

**Selling Solutions:
Emerging Patterns of
Product-Service Linkage
in the Australian Economy**

**Australian Expert Group in Industry Studies
University of Western Sydney
in collaboration with the Australian Business Foundation
and the Australian Research Council**

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PREFACE

The project whose findings are reported here explores the emerging picture of the linkages between products and services in the Australian economy and highlights the implications for business strategy and public policy.

This project was undertaken by the Australian Expert Group in Industry Studies (AEGIS), funded by the Australian Research Council (ARC) through a SPIRT grant. The industry partner sponsoring this project was the Australian Business Foundation (ABF).

AEGIS research focuses on elucidating the dynamics of industrial growth and development, mapping product systems so as to reveal and analyse the drivers of innovation in different industries. AEGIS focuses on exploration and analyses of innovative capacity in industry, including both technological bases and organisational arrangements, and the relationships between such capacity and economic growth. The aim is to provide a more effective base for public policy development so as to assist with Australia's shift to the knowledge-intensive economy the nation needs in the twenty-first century.

AEGIS has expertise in the analysis of the dynamics of innovation in many industries, including building and construction, heavy engineering, furnishings, textiles, clothing, footwear and leather, tool making, medical devices, health industry products and services and processed food. The Group is also involved in international work on clusters and collaboration in innovation in a national sample of industries and on knowledge-intensive service activities.

The Australian Business Foundation is an independent, not for profit private sector research think-tank founded and sponsored by the leading industry organisation, Australian Business Limited.

The Australian Business Foundation has a single mission – to conduct and disseminate ground-breaking research that advances knowledge and fosters new thinking and best practice on Australia's competitiveness, prosperity and jobs.

The Foundation became the industry partner with AEGIS in the conduct of this study into the dynamics between manufacturing and services to better understand the business models and industry structures emerging as enterprises seek to secure competitive advantage in the new knowledge economy.

AEGIS gratefully acknowledges, the support of both the ARC and the Australian Business Foundation. Without this support, the study would not have been possible. In particular, we wish to thank Ms Narelle Kennedy, Chief Executive of the Australian Business Foundation, for her intellectual input and the financial resources of the Foundation which allowed us to undertake the survey of New South Wales manufacturers.

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EXECUTIVE SUMMARY

'You can hardly pick up a newspaper these days without reading yet another glowing account of the golden prospects supposedly in store...If media comment is any guide, almost everyone... is convinced that new information-based businesses and other postindustrial activities have superseded manufacturing as the font of prosperity. The truth is that America's steady retreat from manufacturing cries out for close scrutiny... Not only do those who advocate postindustrialism overestimate the prospects for postindustrial services, but they greatly underestimate the prospects for manufacturing. A major problem with the argument of postindustrialists is that they do not understand how sophisticated modern manufacturing truly is.' (Eamonn Fingleton, *In Praise of Hard Industries*. 1999)

A story of manufacturing and services

For several decades manufacturing suffered a bad press, associated in the public mind with 'rust belt' industries and the decline of the areas they long dominated. The view of manufacturing as a declining field of modern Western economies was widespread among both policymakers and the public interested in economic development. This was fuelled by statistics showing rapid growth in service sector employment and the movement of manufacturing employment towards the third world, the sunbelt regions of the USA or southern Europe to take advantage of lower taxes, tailor-made training courses and a better lifestyle for executives tired of long northern winters.

In Australia a move of population towards the sunbelt of Southern Queensland seemed to herald a similar trend. Numerous studies over the last two decades have focussed on the economic significance of the service sector and suggested the arrival of the 'service economy', particularly in Australia.

By several measures, the size of the Australian manufacturing sector does indeed appear to be shrinking. The share of domestic manufacturing output in the Australian economy has been steadily decreasing since the 1970s, so that by 1997 manufacturing's share amounted to only 14% of GDP rather than the 21% average for all other high-income nations. In Australia by the end of the 1990s, services as traditionally measured accounted for around 75% of GDP, around a quarter of the country's export earnings in 2000 and eight out of ten jobs. It thus appeared that in terms of economic activities, the contribution of services is highly significant.

For several years these trends in services growth were analysed in terms of the perceived decline of manufacturing and the contrasting growth of what was seen as a largely autonomous services sector. The 'decline' in manufacturing was sometimes referred to as a process of 'de-industrialisation', while other scholars later theorised about the emergence of a 'post-industrial society'. The economic significance and value of manufacturing to developed economies were soon recognised again, however. A pathbreaking book in the late 1980s emphasised that 'manufacturing matters' by arguing that much service activity

growth could only be understood as a function of its linkages with manufacturing, meaning that many services needed manufacturing to grow (Cohen and Zysman 1987).

Blurring the boundaries

The importance of manufacturing to the wellbeing of an economy came to much greater analytical prominence in the 1990s as both analysts and policymakers in many OECD countries realised the importance of innovation. The decade showed that the main stable employment growth areas in the 1990s were in manufacturing fields and manufacturing was the sector of greatest investment in R&D and innovation.

Manufacturing sectors in some countries, especially in the areas being transformed by or involved in the production of the new information and communication technologies, were the places of highest wages and job growth in the permanent full time jobs that all countries were seeking. The growth of new technologies and associated organisational changes and the spread of strategies of innovation as the sources of sustained competitive advantage also threw the analysts' ball back into the manufacturing court.

Much of the confusion about the relative positions of service and manufacturing industries stems from the lack of clear analytical separation between service activities, service sectors and service industries.

'*Service industries*' typically include tourism, financial services, producer services, retail, healthcare and so on. '*Service activities*', on the other hand, are services produced by both service and non-service industry firms, either for their own use or for the use of other firms or consumers. Service activities, whether produced internally or purchased, are very important to manufacturers and, according to some estimates, account for between 60% and 75% of the input costs of modern manufacturing. '*Service sectors*' sometimes refers to service industries and sometimes to different smaller or more specialist areas within these industries, such as software creation within the communications industry.

Both service industries and sectors and service activities have grown substantially in recent years, although in different ways. Service activities produced by manufacturers are often innovative and require skilled personnel. Service industries or sectors may or may not be innovative, in much the same way as manufacturing industries differ.

The debate

There have been several dimensions to the debate about the linkages between manufacturing and services and the reasons for this are now more visible. Some analysts see the linkages as reflecting a rise in the service intensity of manufacturing as manufacturing industries increasingly draw heavily on inputs from service industries. Others see the apparent rise of services as linked to shifts in consumer demand.

The OECD (1999) has traced growth in service industries – as registered in the statistics – to a shift to outsourcing by manufacturing firms of some or all of the services they previously carried out in-house. Such outsourcing makes the provision of services statistically visible as they are performed by separate productive entities and can thus be counted in the usual way. The greater degree of organisational specialisation involved in the shift is also seen as a driver of productivity performance.

Their important position in relation to modern manufacturing has ensured that much debate about the size of the manufacturing sector has centred on the position of what is known as 'producer services'. These are services such as accountancy, intellectual property and other legal services, consultancy, R&D performance, transport and logistics and other activities which underpin a successful manufacturing business. Their growth leads observers to argue that manufacturing and producer services should be seen as a single economic sector. Thus, some argue that the decline in manufacturing is not large if producer services and manufacturing are considered together as a broadly defined manufacturing industry. The share of manufacturing has remained fairly constant in many economies.

Other observers go further, concluding, indeed, that statistical evidence suggests an emerging '*integrated manufacturing-services sector*' as 'the complex of production and service activities involved in the creation, production, and distribution of manufactured goods' and arguing that this sector is one of the most rapidly growing segments in the Australian economy (Pappas and Sheehan 1998: 131).

In this view, the blurring of old boundaries has clearly proceeded a long way. Characterising this blurring, several observers have referred to the newer trend of 'servicisation' of manufacturing, that is, the shift towards linking products and services together in one package for clients, together with the sale of 'solutions' rather than products across a broad range of industries.

Our study explores the extent to which and, more especially, the ways in which this blurring of activities between manufacturing and services is proceeding in practice in Australia.

The study approach

The focus of the study reported here is the different forms of service provision strategies appearing across the Australian economy. Specifically, the study looks at the various ways in which firms link products and services, whether in single packages or other forms. What we found led us to question the common notion that 'manufacturing matters, but services succeed'. The data gathered show how many firms in both manufacturing and service industries are putting together products and services into 'packages', suggesting the need for a broader review of how a service-rich economy may work at firm level.

We looked at the strategies of a broad spectrum of enterprises, including manufacturers of a range of old and new economy products; project-based firms, such as those in engineering and construction whose work proceeds project by project, mixing products and services; contract manufacturers; and telecommunications 'bundlers'. All had come from very different past practices but converged into developing new and specific strategies to seek competitive advantage through linking products and services.

The project gathered information using two empirical data collection methods. The broadest was a mail-out survey completed by 479 manufacturers in New South Wales. Designed by the Australian Expert Group in Industry Studies (AEGIS), the survey was administered between July and August 2000 by Australian Business Limited (ABL), a leading member-based business services organisation. The survey was complemented by detailed case studies based on unstructured and semi-structured interviews with 60 companies in several sectors of the economy. The interviews explored the specific ways in which companies produce and package products and services, especially focusing on the

reasoning behind firms' adoption of different kinds of product-service linkage as a competitive strategy.

CONCLUSIONS

The study concludes that the recent growth in service industries as a proportion of GDP and the labour force does not indicate the arrival of what some commentators have called the 'service economy' or 'post-industrial' society. Rather, it suggests the growth of a multiplicity of competitive strategies in which:

- manufacturers are increasingly incorporating services into their offerings to customers, an essential part of what has been called 'new manufacturing';
- service firms are increasingly taking products produced by others and adding a broad range of services, in turn often stimulating the creation of new physical products; and
- project-based firms are linking services to services, as well as products to services.

Thus the most important overall message from the study is that manufacturing is clearly not in decline. Quite the contrary; it is often in the forefront of the development of the new products and processes that constitute a dynamic modern economy. In common with many service and project-based firms, manufacturing is in a process of transformation to meet the demands of new markets in which the customer is king.

Manufacturing firms have moved more and more to link products and services as a central element of their broad competitive strategy. This strategic linkage can be found across many sectors, especially those making complex products or acting principally as project-firms, but their strategies vary along a number of dimensions. In the process of 'servicisation', manufacturers are sometimes redefining themselves, but they still make the products that constitute the basis of the 'solutions' they are selling to clients. In turn, many service firms depend on the availability of the products at the heart of their product-service packages.

We suggest that the best way to view this convergence of activity is to see economic organisations as creating '*product-service packages*', whether the producing firms are classified formally as in manufacturing or service sectors. Moreover, we suggest that each link in many supply chains should also be viewed as being composed of product-service packages, not product inputs alone. Finally, we show that firms producing these product-service packages or 'solutions' are much more likely to collaborate in their production with other organisations. To the degree that collaboration stimulates knowledge flows and hence innovation, these enterprises are more likely to be innovative than are others.

Our study sought to identify the factors that are driving this convergence of business strategy across both manufacturing and services. We found that eight 'drivers' or influences are especially important in most areas and come into play in different industries in different ways. These are:

- customisation and the power of the client (customer demand for greater value and attention to specific needs)

- position of the firm in the supply chain of its product (influences both the potential to offer services and the kinds of services offered)
- the novelty of the products (novelty creates demands for training and information on product use)
- cost considerations (the more expensive a product is, the more likely are clients to request maintenance services)
- geographical proximity to final markets (the further away, the more likely are services such as maintenance to be added)
- added functionality requirements (demand from customers for additions to basic products)
- regulations and standards surrounding a product (which encourage provision of compliance services)
- outsourcing (which encourages supplier firms to add services to their product).

This suggests that we can draw out several messages for businesses thinking about their competitive strategy, for analysts and for policymakers.

Messages for business:

1. *Collaborate with other firms but also with public sector research organisations*
2. *Increase the number and broaden the range of services offered*
3. *Stay close to customers*
4. *Rethink the internal organisation of the enterprise's activities*
5. *Invest in new skills*

Messages for analysts

1. *The study shows that there are in fact three areas of 'manufacturing-service sector' being created, not one, and they are being created in different ways. These emerging areas are composed of product-service integration during production; product-service packaging close to point of sale; and diverse forms of product-service bundling.*
2. *The study shows that we need to re-view how we see the dynamics of the entire economy and lose some of the current emphasis on 'sectors'.*
3. *We need to view the economy, at least for some purposes, as largely and increasingly composed of product-service packages rather than, in most cases, of either products or services.*
4. *We also need to refocus our lenses when viewing the operation of the economy at industry level.*

Messages for policymakers

1. *Policymakers need to refocus the lenses that they use for viewing the industrial landscape and devising policies to assist enterprises.*
2. *Policymakers need to think much more creatively about the packages of policies they offer and rethink many existing ones.*
3. *Venture capital funds may want to rethink their policies so that they encourage the production of product-service packages rather than physical products alone if they wish to maximise their investment.*

Several manufacturers interviewed told us how their activities had shifted so far away from pure goods production that they no longer considered themselves as manufacturing companies. One electronics manufacturer explained that: *'We do so many different things now. We're not just about making things, so much so that I'm not sure we classify as a manufacturing company any more.'*

This comment raises the question 'Is Australia still a manufacturing country or has its economy shifted definitively to providing services?' The answer is now clear: Australia continues to be a manufacturing nation, but it is joining many others in shifting to mixing products and services in many and diverse ways. However, the service industries of Australia seem to be less linked to manufacturing than they are in other places. This may be in part because of the nature of the industrial structure, where manufacturing has been grafted onto a strong resources base.

It is clear from our study that there is enormous diversity in current manufacturing competitive strategies, linking all kinds of service activities from conceptualisation and design to installation to maintenance. It also shows how the newer technologies incorporated into ICT products help link products and services and have created a whole new area of coordination of economic activity. Linking products and services into ICT packages is not only a huge growth industry in its own right but it is also stimulating the creation of new physical products on which to hang new services.

In such ways, manufacturing and service industries interact, interlink and grow competitively in both national and international markets.

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CHAPTER 1: NEW MANUFACTURING: BUILDING LINKS BETWEEN THE PRODUCTION OF GOODS AND SERVICES

'You can hardly pick up a newspaper these days without reading yet another glowing account of the golden prospects supposedly in store...If media comment is any guide, almost everyone... is convinced that new information-based businesses and other postindustrial activities have superseded manufacturing as the font of prosperity. The truth is that America's steady retreat from manufacturing cries out for close scrutiny... Not only do those who advocate postindustrialism overestimate the prospects for postindustrial services, but they greatly underestimate the prospects for manufacturing. A major problem with the argument of postindustrialists is that they do not understand how sophisticated modern manufacturing truly is.' (Eamonn Fingleton, *In Praise of Hard Industries*. 1999)

Introduction

For several decades manufacturing suffered a bad press, associated in the public mind with 'rust belt' industries and the decline of the areas they long dominated. The view of manufacturing as a declining field of modern Western economies was widespread among both policymakers and the public interested in economic development. In the 1980s and early 1990s, this view seemed to be confirmed by the apparent shift to employment in the services sector, both in Australia and in most OECD countries. This shift has meant that by the mid-1990s almost three quarters of the employed population in several countries, including Australia, had what were seen as exclusively service industry jobs.

The trend towards service sector employment in the most advanced OECD economies seemed to many observers to be 'inevitable' stemming from a movement of manufacturing employment towards the third world where wages were lower or to sunbelt regions of the USA or southern Europe to take advantage of lower taxes, tailor-made training courses and a better lifestyle for executives tired of long northern winters.

This was the view in the USA that Fingleton was questioning in *In Praise of Hard Industries* but applied equally in Australia which also seemed to be turning away from manufacturing employment, with high growth in proportions of the labour force working in tourism, the finance sector and other service industries.

In response to the growth of the service sector and an apparent decrease in manufacturing's share of GDP in most industrialised economies, numerous studies over the last two decades have focussed on the economic significance of the service sector and suggested the arrival of the 'service economy' (see especially Gershuny and Miles 1983; Hirst and Zeitlin 1991). Similarly, the governments of many industrialised countries have recently begun to direct more policy attention to promoting particular service industries – leisure, tourism, education or health - or the growth of the service sector in general (see, for example, ISR 1999a, 1999b).

By several measures the size of the Australian manufacturing sector does indeed appear to be shrinking. The share of domestic manufacturing output in the Australian economy has been steadily decreasing since the 1970s so that by 1997 manufacturing's share of GDP was one of the lowest among developed nations and amounted to only 14% of GDP. This compares with a share of around 21% of output for all other high-income nations (World Bank 1999).

Some economists have argued that the trend towards a reduction in the share of manufacturing in GDP and a shift to services is symptomatic of industrial economies where there has been a substantial rise in income per capita. Kaldor long ago argued that when levels of income per capita increase so does demand for services, while there is a corresponding drop in demand for manufactured goods (1966).

On some measures again, it is clear that there has indeed been a substantial growth in activities in the services sector in many economies in recent decades. In the OECD between 1985 and 1997, around two-thirds of GDP growth in the business sector resulted from growth in the services sector. In Australia, services as traditionally measured accounted for around 75% of GDP and around a quarter of the country's export earnings in 2000. Services have also become very important in terms of employment so that in 2000, the service sector accounted for eight out of ten jobs (ISR 2000). It thus appeared that in terms of economic activities, the contribution of services has been highly significant.

For several years these trends were analysed in terms of the perceived decline of manufacturing and the contrasting growth of what was seen as a largely autonomous services sector. The 'decline' in manufacturing was sometimes referred to as a process of 'de-industrialisation', (Kaldor 1966) while other scholars later theorised about the emergence of a 'post-industrial society' (Bell 1973; Kuznets 1972; Rowthorn 1987).

Not all agreed with these early observations, however, and other observers soon focussed again on the economic significance and value of manufacturing to developed economies. In particular, in a pathbreaking book published in 1987, Cohen and Zysman argued strongly that 'manufacturing matters'. These authors argued that much of the growth in service activity in modern Western societies could only be understood as a function of its linkages with manufacturing. These linkages mean that many of the most important services in many economies needed manufacturing to grow. Conversely, should manufacturing decline, one could expect the service sector to decline as well. In other words, the fate of manufacturing mattered to other sectors.

Since this period of argument and counter-argument, several observers have sought greater understanding of the dynamics of the manufacturing sector and the linkages between manufacturing and services (Hirst and Zeitlin 1991; Griliches 1992; Lester 1998).

The importance of manufacturing to the wellbeing of an economy achieved much greater analytical prominence in the 1990s as both analysts and policymakers in many OECD countries came to realise the importance of innovation. It became clear from international statistics that the main stable employment growth areas in the 1990s were manufacturing fields, while at the same time it also became evident that, as measured by the indicators brought together in the Frascati and Oslo Manuals, manufacturing was the sector of greatest investment in R&D and hence it seemed in innovation. Manufacturing sectors in some countries, especially in the areas being transformed by or involved in the production of the new information and communication technologies, were also the places of highest

wages and job growth in the permanent full time jobs that all countries were seeking. The growth of new technologies and associated organisational changes and the spread of strategies of innovation as the sources of sustained competitive advantage threw the analysts' ball back into the manufacturing court.

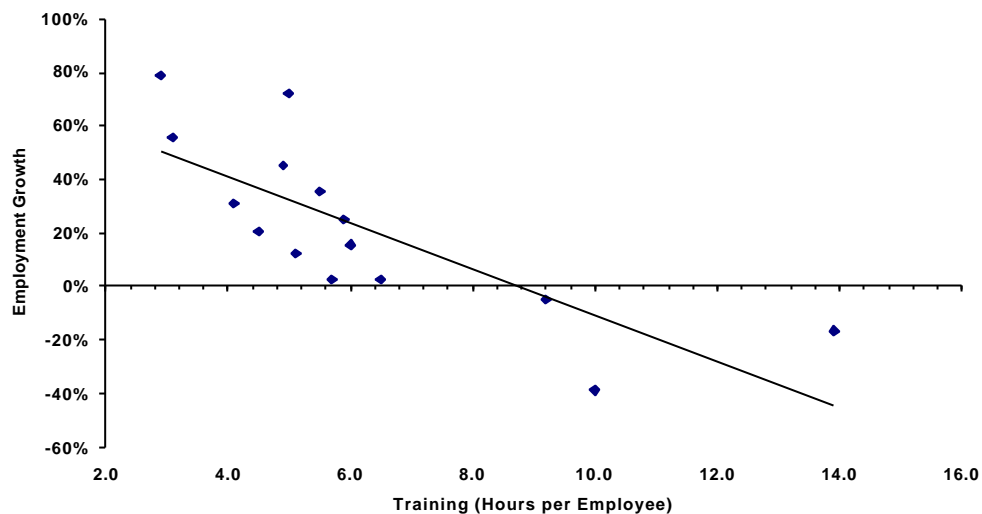
Relying on statistical indices of the 'sectoral' kind misses some important elements of the working of modern economies and the usual analytical 'lenses' used to view relative productivity and hence the view of the relative proportions of activity in an economy may not be appropriate. It may also be the case that the dynamics of the industries concerned have not been the subjects of appropriate empirical investigation.

Statistics on manufacturing's share of GDP can be misleading because they are affected by what is known as the 'productivity-price paradox' whereby the price (in relative terms) of the outputs of industries with higher productivity declines against industries with lower productivity (Griliches 1992; Industry Commission 1996:23). In this way, even if manufacturing increases its volume of output, its share of GDP may decline relative to other industries which have a lower rate of productivity growth (Miles 1994: 245; Toner 2000: 21).

In Australia there has been steady growth in the productivity of manufacturing measured against output per manufacturing worker. A 1997 report by the Industry Commission found that manufacturing accounted for 50 per cent of all productivity growth in the market sector of the economy (Industry Commission 1997: Tables 5.2-5.3). Similarly, Toner (2000: 24) points out that 50 per cent of the long-run growth of living standards (increase in output per worker) is generated by manufacturing industry and that manufacturing industry has been responsible for a high proportion of the expansion in skilled employment in recent years.

In contrast, in the early 1990s employment in the services sectors - in Australia mostly tourism, hospitality and retail - had been growing fastest in areas of the lowest skill. In line with this focus on low-skilled employment, the service industries, as usually defined, were those which invested least in R&D and in worker training. The employment/training relationship (excluding education & agriculture) for the 1985-95 period is shown in Figure 1.1 which suggests that the Australian economy is broadly characterised by faster employment growth in lower skilled broad occupational groups; lower wage industries; industries with a lower measured propensity to innovate; and in industries with a lower commitment to training.

Figure 1.1 Employment Growth by Industry 1985-95 v. Industry Training



Source: ABS 6353.0, ABS Labour Force, Reproduced in Marceau et al. ,1997: 8.16

Manufacturing in Australia also continues to be the most innovative field when measured by investment in R&D or responses to national innovation surveys, as shown by Table 1.1 below. ABS surveys in 1993 and 1997 showed that manufacturing was undertaking more innovation than were the service industries. Also using ABS data, Marceau and Manley (2000) showed that in the 1990s manufacturing continued to devote a relatively high percentage of expenditure to R&D and employed the most scientific and technical personnel. Toner has also noted that manufacturing makes a sizeable contribution to product and process innovation in Australia and is thus a crucial player in wider processes of technical change in the economy (2000). This is in line with international trends as seen in OECD data during the 1990s (see Marceau and Manley 2000).

Table 1.1 Australian Industries' Expenditure on R&D, 1996-1997

Industry	Expenditure (\$ millions)	Percent of total
Manufacturing	2434	59.0
Mining	546	13.2
Wholesale and retail	201	4.9
Finance and insurance	94	2.3
Property & business services	514	12.5
Scientific research	152	3.7
Other	183	4.4
All Industries	4124	100.0

Source: Research & Experimental Development, All Sector Summary, ABS 8112.0

Manufacturing also retains a critical place at the heart of consumer expenditure by OECD populations. Worldwide there is also no evidence of post-materialism in the sense of a decline in the consumption of manufactured products. Australians are now consuming higher amounts of manufactured goods than ever before, a demand that cannot be met by domestic production alone. In 1996-97 imports of manufactured goods were equivalent to 106.2% of Australian manufacturing industry gross product (Manufacturing Industry Australia 1996-7). These statistics alone suggest that the view that, as incomes have risen and countries and individuals get richer, they spend more of their income on services rather than goods, seems to be mistaken. Moreover, recent evidence shows that, for the last 20 years in the USA, the proportion of incomes spent on the purchase of goods has paralleled the proportion spent on services. This means that as people have become richer, they have increased their spending on *both* goods and services in the same way (Lester 1998b).

Classification issues: service activities, service industries and service sectors

It is becoming clear that the separation for the purposes of statistical data collection of activities and industries into the separate categories of manufacturing and services has been over-rigid.

First, national data classify companies and industries according to their 'primary activity', a calculation based on the percentages of different kinds of firms' total activity. At the more aggregated level, such data may miss the full range of activities actually performed within firms, the growing links between industries and the role of manufacturing firms in driving many service activities. Unless these activities are classed as the core activity of the firm, they are excluded from this data. Pilat makes this point when he writes that 'the traditional industrial classification of services does not fully reflect the [services] sector's increasing complexity' (2000: 5).

Second, in previous studies of product-service linkages, employment data have been used to analyse the growth of *all* service jobs, both inside and outside manufacturing. These data reveal a significant increase in the number of service jobs but do not distinguish between services that may lead to innovation and services consumed by firms that may have a negligible impact on the capacity for innovation (eg internal accounting, cleaning and legal services).

Confusion about the relative places of manufacturing and services in the functioning of modern Western economies also abounds. One observer concludes, for example, that 'Despite all the talk of a post-industrial era, the OECD economies are still mainly devoted to the production, distribution, and allocation of material goods...Far from being "service economies" the OECD economies remain firmly anchored in the world of material goods' (Rowthorn 1997: 75). But he also concludes that 'A growing proportion of the people involved in this process are employed in specialist service firms or government agencies, whilst the share of traditional goods-producing sectors is declining...'. (1997: 75)

Some of the confusion about the relative positions of service and manufacturing industries stems from the lack of clear analytical separation between service activities, service sectors and service industries. Howells describes '*service industries*' as those sectors typically classified under ISIC national classification categories as 'services' (2000: 6). These include the well known tourism, financial services, producer services, retail, healthcare and so on. '*Service activities*', on the other hand, are services produced by both service and non-service firms, either for their own use or for the use of other firms or consumers. For

example, manufacturers may undertake testing, logistical services, design, quality control, planning, marketing and research and development for their clients or for their own product development. 'Service sectors' is a term often loosely used to describe either or both service industries, such as ICT, or segments of service industries, such as the production of software for the industry.

Both service industries and service activities have grown substantially in recent years, although in different ways. Services activities, whether produced internally or purchased, are very important to manufacturers and, according to some estimates, account for between 60% and 75% of the input costs of modern manufacturing (Quinn 1992; National Research Council 1994: 141). Service activities produced by manufacturers are often innovative and require skilled personnel. Service industries or sectors may or may not be innovative, in much the same way as manufacturing industries differ.

Appreciating the distinction between service industries and service activities is vital to understanding the growth and dynamics of each and, especially, understanding the linkages between services and manufacturing, the sources of the greater relative growth of the different activities and the characteristics of each area. Thus, for example, in both the international and Australian literature on innovation, service 'industries', such as tourism, have mostly been viewed as low-tech and as either not innovative or, at best, as passive recipients of innovation from other sectors. In this discussion, service *industries* are the focus of attention and in Australia the great majority, although by no means all, of service industries are indeed in the lower tech arena. However, even there, if such service industries are becoming more tradeable and exposed to competition, the competition may be stimulating improvements in performance (Baras 1984, 1986; Soete and Miozzo 1989; Miles 1994; Hipp, Tether & Miles 1999; Howells 2000; Pilat 2000). In Australia, careful scrutiny of the *R&D Scoreboard 1999* also shows that one third of the top 200 firms investing in R&D were in the services sector.

In terms of service 'activities', in contrast, Australia may be just as knowledge-intensive as other OECD countries. Much may depend on where and what kinds of services are produced and the kinds of relationships existing with other sectors. Thus, for example, many services are connected to manufacturing and if produced by knowledge-intensive firms, will be classed as knowledge-intensive services, but if they are produced by sectors seen as low knowledge-intensive they will also be seen as less knowledge-intensive. In other words, identical services produced in different places in the economy may be classified differently in assessments about their knowledge-intensity.

