



MULTINATIONALS, SKILL FORMATION SYSTEMS AND SKILLS CAPTURE

A cross-national study of multinationals in the aerospace sectors in the UK and Australia, and the role they play in skill formation.



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DECLARATION

This work has not been submitted in substance for any other degree or award at this or any other university or place of learning, nor is being submitted concurrently in candidature for any degree or other award.

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Sometimes it takes darkness and the sweet
confinement of your aloneness
to learn
anything or anyone
that does not bring you alive
is too small for you. The Conversational Nature of Reality, David Whyte

The journey that has culminated in this thesis has been one of self-discovery. The past five years have been a period of personal growth, and the journey would not have been tenable without the support of a number of people who have guided me through the process.

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ABSTRACT

Multinationals are important global actors who have changed the face of production through outsourcing and offshoring, but research looking at whether these firms have also transformed the process of skill formation is sparse. This research addresses this gap, with a cross-national study of multinationals in the aerospace sectors in the UK and Australia, and the role they play in skill formation for professional engineers. Conceptually, the research builds on the handful of studies that have explored the role of multinationals in skill development, including work arguing that multinationals have built global infrastructure termed global skill webs that enable them to ‘capture’ the process of skill formation. The project also draws on previous work on skill formation systems, the role of multinationals in shaping sub-national conditions through organisational or institutional experimentation, and the broader literature on the multinational firm. Using this foundation, the research explores the extent to which these multinationals engage with and potentially shape engineering skill systems in the UK and Australia, and whether these firms have built global skill webs that reduce their reliance on national skill systems.

The thesis makes an empirical contribution to the existing work on the role of multinationals in skill formation. The findings from the research challenge some of the existing theories on skill formation systems, by arguing that the multinational as an actor should be distinguished from other firms. The project contributes conceptually, by extending an existing theory looking at the interplay between local, national and extra-national institutions and applying it to the multinational, differentiated from other firms. This adaptation of existing theory extends some of the existing theories on the role of multinationals in skills capture and global skill webs, by highlighting how these are shaped and mediated by national institutions. Certain actors, such as universities, can be connected into this global infrastructure and act as anchor points for what have been termed ‘firm-specific’ extra-national institutions such as global skill webs.

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CHAPTER 1 THE QUESTION OF THE MULTINATIONAL FIRM AND SKILL FORMATION

Some multinational corporations are argued to be important global actors, ‘giant firms’ capable of setting global standards, and more powerful in some ways in negotiations than national governments (Crouch, 2010). Multinationals have arguably irrevocably changed the face of production over the last century through outsourcing and offshoring (Morgan, 2005b). Significant bodies of research have emerged exploring the central role these firms play in coordinating the disaggregation of production (see for example the work on global value chains or production networks Gereffi, 1999b, Gereffi, 1999a, Dicken, 1998) and how these developments have influenced production systems at a national level. However, skills and processes of skill formation are argued to have been overlooked (Ramirez and Rainbird, 2010) and so has the question at the heart of this thesis: what role do multinationals play in the process of skill formation?

Arguments to bring skill formation into analysis of global value chains (Ramirez and Rainbird, 2010) call for the inclusion of work from other fields. These include assimilating research on national business systems, varieties of capitalism, and skill formation systems into discussions about the global transformation of production. However, these calls overlook a broader issue, that there is a dearth of work even within research specifically focused on multinationals themselves that focuses on whether, and how these firms have transformed the process of skill formation.

While studies on multinationals and their role in skill formation do exist (Ashton et al., 2010, Ashton et al., 2009, Brown et al., 2008, Lauder et al., 2008, Jürgens and Krzywdzinski, 2016, Tregaskis and Almond, 2017) work in this area is sparse. Studies often focus on one level of

analysis or scale, either local, national or global, even though a ‘distinctive feature of contemporary capitalism is its ability to operate on multiple scales’ (Dicken et al., 2001, 95).

One project from one of the groups of researchers adopting a ‘global’ level of analysis argues that some multinationals have been able to develop a distinct new form of skill formation, termed strategic or global skill webs (Ashton et al., 2010). The formation of these webs are driven by globalisation, increased international competition resulting in pressures to reduce costs, and technological advancements (ibid). These webs are argued to be characterised by a shift in management from national pyramids to webs, a consolidation of power with headquarters, and standardisation processes that span production and HR (ibid). A central outcome of shifting to global skill webs is argued to be that multinationals become less reliant on national business and skill formation systems, whether their country of origin, or subsidiary countries (ibid; see also Lauder et al., 2008).

