be essential, for example, to know the performance and behaviour of new and recycled materials, particularly for special applications. Examples of the enormous number of new materials either available or being developed include composites for integrated functions, such as sound and thermal insulation, new types of glass, ceramics, plastics, adhesives and coatings. Knowledge of the performance of these materials will have to be integrated and embodied in standards to allow those who specify buildings and sub-systems to predict them accurately under all conditions.

Process innovation must focus on decision support systems, process re-engineering and adopting concurrent construction and "lean" construction methodologies.

There is a role for industry and government to work together. Where industry does innovate successfully in design, building materials, building processes, procurement and management practices, the Government must showcase these developments and help disseminate the knowledge to the wider industry.

Government already has a range of programs to encourage innovation in the industry, but much of the industry is unaware of them. This must be remedied and the industry and public sector research organisations must come closer together.

7.1 Overcoming impediments to R&D

The necessary change in culture in the industry must also cover R&D. Much of the present poor performance in R&D comes from the structure of the industry. In many sub-sectors profit margins are tight and expenditure on R&D may only come when these sections of the industry understand that R&D and the innovation that flows from it are vital for its future growth.

The industry faces a number of issues that potentially hinders its ability to innovate, these are listed below[50].

[50] AEGIS; from a forthcoming report "Mapping the Building and Construction Product System".

Site-based production
Site-based production can involve communication problems for the project team and across projects. The temporary nature of projects also disrupts the innovation processes. One global industry expert notes that international contractors "dream about all the innovations they might introduce if only continuity of work were assured".

Project size and complexity
Large projects may involve hundreds of employees, most of who never meet. This is a difficult context for making decisions and ample potential for "disparate and discordant effort". Large projects are also likely to involve specialised team members with narrow views of the project. This invites difficulties in management and reduces the potential for innovation.

Risk of failure
Uncertainty leads to avoiding risks and preferring "tried and true" methods of construction. This may result in less than the best design, selection, construction, operation and maintenance of facilities. The uncertainty felt by international constructors is heightened by the experience of major design problems in the industry's history – for example, high-rise apartments of the 1960s. Risk also comes from an increasing emphasis on public safety issues and the difficulties of assessing the safety implications of new methods of construction. All of these encourage a preference for established practices.

Competitive bidding contracts
Competitive bidding is the traditional form of contract used in the construction industry. Many believe that entrenching cost as the client's almost exclusive concern undermines the industry's ability to innovate. As a result, firms in all countries have an "overdeveloped sense of cost and an underdeveloped sense of value associated with the benefits of technological change". Competitive bidding involves fixed price contracts that shift risk to contractors. Thus innovation in contracting methods is a major stepping stone to improving innovation throughout construction networks.

Changing finance systems
There is an emerging trend in the industry for contractors to provide finance for projects to secure work. This applies particularly in many developing countries. The trend also applies to developed countries where major changes towards privatisation and deregulation mean that more work is being undertaken for private clients. This shift has seen the need for alternative financing mechanisms and more contractors are being required to take an equity interest in projects. This squeezes the resources of contractors and reduces their scope to innovate.

7.2 Summary

The building and construction industry does not spend enough on R&D. The nature of the industry also influences it to continue to use traditional methods of construction, rather than take the risk of innovating. It is clear, however, that the industry must commit itself to improve its performance. While individual firms may not be able to spend significant amounts on R&D and innovation, acting together they may be able to pool their resources. This could result in setting common and generic research priorities, possibly through some form of industry landmark project. There could also be a role for industry associations to work more cooperatively and prioritise common research needs and/or jointly fund such research. There is some interaction between research agencies, industry and government, which gives the potential to build networking advantages. A mechanism must be found to ensure that expenditure on R&D in research institutions more closely meets the needs of the industry.

8.0 Information Technology

The Australian building and construction industry must take advantage of emerging information technologies. These technologies will dominate the way industry does business and enhance its competitiveness.

The Government clearly recognises the importance of IT and has a four-pronged strategy to help industry take it up. They are to:

- increase awareness of the benefits of IT;
- support the development of industry standards and shared databases;
- encourage a focus on added value from the use of IT; and
- support restructuring of the industry supply chain to leverage the benefits from IT.

The IT revolution has only just begun. Soon such staples as tendering and procurement will be standard electronic procedures. E-commerce will be the way business is done and virtual project teams will become a reality. IT will change the way industry operates and the goods and services it provides. The impact of the changes will be greater than just influencing design, products, materials and project management. They will include relationships with clients and competitors. IT will change every business significantly – and Australia must be in the forefront of those changes.

The Department's research[51] suggests that there are three phases to IT uptake.

Phase 1: Automation – most firms are at this level

- Automating existing practices and processes is a basic competitive necessity.
- It leads to improved productivity, increased capacity, shorter cycle times, improved accuracy and consistency and many other benefits.
- Automation leads only to some short-term gains, mainly through reducing costs that are quickly eroded by the price competitiveness of the market.

Phase 2: Re-engineering – some firms have achieved this

- IT is used to enable the re-engineering of the core business processes.
- Re-engineering allows firms to offer new products and services to the client in new ways.
- It leads to access to new markets, capacity to manage projects from a distance, enhances customer focus, improves international competitiveness, and increases responsiveness to innovation and similar advances.

Phase 3 – Supply chain management through IT – the industry has to move to this phase

- Using IT to integrate the process of developing, designing and construction.
- Being able to both raise the value and lower the cost to the client.
- Greater collaboration and concurrency leads to shorter cycle times and fewer misunderstandings, which saves time, money and litigation.

Those firms which led in automation gained the business benefits of a greater volume of business and profit margins for the short period before their

[51] Australian Graduate School of Management and the Building Research Centre. Faculty of the Built Environment. University of New South Wales (1998) - "Information Technology in the Building and Construction Industry: Current Status and Future Directions".

competitors caught up. They found, however, that because automation makes it so easy to imitate a competitor's success, the only permanent result for the industry was for costs to come down a notch across the board. However, even at this low level, many firms that did not automate have gone out of business. So, IT-based automation became a competitive necessity for firms to remain in business – but, by itself, was not enough to give a sustainable advantage.

The Department's commissioned research found that the industry widely agrees that IT is necessary and valuable. However, this industry view is based on the gains firms have made from automation.

Typically, firms in all sectors of the building and construction industry have adopted IT systems and tools that directly assist them perform their specialist tasks. This has allowed them to automate a number of time-consuming and error-prone activities and gain benefits in cycle time, productivity, and accuracy. For example, using Computer Aided Design (CAD) systems for drafting has resulted in firms in all sectors gaining these benefits when they need to change drawings. This is typical of the use of IT in other industries when automation is the first phase of IT that is adopted.

Some firms have begun to leverage the information they collect as a by-product of automation to improve their management processes. This is typically the second phase of adopting IT. It is, in fact, the first use of IT to add value beyond its role in reducing costs.

Some companies have gone on to the third phase and committed themselves to invest continually in technological advancement and organisational change. These companies have stayed ahead of their competitors by changing their organisation as well as automating. They have gained a strategic advantage by being prepared and able to innovate continually and to manage the changes this involved.

8.1 The opportunities

The goal of the industry must be to progress from automation to managing the supply chain. In other words, it must move from Phase 1 of adopting IT to Phase 3. This move, from what is historically a craft-based industry to the industrialised manufacturing model gives the industry the best chance to compete in the global construction market of the future. The industry in Australia must keep pace with international developments and follow the example of its own industry leaders. The transition will require a coordinated effort from Government, industry and research institutions with four key areas of action being apparent.

8.1.1 Increase the awareness of IT-based strategic change, and the skills to implement it

The Government will need to cooperate with industry to identify, develop and contribute case studies of best practice in moving from automation to the required strategic transformation.

The strategic implementation of IT within elements of the industry appears to be low, notably in the construction trades. This may indicate that the associated awareness and skills are also low. It is important for all sectors and levels of the industry to be aware of the strategic uses of IT and acquire the appropriate skills. It is recognised that in an industry where profit margins are so tight that small and medium sized enterprises (SMEs), in particular, may find it difficult to invest in these skills. To counter this problem, more needs to be done to support the development of short courses for SMEs on the benefits of IT innovations.

An additional role for Government will be to keep the industry informed on the current academic and industry views on best practice IT and innovation.

Case Study — Flower & Samios Architects – Business benefits from continuous innovation

Flower & Samios is a Sydney-based firm of architects who have gained significant benefits from its mastery of IT. In 1987, it made its first tentative steps by leasing two personal computers. The primary intention was to use them for presentations of designs to clients. Within a few years, however, IT had become the engine room of the practice with all design work done on computers. The firm adopted computers on an incremental project-by-project basis until all architects had a computer and had learned to design using CAD software. By 1992, drawing boards were no longer used and the firm did not require any draftspeople. Staff became sophisticated leading edge users of CAD, modelling and multimedia software. In 10 years the firm has invested about $500,000 in IT. Annual turnover has multiplied many times since 1987. The staff has grown only from 16 to 20.

Adopting IT gave the firm greater speed, flexibility and accuracy in design and greater integration across the business with benefits extending to contract administration and project management. The benefits also include high client satisfaction, a reputation in the industry for IT leadership in architecture, lower costs and a competitive edge that will be difficult to overtake. Due to its reputation for expertise in 3D modelling, the firm has gained new opportunities in urban design and local government planning.

In leading the gradual transformation, partner John Flower developed three basic rules to successfully manage IT in the practice.

- First, he determined that the professional architects, starting with himself, had to master IT. It became standard practice to design projects on PCs from the start. This forced rapid learning.
- Second, for IT to provide real benefits it had to be integrated into the business. This meant not employing IT specialists or CAD operators. In turn, this required a strong commitment to individual and organisational learning to ensure the professionals continued to improve their IT skills.
- Third, to do this, Flower &Samios committed itself to using only hardware and software that was commercially available. This was because it was relatively easy to use and did not require specialist IT capability. The competitive benefits did not come directly from the IT systems, which anyone could buy. They came from the commitment to learning and the mastery across IT applications that the professionals gained over time and by integrating IT with the business.