Building on the work of Pavitt on manufacturing firms (1984), Soete and Miozzo (1989) distinguish between three types of service sectors: *supplier-dominated services*; *production-intensive, scale-intensive and network services*; and *specialised technology suppliers and science-based services*. The term *supplier-dominated services* refers to a range of personal, public sector (such as education and administration) and retail trade and distributive services. *Production-intensive, scale-intensive and network services* are service industries that depend on large scale processing. This group includes services that are dependent on information and/or physical networks through the use of ICT and/or hardware technologies developed in the manufacturing sector (such as banking and telecommunications services). *Science-based or specialised technology* groups of service companies generate and develop their own innovations and new technologies which may become inputs to other areas as well. Sectors, as conventionally conceived, can reside in more than one of these categories (Soete and Miozzo 1989). Thus, for example, the

communications sector is both a large scale-intensive services sector and a science-based, specialist technology supplier sector. Service sectors, like their manufacturing equivalents, in other words, are of very different kinds and can be composite in terms of skills, knowledge-intensity and focus of activities.

Not only are there very different kinds of service activities but there are also important differences in the *degree and form of linkages between manufacturing and services as industries*. Studies of the growth of the service sector must take into account both the extent to which and the ways in which service activities and manufacturing are linked.

Blurring the boundaries: a new form of production and economy?

There have been several dimensions to the debate about the linkages between manufacturing and services and the reasons for which this are now more visible. Some analysts see the linkages as reflecting a rise in the service intensity of manufacturing as manufacturing industries increasingly draw heavily on inputs from service industries (Pappas & Sheehan 1998; Karaomerlioglu & Carlsson 1999). Others see the apparent rise of services as linked to shifts in consumer demand (Howells 2000; Pilat 2000). The OECD (1999) has traced growth in service industries as registered in the statistics to a shift to outsourcing by manufacturing firms of services previously carried out in-house. This makes the provision of services statistically visible as they are performed by separate productive entities and can thus be counted in the usual way. This greater degree of specialisation is also seen as a driver of productivity performance. The OECD-sponsored Business and Industry Policy Forum on the Service Economy, for example, thus recently concluded that:

‘There is an increasingly important bundling of services with products - such as software with computers. The relationship is a dynamic one, with software, for example, driving developments in computer technology, and vice versa. Outsourcing is a key factor in this development. With companies focusing on core competencies, more service-related functions are being sourced from specialised firms, which is improving performance in key areas’ (OECD 1999).

Some linkages clearly derive from the extent to which other sectors of the economy either provide or consume outputs from manufacturers. Interdependency between manufacturing and services, whether seen as activities or as industries, is also evident in Australia. Input-output analysis reveals the change in the intensity of the flow of goods and services among different industries in Australia for the period 1974 to 1993-94. Table 1.2 below shows that manufacturing has been increasingly reliant on inputs from the service sector (although there was a marginal drop between 1989 and 1993-94). At the same time, the services sector has decreased its reliance on manufactured inputs.

The percentages in Table 1.2, however, refer only to sectors and do not provide a sense of scale. The table therefore also incorporates information on the share of all transactions between sectors represented by sales between manufacturing and service industries. While the overall trend remains almost the same, the table indicates that manufacturing still supplies more to the service industries than the service sector supplies to manufacturing, although the gap slowly narrowed over the two decades 1974-1994.

Table 1.2: Change in transactions between services and manufacturing in Australia, 1974-1993-94

Part A – percentage of manufacturing or services inputs	1974	1989	1993-94
Manufacturing supply to services (% of intermediate transactions by service industries)	30.72	27.98	25.76
Services supply to Manufacturing (% of intermediate transactions by manufacturing sector)	25.79	30.62	29.65
Part B – percentage of all intermediate transactions	1974	1989	1993-94
Manufacturing supply to services % of intermediate transactions for the Australian economy	16.25	15.66	13.61
Services supply to Manufacturing % of intermediate transactions for the Australian economy	10.57	11.13	9.64

Source: Derived from OECD Input – Output Database 1996 & ABS consultancy services

Table 1.3 below shows three patterns for blocks of service industries supplying inputs to manufacturing. The first is a decline in the share of the supply of services to manufacturing by construction, wholesale and retail trade, community and social and personal services. The second pattern shows those industries that peaked in input exchange in 1989 and have since fallen back somewhat (electricity, gas and water, transport and storage). The third pattern of transactions includes industries such as restaurants and hotels, communication, finance & insurance and real estate and business services and has seen substantial growth during the period.

Table 1.3: Services supplied to manufacturing 1974-1993-4

	1974	1989	1993-94	1974	1989	1993-94
	all	all	all	all manuf.	all manuf.	all manuf.
	intermediate	intermediate	intermediate	intermediate	intermediate	intermediate
	transactions	transactions	transactions	transactions	transactions	transactions
Electricity, gas & water	1.01	1.22	0.87	2.45	3.35	2.67
Construction	0.32	0.04	0.01	0.78	0.12	0.05
Wholesale & retail trade	3.38	3.79	2.93	8.24	10.43	9.02
Restaurants & hotels	0.01	0.13	0.16	0.03	0.35	0.49
Transport & storage	2.34	2.32	1.96	5.70	6.39	6.02
Communication	0.00	0.39	0.38	0.01	1.07	1.17
Finance & insurance	0.53	0.95	0.86	1.30	2.61	2.64
Real estate & business services	0.02	1.53	1.91	0.05	4.22	5.88
Community, social & personal services	2.97	0.76	0.56	7.23	2.09	1.71
Total percentage	10.59	11.13	9.64	25.79	30.62	29.64

Source: Derived from OECD Input – Output Database 1996 & ABS consultancy services

Such examples underpin a debate concerning the degree of service-intensity of manufacturing activities. Some scholars have cited input-output and employment data which show the large number of workers which are classified in the statistics as working in manufacturing but are in fact performing service jobs. For these reasons Pappas and

Sheehan argue that there is 'clear evidence of the increasing service intensity of Australian manufacturing' (1998: 141).

As evidence of this interlinkage, some observers point out that, in recent years, manufacturers have been developing a broad range of services, including full turnkey products with various related services such as assembly, testing, system integration, material purchasing, design, labelling, distribution and repair and maintenance services (which accounts for much apparent consumer spending on 'services'). This is the incorporation of services within manufacturing. Indeed, according to a writer in the *Business Review Weekly*:

'One of the hallmarks of the new manufacturer is the inclusion of research and development as a central plank of a company's strategy. These companies also tend to pay more attention to areas outside their traditional field of operations; they get involved in distribution, marketing and customer relations – what is called the value chain. They often do not see a distinction between domestic and overseas sales and are ready to develop a product for any market. They are hiring more skilled workers but fewer unskilled ones' (Kavanagh 1999: 30).

On the service side, an even more radical transformation has occurred in the relationships between manufacturers and service providers in the creation and distribution of final products. This shift is especially clear in relation to the role played by some service industries in the economy, which constitutes a move towards greater dominance of the manufacturing supply chain by non-manufacturing service firms. This is not new but has not been sufficiently recognised. A decade ago Marceau and Greig explored the ways in which major retailers using the Quick Response system can dominate the clothing manufacturing chain (Greig 1992), following Senker in the UK who explored the ways in which supermarkets can dominate the food processing industry (1988). In 1999 a restudy after a decade by Marceau / AEGIS of the dynamics of innovation in the textile, clothing, footwear and leather product system in Australia confirmed the trend, as did another Marceau / AEGIS study of the furnishings industry in the same year. A current study of the food industry reveals exactly the same trends, both within Australia and worldwide.

Much debate has centred on the position of producer services. These are services such as accountancy, intellectual property and other legal services, consultancy, R&D performance, transport and logistics and other activities which underpin a successful manufacturing business. Nationally and internationally the area of greatest relative growth in service industries lies in the producer services sector. Since the sector is constituted by groups of firms engaged in providing services to producers of goods, their growth leads observers to argue that manufacturing and producer services should be seen as a single economic sector. Thus, Karaomerlioglu and Carlsson, for example, argue that 'the decline in manufacturing is not large if producer services and manufacturing are considered together as a broadly defined manufacturing industry. We assert that producer services are complementary to manufacturing. When they are viewed as such, the picture of de-industrialisation changes substantially.'(1999: 176) On this basis, they conclude that 'if a broader definition of manufacturing is used, the share of manufacturing has remained fairly constant' (1999: 175).

A new form of symbiotic relationship between manufacturing and services, whether seen as industries or activities, thus seems to be emerging. Many scholars have focussed on this

symbiosis and argue on this basis that it is increasingly difficult to distinguish between the services and manufacturing sectors. Richard Lester, for example, writes:

‘The traditional boundary between manufacturing and services is fast becoming obsolete. Manufacturing has traditionally meant the production of tangible goods, but for today’s customers it is the bundling together of the tangible object with an array of intangible services that makes for the most desirable, ‘service-enhanced product’ (Lester 1998: 15).

So important is this trend that Lester argues that it presents a ‘new agenda for economic growth’ (Lester 1998: 15). Pappas and Sheehan concur. They conclude, indeed, that their statistical evidence suggests an emerging ‘integrated manufacturing-services sector’ as ‘the complex of production and service activities involved in the creation, production, and distribution of manufactured goods’ and argue that this sector is one of the most rapidly growing segments in the Australian economy (1998: 131).

Manufacturing enterprises have thus reorganised their activities in many cases as part of a more general restructuring of the economy. The emergence of new forms of manufacturing activity may mean that we need to readjust the analytical lenses with which we look at the productive base of our economy. The blurring of old boundaries has clearly proceeded a long way.

Sometimes the blurring of the boundaries can mean a radical shift in relations between service and manufacturing firms, a shift which can best be appreciated by considering ‘industries’ as ‘product systems’ in which both manufacturing and service industries play a part in producing service-intensive ‘products’. Manufacturing may also become a ‘service’ industry. Howells (2000) describes the trend within manufacturing industry towards bundling together their physical products and associated services and notes how many manufacturing firms are increasing the proportion of their turnover earned from selling services in this way, as a single package or as ‘add-ons’ to products at different times.

Some manufacturers have gone further. Recognising their clients’ changing needs, they have begun to sell not only the product but also taking care of the further needs that the purchaser of the product would seek to fulfil. Thus, Rolls Royce sells flying hours, not just aeroplane engines. Going further again, manufacturers sell whole ‘solutions’ to their clients (Howells 2000; Pilat 2000). Examples given by Howells include the computer industry selling customers solutions to certain tasks as required, rather than simply selling them computers; health care companies offering integrated treatments; and crane manufacturers selling the capacity to lift heavy objects (Howells 2000).

In a similar vein, Pilat (2000) discusses how servicing changing client demand has led to the creation of long term customer-firm relationships that effectively involve a customer in defining *how the supplier can satisfy* his/her needs, not just indicate what the needs are. Such close user-producer relationships have in turn led to an increased emphasis on manufacturers providing services relating to quality and design, convenience, culture and recreation and the environment (Pilat 2000).

In many cases, the client firms are also in industry and what is sold is intermediate products, such as machinery or components for final products such as cars. But the same shift can be seen in relation to final consumer goods as well. In their 1999 report on the motor vehicle industry, PricewaterhouseCoopers predicted that in the future:

‘The auto industry will sell more than vehicles. It will identify and service widely diverse, geographically, economically and culturally differentiated ‘consumer lifestyle’ needs and aspirations over time. In mature markets, it will relate to and entertain consumers’ (PricewaterhouseCoopers 2000:3).

With reference to project-based production in the building and construction industry, Gann and Salter also describe how consumers increasingly expect more than just the good itself - they may now seek finance to buy it, transportation to move it, insurance to protect it, expertise to install it, landscaping to enhance its appearance, advice on how to maximise returns from it and/or expertise in managing it (1998: 443). In response, project-based firms can provide:

‘...planning, [installation], technical support, environmental analysis, design and engineering, systems integration, economic assessments, procurement advice, legal advice, teaching and training; and facilities management and operations support’ (Gann and Salter 1998: 442).

What are ‘services’?

So what are the ‘services’ that analysts are considering in these discussions and how do they differ from other ‘products’. Most definitions of services as ‘products’ emphasise that services are not tangible, that they are consumed at the same time as they are produced, and that they have intangible value added and are labour intensive (see discussion in Karaomerlioglu & Carlsson 1998: 177; ISR 2000). In practice, however, services do not always have these characteristics. In particular, some services are not consumed at the time they are produced; computer programming and life insurance are obviously of this kind. Some services are also delivered after the sale of a particular product, notably maintenance and repair services (Riddle 1986: 8). Other aspects of the definition face similar problems.

Many observers accept, however, the ISR definition of services as products that *‘deliver help, utility or care, and experience, information or other intellectual content – and the majority of the value [of services] is intangible rather than residing in any physical product’* (ISR 1999b).

Definitions of this kind do not evoke the diversity and nature of services themselves, however, and need greater refinement. Services include a broad range of activities, from the knowledge-intensive, such as computer and business services and software, to the relatively low-technology and lower-skill activities incorporated into various personal services. Services also serve different markets – consumer markets, intermediate (producer) markets, and state or public service markets – and involve different production processes, including the transformation of the state of physical objects, people or codified information (Miles 1994: 247). An important part of our study involves elucidating the different times at which and the ways in which different kinds of services are produced, added to products and consumed – that is, how and when products and services are linked.

Aim of the project, focus and approach

It can be seen from the discussion above that most of the analysis of services has focused on two features. The first focus is on the macro elements of the debate about the relationships between manufacturing and services and has been much influenced by the

question of the apparent ‘shrinking’ of manufacturing in modern Western economies. The second focus is on the trend towards ‘bundling’ end products and services post-manufacture into ‘solutions’ for clients which link products and services. This is the case where companies well known for their manufacturing expertise move into the operating side of their products, providing for instance not just aero-engines but a guaranteed amount of flying hours.

The first aim of the study reported on here is to deepen these studies by investigation of the variety of strategies of linked product and service provision across different sectors of the Australian economy, including both manufacturing and ‘service’ firms. A second aim is an exploratory mapping of the developments in these new aspects of productive activity. This investigation in turn enables us to investigate whether the linking of products and services is reshaping production processes in the Australian economy through shifts in organisational structure, inter-firm and user-producer collaboration, knowledge diffusion and innovation and, ultimately, changes in the overall structure of the Australian economy.

The major focus of the study reported here is thus on the different forms of service provision strategies – specifically the various ways in which firms link products and services, whether in single packages or other forms – appearing across the Australian economy.

What we found led us to rethink the common notion that ‘manufacturing matters but services succeed’. Rather we see manufacturing moving towards ‘selling solutions’, just as the more traditional views suggest that service and project-based firms have been doing. The data gathered show how many firms in both manufacturing and service industries are putting together products and services into ‘packages’, suggesting the need for a broader review of how a service-rich economy may work at the firm level. We looked at a broad spectrum of firms. All of these firms had strategies to link products and services. We found that products and services were linked closely together not only by manufacturing firms, but were also linked into ‘bundles’ by ‘service’ firms and into ‘projects’ by firms in a ranges of industries from construction to healthcare.

Methodology

To highlight the trends we adopted a micro perspective. We used a targeted questionnaire and in-depth interviews in New South Wales to focus at firm level on strategies adopted by manufacturers, by information and communications technology (ICT) service companies and by ‘project-based firms’ (such as those in engineering construction) to deliver products and services to customers (often as linked ‘packages’) as a means of gaining competitive advantage.

The survey results indicate how widespread are product-service linkage strategies among manufacturers; while the case studies allow us to illustrate the variety of patterns of service provision across different sectors.

The study provides the basis from which to analyse the significance of service-product linkage strategies for the organisation of company structures. It ultimately suggests that we need to see the trend towards ‘selling solutions’ in packages of goods and services as one which is fast linking together many areas of Australia’s economy. In turn, these developing linkages suggest that it may be useful to refocus our analytical lenses and view the

economy as a series of linked product-service systems rather than as separate ‘industries’, some in ‘manufacturing’ and some in ‘services’.

The project gathered information using two empirical data collection methods. The broadest was a mail-out survey completed by 479 manufacturers in New South Wales. The survey was administered between July and August 2000 by Australian Business Limited (ABL), a leading member-based business services organisation. The questionnaire is reproduced in Appendix 1.

The survey was complemented by a series of case studies based on unstructured and semi-structured interviews with 60 companies in manufacturing, services and construction or similar project-based activity and three industry organisations. Based on recommendations from business units and regional managers at Australian Business Limited (ABL) and a web-based analysis of firms, companies known to offer both products and services were targeted for interviews. In some cases, companies interviewed were also selected on the basis of recommendations by other interviewees.

Structure of the report

The report contains eight chapters and three appendices. Given the importance of clarity in such a complicated field, the second chapter of the report suggests that we should distinguish between two approaches used by *manufacturing* firms to link products and services into packages for sale to clients. The first we call ‘*product service- integration.*’ This occurs when service components are introduced during the process of manufacturing of the product to change the characteristics and/or physical composition of the physical product by use of customisation, design or other production-associated services.

The second we call ‘*product-service packaging.*’ This is when two or more discrete products and services or sets of services are sold jointly rather than separately and are assembled at close to or after the point-of-sale of the product. The resulting ‘products’ are referred to as ‘product-service packages’.

In addition, we discuss strategies undertaken by *service* firms which buy products, add services (and sometimes other products) and create ‘*product-service bundles*’.

In the third chapter, we present the empirical framework data derived from the survey of 479 manufacturers which illustrates the range of services offered and the high proportion of companies answering the survey who had switched to competitive strategies involving new and increasing linkages between products and services.

The next three chapters (four, five and six) use information gathered from in-depth interviews to illustrate in detail how firms differ in the ways in which they link products and services in developing new products and entering new markets. Chapter Four looks at product-service integration by manufacturing firms and the shift to also creating product-service bundles at or after point of sale. Chapter Five focuses on the ICT industry, looking at firms linking products and services into bundles in mass market and customised solutions for clients. These firms take products made by others and add value by bundling them with a vast array of services. Chapter Six looks in more detail at strategies followed by firms in areas which deliver products as ‘projects’ which link goods and services. These include the construction industry but also the emerging area of home healthcare.

In the seventh chapter we look at the ways in which product-service ‘packages’ are being developed in different industries and how adoption of such competitive strategies is shaping organisational structure, inter-firm and user-producer collaboration, knowledge diffusion and innovation. The chapter indicates that firms are having to seek new skills and, even more important, that their propensity to collaborate with others is higher when they are engaged in linking their manufacturing activities with service provision. The propensity to collaborate may indicate a greater tendency to innovate as well.

In the final chapter, we review our findings, draw conclusions and suggest that together the findings of our study indicate the need to re-think how we see the functioning of the Australian economy.

CHAPTER 2: PACKAGES AND BUNDLES: CREATING LINKED PRODUCTS AND SERVICES

Many 'products' in the market place are altering their composition. 'Products' are changing from being discrete independent units - a widget or a gadget - into more complex 'bundles' of goods and services as producers add intangibles to their physical product's components.

Finding the right nomenclature for the new 'products' presents challenges. The usual 'product' terminology does not help distinguish among the increasing and diverse ways in which products and services are linked in the Australian economy. 'Products' traditionally apply only to physical items such as a dress or a machine as they appear at the end of a production process. Further investigation of what is involved in the creation of such 'products', however, highlights the design and other services included and it is increasingly clear that what firms sell is not just their physical products but a range of services added at or after point of sale so that a 'product' increasingly includes many services.

On the service side, service firms are taking physical products, which may or may not have point of sale services attached, putting them together with other products, adding further services and creating yet another 'product'.

We distinguish the outputs of product-service linkage strategies by speaking not of 'products' per se but of the *product-service packages* that firms are using to gain competitive advantage in crowded markets. We use the term *product-service packages* as the generic term to describe the linked combinations of products and services sold on the market, whether they are created by firms principally engaged in manufacturing or in service provision.

Within manufacturing we make a further important distinction when we talk of 'where' in the production and sales process the linkage takes place. In the process of creation of physical products, there are design, technical and customisation services. At time of sale firms may add financial and training services while after sale they may offer maintenance and upgrades. In this way, many firms continue their linkages with their 'product' during its whole useful life. The producer may even collect and recycle the product after its 'death'.

In this study we therefore use two terms to distinguish two different areas of linkage of products and services into new 'products' within the 'manufacturing' sector. We use the phrase *product-service integration* for activities occurring during manufacture and *product-service packaging* for activities occurring at or soon after point of sale.

The third term we use is *product-service bundling* which we use to describe cases where *service* companies take products made by others, add services and thus create a new 'product' or 'product-service package'. The 'bundling' terminology is already in use, notably in the telecommunications industry, where it describes both the line connection services added to a handset or mobile phone to make it work and the total package of financial and other services which can be added as the customer requires. We reserve product service bundling for activities initiated by *service* firms.

Figure 2.1: Three perspectives on the organisation of manufacturing and services

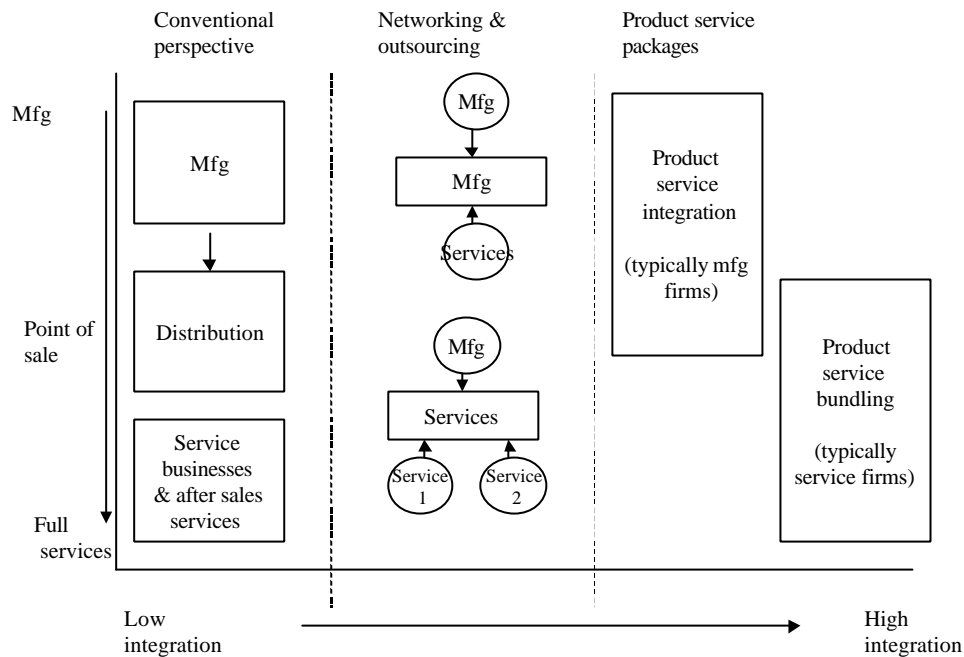


Figure 2.1 shows three views of how economies organise products and service creation and sales. The first is the ‘conventional’ perspective that assumes a continuum from manufacturing through distribution to sales and after sales services. The second is the more recent and modified view which sees diverse relationships between firms that are making and servicing products. These relationships are typified by outsourcing of some manufacturing or business service components to enable the creation of a product.

The third is the one that we are presenting in this report. It indicates that products and services can be linked into packages at any stage of the life of a product, integrated during production or after sale by ‘manufacturers’ or by ‘focal’ service firms who buy products from manufacturers to which they add services to create new ‘bundles’ of products and services combined in various ways. ‘Focal’ firms are the central organisers of the bundled products and services.

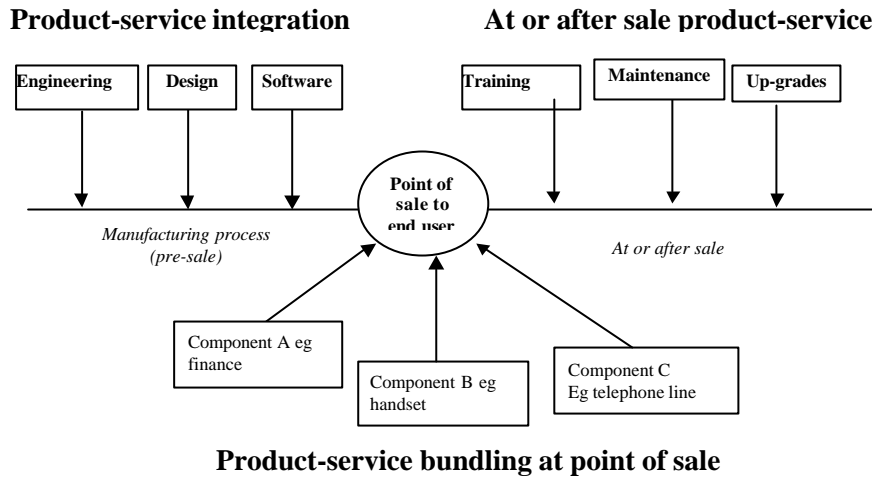
Multiple linkages between products and services

Product-service linkages can take many forms. As suggested in Chapter One, definitions of services often emphasise that services are consumed at the same time as they are produced. Our schema, however, shows that the linking of products and services may well not take place all at one time, meaning that all services are not consumed at the time they are produced and many associated services are delivered after the sale of a product itself. For this reason, with the focus on manufacturing, it is useful to distinguish two main stages in the processes linking products and services – integration of services during manufacture (product-service integration) and product-service packaging at point-of-sale, with or without delivery of after-sales services.

Manufacturing firms can package goods and services at all both major stages – during manufacture, at and/or after sale. In contrast, service firms can only bundle pre-

manufactured products with services at or after the point-of-sale, as indicated in the diagram below.

Figure 2.2: Three kinds of linkage between products and services



Manufacturing strategies

1. Product-service integration: linking services to products as they are created

Integration between services and products first occurs when specific service components are added during the production process, influencing the characteristics and/or physical composition of the product itself. Such service components involve extra input of R&D, design or technical or engineering services. Product-service integration is viewed as additional to the standard R&D, design and engineering activities of firms' productive processes, which show up in the employment statistics indicated in Chapter One, because the input is client-driven, occurring in response to particular clients' preferences or requirements. This service element can be summarised as 'customisation'.

Product-service integration tends to be a strategy adopted by producers of intermediate (industrial) goods rather than those of goods for final consumers. Clients have opportunities for input in the product-service integration process by making specific design or engineering requests. The services offered range from the integration of a product, such as a large piece of machinery, with a specific service such as customised additions to create, for example, what Miller and his colleagues describe as 'complex products,' which are 'high-cost, engineering-intensive products which embody large numbers of customised, interactive sub-assemblies and components, including embedded software' (Miller, Hobday, Leroux-Demers & Olleros 1995: 364).

Product-service integration may be carried out internally by one firm or be 'externalised' as when the main producing firms call on specialists from outside to provide the services to be integrated, thereby involving the main firm and various providers of specialist additional services integrated during the design and production process. Some especially complex products involve participation by large-scale networks of firms. This group of providers may eventually become a longer term functioning network. If this happens,

services offered may broaden in range and deepen in intensity. As Gann and Salter (1998) have pointed out, external product-service integration is typical of most complex projects in the building and construction industry as well as in the building of utilities and communications infrastructure, power, oil and gas, off-shore and process plants, transport nodes and infrastructure and aircraft, ships and high speed trains. These complex projects involve an equally complex network of suppliers of both products such as building materials and services, such as design, engineering, project financing, and environmental services.

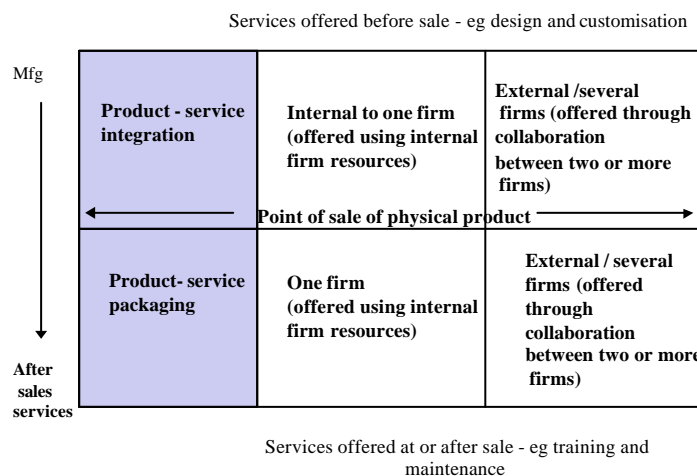
There may also be a move towards the product-service integration strategy in the complex consumer goods arena, as has been proposed for the auto industry (PricewaterhouseCoopers 2000). When this happens, other consumer industries may follow, making the client king across the economy.