Should global skill webs be as encompassing as theoretically depicted, this shift in skill formation would have a significant impact on the organisation of production on a global basis. The reduced reliance on national business and skill formation systems would also impact public policy. In particular, this change would impact how governments use skills, and various skills funding as one means of attracting investment from multinationals.

However, the small number of studies that have been conducted that examine, at least in part, whether and how multinationals engage with either national or local institutions in skill formation systems indicate that these firms seem to engage with skill formation systems and may also be influenced by their country of origin.

Several of the studies indicate that multinationals are able to either engage extensively with institutions such as universities, regional skill networks, vocational schools and colleges or corporatist organisations, or avoid them entirely (Crouch et al., 2009, Jürgens and

Krzywdzinski, 2016, Tregaskis and Almond, 2017). One study, looking at two automotive multinationals operations across a number of subsidiary countries, highlights that how a multinational engages with actors in the skill formation system in its subsidiary country may be influenced by its country of origin (Jürgens and Krzywdzinski, 2016). These studies indicate that multinationals may continue to engage with, or be reliant on skill formation systems.

Again, these are only a handful of studies dispersed across a number of discrete fields of research that look at a small number of countries and sectors. The sparsity of research on this topic, and the differing findings that have emerged mean that there are a number of important questions still to be addressed. This study address some of these questions, through three research questions:

1. To what extent do multinationals engage with the engineering skill system in each of the countries?
2. To what extent do multinationals shape the engineering skill system in each of the countries?
3. To what extent is there evidence of the development of global skill webs in the multinationals studied, and if these have been developed to what extent do they influence engagement with skill formation systems?

First, the extent to which multinationals engage with the skill formation system in each of the countries they operate in, and second, whether they attempt to shape, (or are shaped) by these skill formation systems are important questions. These would establish whether the firms studied are reliant on skill formation systems. Third, the extent to which there is evidence that these same multinationals have developed global skill webs, and if so, the extent to which they influence engagement with skill formation systems is another important question.

Combined, these questions enable the project to address whether global skill webs are as encompassing as theoretically depicted, and if they do reduce a multinational's reliance on skill formation systems, or, whether these firms remain, to a greater or lesser degree, reliant on, and potentially constrained by, national institutions. As such, this research attempts to bridge the different scales, looking at the role multinationals play within local and national skill formation systems, and the influence of firm-specific global infrastructure such as global skill webs.

1.1 WHY IS THE ROLE OF MULTINATIONALS IN SKILL FORMATION IMPORTANT?

The question of what role multinationals play in skill formation, and whether they have reduced their reliance on skill formation systems, is salient on both academic and policy levels. This question is salient at a policy level as governments often use skills and skill formation systems as a means of attracting multinational investment. The use of skills as a policy lever began in developed economies in the 1980s and 1990s. At this point policy debates about the importance of education and skills gained prominence due to 'concerns about international competition, and growing perceptions of globalisation as both threat and promise' (Keep and James, 2012, 211).

These debates have often focused on developing a 'learning society' or knowledge economy (Leitch, 2005, Leitch, 2006, Michaels et al., 2001, Florida, 2006, Reich, 1991). Concerns have been driven by pressures of globalisation and inter-country competition for jobs, with politicians in developed economies claiming that they could not compete with developing countries in terms of labour costs. Instead, policy debates within developed economies have framed the discussion around increasing the levels of skill a country has:

Our nation's skills are not world class. We run the risk that this will undermine the UK's long-term prosperity (Leitch, 2005, 1)

Our natural resource is our people – and their potential is both untapped and vast. Skills will unlock that potential. The prize for our country will be enormous

(Leitch, 2006, 1)

The emergence of these policy debates occurred because the reorganisation of production, via offshoring and outsourcing, initially revealed a tendency to be divided by skill (Morgan, 2005b). Multinationals were initially found to outsource or offshore lower skill, or more standardised work to developing economies with cheaper labour costs. Meanwhile, these same firms were found to offshore, outsource or locate higher skill activity or ‘knowledge intensive services’ in other developed economies (Miozzo and Soete, 2001), usually within regional clusters. Therefore, policy debates tended to focus on using skill investment, and national skill systems, as a way to attract and retain multinational investment of ‘higher skill’ activities. Governments were argued to be increasingly operating as ‘competition states’ (Cerny, 1990), using skills as one of several micro-economic or industrial policies to attract investment. These debates have continued in spite of important critiques, both of how the ‘problems’ and ‘solutions’ have been framed and also in terms of how this has translated into policy (Keep et al., 2006, Keep, 2006a, Finegold and Soskice, 1988, Keep and James, 2012). However, should multinationals be capable of reducing their reliance on national skill formation systems this would remove one of the policy levers that government have used to attract investment.