Essentially, this integration re-engineered the firm's business processes and gave it maximum benefits from the technology. For example, by developing and maintaining a 3D model of the design from the start of a project, relevant drawings and documentation could be peeled off the model at different stages without further work. Designs became easy to amend, with elements of the model being updated instantaneously. By integrating multimedia packages into the process, it has been easy to communicate the designs to customers. A combination of land modelling, measurement and costing capabilities in its systems has made progress faster, more efficient and more accurate. Perhaps more importantly, it has enhanced the capabilities to manage and control the contracting and project administration process. Communications with suppliers and consultants are increasingly electronic with such advances as e-mailed CAD drawings and documents becoming normal practice.

John Flower foresees that soon, external consultants involved in a project will access the 3D model of the project on the firm's server and carry out their specialist part of the design work on-line – and have only read-only access to the rest of the model. John Flower comments: "When all the parties are working concurrently on a project in this way, they will transform the industry."

8.1.2 Develop industry standards and build shared databases

Developing industry standards and building shared databases will be hard for such a competitive industry. But it must be done. The project-centred shared database is the central IT tool underlying the concept of the virtual project team. This database brings a project's concept, design and construction together and uses all the knowledge in the project team to generate maximum value. It produces historical and real-time data on the project which allows all parties involved to assess the effect of design and construction variations throughout its life cycle. This produces a wealth of knowledge to fine-tune the facilities management systems.

Support for the development of project-centred shared databases will need to become a priority. The key will be to establish a standard set of descriptions of products, materials and processes. These must be able to be defined as "objects" that can be exchanged by the software the industry uses. To gain maximum efficiency from the project-centred database, computer files that describe a building product, for example, must be fully accessible to all functions. That means they must be able to be read by CAD software, imported in energy efficiency and other building performance software, exported to lists of materials and then used in facilities management software. The file of each "object" will carry its relevant historical information, how it performs, and its specifications, price and the maintenance it needs.

8.1.3 Encouraging the industry to use IT to enhance performance and add value

As emphasised earlier, the industry will not get the full value of IT tools unless it uses them to support a re-engineered business process and changes its culture to produce an environment of continuous improvement. It must use IT to enhance performance and add value. As demonstrated, automation on its own does not generate sustainable competitive advantage for a firm. IT adds value when it is an integrated and ongoing part of the firm's core business.

8.1.4 Restructuring the industry supply chain to leverage IT benefits

Managing the supply chain through IT is a vital part of the industry's capability to make its mark in the global construction market. The industry must operate as a seamless single-source supplier of innovative construction solutions. The shift from the traditional procurement model to one of supply chain collaboration will require far-reaching cultural change throughout the industry.

The Australian building and construction industry does not operate in isolation. Australian firms have to compete globally as well as domestically, just as international firms compete with Australian firms in both markets. Taking up IT will help Australian firms to create a competitive advantage which will be vital in the global construction market.

9.0 The environment: the need to change

Managing environmental impacts has never been more important. This presents another challenge for the building and construction industry – the need for development to become ecologically sustainable. As we enter the new millennium, the need to change construction processes has become an imperative. Simply, most of the existing building stock costs too much to run, consumes too much energy and depletes the environment.

Additionally, it is now recognised that the productivity and health of users/occupants are critical parts of the business performance of the industry. The economic value of buildings of the future will be determined more by function than location. Structures with flexible interiors capable of accommodating a whole range of services and facilities will be required. This is an opportunity to change the culture by considering the total environment in any design.

One way to do this will be to give greater emphasis on developing modelling tools to rank then select the most appropriate design alternatives that consider environmental, energy, social and sustainability impacts. Another option that may need to be considered is a system to audit building performance.

The building and construction industry is a major component of the Australian economy. This means it has a great effect on our total impact on the environment. Buildings are responsible for some 30 per cent of the raw materials we use, 42 per cent of the energy and 40 per cent of air emissions[52]. Ecological efficiency ("eco-efficiency") in the building form is obviously an important way to minimise the impact on the environment. An environmentally conscious design can deliver significant economic benefits.

Many observers argue that the current process of developing and procuring buildings tends to create incentives for developers and owners to invest less than they should in areas such as energy consumption and durability. The speculative development process works against environmentally sustainable design. Typically, the developer engages an architect or contractor to produce a design concept that will interest tenants and attract financial backing. The financier's main concern is that the investment should be profitable. These buildings tend to be on-sold, with a sitting tenant, and the issue of life-cycle costs is a matter for the tenant and the new owner.

In total, the emphasis is on short-term economic factors such as achieving the lowest possible capital cost. This is likely to be gained at the expense of whole-of-life asset performance – even though research shows over a 30-year period[53], 98 per cent of costs are ongoing (comprising personnel, operations and maintenance) while the initial building cost represents only 2 per cent. The result is that relatively small savings made during the initial stages of procuring the building lead to large additional costs over its life.

From a commercial point of view, energy efficiency is currently not a key consideration for developers. If, however, it could be proved that eco-efficiency generates greater return on investment then that attitude could change. Attitudinal change would also occur if the law required the energy efficiency of a building to be disclosed. Most of the building sector does not recognise that lower utility bills and fewer greenhouse emissions through better energy efficiency have potential economic value. This latent value provides a vehicle to promote private investment in building energy efficiency.

[52] NSW Department of Public Works and Services (1998) - "Economic and Environmental Life Cycle Costs of Buildings: Discussion Paper" prepared on the behalf of the Department of Industry, Science and Resources

[53] ibid

In short, the building and construction industry will have a significant role in defining its own public perception either as a contributor or initiator to the sustainability debate.

9.1 Government strategy

The Government will introduce a comprehensive strategy aimed at reducing greenhouse gas emissions and encouraging voluntary initiatives for energy efficiency from industry. It will also introduce mandatory minimum standards.

Supporting its commitment to the Kyoto agreement, the Commonwealth Government is working with the States, Territories and key industry stakeholders to develop minimum requirements for energy performance. These will be incorporated into the Building Code of Australia and apply to all new buildings and refurbishments that require building approvals.

The building and construction industry has contributed well to this change of attitude. The whole industry has come together to establish the Australian Building Energy Council (ABEC). From an industry that is made of so many different parts with robust points of view and with so many different organisations representing sectoral interests, the achievement in bringing so many to the table and generally reaching a consensus should not be underestimated.

In December 1998, ABEC wrote to the Government supporting the need for a combination of mandatory and voluntary initiatives. The Commonwealth responded and agreed to support industry voluntary best practice initiatives and to eliminate the worst practices through developing mandatory minimum requirements for energy performance. To find out more accurately how much greenhouse gas the residential and commercial building sectors emit, the Government, working with industry, has sponsored a series of baseline studies.

Some States, Territories and local government bodies have already moved to mandate energy efficiency. It is important, however, that any compulsory standards should be consistent across Australia. The Nationwide House Energy Rating Scheme (NatHERS), a cooperative venture by the Commonwealth and all State and Territory Governments, is developing an energy rating system for all Australian housing. State and Territory Governments are implementing the system progressively.

The energy efficiency of a building is not determined by building controls on their own. Planning controls are significant determinants as well . This includes factors such as solar access, orientation and controls on building shape and plot ratios. To cover these, the National Office of Local Government will continue to encourage and promote energy efficiency strategies among States, Territories and local government bodies. These strategies must be consistent with those developed for building control.

Additionally, the Government, through the Productivity Commission, has commenced a study of the building procurement process and associated investment drivers to determine whether the procurement process creates disincentives for investment by developers and owners in energy efficiency and durability. The study is expected to be completed by November 1999.

9.2 Waste management

The industry also faces a challenge in its waste management practices. The Commonwealth is encouraging better waste management through its WasteWise program. This is a program designed to reduce the amount of construction waste going to landfill.

In the first phase of the program, five leading Australian construction companies have volunteered to work with the Australian and New Zealand Environment and Conservation Council to develop waste reduction best practice. Put simply, the companies have to find the best way to reuse, recycle and reduce the waste resulting from their day-to-day operations. Governments can set the framework. It is up to industry to make it work.

The WasteWise program:

- identifies and addresses the technical and behavioural barriers to reducing waste efficiently and economically; and

WasteWise - Case study of Multiplex Constructions Pty Ltd

Multiplex's outstanding achievements in waste reduction and demolition are based on a policy for requiring sub-contractors to find alternatives to sending material to landfills.

At the Homebush Bay Olympic Stadium, 60 per cent of site waste was recycled from April to August 1997. At that site, Multiplex, through special arrangements with their sub-contractor, established a concrete re-use system whereby concrete generated during the excavation and demolition phase of the project was stockpiled. 32,000m^3 was crushed and subsequently used on site. 100 per cent of the demolished concrete was reused. Also at the Olympic Stadium, Multiplex stockpiled and reused 600,000m^3 of clean fill on site for backfill. Cost savings were achieved for this site in the areas of transportation, emissions, energy and tip fees.

Multiplex avoided waste generation on sites where they had the capacity to influence construction design. At the Sydney Park Plaza in Alexandria in NSW, they used two prefabrication techniques to cut waste:

- Ultrafloor, a modular joist concrete floor system which replaces timber form work (with the timber offcuts normally going to landfill).
- Rapid Wall, a modular prefabricated plasterboard system which reduces over-ordering and the subsequent waste of plasterboard offcuts.

100 per cent of Plasterboard waste was recycled on Multiplex's Southbank Towers Apartments site in Victoria through special arrangements with Boral Recycling. At Multiplex's St Kilda Road Apartments the company recycled 80 per cent of all materials on site which included 14,000 panels of glass with a recycler in Latrobe Valley. At their Broadway Apartments in NSW, 92 per cent of all demolition waste material was recycled by subcontractors, Metropolitan Demolition Pty Ltd.

Multiplex's excavation and demolition subcontracting provisions contribute high rates of diversion from landfill and diversity in waste reduction techniques. Multiplex also relies on new sub-contractual arrangements with waste collectors to remove unseparated building waste for recycling or reuse. The subcontractors also monitor its diversion from landfill and report to the company on performance. For example, Multiplex waste reduction results for New South Wales over the months of April to August 1997 show that approximately 14,407m^3 was removed and 8,644m^3 was recycled.