2. Product-service packaging: linking products and services at or after point of sale

Like that of product-service integration, the process of product-service packaging may be internal or external to a given firm. ‘Internal’ linkage occurs where one company puts together its own product and service components to form a product-service package. An example of this is where a motor vehicle company sells cars, the financial services needed to purchase the vehicle and a maintenance package using its own resources. Some firms need others in order to put their packages together. ‘External’ linkage thus takes place when a firm assembles component products and services in collaboration with other firms, for example when a company uses an overseas firm to provide the training and maintenance that it cannot provide alone in distant markets.

Some companies may adopt both product-service integration and product-service packaging strategies so as to maximise coverage of the market. These would typically be in industries producing highly complex goods. It is these firms which are most likely to move their focus to being a ‘service’ firm. They are not alone, however. Some consumer goods producers are moving in the same direction.

Figure 2.3: Product-service packages in manufacturing



The creation of product-service packages can be initiated either by manufacturers or by service providers, as we show in the following.

Service firms' strategy: Product-service bundling

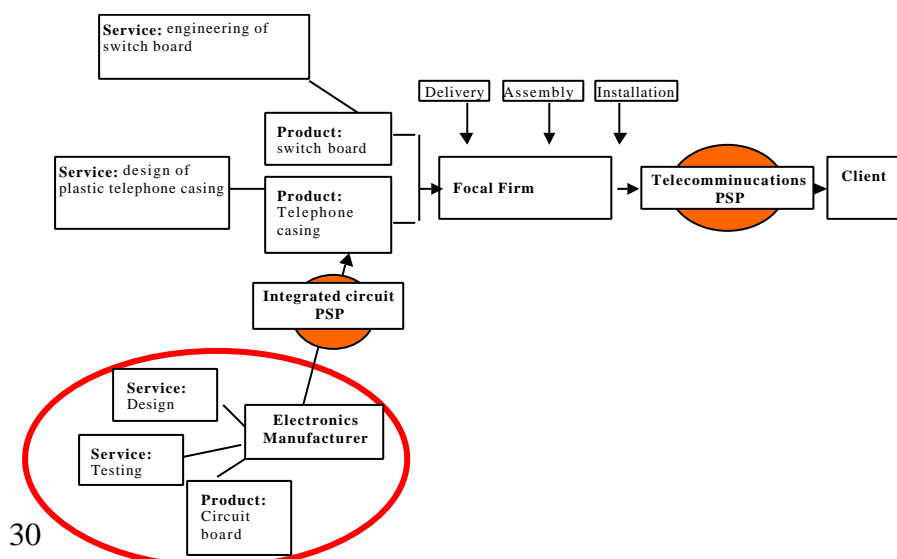
Manufacturers are not the only firms packaging together diverse services and products into one package for sale. What are usually thought of as 'service' firms also link products and services together into 'bundles' for sale. Here the *services* dominate the products in the public mind and many people see the 'products' as services, whether in telecommunications or healthcare. In reality, however, they are packages of both.

A well-known example occurs when a telecommunications company sells mobile telephones produced by a manufacturer in conjunction with its own primary service – access to a telephone line. Clients (customers) deal with only one firm, a 'service firm' that is responsible for the coordination of various components to build a final bundled product and then the supply of this product-service bundle to customers. Similarly, service firms supplying hospitals with surgical supplies are now buying products from others and linking them into packages which have just the right number of sutures, instruments etc for given operations. We call this 'product-service bundling'.

'Bundling' has been defined by Spiller and Zelner as a process 'whereby two or more discrete products or services are sold jointly rather than separately' (1997: 561). Product-service bundles are assembled close to the point of or after sale of the physical 'product' and are made up of components that, while often complementary, can usually also function independently. Some physical product components are, however, service dependent. These include telephone handsets or computers that rely on telephone lines and software to function.

Figure 2.4 illustrates the production of a telecommunication 'product-service bundle'. The telecommunications company provides the final product-service bundle to the end user, adding to the less complex product-service packages provided by various producers along the supply chain. Thus, for example, the electronics manufacturer offers a package which includes both services (design and testing) and a product (a printed circuit board). While the service firm is responsible for the provision of the final product to the end consumer and therefore coordinates more components, the electronics manufacturer provides both a service and a product in the form of a component product-service bundle.

Figure 2.4: Different types of bundles of products and services in the telecommunications sector



We call the 'bundling' firms, those service firms which buy products and add services, 'focal firms'.

The hypothesis underlying our study was that, if we look carefully, what we see happening in modern economies is the development of three kinds of competitive strategies by firms – first, an increase in product-service integration; second, a highly significant shift to selling product-service packages; and, third, enormous growth in the number and range of 'focal firms' buying products from others, adding their own brands of services to create bundles.

The results of our study suggest that this pattern of what may be called generically 'service-enhancement' may well become a dominant trend in modern Western economies. Service enhancement can refer to products in the traditional sense or to the linkage of services to services which only link indirectly with manufactured products

Some manufacturers have gone further in this direction than others, some have shifted further in the direction of becoming focal firms, and some are adding services to services, linking with manufacturing only at one remove. Analysed in this way, there is not one 'manufacturing-service sector' emerging but at least three, each with its own particular characteristics in the ways in which firms go about seeking competitive advantage through exploration of the possibilities of linking products and services into new combinations for new markets.

In many cases we consider that supply chains themselves are more appropriately seen as a series of product-service packages than of the production of simple 'products'. Re-viewing supply chains in this way reveals the importance of linkage between products and services all along each chain and the potential variety of strategies available to firms seeking competitive advantage by differentiating their particular mixes of products and services from those of others.

CHAPTER 3: PRODUCT-SERVICE LINKAGES IN NEW SOUTH WALES MANUFACTURING

Introduction

Between July and August 2000 Australian Business Limited (ABL) distributed its quarterly survey among 637 companies. All companies receiving the survey were manufacturers as classified by the Australian and New Zealand Standard Industrial Classification (ANZSIC) index and were located in New South Wales. The firms were selected from the data base of Kompass, a company which specialises in the distribution of mailing lists. Of the original 637 companies to whom a questionnaire was sent, 479 completed and returned the form, constituting a response rate of 75%. Our questions were a supplement to those in the ABL's quarterly survey. Only seven questions relating to the linking of products and services could be included. (A copy of the questionnaire appears in Appendix One).

We used these seven questions to identify the types of manufacturing companies that sold both goods and associated services and the types of products and services that were offered together. We asked respondents to provide details about their core area of business and main products and to indicate whether they provided any services with the goods they produced. If so, we asked them to indicate which services they offered and whether their firms had extended their range of services during the 1990s. We also asked whether firms had collaborated with other organisations to provide these services.

Summary of findings

The summary of the main findings below is intended to guide the reader through the complex data that follow in this chapter. The survey showed that:

- Linking products and services is a very widespread competitive strategy among manufacturers in New South Wales, with almost three quarters of respondents (342 firms, 71%) indicating that they offer services in association with their products. More than 60% of manufacturers had extended the range of services they offered over the 1990s. This suggests that the manufacturing sector is co-ordinating the delivery of services as well as products.
- The most common services offered by manufacturers were those integrated into products during the production process. Technical services (57%) and design (52%) were the most common services offered, and both of these were offered by more than 30% of all sectors (except the food and beverage processors). Manufacturers seldom buy in services from elsewhere but develop them themselves.
- In contrast, after-sale (installation etc) services were less common among manufacturers' service offerings and varied considerably from sector to sector. For machine and equipment manufacturers, for example, the most common after sales services were installation and repair. In contrast, the wood and paper manufacturers offered transport services, while the textile, clothing, footwear and leather (TCF&L)

manufacturers offered customised services. This suggests that patterns of cross-sectoral coordination vary not only between what are traditionally thought of as manufacturing and ‘services’ companies but between sectors within manufacturing.

- A negligible percentage of firms offered insurance, legal and financial services, indicating that the locus of coordination of these services lies outside the manufacturing sector.
- The groups most likely to offer the widest range of services were machinery and equipment and metal manufacturers. These sectors were also the most likely to customise products, to use ICT enabling technologies to link different areas of firm activity and to offer technical services. They were the most likely to be offering more than one service (over 50%).
- There is a clear contrast between the strategies of manufacturers of more complex and processed products (eg fabricated, sheet and structural metal manufacturing) and less complex or processed products (eg iron and steel, basic non-ferrous metal and basic non-ferrous metal product manufacturing). Manufacturers of more complex products have the opportunity to integrate more services into the creation of their products, notably customising their products. This was especially true of the larger firms in the sample.
- Companies in the small to medium range, 20-249 employees, were the most frequent adopters of product-service packaging strategies. Few very small (under 10) or relatively large firms (250 or more employees) offered such linked ‘products’.
- Some firms used the addition of services to their ‘products’ as a strategy for linking with other firms, for example, in areas near to their customers, with complementary specialist expertise or facilities that allowed bidding for larger projects. This permitted both increased scale and broader geographical reach of activities.

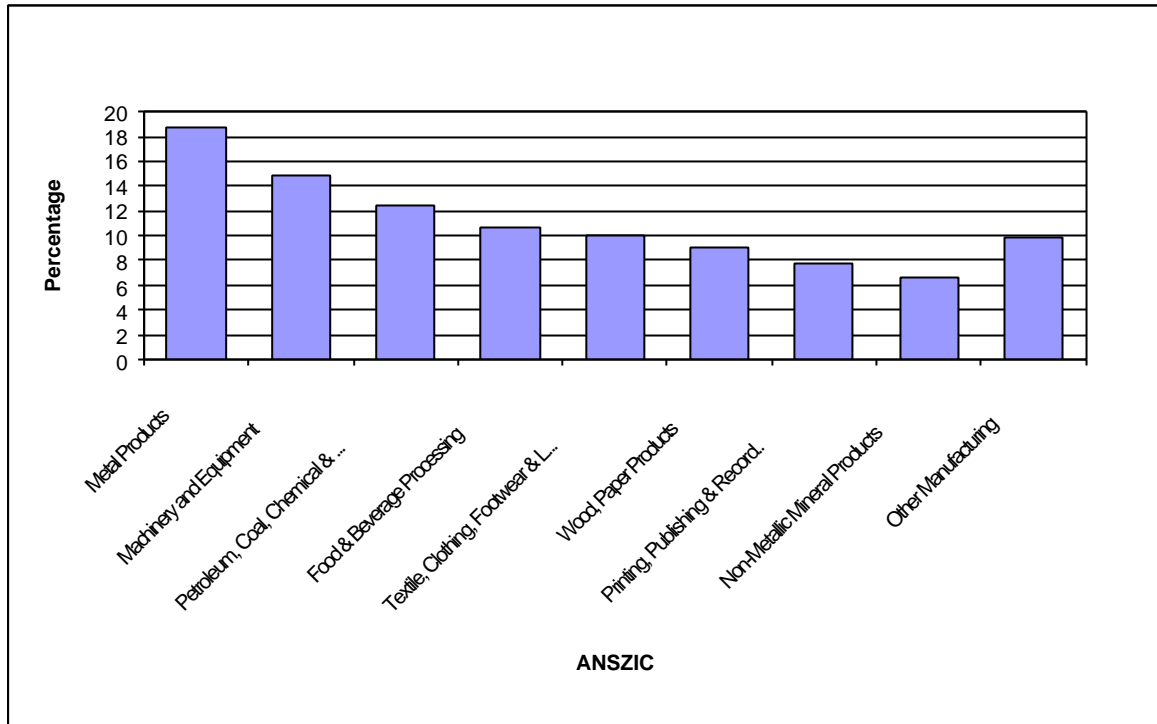
These results clearly show services becoming crucial elements in creating competitive differentiation and adding scale for many manufacturers. Service activities, now occupying a critical place in manufacturing companies’ value adding activities, provide strategic bases for the development of integrated product-service packages as central to their competitive advantage in the future and to shift their self-definition. In other words, the Australian ‘manufacturing’ firms in our survey are well on the way towards re-badging themselves as service providers should they so choose.

The survey

Respondents’ characteristics

Of the 637 companies in the sample, 479 completed and returned the questionnaire. Figure 3.1 shows the spread of these respondents across different areas of manufacturing (ANZSIC codes).

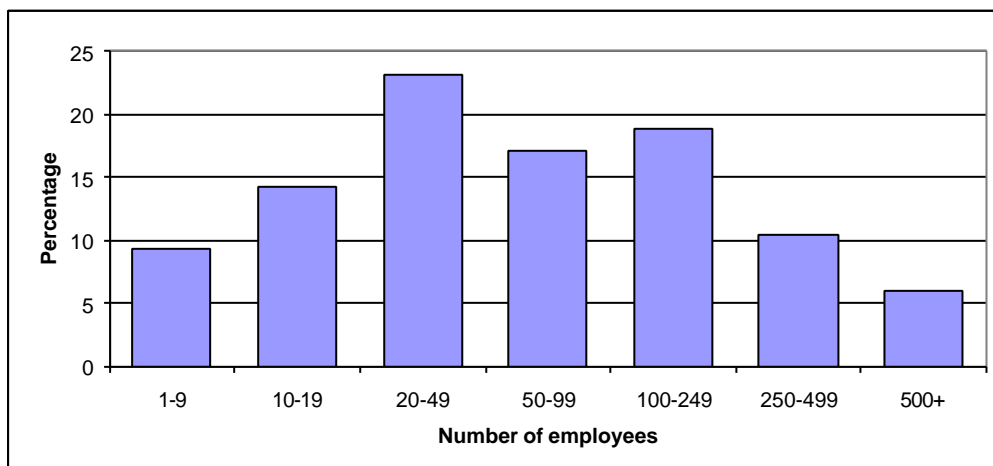
Figure 3.1: Respondents by industrial classification (ANZIC).



As shown in Figure 3.1, the largest single group, almost one fifth, of respondents was in metal products (19%), followed by machinery and equipment (15%) and petroleum, coal, chemical and associated products, which includes plastics (13%).

Figure 3.2 shows the size of companies (by number of employees) that responded to the survey.

Figure 3.2: Respondents by number of employees



Over half of the responding companies (59%) had between 20 and 249 employees. The single biggest group, almost a quarter of firms, was relatively small, having only 20-49

employees (23%). This group was closely followed by that of medium-sized firms with between 100 and 249 employees (18%) and small to medium firms with between 50 and 99 employees (17%). There were very few large firms. The distribution reflects quite well the distribution of manufacturing enterprises in New South Wales (see Appendix 2).

Patterns of product-service linkage

Who offers services in association with their products?

Nearly half (46%) of respondents stated clearly that they offered products and services in one 'product' package. The decision to do so may not have been taken at any one given point of time. In many cases the linking of services and products has occurred in subtle ways and over extended periods of time, perhaps rather more as a 'natural progression' of firms' manufacturing activities than a conscious act of diversification. Some firms, for instance, may have been offering installation and training on the use of their product for many years without seeing provision of these services as a move into service activities *per se*.

Taking a broader view and considering firms that indicated that they offered both products and services but not necessarily in what they considered to be one 'package', the results of the survey showed that between two-thirds and three quarters of respondents (71%) indicated that they offered at least one service as well as physical products. In the following analysis we refer to the 342 firms who indicated that they offered both products and services as the focus population studied.

The propensity to offer services with products varied surprisingly little among industrial sectors or sub-sectors. It was striking that between just under two thirds and four fifths of firms in each ANZSIC category offered services. The only exception was food and beverage manufacturers where only 45% of firms offered services. **Our survey therefore suggests that offering services as well as products is very widespread in manufacturing in NSW, especially among the larger (but not largest) firms.** (See Table A2.1 in Appendix 2).

Results from the survey suggest that, compared with Sydney (71%), a relatively high percentage of companies from Wollongong (88%) and Newcastle (77%) may have a greater propensity to offer services, but the numbers in Wollongong and Newcastle were too small to be anything but indicative. (See Table A2.3 in Appendix 2).

Product-service packaging and company size

Our survey suggests that the size of the firm does not greatly influence the nature and extent of service provision or adoption of a product-service linkage strategy. As shown in Table 3.2, the survey showed a fairly even distribution of firms offering services across all but the very smallest and very largest firms.

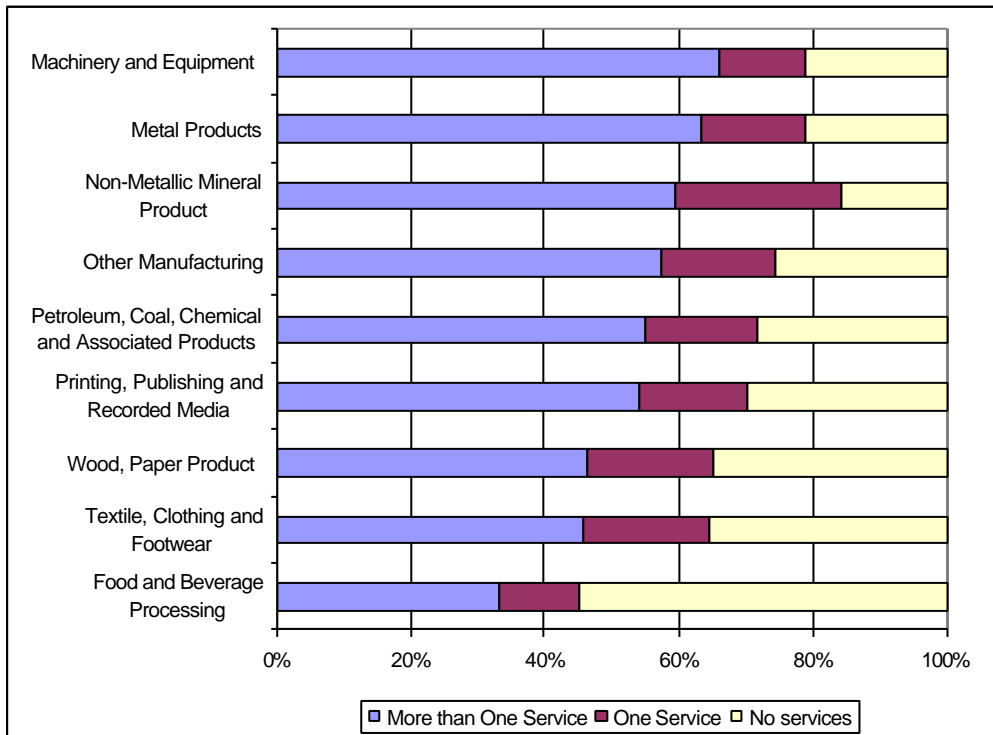
Table 3.1: Firms offering services by size of company

Number of employees	Number of firms in each firm size category	Number of firms offering services in each firm size category	Percentage of firms in each firm size category offering services
1-9	45	31	69%
10-19	68	52	76%
20-49	111	87	78%
50-99	82	56	68%
100-249	90	65	72%
250-499	50	35	70%
500+	29	15	52%
Missing	-	1	-
Total	475	341	100%

Extent and range of services offered

The survey data showed both the extent of service provision within each sector and the range of services offered.

Figure 3.3: Services offered by industry sector

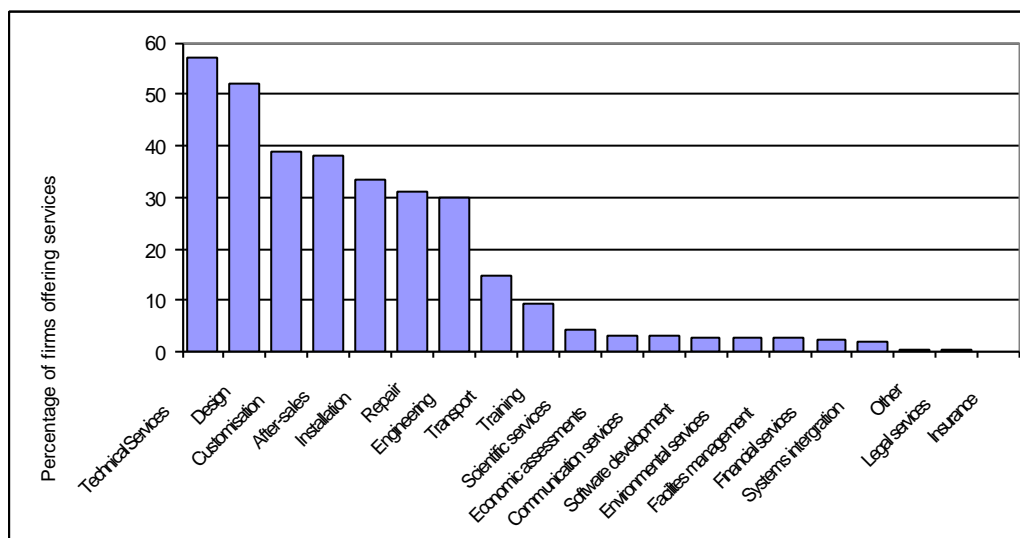


All companies offered more than one service. The propensity to do so, as mentioned above, varied little by industry field overall. However, there were some variations. As shown in Figure 3.3, between 80% and 90% of non-metallic mineral product manufacturers offered at least one service, a proportion closely followed by machinery and equipment and metal product manufacturers who were the most likely to offer more than one service. In contrast, what might be thought of as in some ways the more ‘traditional’ industries, food and beverage processing, TCF&L, and wood and paper product manufacturers were likely to be offering only one service or no services at all.

The services offered and by which firms

Respondents were asked to indicate which services they provided. On the survey instrument nineteen specific services were listed. (The list of services was adapted from a study on service provision in the building and construction industry undertaken by AEGIS in 1999). Respondents could choose more than one service. The percentage of firms offering each service appears in Figure 3.4.

Figure 3.4: Nature of services offered



The most common services provided were technical, offered by more than half (57%) of firms, followed by design (52%) and the composite ‘customisation’ services (39%). Technical services may be the most commonly offered because they potentially include a large number of different types of services, such as testing and equipment calibration as well as on-site technical advice. The widespread provision of technical services may also represent the increase in knowledge intensity required in product development in many industries and the concomitant need among users for special expert advice. The high proportion of firms offering design services confirms other AEGIS studies which emphasise the increasing importance of design as a competitive strategy for firms in a broad range of industries. Firms were also likely to offer after-sales services, notably installation and repair.

Different industry sectors offered different kinds of services. The different types of services offered are shown in Figure 3.5.

Figure 3.5: Patterns of service provision across industrial classifications

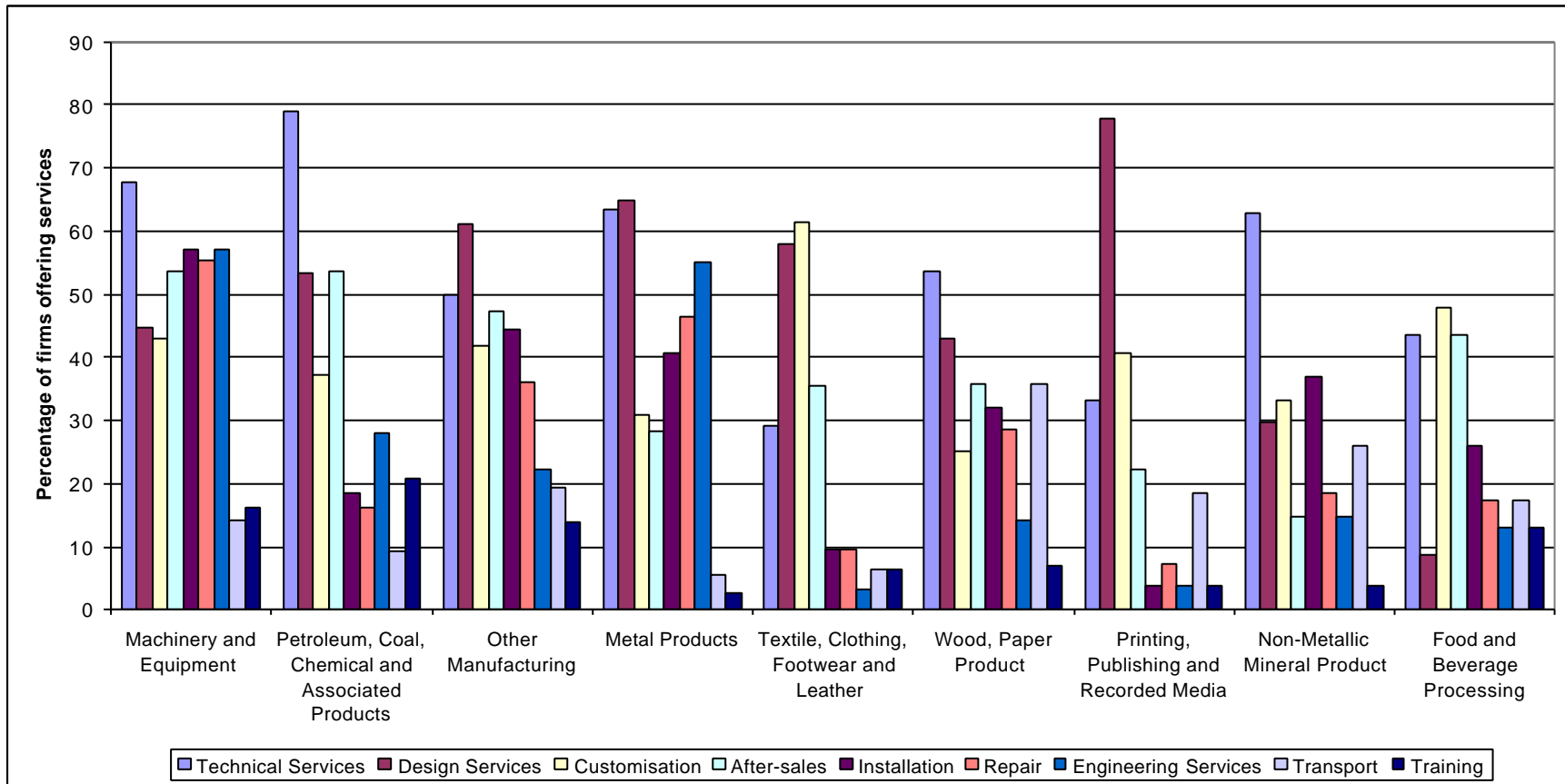


Figure 3.5 shows the variation in kinds of services offered by firms in different sectors. The survey results suggest that, while most sectors offered their clients a combination of technical, engineering or design services during manufacture, the particular services they offered with products varied across sectors. The most common services offered by machine and equipment manufacturers, for example, were installation and repair, while the petroleum, coal and associated product manufacturers offered diverse after-sales service. The wood and paper manufacturers, in contrast, offered transport services, while the TCF&L manufacturers offered customised services. The predominance of particular services provided by different sectors suggests that patterns of product-service co-ordination are not generic across sectors but, understandably, are linked to the kinds of physical products made and depend on circumstances and skills as well as client demands.

The dominant patterns of service-provision in the different sectors can be summarised as follows:

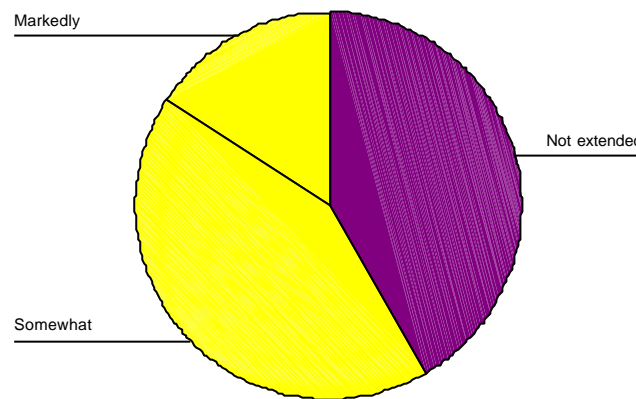
- machinery and equipment manufacturers primarily offer technical, installation, repair and engineering services (between 50 and 60% of firms offering each of these services);
- a high to very high percentage of petroleum, coal and associated product manufacturers (which includes plastics) offer technical, design and after-sales services (almost 80%);
- many firms classified as 'other manufacturing' according to the ANZSIC subdivision codes (which includes prefabricated building, furniture, mattress, jewellery, toy and sporting goods manufacturing) offer design, technical and after-sales services;
- a high percentage of metal products manufacturers offer technical, design and engineering services;
- printing, publishing and recorded media manufacturers focus overwhelmingly on design (almost 80%) and, to a much lesser extent, customised packaging services (40%);
- non-metal manufacturers primarily offer technical, installation and customised packaging;
- textile, clothing, footwear and leather manufacturers offer few services but, when they do, they tend to focus on design and customised packaging services;
- wood and paper manufactures primarily offer technical, design and transport services;
- food and beverage manufacturers as a category offered fewest services and most of these firms restricted their service offerings to customised packaging, transport and after-sales;
- firms are increasing the number of services offered.