As such, the questions outlined earlier are relevant at a policy level, as they address whether certain multinationals appear to engage with, and potentially shape skill formation systems, and if they have developed global skill webs. If these firms have developed global skill webs, the research also examines whether these have reduced their reliance on skill formation systems, therefore making them less susceptible to policy incentives tied to skill formation.

These questions are also important from an academic perspective. Excepting the small number of studies discussed earlier, much of the research on skill formation systems has focused on how skills are a product of nationally bounded systems. The central questions driving much of this research have been how differences in the types of skills produced by different developed economies can be understood. These skill outcomes can be seen to be a product of skill formation systems, that encourage the development of certain types of skills over others (Crouch et al., 1999, Finegold, 1999, Finegold and Soskice, 1988, Estevez-Abe et al., 2001, Hall and Soskice, 2001, Thelen, 2004, Streeck and Yamamura, 2001, Busemeyer and Trampusch, 2012).

In many of these accounts multinationals are not theoretically distinguished from national firms, who are assumed to be ‘bounded’ by these institutional systems. However, if these firms develop global skill webs, they may no longer be as reliant on skill formation systems in developed economies, or their country of origin (Lauder et al., 2008). This final premise is one that requires further research, as, should the assumptions of theories of global skill webs be accurate, these firms may be less bounded by national institutions than theory suggests. Should this be the case, there would be implications for both policy makers, and for theories of national skill formation systems.

1.2 CONTRIBUTION OF THIS PROJECT

The research questions at the heart of this thesis, and their importance to both policy and theory have been outlined above. The first two research questions address whether multinationals are engaging with and shaping skill formation systems. The third looks at whether these same firms have developed global skill webs, and if so, whether these webs are influencing firm engagement with actors within skill formation systems. Combined, these questions enable the examination of whether multinationals are using so called new forms of

skill formation, such as the development of global skill webs, to reduce their reliance on skill formation systems in their country of origin and subsidiary countries.

To answer these questions, a cross-national study of multinationals in the aerospace sectors in the UK and Australia has been undertaken. Aerospace is a high skill sector, where the product strategy of firms will require continuous technological innovation, making it more likely that the multinationals will invest in skill formation (Crouch et al., 1999). In addition, the sector is dominated by a relatively small number of multinationals (Weiss and Amir, 2018), who operate either at the head of complex global production networks, or as first or second tier suppliers of complex components (Aboulaflia and Michaels, 2018, Danford et al., 2002). The existence of global production systems, alongside the requirements for high levels of skill, increases the possibility that these firms have built global skill webs.

The project is a ‘close pair’ research design (Strauss, 1998), choosing two countries that are often grouped together as having similar business or skill formation systems. This enables the project to hold constant some of the conditions for skill formation across the two countries. Both the UK and Australia are developed economies, where the national skill system has been argued to historically have been a low skill ‘equilibrium’, or low skill ‘market model’ (Finegold and Soskice, 1988, Hall et al., 2002, Ashton et al., 2000) and are also referred to as liberal market economies (Hall and Soskice, 2001, Estevez-Abe et al., 2001). In the case of the UK, these skill outcomes have been argued to be a result of ‘deeply rooted structural weaknesses in the British economy’ (Lloyd and Payne, 2006, 151), resulting in low employer demand for and utilisation of skills (see also Mayhew and Keep, 1999, Keep et al., 2006).

Both countries are argued to be characterised by skill systems where the supply and demand for skills is co-ordinated by firms through the market, and have fluid and competitive labour

markets that disincentivise firm investment in most skill development that is not highly firm-specific, due to fears of poaching (Hall and Soskice, 2001). These factors are argued to result in the production of ‘general’, or more portable but less specific skills (Hall and Soskice, 2001, Estevez-Abe et al., 2001), a reliance on higher education, and skill shortages and mismatches (Ashton et al., 2000). The characteristics of both skill systems then, are arguably unlikely to produce all the sector and firm-specific skills required by aerospace multinationals and so will require some form of firm investment in skills.