At the La Trobe Valley Regional Hospital site, 80 per cent of all building waste was recycled including 100 per cent of timber and 100 per cent of concrete and tiles. The timber went to the Moe Food Bank for fire wood to the community and the concrete and tiles was crushed and used on farms to prevent erosion and surface roads and tracks.

Through a "reduction at source" program on the Rockman's Regency Apartments site in Victoria, Multiplex enlisted the participation of all subcontractors and was able to reduce the number of bins provided to the site by 488 (or by 7,320m^3), halving the site's waste costs. For example, during building fitout, this was achieved through reducing packaging, designing materials to fit, having packaging taken back by the suppliers, and eliminating non recyclable materials such as shrink wrap. At Southbank Towers in Melbourne, Multiplex targeted plasterboard for recycling with 600m^3 reprocessed from the site, a recycling rate of 100 per cent. Timber was also targeted and is being recycled at a rate of 60 per cent on this site.

- reuses and recycles significant volumes of building material waste, including concrete and steel.

Phase II of WasteWise expands the program to involve the industry's whole production cycle: construction companies, designers, material suppliers, builders, demolition operators, industry associations and waste collectors. The following industry participants have joined Phase II to lead the Australian construction industry in developing and implementing best practice waste reduction:

- Barclay Mowlem Construction Ltd - a WW partner since 1995
- Civl and Civic (Lendlease Property Services) - a WW partner since 1995
- John Holland Group Pty Ltd - A WW partner since 1995
- Multiplex Constructions Pty Ltd - A WW partner since 1995
- Project Coordination (Australia) Pty Ltd
- The Australian Institute of Building
- Taylor, Oppenhiem Architects
- The Australian Institute of Landscape Architects
- The Institute of Municipal Engineering Australia
- The Civil Contractors Federation
- The Master Builders Association

Industry will benefit from introducing waste minimisation measures. In terms of cost, waste reduction can be cheaper than waste disposal. Improved arrangements with suppliers can reduce the cost of materials supplied, while a voluntary waste minimisation program such as WasteWise can remove the need for costly, separate and disruptive State or Territory-based industry waste minimisation controls.	Responsible practices can improve commercial prospects, both in Australia and overseas, by increasing a company's profile as a best practitioner and industry leader in waste minimisation. Some ways to do this are to refer to waste minimisation efforts in tendering details, publicise the environmental benefits of best practice waste minimisation, and label buildings as built in accordance with waste minimisation best practice.

10.0 Reforming the regulatory system

The efficiency of the regulatory system has a major bearing on the performance of the building and construction industry. Under Australia's federal system of Government, the States and Territories have their own legislative and administrative systems relating to building regulations and planning control. This has resulted in eight distinct regulatory systems which have been made more complex by devolution of State powers to local government. Before building construction can be started, it is usually necessary for both planning and building approval to be obtained.

10.1 Planning Approvals System

In most State and Territory administrations, planning and building functions are undertaken by different departments, with planning approval required before building approval is considered.

Planning approval generally covers issues such as-

- Zoning - residential, commercial, industrial;
- Building type - harmony with adjacent buildings, special issues such as heritage requirements;
- Setbacks - distance from street and other boundary;
- Access - access to and from site;
- Impacts on local community - traffic, carparking;
- Environmental impact - pollution discharges.

Currently, the lack of consistency across jurisdictions adds complexity and uncertainty to the system, undermining investor and community confidence and retarding economic growth. The Industry Commission has estimated the cost of inconsistancy to be $1.1bn per year[54]. It is worthwhile noting the Development Assessment Forum (a joint Government-industry body) was established to streamline and harmonise National development assessment procedures.

10.2 Building Regulations

The Commonwealth, States and Territories, in partnership with industry, have developed a performance based building code, BCA96. The only provisions of BCA96 that are legally binding are the requirements setting the levels of performance of the building elements. The prescriptive elements of the earlier building codes are structured so they can be used as a guide to meet the performance requirements of the new code. This enables a more innovative approach by firms to achieving desired results for clients.

Industry must take advantage of these changes. However, less than 10 per cent of building work is completed using solutions based on performance. In practice, performance-based design tends to occur only in large specialised projects. An example is the Star City Casino in Sydney, where developing an innovative fire protection solution proved to be cost effective.

However this does not imply that prescriptive solutions are the answer for the small project end of the market. Rather, the small end is where the simplicity and relative cheapness of the prescriptive solution is overwhelmingly apparent.

Governments and industry, as partners in developing performance-based codes, have an obligation to encourage and facilitate the development and dissemination of innovative solutions. This requires a mixture of encouragement and education.

[54] Unfinished Business, (1998), Joint Industry Submission to Planning, Housing and Local Government Ministers.

The Australian Building Codes Board (ABCB) has developed an education program aimed at regulators and building inspectors (certifiers) to help them understand how to apply and use the performance-based code. This program will be run in conjunction with several educational and training institutions. They will be assisted to upgrade their skills to handle applications lodged under the new code. In addition, the ABCB has agreed in principle to set up a national peer review panel to provide advice and guidance on the BCA96 building solutions.

The project-specific nature of the industry inhibits the effective promotion of innovative building solutions. The intellectual capital implicit in a performance-based design stays with the designer or becomes the property of the developer who paid for it. No one wants to give away a competitive edge. But, for the industry to advance, it must be able to adopt commonly used innovative solutions. Ideally, they should be incorporated into the codes in the form of "deemed to satisfy" solutions.

Poor information flow is an argument for government intervention. Basic research into, for example, the behaviour of fire, tends to be widely published. This is much less likely to occur when the research is adopted and transformed into commercial solutions.

A clearing house of innovative solutions may be needed to distribute examples of best practice to the industry. Subject to intellectual property considerations, this clearing house could adjudicate on whether innovative solutions meet the objectives of the code. The clearing house should be at arm's length from the regulatory approval process and have the best available technical expertise.

10.3 Minimum regulation versus meeting community expectations

At present building regulations focus primarily on health, safety and, to a lesser degree, amenity. Considering the ageing population, it is unlikely that the current BCA definitions of health and safety will remain as they currently stand as the only community expectations for the performance of buildings. This may lead to conflict, for example, among demands to regulate for safety from external intrusion, existing fire safety measures and the requirements for ease of egress for occupants.

Solutions may be sought for many other objectives, such as:

- consumer protection (durability of products and systems);
- flexibility in choice (multiple levels of quality of buildings);
- environmental impact of buildings (energy efficiency, siting, waste); and
- additional amenity (sound attenuation, installation of heating and cooling devices, pleasant surrounds).

The BCA is a living document. It is already changing to reflect the expectations of the community on the way our buildings should perform in areas as diverse as energy efficiency and access for people with disabilities.

The Government's response to its Kyoto commitments on greenhouse gas emissions includes a domestic policy commitment to energy efficiency. This reflects the expectations of the community that each industry sector will meet the challenge. The building and construction industry has recognised the need for a comprehensive approach combining voluntary commitment and a degree of regulation – an approach which the "living" BCA will adopt.

On another level, the BCA is being modified significantly to meet the needs of people with disabilities. This is to ensure that it meets the requirements of the *Disability Discrimination Act 1992*, which makes it an offence to discriminate on the basis of disability.

At present not all building and construction is regulated through joint collaboration between the Commonwealth, States, Territories and the industry. The States and Territories, for example, regulate on-site plumbing and electrical wiring in buildings. It would be better for both the industry and consumers if all the building regulations could be brought together into unified performance-based regulations. This would reduce the number of regulations and save money.

10.4 Minimising the cost of compliance

The lack of national consistency in technical and administrative systems places a cost-impost on firms. This makes it important to continue to encourage consistency. However, it is important that consistency is achieved in line with community expectations. To ensure this, the Government requires a rigorous regulatory impact statement for all new building regulations.[55]

The Government believes that regulations should be the last option and encourages non-regulatory approaches where possible. Where regulations are needed, the Government believes they should reflect best regulatory practices. They must be the minimum necessary to achieve the performance required. And, if possible, they should lead in time to self-regulation.

Where health and safety issues are involved, the regulatory approach remains paramount as the community prefers that Government has direct control. However, many regulatory processes lend themselves to self-regulation. Recently, the building approvals process, once the strict domain of local government building inspectors, has been gradually opened up to competition and some States and Territories have introduced professional private sector certification of buildings. These changes have led to efficiency gains through reduced costs and large reductions in approval times for construction.

10.5 Internationalisation of standards

Governments recognise that variations between building and construction standards and conformance requirements between countries can be barriers to trade in both goods and services. Mechanisms to eliminate these possible technical barriers are being developed. Australia has signed the World Trade Organisation (WTO) Agreement on Technical Barriers to Trade (TBT Agreement) which deals with this problem. The Asia Pacific Economic Cooperation's (APEC's) Sub-Committee on Standards and Conformance (SCSC) also seeks to remove technical barriers to trade.

In the past the development of international standards for building and construction has been poor. There are major gaps in coverage and some requirements are inappropriate for the Australian environment. One difficulty is that some International Organisation for Standardisation (ISO) standards tend to reflect the European industry or be in conflict with national standards, such as those of the US. This makes them less relevant to the regional economies, that comprise our target markets, and less likely they will be adopted in those jurisdictions.

To overcome this, the Government is taking a proactive approach to developing ISO standards. It consists of:

- taking part in all relevant ISO building standards committees and ensuring that Australian requirements are reflected in international standards;
- becoming the secretariats of key ISO committees such as those responsible for developing performance-based housing standards and timber standards;
- encouraging regional economies through APEC to take part in developing international standards; and
- actively identifying new work items to be progressed through ISO and seeking the support of regional economies in this approach.

Australia will make a major drive to ensure that the many Australian building standards committees are aware of the ISO's work and that it is incorporated into Australian standards - where appropriate. Standards Australia's Joint Standards Coordination Groups, which oversee the work of many of the Australian standards committees, are coordinating a strategic approach to this issue. It is not however, a short-term fix for Australian exporters.