An increasing range of services offered

The majority (almost two thirds) of firms said that over the 1990s they had increased the range of services they offered (see Figure A2.3 in Appendix 2). Although the extent of the increase varied, the evidence from our survey suggests a strong trend towards service-provision across many different kinds of manufacturing over the last decade. It seems likely that this trend will only accelerate.

Figure 3.6 shows the percentages of respondents that had extended the range of services offered over the 1990s.

Figure 3.6: Have you extended the range of services offered over the 1990s?



The relationship between collaboration and service provision

To a striking degree, the firms that offered services as well as physical products were more likely to collaborate with other organisations than were those that did not offer services. Of the 342 firms that offered services, more than half (52%) said their firms collaborated 'somewhat' or 'markedly' with other firms. In contrast, of the 137 firms who did not offer services, only 22 (16%) said that their firms collaborated with other firms. This striking finding suggests that strategies centred around the packaging of services and products promote inter-firm collaboration in a range of fields. The implications of this finding were explored further in the in-depth interviews where we examined the relationship between service-product linkage strategies and the development of knowledge networks between firms (see Chapter Four).

The degree of collaboration recorded between firms suggests that adoption of the strategy of product-service linkage may be an important factor in successful innovation on other fronts since we know that, in Australia and internationally, the great majority of firms that innovate also collaborate (Basri 2000). Linking products and services in a competitive strategy that demands expertise in areas outside the competences of an individual firm may thus be an important step which enables certain firms to invest in other innovative activities by reducing risk and uncertainty. We discuss this finding further in Chapter Seven.

Two case studies

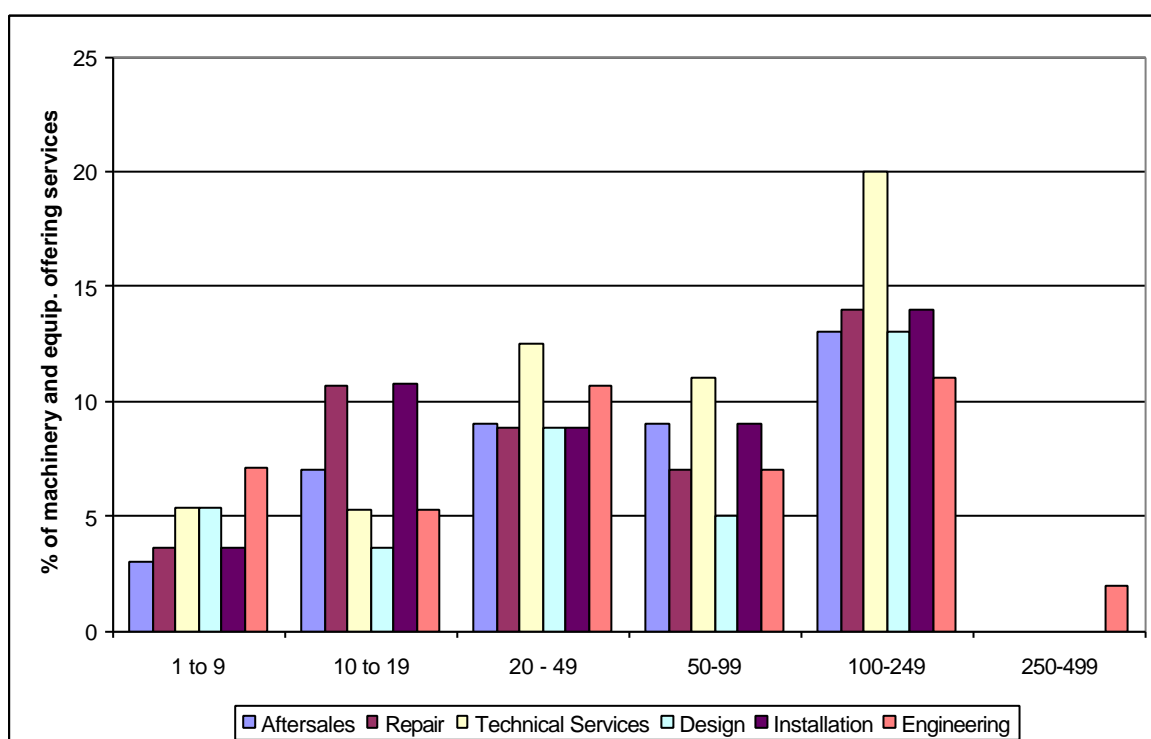
The following case studies enable us to see the ways in which service provision as a competitive strategy, whether measured in terms of number, types or combinations of services, varies by sub-sector within the same overall ANZSIC category. They indicate again the variety of ways in which products and services are linked in different productive fields.

A significant percentage of respondents were producers of metal products (a fifth, 19%) or machinery and equipment (15%). Firms in these two categories were also among the top three providers of products and services in one package and each offered more combined services than the average of surveyed firms in other subdivisions.¹

Case One: Machinery and equipment manufacturers

The size of firms within the machinery and equipment manufacturing subdivision does not seem to systematically affect the kinds of services provided, as shown in Figure 3.7 below.

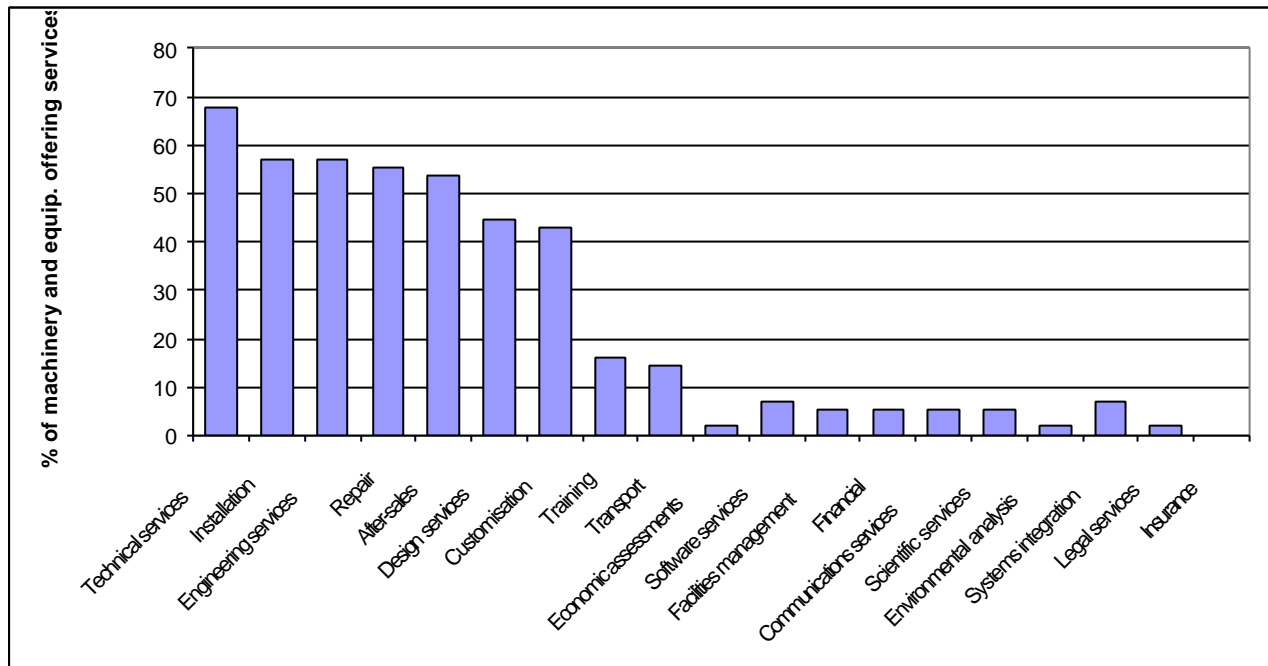
Figure 3.7: Service provision among different size machinery and equipment manufacturers



¹The other major group of service providers were firms in the non-metallic mineral product manufacturing subdivision. However, while 84% of these manufacturers offered services, there were only 32 firms in the category. For this reason this group of manufacturers was not included in the following analysis.

Among almost all sizes of firms, engineering services were the most common services provided. Design services were the next most frequent in all size categories, except in firms with 500 or more employees. Figure 3.7 suggests that on the whole larger manufacturers of machinery and equipment are more likely to provide a package of technical, engineering and installation services than are others but this is not the case for very large companies (those with over 500 employees) where only engineering services are provided.

Figure 3.8: Patterns of service provision among machinery and equipment manufacturers.



A very high proportion of respondents in the category offered technical services and between half and two thirds offered installation and repair services. As shown in Figure 3.8, machinery and equipment makers were most likely to offer to clients a technical package of engineering and design services related to their product manufacturing (service-product integration). A considerable proportion, between half and two thirds, complemented this package by providing repair, customised packaging and after-sales services. Integrated services may be widespread among machinery and equipment manufacturers because they are most likely to be involved in the production of one-off complex products or, in Gann and Salter’s (1998) terminology, because they are acting as ‘project-based firms’ in manufacturing.

The firms in the machinery and equipment sector were thus co-ordinating both production-related activities and bundles of services after the point-of-sale, with over half of the firms in this category that offered services providing installation (57%), repair (55%) and other after-sales (54%) services. This broad range of product-service coordination by machinery and equipment manufacturers supports Gann and Salter’s (1998) suggestion that firms engaged in the production of highly customised products, which they refer to simply as ‘projects’, also offer a significant range of services related to their product. Gann and Salter point to the close user-producer relationships in these firms: ‘Production is triggered in response to user

need and, in this sense, projects are demand-driven rather than the result of [the] arm's length market transactions, which typify consumer goods industries' (1998: 435). In this context, engineering and design services can be thought of those critical to effective user-producer relations in product development and hence to innovation.

To explore this further, Figure 3.9 breaks down the very broad category of machinery and equipment manufacturers into core business areas and shows the main services provided by companies in each of the fields.

Figure 3.9: Core business of machinery and equipment manufacturers providing services.

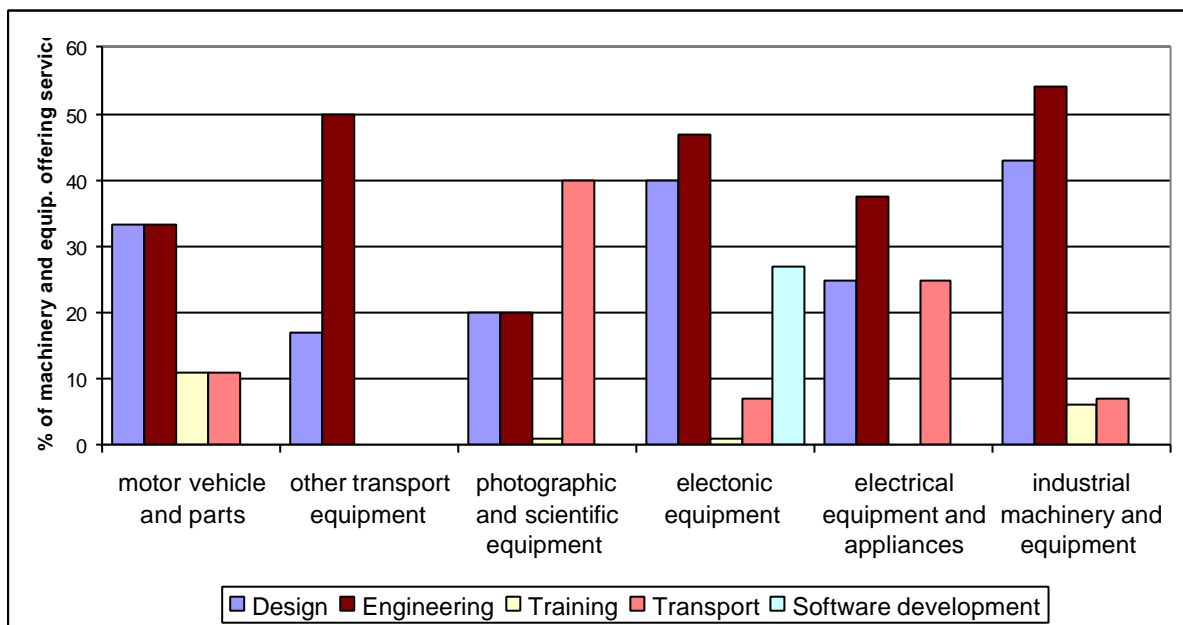


Figure 3.9 shows that the package of engineering and design services was the key combination provided by most types of manufacturers of machines and equipment. The provision of engineering services was particularly common among the manufacturers of transport and industrial machinery. Electrical equipment manufacturing was the only subdivision to offer software services. This is not surprising given the integration of digital technology into the product in this category (Suárez 1995; Quinn et al. 1996).

Over half (59%) of firms manufacturing machinery and equipment indicated that they had extended the range of services they offered over the 1990s.

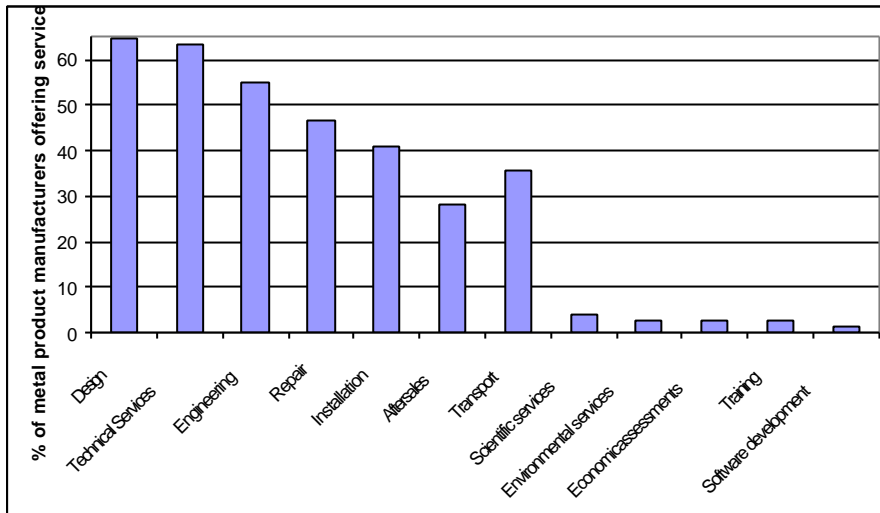
Case Two: Metal Products Manufacturers

High proportions of firms of all sizes, except the largest, in metal product manufacturing companies offer services associated with their products

Metal product manufacturers are most likely to offer design and technical services, as seen in Figure 3.10 below but these are very closely followed by engineering services. These three types of service seem to constitute a single package offered during the production process,

the rest being essentially offered after point of sale. All other services, including scientific (R&D), were offered to a negligible degree.

Figure 3.10: Patterns of service provision among metal product manufacturers.

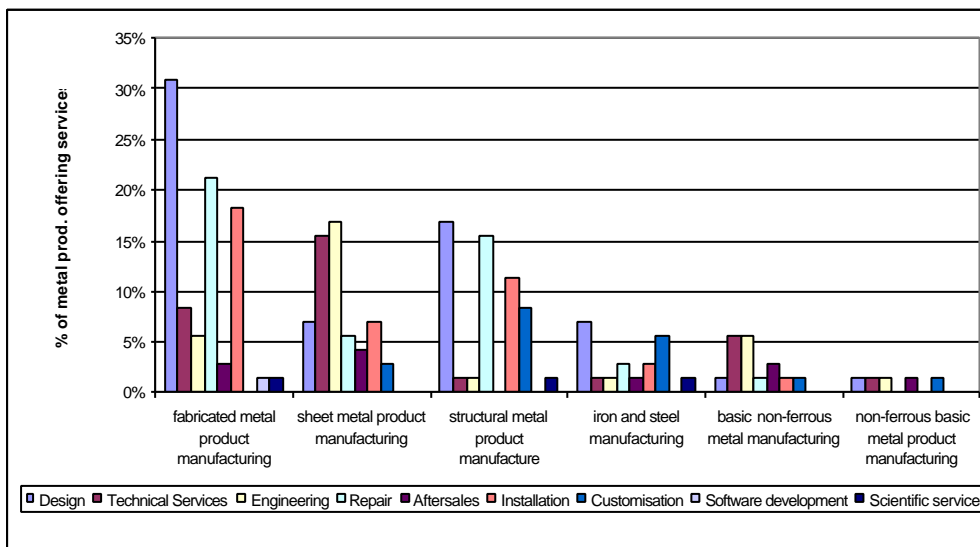


As with equipment manufacturers, a ‘package’ of services, such as design and technical, engineering services, was integrated into the provision of physical product and complemented by installation, repair and after-sales services.

Core business and service provision

Figure 3.11 again breaks down the broad category of metal manufacturers into smaller fields and shows the core businesses of those companies providing services.

Figure 3.11: Core business of metal product manufacturers providing services



The number and type of services provided vary quite considerably when the sector is broken down into sub-units. Fabricated, sheet and structural metal manufacturers appear to integrate more design, technical and engineering services into their products than do others.

Transport appears to be relatively commonly offered by manufacturers of both fabricated and structural metal products, which may be linked to the large size of products fabricated in some cases. Installation is offered principally by fabricated metal manufacturers.

Overall, and not surprisingly, there appears to be a contrast between the manufacturers of more processed metals (fabricated, sheet and structural) and those producing less processed metal products (iron and steel, basic non-ferrous metal and basic non-ferrous metal product), the makers of more complex metal products tending to integrate more services into their product-service offerings to clients.

CHAPTER 4: MANUFACTURING: MOVING TO A ‘SOLUTIONS’ APPROACH

Introduction

Interviews exploring the types of services offered were conducted with 63 companies, across manufacturing and services and project-based firms, and three industry associations during the study to assess how far firms had moved in the direction of selling solutions rather than products in the traditional sense.

For the interviews, recommendations from business units and regional managers at Australian Business Limited and a web-based analysis of firms were used to select companies known to offer product-service packages for interview. Given that the product-service linkage strategies of firms involved in different sectors of the economy seemed likely to be different, we included producers of industrial goods, ‘project-based’ and contract manufacturers, makers of mass-market products, producers of enabling technologies, and firms involved in bundling products with services throughout the life of the product.

The majority of firms interviewed were in manufacturing (15), followed by those in information technology, telecommunications and consumer electronics (13, 8 and 4 companies respectively), firms in building and construction (9) and mining and heavy engineering companies (9). Five interviews were also conducted with firms in the healthcare sector. Some of the ICT firms and those in the healthcare sector were service companies, some of them linking products and services and some linking services and services, but we also considered them to be project-based firms since each ‘sale’ is customised (See Appendix 3 for description of interview sample).

The three categories of firms

The interviews revealed a broad range of approaches to product-service linkage within individual firms and across sectors. The firms interviewed for this study can be divided into three major industry sectors.

The first sector comprises the manufacturing firms. The two most common services offered by these firms were testing and design, services integrated with production, but they also offered services delivered at or after point of sale, with maintenance being the third most common service. This confirms the finding of the survey of manufacturers that manufacturing firms’ main strategy is product-service integration, but also suggests that some manufacturers also package services to their products along the whole line from conception and design right through sales and maintenance and hence, through the life of their physical products.

The second sector is the service firms. We focussed on firms in the IT and telecommunications sector because they were significantly involved in product-service bundling. The services that they offer clients, notably data and voice transmission and installation, selection of products and installation, are bundled with the products, such as

telephone handsets and ‘black box’ equipment which they do not make themselves. It should be noted that some of the firms interviewed were engaged in all of these activities. They may bundle mass market products as well as customising or developing software from scratch. This means that computer service divisions in a consumer electronics firm will compete with software and service divisions of IT firms.

The third grouping comprises project-based firms, including an important cluster of companies in our sample, the building and construction and mining companies. Most of the firms in this group are involved in project-based production where projects are complex, unique and highly customised. Companies in these groups undertake both product-service bundling, for instance, by offering finance in addition to construction for Build, Own, Operate, Transfer (BOOT) and Build, Own and Operate (BOO) or turnkey projects or via long term facilities management, and service-product integration, by including specialist design and construction services in their overall product-service provision strategies.

We have also included providers of post-acute and aged health care in the home as examples of a very different kind of ‘project-based’ enterprise. They were considered to be project-based as they were involved in the creation and delivery of complex product-service packages for one-off use, that is, customised treatment of individual patients. They bought in products and assembled them into a package of products and services. (See Table A3.2 in Appendix 3 for a summary of the most common services offered in each industry sector.)

In this chapter, we explore some of the factors influencing product-service linkage strategies for companies in manufacturing. In the next two chapters we discuss the strategies followed by service providers and project-based enterprises.

Manufacturing: moving to ‘selling solutions’

Current research and debates around the nature of manufacturing suggest that some manufacturing firms are shifting strategies and moving towards becoming organisers and in many cases providers of services (Cohen and Zysman, 1987; Pappas and Sheehan 1998; Houghton 1999). Clients of manufacturers have long been seen to give quite precise instructions about which materials may be incorporated into the manufacturing of the products by downstream suppliers, sometimes including the way materials may be produced. Now, however, manufacturers also offer services to their clients, such as retailers, and to the end-users of their products, according to the industry segment concerned.

All thirteen manufacturing firms interviewed offer services to their clients in addition to ‘products’ per se, a pattern largely confirming the survey results. The services in question are not services that the firms are consuming or using themselves but services that they are *selling* to their clients. The range of services they offer is broad. Seven out of thirteen manufacturers offered more than five services relating to their products, indicating high service-intensity. While it is important to assess the overall significance of these services in greater detail than is possible here, considering, for example, their contribution to sales, employment, turnover and growth, it is nonetheless clear that the manufacturers in our sample are offering their customers much more than an ‘off-the-shelf’ product. Many manufacturers are moving to an integrated ‘solutions-based’ approach to satisfying their clients’ needs.

A key feature of the ‘solutions’ strategies pursued is the provision of services in conjunction with products all along the line, from conception and design. These firms integrate services into production and continue providing them through sale to the end of the life of the product. Five enterprises offered their engineering, design and testing skills to customise products to match client needs, produced the goods and then provided installation, training or maintenance services.

Since the firms specialise in several different products and product markets, their activities provide evidence for the existence of diverse product-service linkage strategies. The cases presented indicate the reasons why firms may pursue competitive strategies that link products and services. (For more details of the core business and key services offered by companies interviewed for the study see Table A3.2 in Appendix Three.)

There were several important ‘drivers’ of or motivations for manufacturers’ decisions to improve their competitive advantage through product–service linkages and development of their service-providing capacities. Here we use case studies to illustrate five of the more important motivations for these decisions.

One arises from the influence on supplier strategies of **shifts in client activity**, especially a move by clients to focus on core or rare competences at the higher value-added end of production, sometimes seen as the classic **outsourcing** strategy. This shift means that suppliers who take on the manufacturing process also have to develop at least some of the skills needed to produce services, both integrated into manufacturing and after sales. Their development of new skills may in turn encourage the one-time contractor to become as much a service provider as the client, perhaps indeed pushing the next company down the line to become uniquely a service-provider. In this way, provision of ‘products’ may be seen as being ‘stretched out’ between different firms as the complexity of products and services proceeds.

The second influence is linked to innovation itself. **New products**, especially those which can be dangerous if improperly used, generate demands by customers for information provision, including help desks and other pre- and after-sales services. The product development process itself generates much information which clients need, encouraging producing firms to provide it before clients will buy the goods proposed. We use the case of new drugs to illustrate this point.

A third influence is the importance of the **high cost of a product** to the demand by clients for a raft of services. At its simplest, if it is cheaper to maintain and repair a piece of equipment than to buy a new one and if specialist skills are needed, it is likely that clients will demand that producers offer maintenance services. This may indeed be the beginning of the strategy of offering ‘flying hours’ rather than aero-engines mentioned earlier. Production of cheaper products is less likely to stimulate associated services. More importantly, the combination of the high cost of a product and a highly competitive market encourages firms to offer services that assist clients to buy. This is the classic strategy developed by the automotive industry which has made Ford Motor Company the biggest financial institution in Australia.

The fourth influence derives from export activities by both local and overseas companies. More specifically, the influence of geography is visible here. If a firm is far from its selected markets it cannot provide the kinds of services which clients demand. The fourth case study presented below highlights both how **distance from markets** may stimulate firms to seek local / overseas counterpart companies to deliver market-related services and how

overcoming the problem of distance can encourage collaboration and the growth of scale which further enhances participating firms' competitive advantage.

Fifth, many new products have to meet particular **regulatory requirements** before they have a chance to get onto any given market. The process of meeting those requirements encourages firms to enhance aspects of their activity, such as design and quality, which may in turn provide them with new skills and better competitive capability.

Case One: Contract-manufacturing and product-service linkages

The move by overseas firms to use Australian manufacturers as local market partners is also related to a significant recent global trend in manufacturing strategies by major firms – the focus on core competencies by multinational assembly firms via contracting out manufacturing. This shift in multinational business practice has given contract manufacturers new opportunities to develop services to meet international requirements.

The following case study of an electronics manufacturer's strategy shows how a firm may develop new services at all points of the manufacturing process and the life of the product, both integrating services into manufacturing and packaging services for its client(s) at and after point of sale. Over the past decade, the firm took on greater responsibility for both the design and testing of the manufactured product and for post-manufacture services, including delivery of the equipment to the client. This was a deliberate strategy, allowing the company to differentiate itself from competitors by the services integrated with the products it offered.

Case Study One: a multinational corporation and a local contract manufacturer

The multinational

For most of the history of its operation the multinational firm interviewed had been directly involved in the manufacture of its products, owning and operating factories in Australia and throughout the world. From the early 1990s, however, the company changed strategy and began to contract out its manufacturing operations. By the end of the decade it relied entirely on subcontracting. The decision to move to subcontracting involved analysing and redefining what that company did to create value for its customers. The interviewee said that the shift in strategy resulting from the analysis created a new emphasis on core competencies and described it as a 'move to forge tighter links between corporate research and business units and a shift to strategic R&D and away from manufacturing.' **Now the company describes itself as 'basically a research, design and marketing company.'** In other words, it has become a *service* rather than an *assembly* or *manufacturing* company, although in the public mind it remains a manufacturer.

The one-time assembler multinational used a contract manufacturer with local subsidiaries as its preferred supplier of circuit boards for all its ICT-related products. Under the arrangement with this contract manufacturer the chain of production of these circuit boards has become divided. The assembler performs most of the early and late value-adding activities, notably design, marketing and sales, while the central activities of manufacturing and delivery activities are performed by the contracting manufacturer who also services the product after sale.

The local contractor

The response of the contracting firm to the outsourcing strategy of its clients was provision of extra services within the contracting company itself, including prototyping, testing, engineering and calibration as well as the point-of-sale documentation and configuration services as required by the client:

‘We are changing our status from that of equipment manufacturer to that of systems engineer and integrator. Our customers, such as telephone companies and large multinational companies, are increasingly outsourcing the technical aspects of their business to others so that they can focus more on serving customers.’

While the multinational client increasingly focused on its core competencies, the range of services offered by its contract manufacturer enabled the client to continue both to have design input and the assurance of particular quality standards without having to devote resources internally to the ‘technicalities’ of the manufacturing process. Similarly, the capacity to offer clients design support in turn differentiated the contract manufacturer from its competitors in the field:

‘As a contract manufacturer the main service is manufacturing but where we give an extra offering to the customer is that we get involved early during the design stage. [During this stage] we give feedback, input, we suggest how to design the boards, right up to testing. We also can re-configure the circuit board in the way it will be configured by the end customer...These packages make it easier for our customers, they cut down their workload.’