The project focuses on the role that aerospace multinationals play in the skill formation of professional engineers. The focus on this specific occupational group has been undertaken for two reasons. First, one of the central outcomes of global skill webs is argued to be that they enable multinationals to be able to standardise skill formation for roles requiring higher levels of skill, including professional occupations (Ashton et al., 2010). The focus on professional engineers allows this assumption to be interrogated. Second, the relative strength of higher education in both countries, over vocational or intermediate skill development, increases the likelihood of aerospace multinationals being able to source and recruit engineering graduates, even if these graduates do not have all the sector and firm-specific skills these firms require.

Qualitative semi-structured interviews were undertaken with representatives from multinationals, professional engineers, and with a series of actors within the engineering skill system in each country. Actors within the skill system include government representatives, universities, professional associations, employer organisations, unions and other skill bodies. Due to the scarcity of research on this topic, the project is exploratory, with the qualitative approach enabling a focus on the process (in this instance of skill formation) and the relationships behind this process (Hyman, 2009).

1.3 CHAPTER STRUCTURE

The thesis is organised as follows. Chapter Two draws together the small number of studies on the role of multinationals in skill formation. First the chapter outlines research on national business and skill formation systems, looking at how skills can be conceptualised as a product of nationally bounded institutions. Then a small number of studies that have analysed multinationals within ‘local’ (region or sector) institutional systems are explored. These are contrasted first with the theories of global skill webs, and then with the broader literature on multinationals including whether their behaviour in other arenas, such as industrial relations, can provide insight into their potential role in relation to skill formation.

Chapter Three outlines the research questions, aims and objectives and methodology, including the adoption of cross-national comparative design, choice of sector, countries and methodological approach. The chapter also provides detailed information about each of the participant companies, and a breakdown of the interview participants in each country.

Chapter Four provides sector, occupation and country context to better situate the phenomenon under study. The chapter outlines the characteristics of the aerospace sector, professional engineering, and the development of, and actors involved in the engineering skill systems in the UK and Australia.

Chapters Five and Six address the findings from the first two research questions – to what extent do the multinationals studied engage and/or shape the engineering skill systems in each country? Chapter Five outlines any relationships found between the multinationals studied and actors within the engineering skill system, including professional associations, the state, employer organisations and unions across both countries. The chapter discusses how the multinationals studied engage with these institutions, whether they use these relationships to shape skill formation for professional engineers, and if so, in what ways.

Chapter Six addresses whether the multinationals studied seem to suffer from any of the negative skill outcomes predicted for skill systems in liberal market economies. The discussion also analyses the relationship between the multinationals and one of the most important actors in the professional engineering skill system, universities. Chapter Seven addresses the findings from the third research question, to what extent have the multinationals studied developed global skill webs, and begins to address whether those firms that have developed these webs have reduced their reliance on national skill formation systems. The chapter outlines whether the multinationals studied have developed global skill webs, and if so, to what extent and why.

Chapter Eight draws all three research questions together to address whether the multinationals studied appear to be still engaging with, and constrained by national institutions or, instead, developing global skill webs and reducing their reliance on national skill formation systems. The chapter discusses the role of multinationals within the broader engineering skill system in each country, and the extent to which they engage with and shape, or are shaped by institutions at a national level, before looking at the scale and scope of the global skill webs that have been developed. Then, using the findings from this study, an existing theory that attempts to bridge the three scales (global, national and local) is extended to help explain how the role of multinationals in skill formation can be understood in this context.

Chapter Nine draws together the main contributions from the project, namely how the multinationals studied seem to be constrained in some respects by actors and national institutions, and influenced by their country of origin even as several of the firms have developed global skill webs. In light of these empirical contributions, the study makes a conceptual contribution by extending a previous theory to help us better understand and

analyse the role of global skill webs for these firms. Finally, the project's limitations, and the significant avenues for future research are discussed.

CHAPTER 2 THE ROLE OF MULTINATIONALS IN SKILL DEVELOPMENT

2.1 INTRODUCTION

What role do multinationals play in the process of skill formation? To answer this question, this chapter reviews the small number of studies that have been undertaken on this topic, but research on this area is sparse. Therefore, the chapter also draws connections across several, mostly discrete fields of research, and touches on some of the important debates within each field that may, at least in part, help us to understand the role multinationals could play in skill formation.