The alignment of Australian standards with international standards is a significant challenge to those who develop and write standards. This applies particularly to meeting the needs of Australian industry. The international move to develop standards based on performance, or which

[55] Building Regulation Review Task Force, Final Report (November 1991)

have multiple performance levels, places an additional responsibility on Australian standards committees to determine the performance levels that are appropriate for us.

10.6 Conformity assessment, mutual recognition and product certification

Products used in building and construction must comply with national building regulations. Procedures to assess conformity vary widely from country to country, both in practice and in their relative sophistication, depending on the strength of the technical infrastructure. In many cases the tests have to be undertaken in the importing country. Other countries accept the testing that is done in the exporting country.

Testing costs money. The additional costs to undertake multiple tests to conform with the requirements of the importing country can be prohibitive.

To overcome this, mutual arrangements to recognise conformity assessment systems should be developed with Australia's major trading partners. This would do away with the need for any additional assessment of conformity.

Australian manufacturers of building products are among the world's leaders. Many companies have made significant inroads into overseas markets and are multinationals in their own right. Doing away with the need for additional assessments of conformity would be a springboard for these Australian companies to further expand their penetration of overseas markets. In turn this would encourage other product manufacturers to explore export opportunities.

The Australian Building Codes Board (ABCB) operates a national product certification scheme. It enables the ABCB to issue a national certificate of conformity when all States and Territories agree that the product or system conforms to Australian standards. The scheme is available to all product manufacturers. The cost effectiveness of the national scheme will be monitored to ensure that it does not impose any unnecessary burden on manufacturers.

10.7 Training and education

The cultural change needed to achieve the full potential of the reforms will not happen unless the industry's widespread needs for education and training are met. Designers, building surveyors, certification officers and industry professionals working with building regulations and administrative systems will require education and training for the reforms to achieve their full potential.

The education system is adjusting to meet this need, but the pace must be accelerated. Multi-faceted education and training programs must be more widely available to ensure they meet the needs of the regulator and industry practitioners. They must also meet the needs of the community.

10.8 Consumer protection and builders' licensing

Building regulation is more than just fostering better construction and design. It also involves the relationships between builders and their clients and providing certainty for both parties.

As part of its response to Recommendation 31 of the Bell Report,[56] the Commonwealth Government undertook to develop with the States and Territories a nationally consistent framework to protect consumers. This included licensing builders. Recently, the Ministerial Council of Consumer Affairs endorsed the broad framework, although some consumer protection and insurance issues are still unresolved.

The framework is being implemented by the consumer affairs portfolios of the respective State and Territory jurisdictions concentrating on the residential end of the market. Action being taken includes Government regulations (builders' licensing), quasi-regulations (adopting standards of competency) and industry self-regulation (insurance requirements for professional indemnity cover).

These approaches are intended to encourage a high level of technical competence in practitioners and for practitioners to adopt sound business practices.

[56] Building Regulation Review Task Force, Final Report (November 1991)

The best long-term solution for consumer protection is to set a standard for the conduct of a business enterprise and carefully monitor that businesses comply. The private sector can provide training in business management, but the public sector is best placed to assess the compliance. A scheme like this may have to be underpinned by an indemnity fund established from licence fees which would recompense consumers who suffer losses caused by the failure of a business.

These approaches provide a high level of consumer protection at the least cost to the taxpayer. They also raise the overall level of competence of practitioners at the small operator end of the market. The approach applies equally to a single practitioner building a house and to a subcontractor operating in the commercial market. In addition, the subcontractor who is both good technically and runs an efficient business is better placed to manage the risk of contractual relationships with head contractors. This is an impetus for the whole industry to improve performance.

11.0 Market access and facilitating trade

Globally, the building and construction industry plays an important part in economic development. According to *Engineering News-Record* research into the construction market in more than 150 nations, countries around the world will spend approximately US$3.22 trillion on construction this year[57].

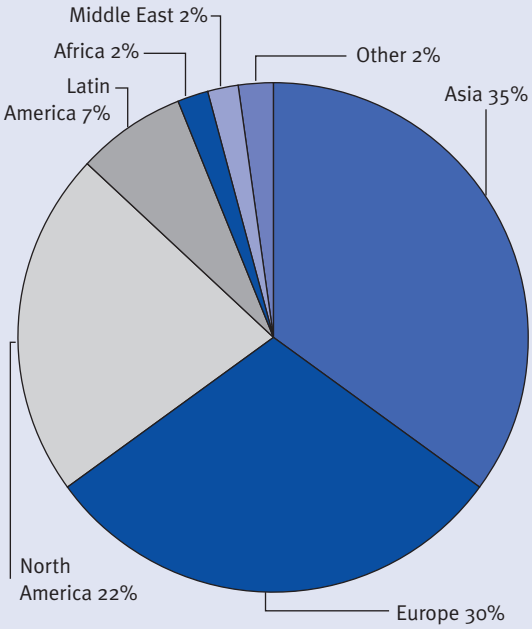
Asia, led by Japan and China, is the largest regional market, at US$1.124 trillion. Europe is just under the US$1 trillion mark, at US$995.6 billion. The US, the world's largest single-nation construction market, combined with Canada to provide US$723.6 billion in construction work in North America. Steadily growing Latin America came in at US$238.6 billion. The Middle East had US$76.7 billion, Africa US$59.4 billion and six Caribbean Islands on the list combined for US$5.87 billion.

The regional market shares are shown in Figure 11.1

As noted earlier, the industry is increasingly becoming globalised. Hand in hand with this trend have come international measures aimed at liberalising trade and promoting a "borderless world". Consequently, international trade has become increasingly competitive.

The cyclical nature of the industry will play its part in this. It will both encourage and inhibit the moves to export as a long-term strategy. In periods of higher domestic activity, firms can survive in the local market and not bother about exports. Paradoxically, when the domestic market dries up, some firms will be driven to diversify into exports. In either case, if firms do not take action now to set a long-term strategy to export they can damage both their domestic operations and their future as a global player. Action is needed now because it takes time to establish a competitive position in export markets.

Figure 11.1 Expected regional market shares in percentages(1998)



Source: Tulacz, G.J. (1998) 'A$3.2 Trillion World Market,' Engineering News Record, Nov 30/Dec 7 1998, p.1

In short, the competitive position of the Australian building and construction industry depends on aggressively embracing an export culture over the next decade. As argued strongly in this report, to do this the industry will have to underpin its domestic and international performance through:

- greater innovation and R&D;
- greater use of information technology;

[57] Engineering News-Record, (Nov 30-Dec 7 1998) - "A $3.2 Trillion World Market: World Market Overview"

- sharper focus on environmental sustainability; and
- building a critical mass to export successfully.

This is not beyond the industry. In the past 10 years its exports have grown from a low base to approximately $800 million a year. Export figures do not take into account the return on investment on overseas manufacturing facilities by Australian companies, which have been significant in the building products area.

Australian firms already have a strong presence in the Asia-Pacific region. This is either through exporting or establishing offices, strategic alliances, joint ventures and plants. By the mid-1990s, the Asia-Pacific region accounted for about 85 per cent of our building and construction exports.

Australia cannot consider itself a significant global player in the construction area. This shows up in an analysis of the world's top 225 construction firms, based on revenue derived internationally[58].

US-based firms have the greatest proportion, with 48. Japan is its nearest rival, with 28. China and Italy are also strong, while Australia, with only two firms in the top 225, has only a marginal presence. This shows up in Table 11.1

Analysing the top 12 firms, again by revenue derived from international operations, the truly international players come from the UK, Japan, the US, Germany, France and Sweden. They make some 40 per cent or more of their total revenue from international operations. In 1996, the top 10 firms controlled one-third of the international market. This highlights the trend for a relatively small number of firms to continue to dominate the international construction market. This is shown in Table 11.2.

Table 11.1 Top; 225 firms in the international construction industry (by revenue from international operations), by country of headquarters, (1996)

Country	No. of firms
US	48
Japan	28
China	27
All others	26
Other Europe	21
Italy	20
Germany	14
Korea	12
Britain	10
France	10
Netherlands	4
Canada	3
Australia	2
TOTAL	**225**

Source: El Gamal, A. (1998) 'The International Construction Market', unpublished paper

In 1996, 40 of the top 225 international contractors were active in the Australian market – another indication that leading firms in the international industry are globalising their operations. As part of this geographic push, they present themselves as local firms in the markets they are penetrating. This strategy involves a number of schemes, including the following:

- establishing regional and local subsidiaries;
- merging and acquiring;
- forming joint ventures and partnerships with local contractors;
- forming nationality group consortiums; and
- investing directly, participating in equity or securing external finance.

Overseas firms new to the international market are using these strategies effectively to gain entry. Established global firms are using them to increase their market share. It is clear that a few large players will dominate the global construction market. It is also clear that these large players will increase their share of the Australian domestic market. Australian firms have to take up similar strategies to compete.

[58] El Gamal, A (1998) - "The International Construction Market" unpublished paper cited in AEGIS, a forthcoming report, "Mapping the Building and Construction Product System".

Table 11.2 Leading international construction firms, by total revenue from international operations (1996), US$ billions[59]

Rank	Firm	Location of Head Office	Internal Revenue	Total revenue #	% of total Revenue earned from International Operations
1	The Kvaerner Group	UK	7.9	9.4	84
2	Mitsubishi Heavy Industries	Japan	5.4	12.7	42
3	Fluor Daniel Inc.	US	4.8	9.0	53
4	Bouygues SA	France	4.1	11.6	35
5	Betchtel Group	US	4.0	7.5	43
6	GTM-Entrepose	France	3.4	7.9	43
7	SGE	France	3.4	8.3	40
8	Hochtief AG	Germany	3.2	7.8	41
9	Phillipp Holzmann AG	Germany	3.2	9.1	35
10	Bilfinger + Berger Bau AG	Germany	2.7	5.4	50
11	Skanska AB	Sweden	2.5	5.4	46
12	Kajima Corp	Japan	2.3	14.9	15

** All revenue figures include the earnings of subsidiaries*
 # Total revenue equals international plus domestic revenue

11.1 Challenges and opportunities facing the Australian building and construction sector

In July 1998, the Department of Industry, Science and Resources hosted an industry workshop. This was part of the consultation process to develop an Action Agenda to consider the challenges and opportunities facing the Australian building and construction industry. The main challenges identified were:

- to increase company capacity and capability to be able to export;
- to maximise industry benefits from the involvement of Australian governments;
- to understand the changing global market and business opportunities; and
- to understand and overcome the barriers to exporting.