The contract manufacturer indicated the increasing importance of its service roles provided to clients. Indeed, the rise in importance of services offered was shifting the whole nature of the business:

‘The provision of services seems increasingly important to contract manufacturers...initially this was just an extra service but now it’s competing with manufacturing as the core business’.

It may be that this company too will eventually shift to provision of services only.

Developing product-service packages of this kind enables contract manufacturers to take a share in the new markets opening up as a result of outsourcing by overseas multinationals and to rethink the nature of the business they are in. Just as major manufacturing companies are shifting to becoming service firms in order to concentrate on rare competencies, so contract manufacturers also are starting to offer services that support and facilitate even those rare competences, including the core design input and quality control, as well as lower-technology services, such as the goods management involved in logistics, delivery and warehousing. This trend pushes the provision of services by what are at first glance manufacturers further and further into the emerging segments of the economy. The client firm remains involved in product-design and quality control only at the level of coordination, not that of implementation.

Case Two: New products increase demand for after-sales services

Manufacturers are knowledge-rich in relation to the uses and limitations of their new products. They hold both codified knowledge and tacit understandings, a combination which places them in a unique position to offer after-sales, help-desk type support to provide better information about the products for users as the market becomes more sophisticated and saturated. The importance of manufacturers' knowledge to clients is particularly clear where the product is highly regulated and clients need good knowledge of product performance. Developing product-service packages with after-sales help-desk support can also help the manufacturer establish and entrench user confidence and loyalty.

Nowhere was this clearer than in the pharmaceuticals industry, a sector where testing is fundamental to product development and acceptance. New over-the-counter and prescription drugs with which the medical market is unfamiliar place pressure on prescribing or advising doctors to have a thorough knowledge of the effect of the drug on different patients. As the range of drugs increases, public demand for information about the effect of the drugs on different disease states also increases. Some manufacturers respond – or try to lead the market – by creating 'help-desk' services for consumers and medical professionals.

The pharmaceutical industry is perhaps the clearest case of where producer information remains critical to sales but it is not alone. Ten out of the other twelve manufacturers interviewed had built up broad-ranging specialist knowledge of products through testing during the development process. This knowledge created a separate market and led to a strategy of developing testing and support services for their clients, including specialist maintenance and repairs. The development of such after-sales services was driven by client demand. Offering after-sales support enabled manufacturers to establish longer-term links with clients and gain access in turn to the user knowledge and ideas needed for further product and service innovation. The case study below illustrates how developing new products can stimulate firms to provide additional training services that not only sought to teach users about the new product's applications but also develop user confidence in the new product.

Case Study Two: After sales service: educating users about new product applications

The development of after-sales services by manufacturers was particularly common where products were difficult to use. The training associated with one of the products made by a medical equipment manufacturer interviewed provides a typical example.

Much of the medical equipment manufactured by this firm could be used in a variety of settings and had a range of adaptable features. Customers, who usually had little such capability themselves, needed training in the use of the equipment, leading the manufacturer to seize a new market opportunity. Thus, in addition to installation and maintenance, the manufacturer's services came to include training programs and providing users with operating certification. In this way the manufacturer also became a training provider, teaching clients how to operate and develop specific applications capability for their equipment.

‘When training personnel for hospitals, we set up the whole unit. We do all the maintenance and training and provide personnel. We help them put facilities in place, we put them through a special course and train to a certificate stage to enable them to operate the product.’

As part of their consultation with users about their intended use for their equipment, the equipment’s manufacturer set up training units for their clients. ‘We involve customers and share resources rather than having a big training design team’, the interviewee said.

Providing these services gave the manufacturer access to user context information which was potentially useful later in the development of product-service innovations.

In this way, the manufacturing company gradually moved from the provision of a product to the provision of a product-service package with several components.

‘... now, in addition, to offering the maintenance support to users of our medical equipment we offer them the skills and knowledge necessary to optimise the utility of the machine. As a consequence we’re doing things we wouldn’t have done ten years ago - we would never have done training before - but now we do it because the customer requires us to do that.’

The case study shows how, by responding to user needs, the manufacturer had taken a further step up the service-provision ladder, offering education as well as the more common services linked directly to the product, such as installation and maintenance. Offering training in the use of one product enabled the firm to develop a broader set of training skills, which could be used in other markets in the future.

Case Three: Cost considerations

The cost of a product influences provision by its manufacturer of a range of assorted services. If a product is expensive, demand for services provided with the product at or after the point-of-sale seems to increase. High cost, both of consumer products and of major intermediate goods, increases demand for financial services to assist users to purchase the product. These services are of many kinds.

Four of the firms interviewed provided financial services to their clients. One of the sheet metal manufacturers, for example, had developed packages for high cost products, although it had not yet used them in domestic markets: ‘We have [offered finance] in some of our tenders, but haven’t had to use it yet. We have set up deals with banks and on some overseas contracts, we have offered finance as part of a package’. Offering finance-based product-service packages is a mechanism enabling manufacturers to encourage expensive investments by clients, making their product more attractive in the market and enabling them to acquire new skills and potential further markets.

Case Study Three: Financial services developed by a high-tech equipment manufacturer

The firm said that clients buying or leasing their expensive equipment sought some way to off-load some of the risk of such a large investment and, in response, the firm offered clients a range of payment options. The firm made some products that were not only expensive and highly customised, but typically had excess operational capacity for most clients. As most clients did not need to use the equipment all the time, it was difficult for them to recoup their capital investment.

As the firm interviewed explained,

‘someone might use the [product] 8 hours a day. That means that we or another company could use it for the remaining hours of the day. In this case we would design a package that financed different clients using the same product, based on the time spent using the product. This might be a matter of us financing their activity. *In this way we can finance clients in a way that gives them a cheaper operating cost.*’

The manufacturer thus became a co-ordinator of different users for the product as well as providing an ordinary financial service.

Key to the manufacturer’s financial services strategy was the provision of long term leasing arrangements which also included an option for clients to eventually buy the product outright. The company provided a range of different payment contracts to suit what the interviewee described as ‘the sometimes lumpy cash flow of our clients.’ The service also offered development of a range of maintenance options. Providing these services became an important way of both keeping existing clients and of attracting new ones.

‘If we had a blank contract we’d miss out on quite a lot of work. It suits some of our clients to pay one way, others another. Some get a grant and say we’ve got so much money to last us three years or one year.’

Case Four: Geographical proximity to product markets

The need for a presence close to markets is a key driver of the move to offer services and products together as a package. This works in both directions: firms exporting need to develop linkages with local service firms operating in their export markets to provide the installation and maintenance of equipment sold overseas, while service companies in Australia are asked by major overseas or inter-State equipment suppliers to distribute products and undertake repairs and maintenance on products sold. As the management of large scale manufacturing production becomes more concentrated globally, distribution (and sometimes manufacture) often becomes more geographically dispersed. Concentrated production creates logistical issues which cannot be easily dealt with by the originating firm. This means that overseas manufacturers exporting to Australia have no ‘on-the-ground’ support for their products and seek local manufacturing companies with knowledge of the products to take up this role. Manufacturing firms in Australia may thus add services to other companies’ products as well as their own.

There are two senses in which proximity to final product markets may influence firms' strategies for linking products or services. First, when manufacturers are geographically close to the final consumers of their product, there may be more opportunities to provide additional after-sales services than when they are situated further up the supply chain or are geographically further away. Second, the current trend towards regional manufacturing (where manufacturers are also establishing regional servicing facilities that can effectively service and support equipment sold in overseas markets) encourages service provision among manufacturers because it increases the capacity of firms to provide after-sales services such as repair, maintenance and training. Some manufacturers provide after-sales services by themselves while others, especially those exporting, need to develop partnerships with service firms overseas.

To ensure a position in supply chains composed largely of a few large players, local resellers of imported manufacturing equipment or manufactured goods in our sample had to demonstrate to often powerful multinational suppliers that they could meet customer demand for maintenance, installation and customisation requirements, as well as managing the sales and delivery of the product. In some cases, this requirement has worked to local firms' advantage as they had to develop strategies which gained them global reputations as suppliers of replacement parts for 'big-ticket' items, such as dump-trucks, backhoes and cranes, by bundling provision of these items with after-sales services.

Case Study Four: Contract electronics manufacturer

A contract electronics manufacturer interviewed for this project had been selected by a large foreign-owned multinational for acquisition. The interviewee believed that a major component of the strategic plans of many multinationals is now to offer clients 'full turnkey solutions' in all its markets.

'Now multinationals want to outsource [work] to companies that not only manufacture and assemble their products but [also] manage the delivery of services to their products' markets.'

The electronics products made by the company were linked to a range of services including installation, on-site calibration and testing, and on-going maintenance.

'Our capacity to offer after-sales support in Australia was an important 'selling-point' to our multinational. If the product [we manufacture] for some reason fails after one year, the client doesn't want to send it overseas to get it fixed. So having the service capability here means it will just come back here. Also sometimes we have to send engineers to the site to fix the problem. That proximity helps a lot'.

The selection of the company for acquisition was based on its ability to offer 'integrated and after-sales support for products.'

'In the end, the company saw us as more than a contract manufacturer and decided to buy the company outright. Now we operate as a complete turnkey solutions provider for the Australian market.'

Thus, as large multinational firms increasingly focus on their core competencies in order to develop economies of scope and scale in marketing, sales and product

development, their demand for service-enhanced, 'solutions based' contract manufacturing seems to have increased. In response, the range of services provided by the contract manufacturer interviewed has increased. Some of these are of the service-product integration type occurring during the development and manufacturing phase. These include prototyping, testing and engineering. Some link products and services after the point-of-sale and include after-sales services such as delivery, warehousing and maintenance. As the interviewee explained:

'multinationals must have a base near their market for two important reasons, namely, the close interaction between suppliers and users and customisation of producer services to the user's particular needs. Accordingly, multinationals must operate many branches within their own countries and abroad in order to locate in areas where manufacturing is dense'

The need to have service-provision located close to markets was felt both by firms entering the Australian market from overseas and by firms entering overseas markets from Australia. One manufacturer interviewed provided a useful example of how a firm that had expanded internationally had to search for after-sales service providers 'on-the-ground' in its own export markets. The firm emphasised the importance of finding 'good reliable agents or partners' in its overseas markets, not just in terms of finding a distributor but, 'somebody that has got quite a bit of technical know-how on the ground, that can provide the ability to go in and do the service and maintenance to our standards using our manuals'. It is often only a local manufacturer who has the capacity to engineer and produce replacement parts. Providing local after-sales support thus stimulates linkages between service provision and manufacturing. It may also encourage collaboration between a group of firms. In this case, the package of products and services offered to clients is not provided by the equipment-maker alone but by a partnership of several firms – a core manufacturer in Australia and its partner service providers in each export market.

Case Five: The regulatory regime and standards surrounding a product: driving demand for integrated services

The highly regulated environments in which some firms operate influence the strategies they develop for service-product integration. Some companies may need to develop design and customisation capability to ensure that products meet regulatory requirements in overseas markets. One high tech equipment manufacturer interviewed, for example, was a market leader in telescope design and construction in markets around the world. Its customers were normally 'the government of the day' so it had to fit the rules surrounding the relevant government procurement program in order to satisfy the design requirements. The design process involved constant interaction with clients. For a project they were currently working on, 'design review discussions occur weekly.' Ensuring that designs meet such regulatory requirements can help firms establish a reputation for quality and reinforce their position in domestic and international markets. Linking services in design to their manufacturing process has multiple advantages in such arenas. In such cases, adjusting broader strategies to meet regulatory requirements can also give firms a competitive edge in less demanding markets, thereby broadening their competences and raising skill levels.

In other industries, the complex regulation surrounding production and sale of new products can encourage after-sales services of many kinds, notably help desks and other forms of

information-provision concerning use and effectiveness. This was particularly true in pharmaceuticals.

Case Study Five: Regulation shaping product/service linkages in pharmaceuticals

We interviewed a pharmaceuticals company manufacturing and selling a range of over-the-counter and prescription products, particularly for the control of asthma and other respiratory conditions. A small proportion of the manufacturer's products went directly to hospitals, while most were distributed through wholesalers. The company is one of the top 30 producers of prescription drugs in Australia and in the top 20 in over-the-counter products.

The strict regulatory processes surrounding the development and sale of prescription drugs ensure that pharmaceutical manufacturers develop knowledge about all aspects of the drug and its effect. The clinical trials require active chemicals to be registered, involving a detailed submission about how the product was tested to show it meets specifications. As our interviewee reported, 'these submissions can be volumes and volumes – for a new product it can mean 1000 pages of documentation.' Testing and the development phase for prescription drugs involves extensive collaboration between the firm and a range of specialists: 'You use a lot more specialists - you have groups you talk to who give advice on whether they think the products are good or not good - you work with universities to do research and development.'

In the case of over-the-counter drugs, the development phase is shorter, involving fewer players, lower levels of technology and fewer resources, but generates considerable information about the effect of the drugs which is recorded by the manufacturer.

Drug manufacturers have to build up knowledge about the effect of a wide range of products, placing them in a good position to develop its help-desk service, providing information about the performance of certain drugs on particular disease states. In this way, the pharmaceuticals manufacturers do not just sell a product but also advice on the use of the product.

CHAPTER 5: ‘SERVICE’ FIRMS: BUNDLING PRODUCTS AND SERVICES IN THE INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT) SECTOR

The next two chapters show how integration of products and services takes place both during the manufacturing process and after sales as well. In this chapter we take a different perspective and focus on ‘third party’ companies that bundle together products from different sectors and add services to them for a vast range of clients, especially where the ‘products’ offered are in the area of the enabling technologies provided by ICT firms. In the ICT case, the locus of coordination of the products with the services often spans many sectors and links these together. Creation of a given product-service package by such ‘third-party’ companies also creates a ‘coordination field’ that can effectively operate as a new industry, one linking both products and services and services and services.

The most important of these coordinating industries at present is the ICT sector and we focus on that here. Most ICT firms operating in Australia are not involved in the manufacture of physical products, but instead buy products which they then link together to create a range of product-service bundles. In the following pages we show how the linking of products and services continues long after the hardware leaves the production line and how the focus gradually shifts, first to provision of extra services and then potentially may eventually to improved physical products in a further feedback loop.

Product-service bundles in the Australian IT and telecommunications sector

In Australia, the coordination field created by the telecommunications and information technology sector is one of the fastest growing and strategically most important areas of the economy. In 1996, for example, the telecommunications sector grew nearly five times faster than the economy as a whole. In the three years to 1997 telecommunications industry revenue increased by 40% to \$25 billion and accounted for 5% of Australia’s GDP (Department of Communications, Information Technology and the Arts 2000). In response to deregulation in the 1980s, increasing numbers of private sector participants, including foreign communications companies, have entered the telecommunications market over the last decade. By May 2000, more than 40 carriers had been licensed to operate by the Australian Communications Association and some 1050 carriage service providers were registered with the Telecommunications Industry Ombudsman (DCITA 2000).

The information technology industry more broadly is also growing rapidly in Australia. According to Houghton (2001:7), employment in the ICT industries has been growing at three times the rate of the Australian economy with a compound annual rate of 6.6 percent since 1996 compared to 2.1 for the economy as a whole. Another sign of this growth is that since 1993 the ICT industries have contributed ‘13 per cent of the total increase in Gross Domestic Income in Australia’ (Houghton 2001:iv). Australian consumers are relatively quick to purchase and use new technologies and recent surveys suggest that Australians are some of the most frequent users of the Internet and computers in the world, with twice the

OECD average number of computers per 1000 people connected to the Internet by the late 1990s (OECD 1999; BAS update, September 2000). As a producer of enabling technologies for others, what happens in this sector is of critical importance to many.

For the present study we conducted interviews with fifteen IT firms specialising in pre-packaged and customised software, eight telecommunication firms and four consumer electronics specialists. Some of the consumer electronics firms had divisions that provided software and telecommunications services as well as consumer electronics.

The services typically offered to clients by the IT firms interviewed were customisation, installation, training, maintenance, technical support and upgrades, bundled together with pre-packaged and customised software and hardware. Respondents referred to product-service packages combining one or more of these services as 'solutions'. The telecommunications companies offered similar services, although setting up communication systems for offices or workplaces often requires less customisation than is required in setting-up IT systems. All the telecommunications firms interviewed had extended their product-service bundled offerings in order to differentiate their output in the market. (For more details on the services offered by Telecommunications and IT firms interviewed for the study see Table A3.2 in Appendix Three.)

The ICT firms studied are service firms which take hardware products and, by linking services to them, act as focal firms for the provision of product-service packages. They are normally thought of by observers as firms whose strategies are greatly different from those of manufacturers. In contrast, our study suggests that these strategies are in fact essentially part of the same trend that we have shown in manufacturing – linking products and services into product-service packages. The difference is that ICT firms are operating further towards the 'services' end of a product-service spectrum of economic activity than are many manufacturers. This does not mean, however, that the strategies are different in *kind*, only that they are different in *degree*. The examples given below illustrate this finding.

Case One: Customisation and the coordination of business activities

Several factors are driving telecommunications and IT firms' decisions to develop their service-provision capacities by selling 'solutions'. One of the most important is client demand for customised 'products', especially to integrate business activities in different parts of a firm. All the firms interviewed said that the more customised a software-based product package, the more service-intense the overall software solution needed to be because the customisation process involved more design, testing, installation and customer training input.

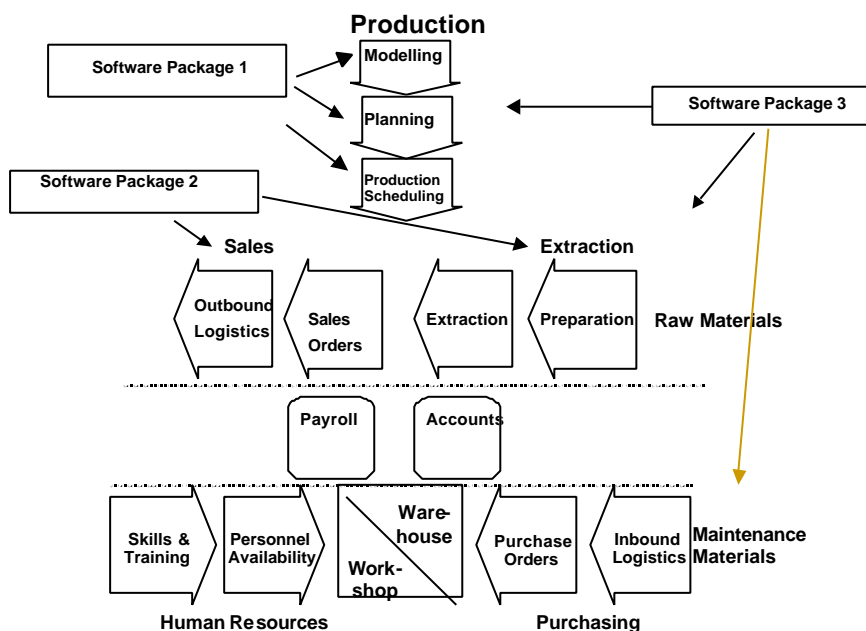
Most IT firms in our sample provide services designed to modify standardised software and hardware systems for clients and then bundle these customisation services with installation, training, maintenance and upgrades. Their clients faced complex organisational challenges in choosing and maintaining IT and communications technologies to support their firms' activities. As new technology has become available to link together more aspects of client operations, and as the operations of the client firms themselves have changed, their IT needs have become more complex to fulfil. The nature of the role of IT systems means that client needs tend to be specific, not only to any one client firm but, in some cases, even to particular divisions within the firm. The specificity of client needs has pushed IT firms to specialise in the design and implementation of IT to address the requirements of individual customers.

Software is the core component of all the product-service packages provided by the IT firms interviewed. Software systems are increasingly being used by firms to link areas of their operation together. The case in point is one which links manufacturing operations to the internal service elements of the business. In order to accommodate different user-requirements, the software components of the systems offered are open, ‘modular’ structures so that they can be easily extended and customised to suit specific requirements. Offering such solutions also brings the product-service bundles provided by these firms back into the domain of manufacturing to create the new products which come to underpin new or expanded services.

In their turn, the software packages or ‘solutions’ created serve as mechanisms through which data relating to business costs, time cycles and the value of innovations such as new manufacturing processes can be used to improve business performance.

An example of the coordination of manufacturing business activities through the use of ICT is provided in Figure 5.1 below. The Figure shows how each software package (1, 2 and 3) integrates the information flowing between specific firm activities within a manufacturing process. In the case of *Software Package 1*, information flows between the activities of modelling, planning and production scheduling are integrated in order to provide 3D spatial modelling, visualisation and analysis tools. *Software Package 2* seeks to model and report on the movement of material through various physical processes as well as manage the supply chain to reduce operating costs. *Software Package 3* offers control of on-site operations by using the functionality of the other two packages to provide information about products at each stage of processing from raw materials to point-of-sale.

Figure 5.1: Scheme of IT 'solutions' packages



Source: Derived from information provided by interviewees

Case Two: New products and new technologies create demand for ICT services

As with the manufacturing example given in Chapter Four, complex new ICT products, such as wireless application protocol (WAP) mobile phones or interactive televisions, and new technologies, such as more powerful computers, increase customer demand for after-sales installation and training services. As some of these new high-technology products have potential multi-usage patterns, telecommunications firms increasingly provide after-sales assistance to customers to help them identify and realise the new products' potential. In this way, the emergence of new products in the IT and telecommunications sector has spurred the growth of help-desk style technical support, equipment training sessions (sometimes delivered on-line), call centre service or other forms of training, just as it has in the manufacturing area. One telecommunications interviewee pointed out that:

'We now have a large number of employees dedicated to educating our customers about the potential uses of our products. These employees can also show customers how these products can be linked to others with the result that they have several more applications. All of this assistance can be provided by our call centre.'

Another telecommunications firm elaborated on the same theme:

'When a technology is very new then there is not much known about it, the client requesting it typically does not have experts on the floor who know about it. Therefore, there is an opportunity (and it is also required by vendors) to be able to provide services to be able to work through that consulting stage when a client is trying to work out what their needs truly are, because they don't totally know what the technology is capable of and also they need on-going services for the implementation as you roll out this new technology to the users.'

The training requirements of their clients often underpin the creation of long-term user-producer relationships for ICT providers.

New technologies have also facilitated the further development of product-service linkage strategies by stimulating upgrading of telecommunications infrastructure by clients. These improved networks have facilitated improvements in the complexity, precision and quality of the services offered by telecommunications and IT firms and have had an important role in setting new standards. The new technologies include hybrid-fibre-coaxial (HFC) cable or asymmetric digital subscriber line (ADSL) upgrades in order to boost the capacity of existing networks and thereby make it possible to carry broad-band services such as data from the Internet or pay TV.

To cope with innovation in the sending and receiving of data, ICT firms have been spending aggressively to upgrade their systems to ensure that they can provide fast access and value-added services. Many interviewees stressed that access to a hybrid fibre-coaxial (HFC) cable network is one of the keys to remaining competitive. One interviewee said that HFC will be up and running by next year and that because of this 'convergence will be inevitable and telecommunications will be able to provide customers with a final solution to all their wants.'

The continuous emergence of new technologies has facilitated service provision among telecommunications and IT companies in two main ways. First, new software has allowed firms to develop user profiles and use these to develop and tailor services to suit specific requirements. The software has also helped firms manage consumers of packages of products and services in terms of both billing and after-sales support. Second, new technologies have resulted in a significant upgrading of telecommunications infrastructure, improving access to current offerings and adding to possible modes of delivery of ICT services.

Case Three: Cost considerations

In discussing product-service provision in manufacturing, we focussed on the effects of high cost products on the propensity of firms to add services to their products to attract clients. The high cost of the products they were using themselves also influenced the product-service linkage strategies of some telecommunications firms but, in contrast to manufacturing, it is the relative cheapness of the tangible components of many physical telecommunications products that has stimulated firms to offer more and more services as a central strategy aimed at improving profit margins. One telecommunications firm thus pointed out that:

‘With increasing commodification of telecommunications products it is important that we seek to have differentiation through packaging. You need to add service to add value – there are no margins on hardware.’

And another added that ‘No one makes money on the handsets. It’s a means to an end. Handsets are offered at well below their cost. So much so that the subsidy becomes a cost of acquisition of a customer.’

Many firms derive little or no income from the sale of tangible products, their firms’ profits flowing principally from the sale of a range of services linked to the tangible products; the products used become the loss-leaders of the industry. Some telecommunications companies, for example, offer mobile phones at such heavily subsidised prices that costs can only be covered upon the sale of additional bundled services.

Financial services, however, can be used in service-service bundles to improve competitiveness just as they can in product-service packages. Some major ICT product-service projects are high cost. As in manufacturing, one of the IT firms indicated that it was collaborating with a finance company as a way of offering financial assistance to major clients who involve the firm in larger projects:

‘We have a relationship with a company that offers finance for large projects that we need to finance where the customer is not willing to organise it themselves. We are looking also to structure future project-management deals in conjunction with that finance company.’

Case Four: Service dependence of hardware components

The ICT sector is differentiated in one important respect from manufacturing in its product-service package. This difference arises from the fact that the many ICT hardware products will not work without the addition of services, meaning that linking products and service into single packages at or after the point-of-sale is a widespread strategy and all telecommunications and IT product-service packages contain tangible components. The reverse is of course also true: long-distance, local, pay TV and Internet access can only function fully when they are operated with hardware. This high degree of service dependence or interfunctional linkage between telecommunications and IT tangible products (eg computers and telephone handsets) and services (eg software and telephone lines) has stimulated the development of a host of related services.

Many telecommunications and IT products require not only one service to make them operational but need a whole range of support products to allow them to reach their full potential which in turn can induce demand for a cascade of assorted products. In the

telecommunications sector, for example, bundles are often made up of many components that are linked. Some of these product-service packages lock users into using products by ensuring that the components are not compatible with competitors' products or systems in an attempt to retain customers. The best known example is that of Microsoft linking its Internet browser – Internet Explorer – to the company's Windows operating system. As one telecommunications we interviewed observed:

'Generally speaking, in the telecommunications industry you usually have additional benefits from having products which are from the same manufacturer because usually there is a lot of proprietary functionality offered. You are usually better off if you have all one brand of product.'

Such a 'closed architecture' competitive strategy did not find favour with all the firms studied. Most stressed the need to develop products that were compatible with a wide range of available products and systems so as to maximise the potential market via the establishment of common standards. As one firm observed:

'We have an open architecture philosophy for two reasons because (a) it is the fastest way for the market to develop and (b) the best way to get good deals from suppliers. We believe that the best way to get a variety of suppliers is to adopt the same standards.'

Case Five: Deregulation: linking products and services to minimise market churn

Telecommunications remains a regulated sector in Australia but the relative deregulation of the last decade or so and the subsequent increase in competition in the market have encouraged firms to adopt a wide variety of product-service bundling strategies. For the more established players, deregulation has made keeping existing customers a priority, while for newer ones getting those customers onto their own books is critical. In both cases, product-service linkages are important.

'Churn is a big problem for telecommunications companies because of the increasing number of participants. Reducing churn is the key to profitability in this industry and bundling can be the answer. ...If a customer has a desire to deal with you for one product they tend to go to you for another product.'

Another telecommunications firm also pointed to the direct relationship between the number of services offered and the likelihood of keeping clients:

'The more services we can offer, the greater the probability of snaring consumers and keeping them. That's because a company that offers one service has a high churn rate, a company bundling two products reduces the churn rate by 30% and a company offering five products reduces the churn rate by more than 60%.'

It is the capacity of service providers to establish and maintain long-term user-producer relationships that provides the competitive edge. The majority of the ICT companies interviewed saw the value of a product-service bundling strategy as crucial to its potential to create ongoing customer relationships and to extending the period for additional after-sales services. Indeed, both reducing customer churn rates and increasing the amount spent by each household on the products of the company were the cornerstones of many product-service linkage strategies.

In the ICT industry, as potentially in other 'service' industries, the physical products sold or used, while providing the basis for a business, play only a relatively minor part in that business' success. It is the services added to the product that differentiate firms, that create and shape markets, and thus ensure competitive success.