This chapter divides the discussion into two parts. First, it addresses the role of firms in skill formation by exploring some of the literature on varieties of capitalism and skill formation systems. The discussion begins by defining skills as a collective good, before exploring how the skill formation systems in countries such as the UK and Australia are argued to operate at a national level, and the expected role of firms as ‘nationally bounded’ actors in relation to skill development.

Once these areas are established, the question of the role of multinationals in skill formation, and how they may differ from ‘nationally bounded’ firms, is raised. The discussion then moves on to explore smaller fields of research, that focus on the role of multinationals and other actors in shaping ‘local’, as opposed to ‘national’ conditions. The processes of shaping sub-national institutional arrangements or conditions in ways that differ from national architecture have been referred to as organisational or institutional experimentation, or institutional entrepreneurialism. While few of the examples are directly related to skills, the discussion raises questions about what these arguments might mean, in terms of how multinationals may engage with, or shape skill formation systems.

The second part of the discussion draws on some of the debates within fields of study that focus on the multinational as an actor, and how these accounts might help us to understand the role these firms may play in skill formation. The discussion begins by examining arguments about the role of multinationals as ‘giant firms’ who can engage in the process of labour arbitrage. Then one of the small number of studies that focuses on whether multinationals have transformed the process of skill formation is considered.

The claims made, namely that these firms are building global skill webs to ‘capture’ skills, and are therefore reducing their reliance on national skill formation systems, are reviewed. These claims are then interrogated using other fields of research on multinationals, including the impact of country of origin, relationships between headquarters and subsidiaries, and how other fields of research have analysed relationships between multinationals and actors in the skill formation such as universities. This review includes some of the small number of studies that have examined the role of multinationals in skill formation and skill formation systems. This half of the chapter raises questions about how global skill webs may operate, including whether they are shaped, mediated or resisted by national institutions, and whether their existence changes the role of multinationals within skill formation.

2.2 SYSTEMS OF SKILL FORMATION AND THE ROLE OF FIRMS

Before we can begin to address the question of the role of multinationals in skill formation, and because research on this is sparse, it is helpful to first discuss the role of the firm in relation to skill. Firms are the end users of skill, and are, in many respects the actors that you would expect to invest in skill formation. However, there are marked differences in how firms choose to invest in skill, and in the role they play in skill formation in different countries. Often these national differences are argued to be because of different skill formation system configurations, and in these accounts, skill is often conceptualised as a collective good of national skill formation systems.

Skill formation systems are argued to be made up of interlocking and sometimes self-reinforcing institutions, that create rules of behaviour that either incentivise or disincentivise firms or individuals to act in certain ways (Finegold and Soskice, 1988). As a result, firms may choose to underinvest in skill formation (ibid), or firms or individuals may invest in certain forms of skill formation over others (Hall and Soskice, 2001).

From an economics perspective, skills are argued to be a problematic collective good, as they are an impure public good. Public goods are argued to be:

non-excludable and non-rival; it is not possible to exclude people from having access to them; and access by one does not prejudice access by another. Skilled labour is in this sense not a pure public good; it is rarely possible to exclude a firm from offering improved conditions to a worker it wants; but it is rival, since if the employee changes firms he or she is lost to the original employer (Crouch et al., 1999) (p.135)

As skills are an impure public good, market failure is argued to be both 'endemic and inevitable', as firms tend to invest less in training than they should (Streeck, 1989, 92, 93).

Firms are often argued to invest less in training than they should because of how markets operate, and it is for this reason that markets are often depicted as the source of the problems of training (Crouch, 2005b). In a competitive market with many firms, it is unlikely that all firms will invest in training. Those firms that do not invest in training are then able instead to invest in higher wages, to recruit (or poach) those trained workers from the firms who do train (ibid). Streeck (1989, 94) argues that this process socialises the rewards of the investment of training. It does so, because firms who train cannot restrict firms who do not from access to the skilled workers they have trained. Therefore, this creates uncertainty in those firms who train. From the viewpoint of the individual employer this transforms workers' skills into a 'collective good'.