It is one of the purposes of this report to find the answers to those four challenges. They are discussed in turn and form an action summary.

11.1.1 Increasing company capacity and capability to export

The workshop identified many of the issues that form the central themes of this report. A key was for the industry to recognise the importance of integrating supply capability to generate a "total package" approach.

Historically, the construction sector is fragmented. The underlying supply chains and business systems are immature. The culture is the short-term project-to-project approach. The increasing globalisation of the construction market will require a dramatic change to a more strategic, long-term and enduring approach to deliver a total construction service.

Increasingly, clients are seeking integrated solutions for their projects. To meet their requirements, they want project managers and prime contractors to provide the complete range of construction services. Construction firms will have to change the methods they use to manage the design, production, distribution and service components of the supply chain.

In future, Australia's building and construction performance will have to be driven by its ability to adapt rapidly and embrace innovation,

[59] Derived form Engineering News-Record, Supplement to December 22, (1997 edition).

information technology and new forms of project delivery and to improve its business skills. If industry takes up these themes, firms will be able to take part internationally in supply chains, networks, joint ventures and alliance partnering arrangements. These business arrangements will be underpinned with gains from the use of information technology and other tools. This will improve the capacity of Australian firms to export by overcoming some of the limitations of the structure of the industry where most firms are smaller than their global competitors.

At present, the level of these activities in the industry is not sufficient to increase the capacity and numbers of firms working cooperatively in the international arena. Because of this, the Commonwealth Government supports the development of a number of industry-driven demonstration models.

The Department of Industry, Science and Resources has also worked with industry associations and State and Territory Governments to produce a consolidated guide to industry-specific programs to assist building and construction firms to export. Videos and other marketing material are also available for public and private sector organisations to market Australia's capability in building and construction.

11.1.2 Maximising the benefits from the involvement of Australian Governments

Issues of access to overseas markets and facilitating trade in the building and construction industry are being addressed on a whole-of-government basis. The Department of Industry, Science and Resources (ISR) carries out its activities in close partnership with the Department of Foreign Affairs and Trade (DFAT) and the Australian Trade Commission (Austrade).

At the government-to-government level, a number of bilateral linkages have been established with counterpart government departments in markets that offer significant opportunities for trade. Memoranda of Understanding (MOU) have been signed with Japan, China and Indonesia. These relationships open up opportunities for Australian industry to enter and expand activities in these markets. The MOUs provide a framework which highlights trade opportunities and allows technical and regulatory impediments to trade to be addressed. MOUs are reviewed periodically to ensure they still assist Australian industry.

ISR also works with Austrade and industry to identify new emerging markets and to provide preliminary information on their regulatory systems. The Government will continue to address market access issues in potential export markets.

11.1.3 Understanding the global market

As a government organisation, Austrade has official status operating an international network of offices which allows it to identify potential overseas buyers, agents and strategic partners for Australian exporters. Austrade also identifies and passes on specific business export opportunities as they arise.

Invest Australia is a partnership between Austrade and the Department of Industry, Science and Resources. Invest Australia has offices in Canberra, Sydney and Melbourne and an Investment Commissioner network in eleven offices around the world. Invest Australia also utilises the resources of Austrade and the Department of Foreign Affairs and Trade's overseas networks, and the expertise of the Department of Industry, Science and Resources to attract and facilitate investment into Australia.

The technical support infrastructure provided by the Government provides the building and construction industry with a conduit to markets as well as market intelligence.

11.1.4 Understanding and overcoming barriers to exporting

The Commonwealth Government recognises that variations between standards and conformance requirements in Australia and export markets can be a barrier to exporting.

To overcome the difference in standards, the Government has launched a three-pronged strategy. This is to:

- align Australian and international standards;
- influence the development of international standards so they recognise the needs of the Asia-Pacific region; and
- encourage regional economies to bring their domestic standards into line with International Standards Organisation (ISO) standards.

ISO standards tend to reflect European industry, which makes them less relevant and less likely to be adopted by regional economies who comprise our target market. To overcome this, Australia is using APEC as a forum to identify regional factors that need to be recognised in truly international standards. Australia is also encouraging APEC economies to join in the development of ISO standards and bring their own standards into line where possible.

This is not a short-term fix for Australian exporters. But the involvement of technical experts from Australian industry to write standards, both here and internationally, is a tangible, long-term investment in export success.

The Government also recognises that different assessments of conformity can pose a barrier to trade in goods and services. The additional costs to carry out multiple tests of products to conform to the requirements of the importing country can be prohibitive. To overcome this problem, the Government will try to make arrangements for conformance systems in target markets to be recognised mutually.

The General Agreement on Trade in Services (GATS), which was concluded in 1994, provided for successive rounds of negotiations. The first was to begin no later than 1 January 2000. It is likely that these negotiations on services will be launched at the WTO Ministerial Conference, to be held in Seattle from 30 November to 3 December 1999.

As well as reviewing GATS rules and procedures, WTO members will be encouraged to extend and deepen their commitment to liberalise service protection. Australia has already made more comprehensive and liberal commitments in most sectors compared with other Asia-Pacific countries. Australia, therefore, will urge other countries to match our commitments and reduce their barriers to trade.

To prepare the Australian negotiating strategy, the Department of Foreign Affairs and Trade will compile a database of barriers to market access in our trading partners. An indicative list of barriers to trade in services which face our companies or individual professionals in foreign markets includes:

- limits on the number of licences granted to foreigners;
- restrictions on foreign direct investment;
- requirements for a minimum number/percentage of local directors/managers/staff;
- restrictions on the form of commercial presence, eg, only individuals or partnerships allowed;
- requirements for joint operations or joint ventures with local professionals;
- requirements on nationality or residence attached to practising rights;
- limited access of foreign suppliers to projects above a certain amount;
- requirements to use local services;
- requirements to employ local professionals;
- lack of temporary employment visas for executives and specialists;
- requirements on licensing or qualifications that discriminate against foreigners; and
- discriminatory or non-transparent taxation regimes.

Huxley Group of companies breaks through in the Japanese housing industry

The Huxley Group has been designing for Australian conditions since 1969, and constructs around 1000 homes every year in Australia. However, in 1996, because of perceived 'crowding' of the domestic market, The Group made the decision to enter overseas markets. In an alliance with BHP, Australia's largest steel manufacturer, the Parramatta-based Huxley Group established a Steel Framed Housing Division to work toward this expansion.

The innovative Huxley EcoHome system uses the Light Steel Framing System (EcoFrame) which was researched and developed by BHP in the 1980's and 1990's.

The Huxley Group has gained a major breakthrough for Australian building technology by winning the Article 38 Approval from the Japanese Ministry of Construction to build houses using the BHP technology. The Group has built a two storey exhibition home in central Tokyo, which features a rooftop terrace and outdoor courtyard, a living room, four bedrooms and two bathrooms in 180 square metres living area.

The Department of Industry, Science and Resources (ISR), through its establishment of a technical group representing Australian industry and its links with the Japanese Ministry of Construction has worked to assist companies to comply with the Japanese building regulation environment. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) conducted tests on behalf of the Huxley Group and provided a technical contribution in the negotiations with the Ministry of Construction.

When the system is approved by the Japanese Government Housing Loan Corporation the Huxley Group plans to market it in Japan through joint ventures with Japanese partners.

12.0 Conclusion

This analysis has identified challenges facing the Australian building and construction industry such as the utilisation of Information Technology tools, innovation and research and development. Environmental issues, innovative procurement and project delivery mechanisms and managing the supply chain have also been identified as impacting on construction practices. Other issues including the role of regulation and challenges of 'going global' have been examined.

The Action Agenda process aims meet these challenges by establishing a partnership between Government and industry to increase productivity, flexibility, efficiency, research, innovation and exports. It outlines the respective roles of industry and Government in achieving this end.

The Government will play a pivotal role in promoting change within the industry, but to be effective it requires a corresponding level of commitment from the industry. With Government and industry working together on a range of initiatives to assist in achieving the industries potential, the gains are well within reach.

Appendix A

A. 1 Overview of projects in Stage 1 of the International Cost of Construction Study

Integrated Hotel and Tourism Resort
This project is based on a resort on a coastal location and therefore uses materials and systems relevant to a tropical climate and has the limitations of construction in a remote location. The project is also designed for a hot and potentially cyclonic environment, which may not necessarily be built under normal circumstances in some of the countries that are part of this study.

The project is estimated to take 18 months to construct in all countries. It contains guest accommodation and facilities, resort administration and maintenance facilities, mainland services and an 18-hole golf course.

Commercial Office Building
The project is based on a high-rise office development in an Australian capital city. It provides for 46,000 m^2 of net lettable space. The design of the project is perhaps more recognisable and capable of substitution in other countries than the hotel project described previously, despite large climatic differences (such as between UK/Germany and Singapore/Indonesia). Nevertheless, the basic design is not fully transportable. The ratio of net lettable area to gross floor area is expected to vary considerably where issues such as higher allowances for car parking space (US) and more stringent egress provisions (Australia) differ, and this will directly affect the true cost of the project in eachcountry.

The project is estimated to take 32 months to construct in each country. It contains basement car parking, steel-framed office tower with precast floor panels and curtain wall facade, and some minor external works.

Factory Shell
This project is based on a new packaging and storage facility built in an industrial area within metropolitan Sydney. The project is representative of typical construction for a factory shed and its design is therefore largely transportable across all countries.

The project is estimated to take seven months to construct in all countries. The built facilities have a gross floor area of approximately 2400 m^2 plus car parking for 176 vehicles.

Major Multi-Purpose Sporting Stadium
This project is based on a new sporting stadium built in the City of Melbourne. The project is a contemporary design, and despite wide differences that can occur with facilities of this type, it reflects an internationally transportable solution.

The project is estimated to take 27 months to construct in all countries. It has a gross area of 104,405 m^2 and contains spectator seating for 52,000. The project features a retractable roof, but excludes equipment and fitout, basement car parking and precinct infrastructure costs.