In this report the nature of our samples has led us to focus more on the manufacture of intermediate goods and ICT products than on products designed for final consumers in mass markets. ICT technologies may also, however, assist manufacturers in consumer goods markets to 'mass customise' their products by allowing them to link consumer preferences directly to their manufacturing processes. We were not able to collect data on this aspect of firms' product-service linkage strategies in the ABL survey, but an example of the possibilities is provided by the Lego Company. In his study of firms' internet strategies, Andersen describes how Lego uses the internet to drive the manufacturing process. Lego has created a new product, Lego Mosaic, where consumers send a design to Lego, which then manufactures the bricks needed for the construction of the design, mailing them back to the customers to build their own model (Andersen, forthcoming).

CHAPTER 6: SERVICE-ENHANCEMENT IN PRODUCTION: PROJECT-BASED FIRMS

The survey data gathered for this study suggest that the greater the extent to which a product is customised, the more likely it is to be also service-enhanced because the manufacture of customised products relies particularly heavily on high level technical design, engineering, computing and management skills. In this chapter we show that projects – ‘products’ designed in one-off or very small batches for a unique application – are also likely to be service-intensive. Project-based firms, such as those in engineering construction whose work proceeds project by project, mixing products and services as each project proceeds, are therefore especially likely to provide an extensive range of services in conjunction with their products. We show this through three case studies of the product-service linkage strategies pursued by different types of project-based firms. In this chapter we do not follow quite the same format as in the last two chapters, focussing on sectoral activity rather than type of production activity (manufacturing or services).

The first case study is of strategies devised by three firms involved in the development and operation of a coal mine and examines the link between outsourcing strategies by core firms and the development of service provision by partner enterprises. It also notes how the huge expenses of mining have led to the development of specialised financial services among some mining contractors.

The second case study looks at the construction of a multi-purpose sports arena to show how outsourcing by governments and the imposition of strict environmental regulations and standards combine to influence service provision by different players involved in a major building and construction project.

Finally, we present a very different arena in a case study of players involved in the delivery of health services in the home. The study suggests that the development of product-service packages within this area of health care is strongly influenced by a range of emerging new technologies developed by manufacturing firms, who may well work to develop ideas from the service providers in an interactive loop.

A mining project

We interviewed the owner of a mine, a contract mining company, and a mining equipment manufacturer involved in the operation of a coal mine in the NSW Hunter Valley. We found that all the firms outsourced some activities, creating an ‘outsourcing chain’ that linked players at different points in the supply chain.

The case study examines the nature and extent of outsourcing by each firm working on the project and how the shift to outsourcing has influenced the provision of services along the chain. This is a particularly interesting case because it shows both how cost considerations have encouraged provision of financial services (in this case, taking equity) and provision of maintenance for the equipment manufactured. Indeed, in this case, the profit from the services was critical to the continuation of manufacturing which would not have been profitable without it. It also shows how the regulatory framework, here relating to the

environment, again stimulates the development of new skills for service provision, leading in this case to the establishment of an additional company. It further encouraged a shift to service provision by related and supplier firms.

Project One: The development and operation of a mine

The major firm interviewed for this case study was a large public company that has owned a mine for the last fifteen years. The company described its activities with regard to the mine as the ‘value-added activities’ associated with the marketing of semi-soft coking coal to international buyers. The mine owner does not operate the mine itself but uses other companies to conduct most on-site mining and mining-related activities.

The mining contractor used by the mine owner to operate the mine provided a range of services to its client, from initial exploration through to drilling. It also provided technical services, prepared applications for mining leases and mining approvals, EIS, and development consents, ‘in fact the whole approvals process to start mining. From that point we do the drilling, blasting loading, hauling etc.’ The contractor also provided earthmoving services and moved over 150 million tons of earth a year.

The considerable costs involved in setting up and operating mines mean that, in common with practices in some areas of building and construction and provision of heavy infrastructure, financial services had also become a growing area for the prime mining contractor.

‘Our clients often take on a contractor to raise the capital they need. For this reason, some contractors are taking on risk by investing or taking equity in mines. Even the largest [coal mine owning] companies are going to want to have less capital invested in their projects so that they can use their available capital elsewhere. One of their strategies is to have a contractor come in and get [that firm] to invest. In this way they don’t have to have all their own capital invested.’

Not all mining activities, however, were provided by the prime contractor firm, which in turn often subcontracted to others. As the prime contractor pointed out:

‘We are not trying to diversify to the extent where we want to get rid of other subcontractors. We do some projects where we are just the project managers and everything is subcontracted – most of our building projects, for example, would be 95% subcontracted and 5% own labour.’

One activity the contractor firm outsourced was the maintenance of earth moving equipment. This was carried out by the equipment manufacturer which, extending its own reach into service provision, had developed a kind of leasing arrangement with the prime contractor to reduce the up-front costs of acquiring equipment. Most of the manufacturing firm’s profits came from the maintenance and service contracts associated with the leasing of its equipment, not from its manufacture:

‘It can take a while to make money, sometimes up to five years after the sale of a piece of equipment, but through the maintenance and equipment contract we can turn a profit. Without the maintenance contracts our businesses would not be viable’.

In this case, the addition of services made it possible for the firm to continue to manufacture and had thus become essential to the business.

A broad range of environmental services was also developed by the prime contractor to ensure compliance with local, State and Federal Government legislation. Initial environmental impact statements were put together by specialist sub-contractors but most subsequent environmental services, notably waste disposal and rehabilitation activities, were provided by the contractor. As the scope of environmental activities expanded, the contractor eventually established a separate company to provide environmental services.

In this way, in response to the mine owner's outsourcing strategy, the contractor developed a range of services and products to offer the owner a complete mining package. These included financial services and the establishment and management of the mine, from initial start-up through to waste disposal. Some of these activities involved other players, such as equipment manufacturers, who in turn developed new services linked to their products. Other mining-related activities were also either developed in-house or subcontracted further. The equipment manufacturer in turn developed product-service packages focusing on maintenance and parts replacement. Importantly for that firm, it was the provision of services, rather than products, that earned the most money.

This case study shows that outsourcing by firms engaged in mining stimulates service provision among firms in much of the mining product system, including emerging areas. In short, mine-owning companies increasingly recognise that, through the use of external specialists, they can improve mine performance. In response, other firms involved in the mine have recognised the demand for expertise as an opportunity to develop their own businesses by developing new services.

The financial area is once again a key one in service provision for many players. The high cost of a project may also stimulate the development of financial services in order to share risk between partners or assist users to purchase the product. Finally, the ratio of cost of repair to total cost may also stimulate service provision as a strategy for firms, making the sales of tangible products sometimes less important than the services now bundled with the physical product.

Constructed projects

Building and construction has always been a project-based industry, where lead firms coordinate a range of specialist skills, bringing them together for a specified period on specified sites to create a specific building or engineered construction. In more recent years, the responsibilities taken on by building and construction firms have expanded greatly in relation to major works. Outsourcing is an organisational trend not only among players operating within the private sector; a new model of privatised infrastructure development is increasingly favoured by the public sector. The Build, Own, Operate and Transfer (BOOT) model has become a common strategy used by Australia's State Governments to promote infrastructure development. While in the past, firms in the private sector may have participated as contractors in large-scale public infrastructure projects, increasingly private sector companies are the only groups directly involved in public works construction (AEGIS 1999c). State Governments use such outsourcing as a way to reduce the costs and risks associated with building public works.

Buildings and engineering constructions are high cost products so again finance is important in the stimulation of services provided by contractors:

‘BOOT contracts are all about the government removing itself from risk. They don’t want blow outs any more. Now they say “we’ll give this sum of money and you take on carte blanche all the risk”, that’s risk on completion, on cost overruns and operation loss. So we take the risk and we take central control. The government doesn’t want to know about the risk any more. Even if this fails, the government doesn’t care – it’s our risk - that tends to focus you.’

The following case study indicates how government outsourcing of the construction of a multi-purpose sports arena has affected service provision by a builder-developer and an architectural firm. It shows the effects of shifts in the regulatory framework in which the industry operates, in this case the special circumstances of the ‘green Games’, as a stimulant both to provision of new services and, through the regulatory obligations, to new partnerships and perhaps new manufacturing.

Project Two: The creation of an indoor sports and live entertainment venue

Since the late 1980s, the NSW Government’s Department of Public Works and Services (DPWS) has outsourced much of its public works construction. More recently, the DPWS extended this risk-sharing strategy to contracting out the ownership and operation rights of public works to private contractors for specified periods. In July 1997, the NSW State Government awarded a contract to Build, Own, Operate and Transfer (BOOT) a major indoor sports and live entertainment venue to a major firm in the building and construction industry (hereafter referred to as the lead firm). Under the BOOT contract the lead firm was required to undertake the coordination of the construction of the facility to the stage where it was ‘up and running’ and then to operate the facility (including the staging of sporting and/ or entertainment events) for the next thirty years.

The BOOT contract involved the lead firm in many aspects of the project, from contracting sports planners and architects, hiring staff and purchasing equipment (both highly technical equipment and consumables), to events management and catering.

In the first stage of the process, the lead firm assembled a team from its national resources. Included within this team were construction and building managers, cost planners, architects, contract and systems staff, engineers, administrators and clerks, site managers, foremen, tradesmen and secretarial staff. It then established a project-specific Design Office to ensure that the front end design was carried out efficiently and rapidly and appointed Design Managers to each sub-site of the total project. The lead firm utilised ‘a team-work approach to solving project-related problems’.

Our respondent explained how the responsibilities of the lead firm in respect to the project began to grow very early on:

‘We started as part of a consortium which had a merchant banker, a big international builder and ourselves as a local component. During the bidding process, though, the other partners left so we wound up as the only one. So it started out as a construction project but we now own everything, except ticketing and taking the rubbish away.’

It appears that the lead firm considered these services to be part of the overall package provided to the client. The interviewee said that his role was to act as ‘bid manager for all

the design construction and then to ensure that all of our operations were integrated into a package, so that we were actually building a machine which would service the business.’

Under the contract, the lead firm was also required to ensure that the design and construction of the arena met rigorous environmental standards. These standards not only affected initial construction activities but also the ongoing operation of the arena. The lead firm was committed to the purchase of ‘pure energy’ generated from solar, biomass, wind, or hydroelectric sources from Energy Australia and incorporated in the arena’s design the facility for a 70kw solar cell system on a section of the roof to return ‘Green Energy’ into the main electricity grid of New South Wales. Building materials were also carefully selected and extensive use was made of insulation derived from recycled paper/cellulose. Energy-efficient lighting controls and various water consumption minimisation strategies were also developed by the lead firm. As part of the firm’s waste management initiative a direct ‘site to recycler’ waste recycling system was set up, resulting in a significant reduction of dumping to landfill. Also, various energy-efficient mechanical services, including a microclimate air conditioning system and energy efficient refrigerators, were used.

The incorporation of these energy-efficiency services and products led to the development of a range of new environment-related competencies within the firm. The lead firm particularly noted that:

‘In this project we had to achieve very high environmental outcomes. It was a great learning curve for us and we were successful in developing the skills needed. No one has taken a building type like this and tried to build something that is as environmentally responsible. It has the largest operational rooftop solar cell in the world. We believe we set new standards during this project.’

Meeting environmental standards also depended on the availability of a range of highly skilled professionals, including architects, service engineers, structural engineers, civil engineers, mechanical engineers and architects. The Sydney-based architectural firm concerned was commissioned to design, document and provide advice throughout the construction on technical matters of the project. The architect in turn sought the assistance of international sports arena architects in the United States who had experience in designing multi-purpose arenas, creating a cascade of skilled professionals who could ensure that not only was the project environmentally sound but that it could be operated in an environmentally sustainable manner.

‘There was a strong environmental aspect to our brief. In response we had to come up with design solutions that ensured the arena was energy efficient. Design solutions can be related to staffing levels, security or maintenance. So when we tried to design an energy efficient building we thought of all aspects of its operation and then tried to think of ways of how the building could operate in an energy efficient way.’

This case study suggests that the opportunity for firms in the building and construction sector to add value via the provision of new services can be related directly to the extent to which clients outsource the project. The length of BOOT contracts (often more than 20 years) may also encourage project-based firms to diversify service offerings into areas not generally associated with building and construction, such as catering, facilities and events management. The case study also suggests how regulations and standards can affect the directions taken in service provision. In the case of both the lead firm and the chief

architect's office, environmental regulations stimulated the development of capacity to install and use environmentally-friendly products and, in the case of the architect's office, the capacity to find energy-efficient design solutions, thus again encouraging the development of new products and creating new services linked to them.

Healthcare in the home

'Health services' are commonly perceived as consisting of services alone. In reality, however, all health services involve linkages of products and services (see AEGIS report on Innovation in the Health System 2000). We conducted a small number of interviews with players in the health product system to examine the role of hospitals and private companies in the delivery of health services and products offered in single 'packages'. These packages are often combinations of home care, medical support and technology-intensive products that allow the delivery of care not only in hospitals but in smaller clinics and in the home, sometimes even remotely.

We focussed specifically on the delivery of health services to patients at home. The organisations delivering these services in the home were considered 'project-based' firms because they were involved in providing mixes of products and services that were both complex and tailored to the needs and treatment of a specific patient or patients. Thus, like other project-based activity, the packages of products and services offered had to be customised for individual users and were service-intensive.

We interviewed two providers of home health care. One was a major regional hospital which provided post-acute care services and products while the other was a private company that offered health services and products for the aged. Both organisations delivered these products and the linked services in product-service packages to patients in their homes.

In Australia, present increased interest in the provision of health services in the home is related to two trends. On the one hand, there has been a decline both in the number of hospital beds and in the amount of time patients spend in hospitals and a converse growth of same-day surgery (AEGIS 2000). On the other hand, demands placed on provision of health services as a whole have increased, partly resulting from the needs of an aging population. According to ACIL Consulting, the general public health care bill is rising fast and the aged health care bill is rising even more quickly. One view is that the aged care bill could rise from the current 3% of GDP to 6% of GDP in 50 years' time (Commonwealth Department of Health and Aged Care 1999:19). According to McIntosh (1998), in 1997, 35% of total expenditure in the health system was on people over 65, at a time when this group constituted around 12% of the population, and is expected to rise. Healthcare in the home may thus be a growing market. It may well involve the development of both new products and new services, both of which will in turn encourage growth in the others.

Healthcare-in-the-home programs offer an increasing number and diversity of service-enhanced products and services. Some of these are serviced-enhanced services, including, for example, a basic nursing service which is linked with other services such as physiotherapy treatments. In the case of health care for the aged or injured, some private providers offer nursing services in a package along with home help, personal care, meals, gardening and other domestic services.

Central to the delivery of health services outside hospitals or nursing homes is a range of new technologies. These technologies allow both remote consultative capacity and the delivery of

drug therapy and other treatments in the home. Other enabling technologies include monitoring systems to summon help, such as video links and pendant and wrist transmitters, memory-joggers for those with learning difficulties or mild forms of dementia, and smart cards which can be programmed to switch electronic appliances on or off. There also now exist smart items of furniture, most famously the ‘smart loo’ invented in Japan which not only conducts tests not only on excreta but also monitors blood pressure and physical movement in the area, raising the alarm if no movement is registered for a specified period.

The development of these products should involve real users in their design. Gann and his colleagues write that ‘participation [in design] promotes a sense of ownership, commitment and understanding of the design solution. Conversely, failure to involve users can lead to products and services which are poorly matched to requirements and which seriously under-perform from a user perspective. In particular, ease-of-use is very important to older or disabled users.’ (Gann, Barlow and Venables 1999: 33).

The following case study is based on interviews with two healthcare-in-the-home providers and examines the nature of and the links between the products and services involved in delivery of this type of healthcare as a ‘product-service package’. The study also examines the role played by new technologies in the development of these packages.

<p>Project Three: Healthcare-in-the-home for the aged</p>
<p><i>Background: the shift from hospital care to the use of new technologies in post-acute healthcare in the home</i></p>
<p>Innovation in procedural care and the development of new IT technologies, improved devices and new drugs play an important role in permitting delivery of health services in the home by the hospital interviewed for this study. New drugs, such as a recently developed anti-coagulant, have improved IV therapy systems in ways that allow the better management of dosages in the home. While post-acute care still involves domiciliary visits, it is also now often possible to use various IT technologies to talk to patients about symptoms or even to conduct most treatments at home. One such IT technology is the basis of an ad hoc monitoring service, known as HOLTER, a device to monitor people with irregular heartbeats or other cardiology problems. There are also some technologies that allow health services to be delivered remotely. These include modification of telephones to allow doctors and nurses to measure a patient’s pulse from a distance.</p>
<p>The delivery of post-acute care services in the home has also been encouraged by new procedural advances within the hospital which enable patients to return home more quickly. Use of less invasive surgical techniques, such as key hole surgery, has dramatically reduced the time of expensive hospital-based post-operative recovery but extended the ‘cheaper’ time spent at home recuperating. The hospital’s provision of home-style services has been accompanied by an increase in the number and activities of outpatient facilities. Seeking to encourage day-only attendance at clinics, these satellite centres are multi-purpose treatment centres and form part of most major hospital post acute care strategies.</p>

In the case of health care for the aged which we studied, the provider was a private company. The firm described its business as selling ‘aged care packages’, linking health services to broader service provision:

‘So where the company was providing just health service (ie registered nurse and enrolled nurse type services) I believed it should be more of a package of services, inclusive of home care type services such as cleaning, gardening and the like. So we built up that aspect of the service and that actually grew much more quickly than the health aspect.’

The company therefore now also provides meals, respite services, outings and handyman type services. Ancillary services, such as hairdressing, shopping and other services can also be added to the package.

New technologies enabling remote monitoring of patients were important to the private health provider delivering home services. When the company started out, some technologies it now uses had yet to be developed so the company had to become involved itself in the development of some of the products needed. The company representative interviewed noted that the idea for some products came from what he knew of technologies used in the security industry:

‘In some cases the equipment wasn’t right. So we looked at the software that the security industry was using to monitor buildings...we had to develop it as a health-related technology from scratch. The equipment and software we have developed is a the world leader and it’s about to be exported...’

The private health provider noted the role of the user during the design stage of new technologies:

‘One of the primary things that we do is virtually see what the client really does need. Rather than ask the client to sit around the technology, we developed the technology around the client’s own particular needs.’

The case study shows that, as the emphasis of health service delivery shifts from the hospital to the home, a variety of services and products enabled by new technologies has begun to emerge. The case shows how the need to provide services has caused the provider to develop new physical products. This intertwined development shows that, far from service growth inevitably replacing manufacturing, it can be the catalyst for new product development and hence new services, building a virtuous circle. It also shows that these new products and existing services are often linked to form packages for specific projects. The development of both products and services is stimulated by the particular projects at hand. In the production of healthcare project services, as in projects in other industries, there is thus considerable blurring of the divisions between the provision of goods and services.

CHAPTER 7: GOING-IT ALONE OR WITH OTHERS: PRODUCT-SERVICE LINKAGE AND ORGANISATIONAL CHANGE

Over the decade of the 1990s, many observers, notably Hedlund (1994), Miles et. al (1997) and Rycroft and Kash (1999), pointed to the new forms of organisation that were emerging to cope with the increasing complexity of products, communications and emerging technologies. There has been a good deal of work especially on the impact of the decision to adopt new physical technologies (eg Etlie & Reza 1992; Griffith et al. 1999; Tantoush & Clegg 2001). Firms which decide to link products and services require knowledge of both new technologies and products and potentially associated services in that domain, especially where service-product integration strategies are followed during manufacturing.

To maximise their return on new investments made, firms also require knowledge about the highly differentiated and often conflicting, requirements of customers. They may also need to develop their capacity to coordinate and project-manage a broader range of products and services. Many of these are by definition new to the organisation. They are often customised and perhaps require supplier firms to acquire new skills to design and implement changed product-service mixes. These new skills could be expected to relate especially to increased client-supplier communication and to designing and managing new organisational arrangements, such as greater use of teamwork in order to bring together products and services.

To be successful in adopting and benefiting from the product-service linkage strategy, firms' internal systems and external networks must be able to support operationally the development and sale of product-service packages.

The strategy of developing new 'products' by linking products and services could therefore imply that firms were also making other changes to the organisation of their business to support the strategy. In this chapter we present evidence from our study that suggests that the hypothesised associated organisational changes are indeed taking place, although the survey format did not allow us to explore this aspect in detail.

In this chapter, we focus first on internal changes, notably the recruitment of staff and development of new divisions of activity. Second, we consider external organisational change, focusing on collaboration with other firms to access new or additional skills and create the scale needed to work successfully in new markets.

Internal strategies

A number of strategy theorists have emphasised the importance of firms' core competencies to competitiveness. Developing new services also involves development of activities complementary to existing ones, thereby extending core competencies in new directions. In their dynamic capabilities approach to understanding firms' strategies, Teece et al. (1997) have shown that the mechanisms by which a firm accumulates and deploys new skills and capabilities are critical to its ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments. In two works, Hamel and Prahalad

(1989, Prahalad and Hamel 1990) have also emphasised that the process of internalising core competencies can enhance competitiveness, while Hamel in 1991 presented a skills-based view of the firm, focusing on the transfer of knowledge and the development of firms' earning capacities through the development of new core in-house competencies.

Moving towards linking services and products into product-service packages – in effect making new 'products' – could be expected to affect the mix of the intra-firm skills required to undertake the new activities. Successful product-service integration often depends on the recruitment of employees with skills in both technical and managerial areas, such as production coordination and marketing, when previously single skill sets were enough.

Problems of recruitment of new personnel with perhaps unusual skill combinations may be acute. This is especially the case in industries where new products come onto the market regularly and the impact of changes to products is not always clear to users. Similarly, in many cases the nature of the products means that client professionals who prescribe or recommend them to own clients (patients) need to build up expertise to minimise claims of misuse or negligence. In other areas, new skills are also crucial where companies are co-ordinating a large team of after-sales repair and maintenance contractors dispersed over a number of sites.

The pharmaceutical manufacturer interviewed in this study, for example, had experienced a period of growth in the range of products that it manufactured and a corresponding increase in customer and professional inquiries about the impact of those products on different disease states. In order to meet customer and professional inquiries about products, it sought staff with both 'information management expertise' and 'functional understanding' of products, a combination not needed previously.

Firms have four alternative strategies for filling these skill 'holes'. They can recruit externally, train internally, outsource some areas or pursue a combination strategy. Combination approaches seem common. Some firms in the study were outsourcing more of their services, rather than building their in-house capacity to provide them, but were also seeking graduates with the technical skills to ensure the requisite quality of the work of the subcontractors.

As some manufacturers had become the preferred suppliers of parts for products manufactured by multinationals working all over the world, the *coordination* of services became as important as the capacity to provide them each individually and often required firms to re-organise at home as well as develop new organisational modes elsewhere. As firms make the transition from product-providers to becoming project managers or providers of linked products and services, they often need to develop expertise in new areas and the management skills required to organise work sites spread over different States and countries.

Internationally, several observers have noted that the trend to integrating products and services has led some enterprises to make organisational changes, such as the creation of new divisions which then need new or differently skilled staff. Davies, for example, has noted that 'companies are [increasingly] opening divisions responsible exclusively for the integration of various products and services' (1997: 252). In some industries the organisational changes required may be more radical still. Chaisson, for example, in his study of product-service bundling in the telecommunications industry, indicates how such bundling requires 'a complete departure from the traditional vertical structure of historical telephone companies to a more complex model of horizontal integration across the full spectrum of voice, data and

multimedia services, while at the same time preserving customer facing segments' (1999: 43).

Many interviewees from ICT firms agreed with Chaisson, stressing that successful product-service linkage strategies do indeed require a more complex horizontal structure because, as one telecommunications industry respondent stated, 'in the industry today you must begin with the customer and work backwards'. Chaisson also argues that it is important that the process of product-service bundle development be managed by small, empowered cross-functional teams and that constant evaluation of progress in developing the bundle take place. This development could be seen in our study as well.

Similarly, the growth in demand for services in conjunction with products often meant that our firms not only had to recruit new staff but also to create new divisions within the organisation. Underlying this approach lies the view that 'you can no longer have separate product lines' and firms must create 'divisions that focus on the integration of components into packages, not the marketing of individual products'.

The case study below shows that tailoring packages for clients can cause such tensions inside the existing organisational structure that firms may have to draw on a range of competencies from across their company, breaking and reforming intra-organisational boundaries in the process.

Case One: Sharing a point of view: the organisational impact of the move to solution selling in ICT

The linking of products and services into one package had significant organisational implications for one major multinational IT company interviewed for this study. In the early 1980s, the company began to develop packaged products and services. The move to selling the resulting packages, however, posed significant challenges because selling bundled packages of products and services did not fit with the way the company was organised. At that time, the firm was made up of different divisions focused on the production, development and marketing of different products, with each division having its own sales force. This posed problems, especially of internal competition. As our respondent noted,

'In the early days "intramural" competition tended to get in the way of selling packages. Our company has a history of having competitive, product-focussed sales forces who have had trouble piecing together solutions.'

Changing the culture within the firm to one where all the company's divisions, including systems, networking and services, could work together to offer consistent bundled products was identified as an enterprise priority. Since it was acknowledged that the company had to develop various capacities 'with a single view of a customer' rather than various views, the firm decided to set up a new division specifically responsible for the coordination and integration of components into packages.

These accounts of internal organisational change suggest that the development of new products or manufacturing processes is not the only driver of organisational change for

manufacturing firms; rather the services requirements of clients can also influence firms' organisational structure.

Collaboration and strategies for external partnering

Recent studies show that good strategies for developing collaboration and partnering, especially in the search for new products and markets, can be useful in creating more competitive firms. International work on the benefits of collaboration for firms shows that, in particular, collaboration may assist companies to gain valuable experience, increase their exposure to related markets and improve their ability to sense and respond to new opportunities. Multiple co-operative relationships between firms can be the source of competitive strength for all involved if they are managed well and partners are well chosen (Hagedoorn, Link & Vonortas 2000: 573).

Collaboration in the productive arena can take many forms, from informal networks of interaction to formal joint ventures. Networks of all can be formed to link and exploit the different competencies of a group of firms within a quasi-organisational framework. The formation of strategic networks brings gains in efficiency, synergy and power.

Networks can assist firms to achieve both efficiencies through increases in scale and scope and via the reduction of transactional inefficiency in the open market. The efficiency and effectiveness of a network can also be attributed to the improved technological capability obtained, the opportunity to lower transaction costs (Gomes-Casseres 1996) and the possibility for joint value creation (Jarillo 1988). Linkages between firms with complementary skills which create synergies may also encourage more effective specialisation by allowing each firm in the network to concentrate on those parts of the value chain that better reflect individual firm competitive advantage so that all enterprises in the network can capture the benefits of specialisation, focus and scale (Miles and Snow 1984). In addition, early adopters of network strategies can gain power and enjoy a first-mover advantage in securing resources, gaining market position and political influence, controlling information, and brokering new cooperative arrangements (Miles and Snow 1984; Hagedoorn et al. 2000: 272).

Put differently, the improvement in capabilities acquired through network participation and collaboration also assists firms to improve competitive position by enabling them to better exploit their existing resources which are valuable, rare and not easily substitutable. Access to external resources via collaborative activities may be necessary in order to fully exploit internal assets (Hagedoorn et al. 2000: 572). Collaboration helps managers to determine prospectively the set of resources and capabilities necessary for superior performance in the kinds of uncertain market environments that most companies face (Sanchez 1993).

Recent international evidence on product innovation in manufacturing also shows that collaboration in innovation between firms and their clients and suppliers is the key to success.

We hypothesised that the development of product-service linkage strategies, especially those which involve cross-sectoral coordination, would foster innovation among manufacturers more than would product development alone. We suggested that the development of the more complex and diverse product-service packages would encourage greater collaboration among users, producers, regulators and public sector R&D organisations. We further

hypothesised that firms linking products and services would tend to form the collaborative relationships and network relationships needed to leverage the capacities of both their own and partner firms.

Our survey did indeed show a much greater propensity for firms producing both products and services to collaborate with others than for firms making only physical products. These laid the groundwork for developing efficiencies, synergies, power and capabilities to grow or shift. The following sections illustrate with case studies our major findings relating to the propensity for collaboration among the creators of product-service packages.