So how do institutions influence the role that firms play in skill formation? The actors that are argued to have the most influence over the process of skill formation are those involved in

collective action, including ‘the state’, collective organisations such as employer associations and unions, and the individual company referred to as a ‘corporate hierarchy’ (Crouch et al., 1999). These actors are able to shape the process of skill development as they have the ability to place restraints on labour markets, whether through collective bargaining, labour law or through informal mechanisms that place restrictions on firm behaviour. The degree to which these institutions place restrictions on labour markets can either incentivise or disincentivise firms to invest in skill, and can also influence what forms of skill formation firms invest in.

2.2.1 SKILL FORMATION SYSTEMS IN LIBERAL MARKET ECONOMIES

In both the UK and Australia there have been debates about the structural weaknesses of the national skill formation systems, and the chronic underinvestment by firms in skill development (Smith, 1998, Smith, 2006, Mayhew and Keep, 1999, Lloyd and Payne, 2003, Keep, 2006a). These features are often explained within theories of national skill formation systems as a result of coordinating via the market, and multiple authors (Hall and Soskice, 2001, Ashton et al., 2000, Bussemeyer and Trampusch, 2012, Iversen, 2005), group countries based on a preference for market coordination. These countries are often referred to as liberal market economies. Other countries who coordinate via other means have been referred to as coordinated, embedded, organised or corporatist market economies (Thelen, 2004).

In two of these frameworks, the skill formation systems in the UK and Australia have been argued to produce lower levels of skill (Finegold and Soskice, 1988, Hall et al., 2002, Ashton et al., 2000). In another, the Varieties of Capitalism framework, both countries are conceptualised as having fluid labour markets, coupled with short-term and venture capital and a high tolerance for risk (Hall and Soskice, 2001). The skill systems of liberal market economies are argued to service production strategies that rely on numerical flexibility as opposed to those that utilise higher levels of skill for functional flexibility. In part, this is

because market forms of coordination often include less restrictions on labour markets in the form of collective bargaining or labour law, resulting in fluid or competitive labour markets, and a ‘private ordering’ of employment relations (Hall and Soskice, 2001, Colvin and Darbshire, 2013).

Fluid labour markets are typically defined as those making it relatively easy for firms to hire or lay off labour in response to short-term financial demands. This is argued to make it easier for firms to pursue new opportunities, and production strategies involving numerical flexibility, but less attractive to pursue production strategies based on long-term employment (Hall and Soskice, 2001, pp.17-18, 30). Fluid labour markets are also argued to enable technology transfer through skilled worker mobility (ibid). The combined features are argued to lead to complementarities, culminating in firms in liberal market economies taking advantage of new opportunities provided by radical innovation (ibid). However, fluid labour markets may also result in the disincentives to train referred to earlier, such as poaching.

The ‘private ordering’ of employment relations refers to firms being able to determine their employment practices, influenced only by the market (Colvin and Darbshire, 2013). This is compared to public ordering, where other institutions such as collective organisations including employer associations and unions, or the state, play some role in negotiating or enforcing employment practices or conditions (ibid). Examples would be collectively bargained, or state set industry wage agreements, sanctions for poaching skilled labour, or overseeing and setting the training standards for apprenticeship training.

The role of collective organisations such as employer associations and unions in both countries in relation to the skill formation system is argued to have declined. Since the 1980-90s when both the UK and Australia adopted neoliberal ideology that encourages market coordination, there has been a decline in the public ordering of employment relations, and a

weakening of the institution of collective bargaining (Colvin and Darbshire, 2013). While unions and employer associations still play a role in both countries, there is a focus now on individual firm agreements and greater diversity between firms, rather than on sector or industry-based agreements. This has reduced the role of employer associations and the state within the skill formation system, in sanctioning firms who engage in behaviours that undermine investment in skill, such as poaching, or in enforcing training activities through levies.

It should be noted that intervention by the state, employer associations and unions in skill formation is more institutionally entrenched in Australia, due to their arbitration model of industrial relations (Mitchell et al., 2010). This has historically included wage setting through industry awards, the inclusion of qualifications within these agreements, and systems of conciliation and arbitration involving the state in conflicts between firms and workers. The UK has traditionally had much weaker corporatist roots, and so collective organisations have historically been weaker, with a predominately voluntarist state. These differences will be examined in greater detail in Chapter Four.