Multi-Lane Highway/Freeway
This project is based on upgrading an existing arterial highway within 100 km of a provincial city. The price has been calculated using a schedule of quantities of civil works, road pavement and bridge construction.

The project is estimated to take eight months to construct in all countries. It contains 14 km of concrete dual carriageway and substantial earthworks assessed as 40 per cent drill and blast, 20 per cent rippable rock and 40 per cent other than rock.

Underground Commuter Rail

This project is based on a new rail link in suburban Sydney. Different methods of construction have been adopted where appropriate, so an international comparison is realistic.

The project is estimated to take 20 months to construct in all countries, despite the different construction methods employed. It contains 3.66 km of track (comprising 1.48 km of tunnel) and one underground station.

Ethylene Production Plant

This project is based on the design and construction of a facility with capacity to produce 500,000 tonnes of ethylene per annum. It has been assumed that the project is in a remote location, but with shared infrastructure and feed facilities available.

The cost has been computed using quite a different methodology to that employed for the previous projects. The plant is considered to be an international prototype and therefore only a part of the total cost is subject to local factors. The project has been based on a A$530 million actual project built in Australia, adjusted for labour costs, productivity, import duties and transportation of equipment in-country. Plant equipment, purchased by international tender, is typically sourced from Europe, US or Japan.

The project is estimated to take 24 to 36 months to construct (including commissioning) depending on location. It contains equipment purchased by international tender (including freight, insurance and import duty), 0.5 million man hours of design work, two million man hours of construction, site establishment, fees and supervision.

A.2 Construction industry performance

The building and construction industry plays an important role in economic development. The countries examined in the International Cost of Construction Study are working to increase construction productivity through human resource development, technical guidance, mechanisation and support for research and development. These countries see competitiveness in the industry as crucial and are pursuing policies with this as the objective. Also, they are promoting partnerships between the public and private sectors in the industry.

With the exception of Germany, all selected countries are using Build-Own-Transfer (BOT) projects or other forms of private sector involvement to develop power plants and other types of infrastructure. They are hoping that private sector involvement in domestic infrastructure projects will attract direct investments from abroad. Involving the private sector is expected to bring about efficient infrastructure development.

Infrastructure projects in China have attracted private sector funds into BOT projects. The private sector is involved in the development of power plants and other energy sector projects, telecommunications infrastructure, transport infrastructure, water systems and other sanitation facilities, and tourist facilities. At present, Singapore does not practice BOT, Build-Own-Operate (BOO) or Build-Lease-Transfer (BLT) for infrastructure projects. However, private sector involvement in infrastructure projects has been increasing due to the corporatisation of several major public agencies.

The construction markets of the Asia-Pacific region provide challenging opportunities. However, understanding the structure and dynamics of the region are crucial as globalisation impacts on the national building and construction industries.

The UK and the US use a wide range of procurement systems in both the public and private sectors. They include the following traditional and alternative procurement and delivery systems:

- Traditional Lump Sum
- Provisional Lump Sum/Schedule of Rates
- Cost Reimbursement (Cost-Plus)
- Design & Construct Contract
- Construction Management
- Project Management
- Build, own, transfer (BOT) and Build, own, operate and transfer (BOOT).

The German industry is very conservative in its procurement systems. To date, few projects have used alternative procurement systems. This is despite the scale of the recent building boom in Berlin brought about by the move of the Government from Bonn, and the need to accommodate parliamentary and ministry staff.

The Asian countries use several different bidding systems, such as public bidding, selective bidding, and negotiations. The type of system to be used is decided on the basis of the nature and size of the project, special technical considerations, urgency, and other factors. With the emphasis that has been placed upon liberalisation and fairness in recent years, there has been a trend toward more transparent and open systems. In China, a greater percentage of contracts are now being awarded using some kind of bidding system. Hong Kong, Singapore, and India are increasing their use of the design-construct system to take advantage of special technologies, shorten project time and reduce costs.

In China, open tenders, invited tenders, and negotiations are used. The Regulation for Project Tendering formulated in 1992 requires that contracts for all projects be awarded through a tendering process except in special projects. The percentage of contracts awarded through a tendering procedure rose to 40 per cent, and today the percentage of invited tenders in all tendering systems is 80 per cent.

In Indonesia, the most common systems are open competition, selective competition, and negotiated contracts.

Contracts in Singapore are usually awarded on the basis of open tendering, selective tendering, negotiated contracts, serial contracts, or design and construct contracts. Open tendering is the most commonly used form of public sector procurement. A contract is normally awarded to one of the two lowest-priced bids. The government will begin working in 1999 to formulate the new Public Sector Standard Conditions of Contract for design and construct projects, which are increasingly more common in both the public and private sectors.

The Agreement on Government Procurement (GPA) was part of the World Trade Organisation (WTO) Treaty that was signed in 1996. The GPA requires that signatory members do not discriminate against products, services and suppliers of another member. This includes the procurement of construction goods and services.

With this trend toward a 'borderless world', the European and US markets are open to construction companies from around the world. For the West Europeans, this has reversed a long tradition of not allowing foreign contractors into their local markets.

Following the GPA, Asian countries are adopting market-opening policies to attract foreign investment. Japan, South Korea, and Singapore are opening their markets. Vietnam and the Philippines are relaxing restrictions on capital inflows and India is deregulating and working on market-opening legislation. Foreign firms are also increasing their presence in China, Indonesia, and Malaysia.

The Chinese Ministry of Construction now allows overseas building firms to contract for projects within Chinese territory, after the government issues a Qualification Certificate of the Foreign Contracting Enterprise to allow operation in the domestic market. Companies from 13 different countries and territories are now active in China. The Construction Law, the law dealing with building and construction activities, was promulgated on 1 March 1998. The purpose of this law is to establish an open, competitive, and orderly construction market.

In Indonesia, once a foreign construction firm has established a representative office and formed a joint venture with a domestic construction firm to carry out a particular project, the Government issues it with a three-year construction licence. The registration fee is US$100. The Indonesian Government has been working to open its markets ever since it first took steps toward deregulation in the early 1960s. By 1996, 225 construction firms from 29 different countries were active in Indonesia. The Indonesian Government is encouraging domestic contractors to become more specialised, develop the capability to take part in design-construct and turnkey projects, and provide more training for their technical personnel.

In September 1996, Singapore's application to join the Agreement on Government Procurement (GPA) was approved by the World Trade Organisation (WTO). Singapore is meeting the GPA requirements of members on procurement of construction goods and services within the regulatory framework already established there by the Construction Industry Development Board (CIDB). For example, from July 1999, all CIDB-registered G6-G8 contractors will have to be certified to the ISO9000 standards.

Apart from these general construction industry issues, a number of other contextual factors also bear on the appropriate comparison of construction performance between countries. These are discussed under separate sub-headings. However, without an adequate supply of primary data on these issues, the commentary is largely circumstantial.

A.2.1 Site location

It has already been suggested that costs vary according to the proximity of the site to large population centres. This variation can be as much as 25 per cent. The countries most affected are Australia, China and US, particularly for projects such as highways. On the other hand, inner city development can attract its own cost penalties, and it is difficult to generalise. Smaller countries like Singapore would usually have an advantage. Overall this factor is not of great importance for the majority of construction projects.

A.2.2 Site conditions

Foundation conditions and access will impact on project cost. Stage 1 of this study assumed identical site conditions, and therefore the derived costs were are not affected. It is worth mentioning, however, that particular problems such as the high water table in Jakarta and other parts of Indonesia make underground construction difficult and expensive. Projects would not normally be designed with large basements and an underground railway project is unlikely to ever be built there. Singapore also has a slight disadvantage in parts of the island where extensive land reclamation has occurred. Again, from an overall perspective, the impact of site conditions on the comparison is minimal.

A.2.3 Climatic variations

Seasonal variations in climate can affect the comparative costs of projects. High rainfall areas will result in less productive days on site and extend the project duration, creating inefficiencies. But a more significant issue is the design of the projects themselves. Climatic conditions will usually affect the materials and systems used in buildings, which may result in quite different solutions being adopted. This situation undermines the methodology of pricing a standard design across various countries. Some adjustment is necessary therefore where Australian designs are assumed to be built in other parts of the world. The construction of a tropical resort in northern Europe, for instance, is a clear example.

A.2.4 Regulatory standards

Perhaps the most important contextual factor is regulatory standards. Building codes and practice differ widely between the sample countries, and the impact on cost of additional requirements is undeniable. Car parking requirements for US office developments and egress provisions necessary for Australian high rise developments are two classic examples. Cultural differences will also impact on project design and layout, as well as design philosophy, material choice and standards of occupant comfort.

Germany has a high level of quality assurance that must be considered when making a comparison with other countries such as Indonesia and China. Australia, UK and US also have quite high standards of workmanship. These benefits can lead to long-term operating benefits such as reduced maintenance, longer component life and energy efficiencies.

A.2.5 Government controls

Political intervention by governments can both improve and hamper a country's construction performance. Positive benefit occurs where countries introduce policies to encourage best practice and to increase incentives for better productivity. Negative benefit occurs where intervention is either ineffective or increases administrative processes for little gain. Generally the developed countries out-perform the developing countries in this area.

A.2.6 Coercion/ethical factors

Coercion is inevitable in some form, but where an industry is characterised by routine payments to officials, disguised in the form of "fees", then overall inefficiencies will occur. *The Economist* (16 January 1999, pp. 21-23) examined a range of countries from the point of view of coercion (although admittedly not specific to the construction industry) and presented a comparative index. On a scale of 0-10 (10 being the least corrupt), Denmark was rated in first place with an index of 10. Interpolating the graph, Singapore had an index of about 9, UK about 8.5, Germany about 8, US about 7.5 and Indonesia about 2. Australia and China were not surveyed. It is widely acknowledged, however, that in both China and Indonesia, while these countries are trying to stamp out such practices, isolated examples of unethical dealings can still be found.