Technology transfer

Collaboration speeds the spread of technical knowhow in many kinds of productive organisations. Studies by Gann and Salter of the production of larger-scale projects in the building and construction industry have shown that the new interfaces formed between manufacturing and service businesses during these projects can lead to the rapid transfer of technical knowledge within complex networks of specialists and/or suppliers. They note that the interdependence between components and sub-systems characteristic of project-based manufacturing 'creates the need for an exchange of technical know-how across a range of professional and engineering disciplines.' (Gann and Salter 1998: 435). Many of the firms in our study were developing links that could improve technological spread, but it would need a more detailed study to assess the speed of this transfer.

The same need for an exchange of technical know-how is increasingly present where firms adopt outsourcing strategies, as Wyckoff and Fox (1997: 74) have pointed out, especially in electronics contract manufacturing and could be seen in Australian firms from our interviews. Technology transfer and the sharing of expertise are a feature of many multi-national producer-local contract manufacturer relationships, as we saw above. Wyckoff and Fox add that:

'It is important to manage the effects of the change from in-house manufacturing to outsourcing, including the development of a technology transfer schedule...Close customer supply links enable the supplier to improve quality of incoming parts and materials and to provide expertise in designing new products and reducing costs.'

While sub-contracting has always involved the transfer of technical knowledge from one firm to another, for example, through the sharing of plans and drawings, what may be new here is that joint development of product-service packages have encouraged greater levels of collaboration between the manufacturers and other firms in satisfying the needs of their clients. Marceau's 1989 study of the auto industry suggested that this was already the case among auto firms and their subcontractors but that its value was not then properly recognised by many in the industry. What may have changed in the interim period is better recognition by businesses of what needs to be done to ensure more effective knowledge transfers.

And, indeed, greater collaboration may well mean that firms may change the ways in which and the frequency with which they communicate with colleague enterprises, as well as tying production activities more closely together. Product-service packages that incorporate new technologies, in particular ICTs, can significantly change conventional communication networks and encourage the emergence of new partnerships between companies via access to the Internet and the use of e-commerce as well as within local networks. Few companies bundle the full range of technologies and services required by the telecommunications or IT

sector for their clients. All the companies interviewed in this sector found it necessary to source some product-service package components externally. These components were generally obtained through partnerships and resale agreements.

Interviewees were asked about the type and nature of relationships formed among players involved in providing a bundled product. Often there is massive information sharing between different sectors, particularly between the IT and the telecommunications companies. This involves sharing ways of using data to improve telephony and a range of other activities as they move over to the web, including banking, e-commerce and retail. New ways to use the Internet or use data to replace voice-based telephony may well emerge from the telecommunications and IT companies working together to develop more complex and comprehensive bundled products.

One telecommunications firm interviewed described the nature of its relationship with other players involved in the bundle:

‘An [IT company] is our main supplier of our IT network ...we have a supplier agreement with them. We have our own engineers but we also use the engineers from this [IT company]. While we do not rely on [the IT company] to run our network for us, their engineers often come on site and manage, design and roll-out our network. They also give us the training and the understanding of how to run the network. ...Also they learn from us. As things evolve and change, the demands involved change and they have to learn what their products need to do and hopefully they will fit this into their development cycle.’

Alliances

The development of alliances and networks to complement their existing skills and areas of expertise was an important strategy used by firms to complete product-service packages.

The most common organisational changes mentioned by interviewees in this study were the formation of new alliances with other firms to temporarily change the geographical and product market reach of individual firms, create scale and improve access to skills.

Several types of alliances were formed. They included regionally-based alliances between firms located in the same geographical area and which had complementary skills or resources; global alliances tapping into expertise in certain regions; alliances with suppliers to develop new processes; alliances with competitors to exploit generic enabling technologies (this was particularly relevant to the telecommunications field); and alliances with dedicated research and development organisations or other firms to undertake fundamental or applied research. Drawing on interviews across all sectors, we illustrate different aspects of external, collaborative organisational changes.

There were five main reasons for the alliance collaborations observed. First, firms often did not have the range of skills in-house to provide all aspects of the packages they wished to offer clients. Forming partnerships allowed them to access the wider range of skills needed to complete product-service packages for clients.

Second, where users and producers were geographically distant from each other, establishing partnerships with firms located closer to the user improved the ability to offer maintenance

and after-sales services in these markets. In this way, collaboration was used as a strategy to overcome geographical distance in the implementation of product service linkage strategies.

Third, the issue of scale was important. Many potential contracts required tenderers to show that their operations had a scale sufficient to do the job as promised.

Fourth, where technologies are changing rapidly, firms often form informal collaborative relationships based on knowledge-sharing, in order to keep up-to-date. This was particularly the case with firms in the study working in the IT and telecommunications sector.

Finally, in some markets fundamental R&D was required and firms developed collaborative relationships with public sector R&D organisations and with other firms to improve the affordability of access to the new knowledge needed. Collaboration through alliances enabled them better access to new research of relevance to their product-service linking strategies.

Drawing on interviews across all sectors, we illustrate some of the collaborative strategies used by firms to access skills, overcome geographical boundaries and increase knowledge. In some cases, collaborations led to innovations in product and process, as highlighted in the following case studies. In many cases, all five of the potential motivations for collaboration were present and are not always fully separated in the case studies as to do so would be artificial.

Skills

Collaboration can have the effect of creating a pool from which the firms involved can draw to find the extra skills needed to complete tailored packages of products and services for different clients. The manufacturer in the example below was already offering clients product-service packages that it had developed and provided on its own but to achieve larger and more specialist contracts the firm had to gain access to the more extensive design and engineering capability available in other firms. The firm thus gained both scale and special skills.

The skills needed cannot always be found in a firm's local area, however. The search for skills can result in the creation of even global networks and the formalisation of collaborative relationships through the development of new business entities around the world. A project-based manufacturer interviewed told us how a collaborative relationship developed initially to work on a large project with engineers based in the United States also led to the evolution of a new subsidiary in that location. The project had led to a 'real intellectual gathering' in which our interviewee 'basically said to the engineers and scientists working in Arizona that we will win the contracts for them if they can build the telescopes.' The company established subsidiaries and a network with the expertise in the States because it 'wanted to recruit from [there]'. Now the company designs and develop systems 'from go-to-whoa' and offers 'turnkey or management control of satellites'.

For some firms, the challenge is not so much to unlock skills located elsewhere as to encourage the development of the skills needed to create and market product-service packages within a group of existing suppliers. One firm may have the idea, for instance, but making it happen depends on improving the capability of its suppliers. The following case study illustrates how collaboration between a manufacturer and its suppliers can help both parties develop product-services packages to overcome barriers to new markets.

Case Two: Developing quality packaging in the oil processing industry: productive collaborations between processors and suppliers

The firm studied specialises in the supply of bulk seed oil. Some of its products, however, are ‘destined for the supermarket and some for the Japanese gift market’ and require smaller scale and better packaging. In the late 1990’s, the firm was asked by its clients to bundle its organic oil product with customised packaging.

‘The client came to us and said “we don’t want to do this in Japan - can you take it on?”. We can produce it cheaper here than they can in Japan due to the cost structure in Japan. It was their initiative but we said we’d do it. With the other organisation in Japan it was the same, they asked us to deliver a retail-ready product’.

Preparing a retail-ready product for the Japanese gift market meant that the company had to meet specified packaging standards.

‘Japanese quality control starts from when they open the container. The packing in the container and the printing on the labels has to be consistent – they notice all of this. The cartons can’t be dirty, they can’t have finger marks on them- so you have to be very careful. It’s the same for the cans. The printing on the cans has to be in the centre of the label – there can be no scratching. This is mainly because you’re in the upper end of the market. It’s a great niche because it isn’t changing that much but you can’t send a damaged can. It’s quite an interesting quality control operation to make sure we get the right cans.’

Developing close relationships with their can and carton manufacturers was critical to the firm’s ability to ensure the required quality of packaging: ‘the only way we can ensure the quality is to have close relationships with manufacturers’. These relationships often involve product development. In one case in particular, the oil processor had to work very closely with the manufacturer it used to supply PET bottles to develop heat shrink plastic. The development process took two years of intensive work to complete and ran the risk that the supplier would pull out before it was completed. In order to ensure that its suppliers were committed to its own production development goals, the processor felt it would ‘always move towards an alliance type relationship’.

Geographical distance

For companies whose markets are geographically distant, the development of partnerships and alliances on the ground to provide after-sales support to clients is essential. This is particularly the case where products are complicated to use or repair. Manufacturers are often in a good position to provide these services, particularly if they have the capacity to engineer and manufacture replacement parts. We reported earlier the emphasis that the mining equipment manufacturer interviewed placed on finding the right companies to fulfil its after-sales commitments to clients in geographically distant markets. This was also the case for one of the maintenance firms, contracted to multinational assemblers of x-ray equipment to repair x-ray machines in the assemblers’ global markets. The same need for scale and skills for geographically distant markets can be seen in the case studies both above and below.

Creating scale

In some cases, collaboration between small firms in a large network can have the effect of creating a larger organisation. Projects that would normally be out of reach for any single unit become feasible when firms are working together. As the case study below illustrates, this type of collaboration is not only a strategy for firms operating in project-based product markets but is also a feasible strategy for smaller firms. One of the materials and sheet metal manufacturers in our study described his involvement in the creation of a regional alliance that aimed to secure large contracts through collaboration in this way.

Case Three: Turning 40 people into 300

One of the manufacturers interviewed made product-lines ranging from tanks for use in hospitals and remote locations to containers, crushers, ‘anything with metal’, for a range of businesses in the wine-making industry, mining sector and armed forces. The physical products manufactured were not always unique to any given project, but the considerable customisation required in the delivery of the services associated with the products often made its product-service packages unique to given users. As each tank has specific operational procedures, the clients relied on the manufacturer to develop training programs, including ‘setting up the whole unit’ and the provision of training personnel. This product-service bundle was customised for each client, based on its staff resources and usage requirements. The manufacturer also provided maintenance and repairs on its products, formalised in what it referred to as ‘life-of-support’ (lifetime) contracts. Work based on life-of-support contracts was growing, constituting ‘25% of turnover’ in the last financial year compared to a negligible proportion the year before.

Although the manufacturer had developed expertise in its after-sales offerings, it had less expertise in the services required for service-product integration such as design and engineering. The ‘gap’ in design and engineering expertise faced by the firm prevented it from competing with companies offering full ‘turnkey solutions’ or greater design and engineering capability. For this reason, the company, interested in larger and more complex projects, explored possibilities for partnerships with other firms as an alternate strategy to the much more expensive and riskier investment involved in ‘having a big design team’.

The resulting alliance consisted of several firms from the same region with strengths that complemented each other’s. The alliance benefited not only the manufacturer interviewed but also the other firms in the network by creating what was in effect a larger and hence more ‘reputable’ and ‘competent’ supplier organisation:

‘We had [a potential client] here last year and used the facilities of [the group] to entertain and showcase some of the companies that would be working on that project under the banner of [one company]. The [potential client] looked at our company as employing 300 people instead of 40. The companies can work together to achieve a result.’

Collaboration thus allowed the integration of a wide range of services which would otherwise be beyond the scope of a small firm, in effect permitting a broader range of specialist services and products to be offered. At the service level, the firm said that it had:

Collaboration thus allowed the integration of a wide range of services which would otherwise be beyond the scope of a small firm, in effect permitting a broader range of specialist services and products to be offered. At the service level, the firm said that it had:

‘...worked with a telecommunications and electronics expert company. For IT and special electrical we need highly specialised companies and machine tool shops for complicated componentry’.

The company also worked with a single large firm in the field. Whereas on the product side, in wine tank manufacture for example, our interviewee had previously found it hard to compete with larger players, the alliance with a larger manufacturer and working ‘under [its] banner’ made entry to a broader or more specialist market segment possible. The larger manufacturer offers clients a range of services, including design and after-sales installation, while the smaller one provides an additional labour source for both specialist products and the associated services.

Joint R&D

Access to scientific knowledge generation can be needed both locally and globally. Two firms in our sample had established links with dedicated R&D centres to undertake the developmental work needed for their new product-service packages. In one case, access to research and skilled researchers was so important to the development of the coordinating firm’s reputation in the design and construction of high-tech laser equipment for clients around the world that the enterprise set-up a subsidiary in the United States in order to tap into that large pool of highly skilled research engineers. Supporting this network of engineers is a strong international network of institutional research organisations.

Case Four: Creating an R&D network to support product-service linkage strategies: a project-based manufacturer of high-tech equipment

The main company concerned here was a project-based manufacturer involved in the design and construction of observatories used for astronomy, astrophysics and meteorological observation. The company is regarded as the world leader in the construction of observatories and needs access to engineering and design capability located in Australia and the United States and will need in Europe for its planned expansion. As our interviewee pointed out, one of the reasons for its success is that it ‘establishes subsidiaries and networks where the expertise is.’ The company is committed to the development of research capability to support its staff and had developed R&D networks both in Australia and overseas.

‘We collaborate with ANU’s School of Laser Physics. We have laser physicists working with us who have done PhDs sponsored through the ANU. We also use research collaboration with the ANU for other programs that are mutually beneficial. Sometimes they will be researching a coating of a mirror that is a useful application for us. We also fund some of the equipment and personnel within the university. In Germany we do the same sort of thing. We hope to have electronics manufacturing capability in Germany going down the same road as we’ve done in Arizona. We also have collaborations in Bavaria. Similarly, in Arizona we are making a collaborative effort as well, although not as big as the ones in Australia or in Germany.’

These alliances contributed to the capacity of the manufacturer to undertake larger scale work and to compete by offering technological innovation. The development of these R&D networks also helped establish a high technological reputation for the firm among the scientific community, including both existing users and potential clients:

‘One way of ensuring the right people know about you and your capability is through building a reputation among specialty scientists or engineers. They usually know of us before we know about them’.

The case study above illustrates the importance of a strong research and development network for manufacturers competing in high-tech markets. The case of the oilseed processor discussed previously also shows how linkages with research and development organisations can be useful in the development of low-tech product-service packaging as well. In the oil seed case, the processor had a collaborative relationship with the CSIRO food arm for organic products so that, in the words of our interviewee, ‘we go to them with problems’. This collaboration was regarded as ‘very productive,’ especially in the development of organic shelf-ready products, which the processor linked to customised packaging for clients’ export gift markets, thus bundling together the product and a specific new service. The addition of the service to the physical product offering had raised the level of capability of the supplying firm, enabling it to move further into new markets.

In other cases, the process of developing product and service packages for clients meant collaboration with public sector research and development organisations, often undertaking the R&D as part of the customisation of products for clients.

Collaboration with clients over the long term

Innovation theorists have long emphasised the importance of long term user-producer relations to innovation and greater competitive strength. Innovation through the production of closely linked products and services seems to encourage closer collaboration with clients and therefore may encourage further innovation.

Services tend to be developed at clients’ behest and providing them often involves deep understanding of customer operations. In some areas, the development of closer user-producer relations through provision of linked products and services can improve firms’ competitiveness by providing particular ‘insider’ knowledge and enabling them to access new markets with confidence about ensuring client satisfaction. In other areas, software

systems can be designed for the integration of most aspects of a company's operation, including acquisition of materials, their progress through the manufacturing process, maintenance and repair costs, sales, quality control and all aspects of the accounting and book-keeping associated with a firm's production operations.

In many cases, the process of customising and installing such software applications is lengthy and involves not only evaluation of a client's existing software but also consideration of the client's plans for growth and the development of a strategy to integrate existing software applications with new ones. In some cases, IT firms can thus become involved in introducing new work practices for their clients and as this consultation, customisation and installation process proceeds the basis for long-term relationships can also be laid. The case study below illustrates this potential.

Case Five: Product-service packages as a way to secure long-term clients

The IT company concerned customises and installs computer systems to control automation in the heavy manufacturing, mining and utilities sectors. The systems developed for its clients integrated 'data acquisition, business systems, such as asset maintenance, maintenance management, and financial systems'. One of its newest packages was designed to enable its manufacturing clients to respond more rapidly to requests from their own clients for urgent orders. For these clients, the company 'developed a unique pricing software to enable them to track their product, set-up and so forth'.

In describing the installation and customisation process for this and similar projects, the IT firm illustrated the close relationship it has with its clients. Typically, the customers would 'choose the particular software because it was modifiable'. Evaluation of the client's production and work processes involved regular consultation, enabling the IT firm to build up knowledge of the manufacturer's operations and the manufacturer to identify its core activities and goals:

'In that implementation strategy we did a review of the complete work practices and customised the product to suit that. That's something that we've been doing for nearly 3 years for that particular customer. And over that time we've done upgrades and we've carried out all of the training as new staff have come on board. We also provide all the documentation and any ongoing customisation. From that we've also developed a fairly sophisticated reporting system on top of asset management, so they're able to get customised reports on all their work activities. They can focus down to individual cost centres and look at how they're performing.'

The IT firm had thereby established such a close and long-term relationship with the manufacturer that it was included in 'management's decision making' and was clearly well placed for a commission for future rounds of IT development.

Collaboration may also be part of new product-service development, creating a package used initially by one firm but available for sale to others later and improving both firms' market positions.

Case Six: Producer-client collaboration in the development of customised software

The software development company interviewed developed computer applications to run the electronic distance measuring equipment (EDME) and ‘Total Stations’ used by surveying and civil engineering professionals in the building and construction industry. The nature of construction requires surveyors to collect detailed and accurate data about the topography of a given site to assist the design-team to plan the construction. Once the plan is completed, it must be set out on the land. Once again, the site must be surveyed, this time setting out the foundations for the actual construction.

In recent years, the building and construction industry has adopted ‘Total Station’ technology which allows the surveyor to record the original measurements in the field electronically. The data can be downloaded into software such as AutoCad TM or CivilCad TM and used by the design and engineering teams. The measurements required to set out the plan can then be transferred back to electronic distance measuring equipment in the field, via MicroStation TM software, which enables the surveyor to set out the foundations in preparation for construction. Measurements are not entered manually at any point, the ‘paper trail’ is reduced and accuracy is improved.

Feedback from industry regarding the existing suite of applications was that, in addition to the advances made by Total Station technology in the field, the clients of the surveying and engineering firms often wanted ‘plots’, paper plans, of the topography of an area, as well as the flexibility to download designs directly into an EDME for use in the field.

Our interviewee therefore sought to customise a Total Station software package capable of performing both these functions for its clients and collaborated with one of its clients to refine its existing package. This product development involved ‘regular to-and-froing’ about the features required, which then ‘went into [the] product and added a whole new dimension to the software’. The software developer recognised the value of working with its client in this way, saying that ‘the stupid thing was, it was something that took us a couple of days to do. [Our client] got more gains out of things we hadn’t even thought about. That feedback’s fantastic’.

The initiative for collaboration can come from either client or supplier. In this case it was one of the managers in the engineering/surveying firm that had skills in both engineering and computing that pushed the collaboration that both sides benefited from.

‘They had this classic person that made the difference. He was an engineer and knew the computing side as well, and he wouldn’t take no for an answer. He pushed his people to the very limits. And they pushed the service we were offering. They came to us and we were willing to push the envelope and make the software faster and the process smoother. He was a rare animal – an engineer who knew the whole process’.

The software firm tries to work with all its clients in the same way.

‘When we develop our product we don’t do it in a vacuum. I’m a mathematician and I can develop anything at all but it’s no use if no one’s going to use it. We always try and find groups to work with. We look at their process and what they need to get done and at the end of it, we have a satisfied customer.’

In order to adjust more quickly to client demand for different services, firms in our study made both internal and external organisational changes. As clients’ service needs changed over time, companies were able to gain access to the extra skills and knowledge needed to provide a greater

range of services over a long-term period by building up competencies in both technical and managerial areas, reorganising tasks internally and collaborating with others.

In another product developed by Lego, the Steven Spielberg Moviemaker Set, software technologies allow the company to track buyer behaviour and preferences for new Lego products. Here, consumers use plug-ins to photograph scenarios they develop for their Lego sets, then edit the photographs on screen to recreate a story. The nature of the story developed by the consumer, including the setting and characters involved, provides Lego with information about the types of products their consumers want. This information does not feed back into the manufacturing process directly, in the way that would enable Lego Mosaic to position the consumer as the driver of the manufacturing process, but does enable the manufacturer to channel user preferences into its product development process over a longer period.

The example provided by Lego shows that enabling technologies can be used to link products and services not only in the equipment and machinery sectors, but also in consumer goods markets. In particular, it illustrates the ways in which enabling technologies can help manufacturers link products and services in order to customise products for clients and, in so doing, cultivate brand loyalty.

CHAPTER 8: CONCLUSIONS

There are three major conclusions to this study.

Conclusion One: The continuing importance of manufacturing but ever closer links with services

First, the most important overall message from the study is that manufacturing is clearly not in decline. Quite the contrary; it is in the forefront of the development of the new products and processes that constitute a dynamic element of the Australian economy. The study shows that the recent growth in service industries as a proportion of GDP and the labour force does not indicate the arrival of what some commentators have called the ‘service economy’ or ‘post-industrial’ society. Rather, it suggests the growth of a multiplicity of competitive strategies in which manufacturers are increasingly incorporating services into their offerings to customers, service firms are increasingly taking products produced by others and adding a broad range of services and project-based firms are linking services to services as well as products and services. This incorporation of services into manufacturing is an essential part of what has been called ‘new manufacturing’.

Although national statistics suggest that in Australia, and in other nations, manufacturing has declined in size in relation to service industries as a proportion of GDP, it has been argued by scholars such as Hirst and Zeitland (1991), Quinn (1992) and Lester (1998) that such measurements are misleading and that the two sectors are linked in ways that are not always commonly observed. The study reported here confirms that view.

There are two aspects to this first conclusion. The first is usually referred to as ‘*service activities*’, while the second refers to ‘*service industries*’.

The services offered by manufacturers (*service activities*) are available both during the production process and at and after the point of sale. During the production process, goods producers very often also provide a broad range of services, including design, engineering, testing, quality control, planning, project management, marketing and R&D. These services are integrated into the manufacturing process. At and after point of sale, manufacturers are also increasingly provide services such as transport, training, maintenance and upgrading, which they bundle together with their products. In both cases, they are providing ‘product-service packages’ rather than what are traditionally thought of as ‘products’. In other fields, notably, ICT, service firms bundle together products and add services.

Our study thus confirms what several observers, notably Howells (2000) and Pilat (2000), have referred to as the newer trend of ‘servicisation’ of manufacturing, which is the shift towards linking products and services together in one package for clients, and the sale of ‘solutions’ rather than products across a broad range of industries. This is very clear in our study. ‘Selling solutions’ is therefore now critical to the competitive position of many manufacturing firms, to the point where one of the firms interviewed queried the whole classification of his firm as a manufacturing company although it was clearly a goods producer.

Manufacturing and service *industries*, rather than activities, are also linked in numerous and complex ways. Work by Marceau and Greig on the drivers of innovation in the textiles, clothing, footwear and leather industry and by Marceau and AEGIS colleagues on the furnishings industry and, more recently, on the food industry have shown that the dynamics and functioning of manufacturing supply chains can often only be understood by analysing the role played by non-manufacturers, notably retailers.

Thus, for example, clothing firms are being pushed by retailers to improve quality, hasten delivery times, deliver to shops directly to the floor, and produce just-in-time using 'quick response' management technologies. Similarly, in the furnishings product system, innovation can only be properly understood when the strategies of 'external' players are included. In one chain within the industry, large retailers are central to firms' decisions about what and how to produce and in the other chain, interior designers and architects of office areas are the drivers of what happens in the chain. In these ways, service *industries* impact directly on *manufacturing* sector decisions.

Services and manufacturing can also usefully be viewed as linked in different ways in different places (different times) in the supply chain, sometimes inside manufacturing firms and sometimes through what are usually seen as service providers. An important sector in linking products and services together, for example, is the Information and Communications Technology (ICT) sector. It was the ICT sector in this study, for example, that both offered the greatest range of bundled services to clients and stimulated the provision of linked products itself.

The complexity of customer IT and transmission requirements means that ICT firms became involved in the customisation of enabling technologies to help their clients track aspects of their operation more carefully and thus have greater involvement in the decisions made by their clients relating to business practice and activities. This involvement in turn may allow their clients to access information about the products or services they sell, which may assist these clients in providing services for their *own* clients. The linking of products and services is thus multi-layered and cannot be explored without focusing on players from all sectors and different levels of the supply chain.

Despite the diversity and spread of such product-service linkages their existence and location have often been overlooked in national data classifications which have used other analytical lenses to view the functioning of modern economies. It is time to re-view this functioning.

Conclusion Two: Extensive organisational change, new skill combinations and increased collaboration

A good deal of international literature emphasises that the introduction of major technological change necessarily has ramifications for the internal organisation of the enterprise, as outlined earlier. The second conclusion of our study is that the same extensive reorganisation is necessary to support the strategic decision by firms to compete via the linking of products and services. Firms offering product-service packages also found that they often needed to create new structures or reconfigure existing ones to enable decision-making at different levels and for the extra coordination needed for the new direction. A new mix of expertise was also required in the labour-force associated with product-service packages. Firms, for example, found that they needed to seek employees with a combination of technical and managerial skills.

The AEGIS survey conducted through Australian Business Limited indicated that firms that offered services in association with products were much more likely to collaborate with other firms on a regular basis than were firms not offering services. Because such alliances permit good exchange of information, these firms may well be the most innovative. Firms collaborated with clients, public sector R&D centres and suppliers and, what may surprise some, with 'competitors'. They did so principally to gain competitive advantage by accessing the skills and resources necessary to provide clients with full solutions rather than single products. This also enabled them to increase the scale of their operations and internationalise to gain entry to new markets. As one interviewee remarked, 'alliances had enabled the firm to turn forty employees into 300'. These findings suggest that there is some synergy between product-service packaging and collaboration.

Conclusion Three: The causes of convergence: The eight drivers of product-service linkage strategies

Our study sought to identify the factors that are driving the convergence of strategy between manufacturing and services, whether considered as activities or industries. We found that eight drivers or influences are especially important in most areas and come into play in different industries in different ways.

Customisation and the power of the client

The study found that the greater the degree to which a firm customises its products, the more likely is it to integrate or bundle services and products to tailor products to meet the requirements of particular clients. At one end of the spectrum, for example, the survey found that, compared with other industries, textile, clothing, footwear and leather manufacturers offered more customised products. This may reflect the power of its client retailers who demand specific products, which, when taken to the limit the limit, turn clothing manufacturers largely into sub-contractors. At the other end, the creators of highly complex products integrate their clients' needs on a highly interactive and collaborative basis. IT companies seeking to provide highly customised solutions also sought to constantly develop the range of services they offered in association with their core software products.

Position of the firm in the supply chain

The position of firms in the supply chain of their sectors was a considerable influence on adoption of the product-service linkage strategic direction. Both the survey and in-depth case studies found that firms closer to end-users than to suppliers, such as telecommunications and IT firms, tend to bundle services and products, while firms closer to materials suppliers, such as manufacturers, tended to integrate services into their production. Manufacturers of intermediate goods are most likely to offer their clients integrated services such as design and engineering services. In contrast, the IT and telecommunications firms interviewed in this study offered the greatest range of bundled services. Firms closest to end customers were perhaps most likely to offer financial services, but this was mediated by the costs concerned.

The novelty of products

The launch onto the market of new products can clearly stimulate client demand for services at or after the point-of-sale. There are several reasons for this.

Most importantly, if a product is unfamiliar to users and/or is initially difficult to use, clients and final consumers demand after-sales services such as training or advice on the potential uses of the product. This is particularly the case with IT products and pharmaceuticals. Where ICT is concerned, users may not have the experience or training to exploit the full range of functions of their new computers and may seek help-desk style technical support, software training sessions (sometimes delivered on-line) or other forms of training, as well as systems design and installation. This training and technical support encouraged the building of the long-term relationships with clients often needed for further innovation and reduction of the risk of otherwise uncertain markets, thereby assisting firms to build customer and/or brand loyalty. This finding indicated the strategic power of product-service packaging to firms operating in sophisticated or saturated markets, where consumers expect to be well-informed and receive technical advice and support.