A.2.7 Imported resources

Highly developed countries such as the US and the UK would have little need to import large amounts of construction resources for their projects. This tendency is reflected in the prices calculated in Stage 1 of this study. Countries such

as Singapore, with few natural resources, need to import a relatively high proportion of resources. Distance from the import source is also a factor. In the case of the petrochemical project, for example, it was noted that the supply of specialist equipment was likely to be sourced from just a few destinations, particularly US, Japan and northern Europe. Therefore countries like Singapore, Indonesia and Australia would incur higher costs due to the larger distances involved in transportation. Import duties further impact on this situation.

A.2.8 Industry maturity

Germany, UK, US and Australia have developed mature building and construction industries comprising supply chain systems that can deliver efficiencies at the project level. These include issues such as alternative methods of procurement outlined earlier in this report. It also relates to the skills of workers and the training infrastructure that supports them. All of these issues give an advantage when making international comparisons.

A.2.9 Innovation

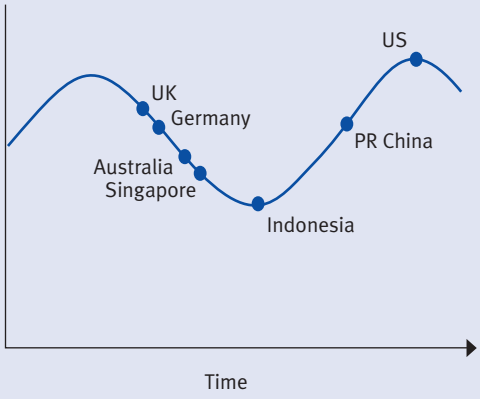
Following on from industry maturity, a propensity for innovation is more likely to be found in a well-developed building and construction sector. There is a relationship between the implementation of systems, particularly information technology, and achieving industry goals such as providing value-added services. Innovation is also linked to the level of research and development.

A.2.10 Building cycle

It is generally accepted that the building and construction industry is cyclical, ranging from periods of boom to bust as investors try to build in advance of a perceived demand for space. Due to the delays between investment decision making and completion of projects, there is often an "over-shooting" of supply as markets become saturated with particular types of facilities and investors turn to other alternatives. In recent times the Asian economic crisis has resulted in a rapid slow down of construction activity throughout South-East Asia. Singapore has weathered this problem better than many countries due to targeted Government capital works projects that have replaced the down-turned private sector market.

The countries included in this study are at various positions in the building cycle. Despite this, the estimates produced in Stage 1 were generally based on "normal" prices ignoring special factors, such as the effect of the Sydney Olympic Games development on industry activity. The need to adjust prices according to overall economic performance is reflected in purchasing power parity calculations, and therefore it is important that estimated costs are not adjusted using some other index to account for building cycle position. Nevertheless, the current performance of the industry is an important factor of a fair comparison. The following chart indicates the possible position of each country in the cycle.

Figure A1 Building cycle overview



Source: Construction Economics

A.2.11 Labour productivity

Labour costs are a significant component of the in-country estimates. Low wage economies such as China, Indonesia and Singapore enable lower overall construction costs to be achieved. Productivity would be considerably less in these countries, and therefore the efficiency of the workforce is markedly different. The productivity factor directly impacts on overall construction times. It is generally recognised that US projects are built faster, this being a function of their industry structure, procurement methods and constructional methods. Lost time on site through

a range of factors such as inclement weather, work stoppages and safety issues also are relevant.

A.2.12 Environmental considerations

Environmental considerations include the concern for minimising environmental impact, reducing waste and maximising resource deployment. In the developing world environmental considerations are given little weight. This is understandable, as it would be inequitable for the developed countries, having depleted their environments during their push for industrialisation, to then expect the developing countries not to use their resources to enable similar development processes. While the environment is not a factor that will significantly affect international comparisons, more emphasis is being placed on these issues now, than in the past, and such a trend can only continue.

A.2.13 Site safety

Given the substantial empirical evidence of construction safety, more concentration has been given to this factor.

The separate States in Australia are responsible for legislation and regulation of construction industry safety. There are some differences between the States, but the overall pattern is one where the employer has to ensure that a site is as safe as possible. Although the Australian construction industry has a poor safety record compared with other industries (with the exception of agriculture), by international standards it appears to be exceptionally well managed. There are two reasons for this. First, it is largely due to the emphasis that the unions have placed on safety, as one of the few reasons they have for stopping work on a site, and second the cost of workers compensation insurance (premiums paid for Occupational Health Safety and Rehabilitation [OHS&R] expenses to State Government authorities).

The industry in both China and Indonesia has a reputation of being extremely unsafe by the standards of Europe or America. Virtually no safety equipment (netting, side-walls, and the like) is seen on sites, and many workers lack boots, gloves and helmets. No legislation currently exists that regulates safety practices in the building and construction industry or site management. Equally, no statistics on fatalities or injuries in the building and construction industry in these countries are available.

The building and construction industry in Singapore was known as the graveyard industry in the early days of the country's development, because of the high accident and fatality rate. The large number of unskilled foreign workers in the industry was a major reason for this. In 1985 the Ministry of Labour introduced the first regulations for safety in the industry, and required the employment of safety supervisors. The accident frequency rate fell from 5.5 cases per million man-hours in 1985 to 2.6 cases per million man-hours in 1993. In 1994 the Ministry of Labour implemented compulsory safety management systems and safety audits for building projects. This places responsibility on building company managers to develop a safety management system. This is modelled on the ISO9000 certification for quality management systems that is compulsory for large contractors in Singapore. Safety plans are now often required as part of the tender documentation, and these plans are frequently audited to evaluate their efficiency and effectiveness.

In the UK, the Health and Safety at Work Act (1974) and subsequent regulations cover all industries. Generally, the risk of a fatal injury is about four times greater in the UK building and construction industry than in manufacturing, and the risk of a major accident about 1.5 times greater. Over the 1980s the average deaths per 10,000 persons was around 0.85, and major injuries averaged 0.15. In both cases the trend for more injuries and accidents is rising. A Government officer will give a ruling if there is a safety dispute, however most sites are far in excess of requirements for safety. The Working Rule Agreement allows for safety representatives to be appointed and also a safety committee. The safety representative can only make representation to the employer and cannot stop work.

In Germany, a separate authority nominated by Government will provide a determination on whether a condition on site is safe or not.

Accidents in the industry are almost double the average of all industries. However, safety disputes are not an issue of collective bargaining but an issue of law. A body which is independent of Government administers occupational health and safety. However, within a company, safety is a major role of the Works Council which normally resolves a problem or can inform the public authority if the occupational health and safety provisions are not correct. The authority makes spot checks on safety every four to six weeks and provides a list of items to be fixed. Normally the project is allowed to continue. There is a specialist for electrical work and large sites have a safety representative. The union representatives are no more or less responsible than other workers for safety. The Works Council is responsible for site safety and is expected to both visit the site and receive any complaints. Overall, the safety performance of the construction industry is good.

In the US, by the late 1960s the rising industrial injury rates became significant enough to warrant the establishment of the Occupational Safety and Health Administration (OSHA) in 1970. This Federal agency is charged with monitoring a wide range of job-site safety and health standards through on-site inspections and investigations. As the central Federal agency, OSHA can impose fines and sanctions on violators. The construction site is generally regarded as one of the most dangerous industrial settings. The 1990-91 Bureau of Labor Statistics estimates of occupational injury and illness found that construction had the highest incident rate of all sectors for total cases of lost workdays. Thus a fairly contentious debate over the path to reducing construction-related injuries has developed.

A.2.14 Industrial disputes

In the marketplace today, the time lost due to industrial disputes is not as significant as it used to be. Australia in particular had a reputation for strikes, particularly politically-motivated actions, which threatened the ability of the industry to be internationally competitive. Most countries have dispute resolution processes which enable site activities to continue while the matter is resolved. Nevertheless, countries like Singapore, China and Indonesia have minimal industrial actions and therefore have an advantage over more developed countries where issues of maintaining living standard and wage relativities are fundamental issues.

A.2.15 Research and development (R&D)

The percentage of GDP returned to the industry through research and development enables improvements in materials, systems, procurement methods and innovation to be pursued. In many countries, including Australia, investment in R&D is at very low levels. Countries like UK, Germany, US and particularly Japan are quite different. While the benefits of R&D might be evident in the construction costs that have been calculated, it has a more pervasive effect that realises long-term gains and enhances international competitiveness.

A.2.16 Taxation

Taxation considerations vary from country to country and from one year to the next. Most countries have some form of goods and services tax (GST). UK has 17.5 per cent, Germany 15 per cent, Indonesia 10 per cent and Singapore 3 per cent. Although the US does not have a GST, State taxes effectively equate to 8-10 per cent on all goods and services. China also has Government fees which take the place of consumption taxes. Currently Australia has a high sales tax regime. Assuming an introduction of a 10 per cent GST, the level of sales tax will be effectively removed, and for many materials this will result in a cost reduction. Overall the effect of an introduced GST is not expected to be significant for the Australian building and construction industry, although it may adversely affect the comparison by between 3-5 per cent. Further research is necessary to confirm this impact.

A.3 Summary of factors

A.3.1 The main cost issues

The costs have taken into account local labour prices, importation requirements and national taxation structures. Commodity adjustment has enabled these costs to be viewed in the context of national living standards, and by removing exchange rates as a key part of the methodology, has negated common criticisms of international comparisons.

Regulatory standards differ between countries and it is therefore understandable that a generic design that is priced locally may overlook this impact. The cost of constructing a five-star office building of 50,000 m^2, for example, in each country without specifying the actual design may lead to quite different results. It is expected that the impact of regulatory standards could lower the costs in countries other than Australia by 5-20 per cent.

When considering cost, it should be recognised that most of the countries examined have some form of GST. While Australia currently does not, it is expected that the impact on the overall comparison will be minimal. This is because the removal of sales tax for many materials will in part offset the new GST. Australia is contemplating a 10 per cent GST, but UK has a 17.5 per cent tax and Germany a 15 per cent tax. Indonesia has a 10 per cent tax, Singapore a 3 per cent tax, and China and US have no official GST. In the US, it is estimated that in many States local taxes equate to between 8-10 per cent of the price of all goods and services.