Cost considerations

The cost of a product seems to be significant both in encouraging service-product integration and product-service bundling. High or low costs may have different effects on the terms and types of the services provided. If a product is expensive, our study suggests, there may be greater demand from end-consumers for bundling the product with services, both during manufacture and at point of sale. High product cost may stimulate service-product integration during the manufacturing process as costly items are more likely to incorporate a higher level of customisation in design, R&D and other forms of service intensity in order to attract and satisfy customers. In this case, cost and customisation clearly interact as motivators of product and service linkage strategies. In addition, the ratio of cost of repair to total cost may also stimulate service provision as a strategy for firms because, if products are expensive but have parts that are replaceable and are less expensive than the totally replaced product, the customer may seek various after-sales services, such as maintenance and repair services.

High cost may mean increased demand for financial services at point of sale to assist users to purchase the product and our study found that the higher the cost of the product, the more likely are firms to develop financing strategies. Although assistance with financing was relatively uncommon, some manufacturers had developed financial components within their product-service packages, either by including flexible payment options to match clients' variable cash-flows or by co-ordinating leasing arrangements between different users.

In contrast to the situation facing some manufacturers, it appears that, for many *service* firms, it is the relative *cheapness* of some of the tangible components in IT and telecommunications product-service packages that has stimulated service provision. Some companies interviewed said that they derived little or no income from the sale of tangible products such as mobile telephones and computers and that, instead, their firms' profits flowed principally from the sale of a range of services linked to these tangible products.

Adding functionality

Some firms produced goods that function better with the support of other products and services or indeed which may be totally dependent on other goods or services in order to function at all. This dependence is clear in the case of telephony, where handsets require access to a line and back-up connection and related services, but can be true in other areas as well. These 'interfunctional' products often require a range of support products to allow them to reach their full potential or produce a demand for a cascade of assorted products and services such as the installation of an integrated IT networked system. Using the same supplier for both the original

products and associated services and those added later for better functionality gave customers greater confidence that the individual components worked together and that the promised reliable support for the components and connections would indeed be provided.

Geographical proximity to final market

The need to provide services is met by firms in different ways and can be affected by distance from markets. A manufacturing firm's proximity to its product markets influences its capacity to offer after-sales services such as installation and repair. This is because customers close to the place where a product was manufactured had a higher expectation for after-sales support and the manufacturer had improved service-delivery capacity. For manufacturers geographically distant from their product markets, strong relationships with contract maintenance and repair crews are critically important to winning contracts and maintaining sales. Local partners also tended to be manufacturers of similar or related products, and not pure service providers, because in many cases they alone have the skills, expertise and technologies needed. The relationships in turn encourage the partner manufacturers to add service provision to their offerings.

Proximity was not, however, found to be an important driver of product-service linkage strategies among IT and telecommunications companies. Many of these firms can deliver their services remotely, on-line.

Regulations and standards surrounding a product

Regulatory regimes often involve use of standards relating to safety or such issues as environmental protection. Standards significantly influence how and which products are developed, produced and employed. In our study, the effects of regulation on product-service packages can be seen most clearly in the trend within the highly regulated pharmaceutical industry towards the provision of help desks and user guides in addition to the drugs produced and sold. Similar effects are shown in the study in the strategies of project-based firms where the new product-service packages resulting from regulation include environmental services developed by mining companies to rehabilitate mine sites.

Linking services with products may also be required to ensure that products meet an array of operating standards. These standards range from the electrical or telecommunication standards operating in different countries, through regulations determining manufacturing conditions to customs/import regulations regarding labelling of country of origin.

Legal and regulatory constraints can also influence the ability of firms to link certain components into a package or to 'cross bundle'.

Outsourcing

The current environment where firms face higher levels of competition and increasing globalisation is stimulating manufacturers to develop their service delivery capabilities as part of their market strategy. As a consequence, some manufacturing companies, notably many major multinationals, are remodelling themselves and shifting towards becoming simply brand managers, outsourcing the manufacturing process and relying increasingly on the services offered in conjunction with their products, such as market testing. The outsourcing process is not always complete: in some industries, such as food processing, some brand owners outsource manufacturing for some brands while keeping production of others entirely in-house and adding services to both.

A manufacturing outsourcing strategy involves ‘externalising’ labour, which in turn allows the externalisation of some business risks and costs as well as social responsibilities. Outsourcing and subcontracting strategies in turn encourage subcontracting manufacturers to develop new services to meet multinationals’ local market requirements. This, and the importance of service delivery capabilities on the part of the subcontractor so that they can adequately and quickly make adjustments in response to the contactors’ needs, has been noted in several recent studies.

Principal implications of the findings of the study

The most important overall message from the study is that, rather than being in decline, manufacturing is transforming itself as a key part of a dynamic modern economy characterised by diverse product-service linkages.

Manufacturing firms have moved more and more to link products and services as a central element of their broad competitive strategy. This strategic linkage can be found across many sectors, especially those making complex products or acting principally as project-firms, but their strategies vary along a number of dimensions as seen by the differing influence of the eight drivers in different fields detailed above.

This said, there are a number of ‘messages’ which businesses, academic analysts and policymakers would do well to take on board. Some of the major ones are outlined below.

Messages for Business

The lessons for business to be drawn from this report reinforce the messages emanating from the OECD and other international organizations and analysts that have carried out studies of innovation and industrial competitiveness. There are four sets of major messages.

- Developing product-service packages can be a strategy for *all* firms in a chain of production, regardless of their position. The study reveals the importance of linkage between products and services all along the chains and thus the potential variety of strategies available to firms seeking competitive advantage by differentiating their particular mixes of products and services from those of others.
- We see that products and services may be linked in many ways and at all points of a product’s life, from conception and design through manufacture to sale and repair as well as training in use. When we look more closely at companies that have traditionally been regarded as part of the ‘services’ sector, we see that they have a critical role in continuing the linkage of products and services at the point-of-sale and throughout the life of the product. *This role indicates the complexity of cross-sectoral co-ordination of products and services.*
- The importance of collaboration with other firms and linkages with external organizations such as public sector research units in developing a successful product-service package strategy. This collaboration is essential for new product package development, for gaining access to overseas markets, especially if the initiating firm is of small or medium size, and for maintaining a position in existing markets and to supply after sales services in distant markets.

- The importance of recognising the critical link with customers as sources of successful new ideas.
- The need for firms to understand the specific ways in which the addition of services to products, whether before or after sale, can give a firm competitive advantage and tailoring their strategy precisely.

These four elements are closely interlinked and are addressed together in below as message for business.

1. **Message One: Collaborate with other firms but also with public sector research organisations.** The survey of New South Wales manufacturers carried out for the project revealed the importance of collaboration when the strategic choice of linking products to services has been made. Firms selecting the creation of product-service packages as a central strategy to ensure competitive advantage were much more likely to collaborate than were the others. *Indeed, the results of the study are so striking that they suggest that firms selecting this strategy may well not succeed if they cannot find partners for their enterprise.* This is especially the case if they are attempting to enter or maintain presence in overseas markets.
2. **Message Two. Increase the number and broaden the range of services offered.** The use of services as a strategic addition to physical products stands out as a mechanism for enhancing competitive advantage. Our study showed that firms were offering both a greater number of services than they had done in the past and that they were increasing the range of services offered. They were investing in this aspect of their business perhaps more than in new physical product development. ***Firms that do not invest in the creation of product-service packages may lose out in competitive markets.*** Customers clearly want to purchase not just ‘products’ per se but the product-service packages that provide them with ‘solutions’ to a number of issues raised by their own competitive strategies. *Firms now need to capitalise fully on both their codified and tacit knowledge of the potential performance of their physical products so as to assess the critical areas for adding service development. This may mean that firms need to rethink where in fact their competitive advantage lies and where in the manufacturing-service continuum they really are situated or should be situated.* Recognition that the addition of strategically selected services may be essential may cause firms to rethink the field on which they are playing.
3. **Message Three. Stay close to customers.** Much international literature now emphasises the important role played by customers in new product development. Our study confirmed that staying in close contact with customers is critical to the creation of successful product-service packages. Indeed, it was listening carefully to customers that provided the catalyst for many firms to offer services as well as products. This listening is at the fore during the manufacturing process, especially of complex products, where clients are providing input to design and using a range of technical and engineering services so that they can be sure that the final product will be satisfactory. But it goes further than that. The firms constantly mentioned the significance of client requests for point of sale and after sale services in leading them to offer product-service packages to the market. Some of these were customised, tailored to the needs of particular purchasers, but, in many cases, it was experience gained by firms in the customisation process that enabled them to develop broader or less specific packages for a wider market. This was especially the case for after sales services. Many customers were seeking to tap into the deep codified and tacit knowledge that manufacturers of products have in abundance but

have often not used to full advantage or have given away rather than sold. Staying close to customers is especially important in both fast moving and highly competitive markets.

4. Message Four. Rethink the internal organisation of the enterprise's activities. The study showed that taking seriously the development of services as well as products often requires changes to the internal organisation of activities. These changes include:

- *reorganisation from the traditional hierarchical enterprise to flatter structures where operating units are close to customers;*
- *improvement of internal communications mechanisms to ensure that marketing, customer relations and production design and implementation share information efficiently and rapidly.* This is the context in which knowledge management has become so important. In many firms, *product* knowledge may have been good and well managed but, in the new situation, firms need to be good at understanding and managing *service* knowledge as well and this may be currently less well done. In particular, the seamless product-service package knowledge management may not yet be finding the central place it deserves.

5. Message Five. Invest in new skills. Many companies producing product-service packages reported that they needed to employ or develop in-house people with new skills. In particular, they required people with *coordination skills* needed to link together the different areas of the enterprise so as to present a coherent face to clients, whether the services offered were incorporated during production or at or after point of sale. Coordination skills become especially important when the product-service packages offered involve other firms in devising or delivering the new 'products'. Increasingly customers want a seamless package where they can be confident that delivery of everything related to the purchased package can equally be guaranteed and not just the physical product alone. Coordination skills are also closely related to the need to develop teamwork where technical and other skills are linked in effective ways. The need for staff who had both technical and marketing skills and management and marketing skills was also clear and linked to the coordination skills. This is a lesson that providers of training also need to note.

Messages for academic and industry policy analysts

The present study makes it clear that observers who have talked of the creation of a new 'manufacturing-service sector' are describing a critical development in modern industrial societies and confirms the results of several recent studies.

Our study goes further than this, however, and refines how we should see the operations of the economy. Given that co-ordination of linkages between manufacturing and service activities can occur equally in what are conventionally called manufacturing and service industries, the study would suggest that these sectors are converging in significant respects. The extent of this convergence suggests that analysts of the operations of modern economies may need to revise urgently the ways in which they describe the functioning of the productive base and find better ways of describing the dynamics of the economies with which policymakers are dealing.

The following four messages indicate the implications of the convergence and the new dynamics of the economy as seen in the actions of the firms that comprise it.

1. **Message One.** *The study shows that there are in fact three areas of ‘manufacturing-service sector’ being created , not one.* The three areas are:
 - those created via activities either before or after sale
 - those created by linkages between services and services using manufactured products as the base for the services and
 - those where service firms drive shifts in manufacturing activity.
2. **Message Two.** *The study shows that we need to re-view how we see the dynamics of the entire economy.* While it is convenient for many purposes to see the economy through sectoral lenses and to separate out ‘services’ from other fields, for other purposes this sectoral and related division distorts our understanding of how firms are behaving in the economies under scrutiny. This is especially relevant where the focus of the analysis is innovation capacity and practice.
3. **Message Three.** *We need to view the economy, at least for some purposes as largely and increasingly composed of product-service packages rather than, in most cases, of either products or services.* This re-viewing will enable us to elucidate many aspects of our productive base that currently remain obscure. In turn the new focus will enable us to better understand where skills are needed and skill shortages are occurring, where and why new production technologies are likely to be taken up and the effective importance of new physical technologies to the competitiveness of different kinds of firms. Similarly, the successful linking of products and services depends increasingly on intensive use of ICT by all industries and for many firm-level activities. Perhaps policies that emphasise ICT uptake as a linkage mechanism could grow out of this new understanding.
4. **Message Four.** *We also need to refocus our view of the operation of the economy at industry level.* The fact that some firms that produce intermediate packages for clients who then include them in their own packages indicates that product-service linkages strategies are becoming pervasive and suggests that supply chains themselves may need to be reconceptualised. In particular, our study suggests that we need to understand supply chains and their functioning as a series of linked product-service packages rather than of products alone. It seems that at most if not all levels of the supply chain what is effectively offered to and purchased by firms is services linked to products. This aspect of supply chain functioning has been largely neglected before and therefore policies that seek to improve supply chain management may be missing critical elements.

Messages for Policymakers

The study’s results have several messages for policymakers that grow out of the lessons for analysts outlined above. Some examples of the implications of the new vision are given below but in reality a much broader rethinking will be necessary if policymakers are to take on board the results of this study and maximise policy effectiveness in many fields.

1. **Message One.** *Policymakers need to refocus the lenses that they use for viewing the industrial landscape and devising policies to assist enterprises.* In many areas present policies focus narrowly on assistance to special and relatively narrow areas of enterprise activity. One example of this need to re-focus is provided by the R&D tax

concession which addresses only one area of product development and does so effectively in only a very small minority of manufacturing firms. This policy assumes that research and development are the keys to product development and hence to manufacturers' competitiveness. In contrast, our own study suggests strongly that laboratory-based research and development may be *decreasingly* linked to competitive success in the sense that products *alone* are becoming less and less the key. Our study reveals that the key is the *development of product-associated services and the devising of smart mixes of products and services that differentiate a firm from its competitors and can lock clients in for long periods through the provision of an increasing range and number of services*. It seems that it is the range and number of *services* that is increasing, not the range and number of *products*, although we have no direct evidence of that and it would require a separate study to determine. In any case, services do not usually require large inputs of R&D.

2. ***Message Two. Policymakers need to think much more creatively about the packages of policies they offer and rethink many existing ones.*** In this case, policymakers need to rethink the best means of encouraging both product and service development as a set of related issues. They may wish, for example, to focus more clearly on the fact that the IT and telecommunications sector commonly has a critical and specific role in blurring the boundaries between manufacturing and service activities because it is the driver of the development and diffusion of key enabling technologies, particularly specialised software. This key technology both enables inter-company linkages across vast areas and different industries and the execution of strategies that can vary from the integration of customer requirements in design through the bundling of products and after-sales services to a broad shift to mass customisation.
3. ***Message Three. Venture capital funds may want to rethink their policies so that they encourage the production of product-service packages rather than physical products alone if they wish to maximise their investment.***

Many of the manufacturers interviewed for our study told us how their activities had shifted so far away from pure goods production that they no longer considered themselves as manufacturing companies. One electronics manufacturer explained that 'We do so many different things now. We're not just about making things, so much so that I'm not sure we classify as a manufacturing company any more.'

This comment raises the question asked at the beginning of our study: 'Is Australia a manufacturing country or has its economy shifted definitively to providing services?'. The answer is now clear. Australia continues to be a manufacturing nation, despite the huge recent growth in service industries, but its manufacturing businesses are joining those in other advanced countries in shifting to mixing products and services in many, new and diverse ways.

It is likely that it is through these interlinkages that the dynamism of the economy will be expressed in coming decades. Our study suggests the enormous diversity of current manufacturing competitive strategies, linking all kinds of service activities from

conceptualisation and design to installation to maintenance, as well as the great growth in the number on offer.

It also shows how the newer technologies incorporated into products help link products and services and have created a whole new area of coordination of economic activity.

Linking products and services into packages is not only a huge growth industry in its own right, but it is also stimulating the creation of new physical products on which to hang new services. Services can also grow from interlinkages with services based on a manufactured product.

In such ways, manufacturing and service industries interact, interlink and grow competitively in both national and international markets and, with them, grow modern economies.

APPENDICES

Appendix 1: ABL survey instrument

Some businesses are now integrating different products and services (e.g. in addition to a product, a manufacturer may provide installation and delivery) or bundles of different services. Please would tell us whether you are offering goods and services within single packages and, if so, which services.

Q1 What are your core areas of business and main products (if manufacturing please specify your main product area eg mining equipment, auto components, packaging, processing food)?

Q2 Do you provide any goods with associated services in one package for your clients?

yes no

Q3. Could you indicate below which services you offer your clients? (tick any or all as appropriate)

- | | |
|---|--|
| <input type="checkbox"/> installation services | <input type="checkbox"/> legal services |
| <input type="checkbox"/> after-sales service with dedicated personnel | <input type="checkbox"/> insurance services |
| <input type="checkbox"/> repair and maintenance | <input type="checkbox"/> financial services |
| <input type="checkbox"/> customised packaging (ie client specified) | <input type="checkbox"/> communication services |
| <input type="checkbox"/> technical support | <input type="checkbox"/> teaching or training services |
| <input type="checkbox"/> design services | <input type="checkbox"/> transport services |
| <input type="checkbox"/> engineering services | <input type="checkbox"/> software development |
| <input type="checkbox"/> scientific services | <input type="checkbox"/> systems integration |
| <input type="checkbox"/> environmental analysis | <input type="checkbox"/> facilities management |
| <input type="checkbox"/> economic assessments | <input type="checkbox"/> other services (please specify) _____ |

Q4 Has your company extended the range of services offered over the 1990s?

? no ? to some extent ? markedly

Q5 Does your organisation collaborate with other organisations to provide product-service packages?

? no ? to some extent ? markedly

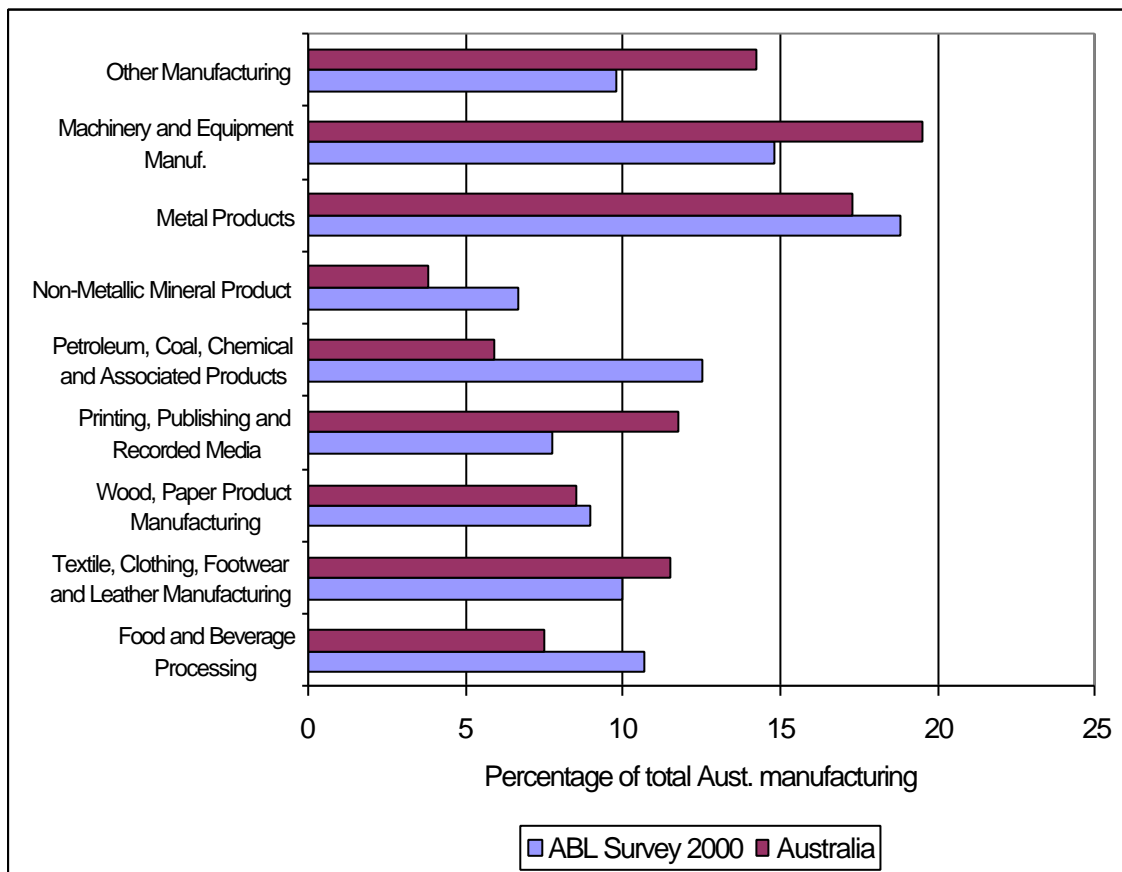
Appendix 2: Respondents to ABL survey

Representativeness of respondents to ABL survey

In order to measure the degree to which the 479 respondents were representative of Australia's manufacturing industry, we compare some of the characteristics of the ABL sample with those of the ABS statistics collated on all Australian manufacturing companies.

Figure A2.1 compares the percentage of companies in each ANZSIC manufacturing subdivision in the ABL sample with those in Australia collated by the ABS in 1999.

Figure A2.1: Manufacturing subdivisions in Australia in 1999 compared to the ABL survey



Source: ABS commissioned data 1999.

Figure A2.1 shows that among respondents petroleum, coal, chemical, food and beverage were over-represented in the ABL sample while printing, publishing and recorded media were under-represented compared with Australian manufacturing as a whole.

Table A2.1 compares the percentage of employees found to be in each ANZSIC manufacturing subdivision in the ABL sample with those in Australia. Table A2.1 shows that smaller companies, particularly those with less than 10 employees, are under-represented in our sample. This is the case for all ANZSIC subdivisions. Table A2.1 also shows that, compared with

manufacturing in Australia, there was a greater proportion of large companies among respondents to the ABL survey. This was particularly pronounced in four sectors: food and beverage; non-metallic mineral; printing, publishing and recorded media; and, machinery and equipment manufacturing.

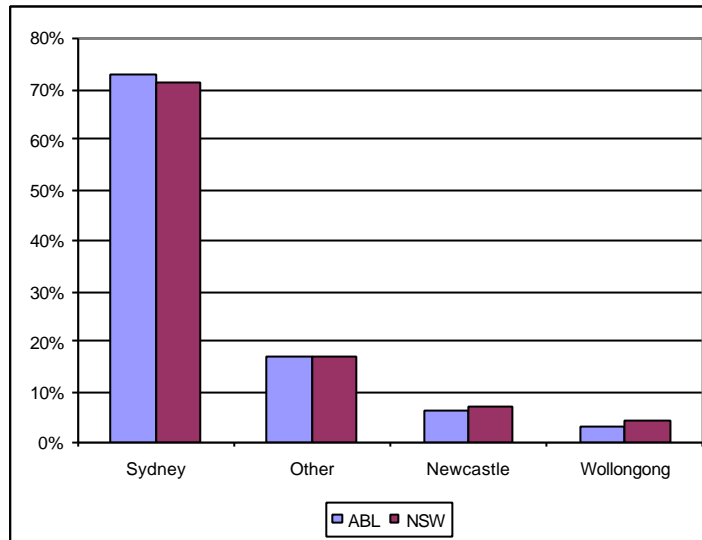
Table A2.1 Comparison of percentage of employees by ANZSIC manufacturing subdivisions in ABL sample to those in Australia

Percentage														
	1-9		10-19		20-49		50-99		100-249		250-499		500+	
	A BL	Au st.	A BL	Au st.	A BL	Au st.	A BL	Au st.	A BL	Au st.	A BL	Au st.	A BL	Au st.
Food and Beverage Processing	4	60	8	17	18	12	22	5	16	3	16	2	16	2
Textile, Clothing, Footwear and Leather	8	79	17	11	19	7	29	2	17	1	6	0	4	0
Wood, Paper Product	12	77	19	13	24	7	17	1	17	1	2	0	10	0
Printing, Publishing and Recorded Media	11	76	8	13	24	7	11	2	27	1	14	0	5	0
Petroleum, Coal, Chemical and Associated Products	13	64	18	14	17	12	13	4	22	4	13	1	3	1
Non-Metallic Mineral Product	3	76	28	12	13	6	9	2	25	2	16	1	6	1
Metal Products	9	75	12	14	33	7	20	2	16	1	3	0	7	0
Machinery and Equipment.	7	74	10	12	19	8	16	3	23	2	21	1	4	1
Other Mfg	17	81	15	11	38	6	13	2	13	0	4	0	0	0

Source: ABS commissioned data 1999.

The majority - 349 or 72.9% - of respondents' companies were based in the Sydney area, while 6.5% were located in Newcastle, 3% in Wollongong and 17% in other areas of NSW. As shown in Figure A2.2 these results are comparable with the location of manufacturers in NSW based on ABS data.

Figure A2.2: Comparison of location of respondents with manufacturers in NSW



Source: ABS 1999 Manufacturing Australia Cat. No. 8225.0

Description of manufacturers offering services

Firms offering services by regional location

Table A2.3 shows the geographical location of firms offering services. The third column titled 'Percentages offering services' represents the percentage of firms from each location offering services. Thus, out of a total of 16 firms from Wollongong, 14 offered services, which is 87.5%.

Table A2.3: Firms offering services by regional location

Companies' location	Number of respondents in each location	Number offering services	Percentage offering services in each location
Wollongong	16	14	88%
Newcastle	31	24	77%
Sydney	349	249	71%
Other	83	55	66%
Total	479	342	71%

Results from the survey show that, compared with Sydney (71%), a relatively high percentage of companies from Wollongong (88%) and Newcastle (77%) offered services but the numbers in Wollongong and Newcastle were too small to be anything but indicative.

Firms offering services by industrial classification

Table A2.1 shows firms offering services by industrial classification. As the table shows, a significant percentage non-metallic mineral product manufacturers and metal product manufacturers offered services. For non-metallic mineral product manufacturers 27 out of 32 firms in this sector offered services, which was 84% of the sector. For metal product manufacturers, 71 out of a total of 90 firms in this sector offered services, which was 79% of the sector.

Table A2.4: Firms offering services by industrial classification

Industrial Classification (ANZSIC subdivisions)	Number of firms in subdivision	Number offering services	Percentage within subdivision offering services
Non-Metallic Mineral Product	32	27	84%
Metal Products	90	71	79%
Machinery and Equipment	71	56	79%
Other Manufacturing	47	36	77%
Printing, Publishing and Recorded Media	37	27	73%
Petroleum, Coal, Chemical	60	43	72%
Textile, Clothing, Footwear and Leather	48	31	65%
Wood, Paper Products	43	28	65%
Food and Beverage Processing	51	23	45%
Total	479	342	71%

Appendix 3: Interviewee Sample Data

Description of interviewee sample

Table A3.1 shows the number of interviewees by sector or industry. As shown in the table, the majority of firms interviewed were manufacturers followed by information technology companies, telecommunications companies, building and construction companies, mining and heavy engineering companies. Some interviews were also conducted with firms in the health sector.

Table A3.1: Interview respondents by sector/industry

Industry sector	Interviews Completed
Manufacturing	15
IT (pre-packaged software and customised software)	13
Telecommunications Companies	8
Consumer electronics	4
Building and Construction	9
Mining and Heavy Engineering	9
Health	5
Industry Associations	3
TOTAL	66

Core business and key services offered in conjunction with products

Table A3.2 shows the core business and key services offered by manufacturing and IT and telecommunications companies interviewed for the study.

Table A3.2: Types of services linked with products offered by each sector

Type of firm	Industry sector	Most common services offered by companies in each industry sector
Manufacturing	Manufacturing (n=15)	<ul style="list-style-type: none"> ▪ Testing ▪ Design ▪ Maintenance
Service Firms	Telecommunications (n=12)	<ul style="list-style-type: none"> ▪ Data transmission (e-mail, fax, on-line, PCS, specialised mobile radio, paging-narrowband or wideband, cable-terrestrial or satellite communications) ▪ Voice transmission (local exchange fixed or wireless, long-distance, domestic and international and mobile-cellular)
	IT/ Software Solutions/ (n=13)	<ul style="list-style-type: none"> ▪ Software engineering and design ▪ Package or enterprise solutions ▪ Upgrade, ongoing maintenance and support ▪ Installation
Project-Based Firms	B&C, Mining and Heavy Engineering (n=9)	<ul style="list-style-type: none"> ▪ Project Management and co-ordination and service-product integration of specialist services (architecture, engineering, geological survey) ▪ Building and Construction (incl BOOT/BOO/turnkey)
	Health (n=5)	<ul style="list-style-type: none"> ▪ Management of decentralised health services

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