Remote sites may increase costs over metropolitan sites by as much as 25 per cent. Even the cost to construct in major cities can vary. *Rawlinsons Australian Construction Handbook*, using Sydney as a base index of 1.00, identified a range of costs from 1.07 in Darwin to 0.8 in Brisbane. This compares internationally with the UK, where major centres can range from 0.70 to 1.06 compared with London, and in the US, where they can range from 0.79 to 1.21 compared with Los Angeles.

A.3.2 Time issues

Time to construct has been estimated for each project type, but in Stage 1 these durations were assumed to be constant across the nominated countries. It is generally acknowledged that construction in the US is often faster for some project types because of different construction methods, material choices and procurement styles. On the other hand, overall construction time is less in Asian countries due to the use of 24-hour site operation strategies.

Lower labour costs in Asian countries to some extent mask the lower productivity that can be expected from their workforces. Less time lost due to bad weather and industrial disputation is also worth considering. Use of offsite fabrication, now common in many western countries, can minimise delays on site as well as increase quality. Greater use of automation on site will quicken this trend.

Choice of contractual method will obviously impact on time performance. Use of innovative procurement systems will lead to efficiencies throughout the construction industry. These practices exist in western countries. Indonesia and China tend to rely on traditional procurement options. Materials handling decisions will dictate site productivity performance. Cultural variations may lead to less efficient choices. Limited availability of plant and equipment and poor access to material supplies will not only increase construction time but cost as well.

A.3.3 Quality issues

Quality is a function of cost and time. Higher construction costs may lead to higher quality, and restrictions on time may lead to lower quality. Anecdotal evidence suggests that construction quality is high in Australia, Singapore, UK, Germany and US but relatively poor in China and Indonesia. Quality is linked to workmanship standards and adequate supervision, which in turn is a function of education/training systems and available labour resources.

A further issue is operational costs. Poor initial construction quality linked to low capital costs may lead to high maintenance and energy costs. There is evidence to suggest that operating costs can far outweigh initial costs over a 30-year time horizon. Relying on capital cost as the basis for industry performance evaluation is therefore taking a narrow view of overall efficiency.

Quality Assurance (QA) is a contemporary practice, but in some countries adequate QA procedures are not yet common. Contractor selection criteria will determine the quality of the finished product. In many countries, Australia included; the low profit levels in the industry make it less likely to regularly deliver a high quality product, on time and within budget.

Bibliography

ACIL Consulting, 1998, *Skill Development and Training in the Building and Construction Industries*, Department of Industry, Science and Resources, Canberra

Atkinson, MM, and Coleman, WD, 1989, *Strong States and Weak States: Sectoral Policy Networks in Advanced Capitalist Economies*, in British Journal of Political Science, No 19, January

Australian Bureau of Statistics, 1995, *Australian National Accounts: Input/Output Tables*, Catalogue No 5209.0

Australian Bureau of Statistics, 1998, *Australian System of National Accounts*, Catalogue No 5204.0

Australian Bureau of Statistics, 1998, *Manufacturing Industry, Australia*, Catalogue No 8221.0

Australian Bureau of Statistics, 1997, *Private Sector Construction Industry, Australia*, Catalogue No 8772.0

Australian Expert Group in Industry Studies (AEGIS), University of Western Sydney, Macarthur Campus, 1999, *Mapping the Building and Construction System;* and *Building and Construction Product System: Public Sector R&D and Education and Training Infrastructure* (both forthcoming), Department of Industry, Science and Tourism, Canberra

Australian Financial Review, 1999, *Australian Architects Best in World*, Australian Financial Review, 18 January

Australian Graduate School of Management and the Building Research Centre, University of New South Wales, 1998, *Information Technology in the Building and Construction Industry: Current Status and Future Directions*, Department of Industry, Science and Resources, Canberra

Australian Pacific Projects Corporation, 1998, *Procurement and Project Delivery in the Building and Construction Industries*, Department of Industry, Science and Resources, Canberra

Australian Procurement and Construction Council, 1997, *Construct Australia - Building a Better Construction Industry in Australia*, Australian Procurement and Construction Council, Perth

Australian Procurement and Construction Council, 1998, *Construct Australia - Forecast of Construction Industry Activity: Australia and all States and Territories*, Australian Procurement and Construction Council, Perth

Bakens, W, 1994, *Future Organisation of the Building Process: Interim Results of a W82 Study Project*, CIB Working Commission, the Netherlands

Building Regulation Review Taskforce Final Report, Nov 1991

Coates and Jarrett Inc., 1994, *Infrastructure and Construction 2025: Project 2025, A Phase Two Report*, Coates and Jarrett Inc., United States

Commonwealth of Australia, 1998, *Building for Growth: a draft strategy for the Building and Construction industry*, Australian Government Printing Service, Canberra

Commonwealth of Australia, 1997, *Investing for Growth: The Howard Government's Plan for Australian Industry*, Australian Government Printing Service, Canberra

Commonwealth Treasury, 1999, *Economic Roundup* (Summer Edition), Commonwealth Treasury, Canberra

Construction Forecasting Committee, 1998, *Non-Residential Construction Forecasts: Short Term Prospects July 1998*, Construction Forecasting Committee, Canberra

Construction Training Australia, *Building and Construction Workforce 1998-2005 - Strategic Initiatives: Draft Discussion Paper*, Construction Training Australia, Melbourne

Danish Building Research Institute (SBI), *SBI in Brief*, Danish Building Research Institute, Horsholm, Denmark

Department of Foreign Affairs and Trade STARS database

Department of Industry, Science and Resources, 1998, *Australian Building Regulations, Standards and Conformance Systems*, Department of Industry Science and Resources, Canberra

Department of Workplace Relations and Small Business, 1998, *Report on Workplace Relations Issues in the Building and Construction Industries*, Department of Industry, Science and Resources, Canberra

Engineering News-Record, 1997 & 1998, *Supplement to December 22, 1997*; and *A $3.2 Trillion World Market*, Nov 30/Dec 7 1998

Ernst & Young, 1998, *Mergers and Acquisitions Index 1998*, Ernst & Young, Melbourne

Gattorna, J (ed.), 1998, *Strategic Supply Chain Alignment: Best Practice in Supply Chain Management*, Gower Publishing, London

German Federal Government Ministry for Research and Technology, 1993, *The German Delphi Report on the Development of Science and Technology*, Federal Government Ministry for Research and Technology, Germany

Housing Industry Association, *Housing 100 1997/98*, Housing Industry Association, Canberra

IBIS Business Information Service, data contained in IBIS Industry Sets B1411, B1419, C2313, C2323, C2542, C2621, C2623, C2631, C2632, C2633, C2634, C2635, C2741, C2742, C2749, C2911, C2919, E4111, E4121, E4122, E4113, L7711, L7712, L7720, L7821, L7822, L7823, L7829

Industry Commission, 1991, *Construction Costs of Major Projects*, Australian Government Printing Service, Canberra

Industry Research and Development Board, *R&D Scoreboard '98: Business Expenditure on Research and Development*, Industry Research and Development Board, Canberra

Japanese Ministry of Construction, 1994, *Outline of Research and Development in Construction Technology*, Ministry of Construction, Tokyo

Japanese Science and Technology Agency, 1992, *Outputs from the Japanese Delphi Survey for the Sector - Urbanisation and Construction*, Science and Technology Agency, Tokyo

KD Consultants, 1991, *Construction, A Challenge for the European Industry: Defining Priorities for R&D*, for the Commission of European Communities, DGXII

KD Consultants, 1991, *The Open Building Process: Future Organisation of the Building Process*, paper delivered at Workshop 37 at the 2nd European Construction Symposium held in the Netherlands

McKinsey and Company Australia, 1995, *Growth Platforms for a Competitive Australia*, McKinsey and Company, Melbourne

Melford, DA; Rice, PDR; Bonfield, W; Waterman, N; and Ashby, MF, 1989, *Industrial Materials for the Future? A Wish List From Some Major Materials - Using Sectors*, London

National Institute of Economic and Industry Research,1998, *Australia's Building and Construction Exports*, Department of Industry, Science and Resources, Canberra

New South Wales Department of Public Works and Services, 1998, *Economic and Environmental Life Cycle Costs of Buildings*, Department of Industry, Science and Resources, Canberra

New South Wales Department of Public Works and Services, 1998, *Environmental Management Systems Guidelines*

New South Wales Government, 1998, *Construct New South Wales*

Newton, PW, 1999, *Built Environment Sector Outlook*, Commonwealth Scientific and Industrial Research Organisation (Division of Building Construction and Engineering), Melbourne

Page Kirkland Partnership, 1999, *International Costs of Construction Study - Stage 1 Base Cost of Construction*, Department of Industry, Science and Resources, Canberra

Pietroforte, R, 1997, *Building International Construction Alliances: Successful Partnering for Construction Firms*, E and FN Spon, London

Royal Australian Institute of Architecture, 1998, *1998 Profile of the Architectural Profession*, Royal Australian Institute of Architects, Canberra

Technical Resources Pty Ltd, 1998, *Regulatory Reform in the Building and Construction Industries*, Department of Industry, Science and Resources, Canberra

Technology Development Centre Finland, 1997, *Progressive Building Process - Technology Program 1997-2001*; and *Well-being Through Construction in Finland 1997*, Technology Development Centre Finland, Helsinki

The Global Construction Market and International Contracting, a presentation by the University of Reading and Skanska to the Construct IT forum held in Cambridge, United Kingdom, 19 and 20 November 1998

United Kingdom Department of the Environment, Transport and Regions, 1998, *Rethinking Construction*, Department of Environment, Transport and Regions, London

United Kingdom Office of Science and Technology, 1998, *Foresight in Business - Preparing for the Future: Foresight in the Construction Industry - A Case Study*, Office of Science and Technology, London

University of Technology, Sydney - Construction Economics, 1999, *International Costs of Construction Study - Stage 2 Evaluation and Analysis*, Department of Industry, Science and Resources, Canberra

United States Department of Commerce, 1992, *A Competitive Profile of the Construction Industry*, National Institute of Standards and Technology, United States

Unfinished Business, joint industry submission to Planning, Housing and Local Government Ministry, 1998