Human capital theory suggests that market competition specifically disincentivises firms from investing in training that produces portable skills. Firms are only likely to invest in ‘general’ training that is valuable to other firms in the market or industry and are portable, if the firm is able to pass on the costs to workers such as through reduced rates of pay (Becker, 1962). Employees bear the cost of ‘general’ training, by receiving wages that are lower than market rate. Firms are likely to prioritise ‘specific’ training that increases productivity most in the firm providing the training, and therefore is most valuable to that firm but has less value in the external labour market (ibid). In essence then, where firms in the UK and Australia do invest in training, Human Capital Theory would imply this is more likely to be ‘specific’ and not to produce skills valuable to other firms.

The Varieties of Capitalism framework argues, instead, that rather than general and specific skills, there are three levels of skill portability:

Compared to general skills that can be used in many settings, industry-specific skills normally have value only when used within a single industry and firm-specific skills only in employment within that firm (Hall and Soskice, 2001, p.25)

In this framework, general skills are linked to a reliance on the use of graduates such as in the case of the US, industry skills are linked to apprenticeships with Germany's dual apprenticeship system used as illustration, and firm-specific skills are used to refer to comprehensive in-firm training programmes seen in the Japanese model.

In liberal market economies, firms are argued to be less likely to invest in industry level skills due to fears of poaching, and individuals are more likely to invest in general skills through universities, as these are more transferable between firms (Estevez-Abe et al., 2001, Hall and Soskice, 2001). In comparison, coordinated market economies such as Germany or Japan are argued to rely on industry or group based coordination, as opposed to market based (Hall and Soskice, 2001). This means labour markets in these countries are seen to be less 'fluid'. In Germany this has been achieved through strong employer associations and the role of industry wide collective bargaining agreements that set worker wages. In Japan it has been managed through 'life-time' employment, and the weakening of the external labour market.

Less fluid labour markets are argued to be coupled with patient capital, strong inter-company relations and labour strategies reliant on high levels of industry or firm-specific skills (Hall and Soskice, 2001). These features of coordinated market economies are argued to be supported by social protection (Estevez-Abe et al., 2001). In Germany, the centrality of collective bargaining sees both unions and employers avoiding lay-offs during times of economic recession. In Japan, employers advocate for wage subsidies during downturns instead of laying off skilled workers (ibid).

2.2.2 CRITIQUES OF THEORIES OF NATIONAL SKILL FORMATION SYSTEMS

The review of some of the main debates above in relation to national skill formation systems in liberal market economies, would seem to indicate that firms in the UK and Australia will be disincentivised from investing in more portable or higher level ‘industry’ or ‘firm’ skills, while individuals are incentivised to invest in general skills. The arguments would also indicate that, due to market coordination, that the main institutions involved in skill formation in both countries are likely to be firms, training providers such as universities and the market. However, there are several critiques in relation to this account of skill formation systems in liberal market economies.

One critique relates to how the Varieties of Capitalism framework conceptualises skill. Becker’s (1962) already criticised thesis of skill portability is used to divide skills up into three realms, firm, industry and general, and is then conflated with the delivery mechanisms through which training is provided. One example would be the assumption that firm level skills are not portable outside of the firm, using the Japanese case. However, this account overlooks that certain highly valuable skills are best acquired through different mediums, such as at the workplace, but are highly ‘transferable’ (Streeck, 2011). Firms may then invest in skill development for skills that they require as a firm, but that are also highly portable.

The argument that countries such as the UK and Australia have skill formation systems coordinated by the market, and that other institutions play a smaller role is also contested. The use of the market to coordinate skill formation is argued to result in skill shortages and mismatches (Ashton et al., 2000), and echoes the argument made earlier that market failure for skills is ‘endemic and inevitable’ (Streeck, 1989). Skill shortages and mismatches are argued to occur because it takes time for education institutions such as universities to respond to employers signalling changes of demand for skill through recruitment, and to then increase

the supply of skilled labour. As a result, the state is argued to play a far more significant role within skill formation systems.

In both countries the state has restructured and intervened in the running of the national skill formation system. State intervention has included the expansion, deregulation and marketisation of higher education, and the introduction of tuition fees (McCaig, 2011, Harman and Harman, 2003, Brennan and Shah, 1994, Goedegebuure et al., 1994a, Goedegebuure et al., 1994b, Meek, 1994, Sokodvin, 1999). The role of the state has increasingly focussed on 'supply side' policies (Lloyd and Payne, 2003, Hall and Lansbury, 2006), to combat market failure. Supply side policies place the onus on individuals to fund their own skill development, such as by increasing the number of graduates, or by providing subsidies for training, rather than attempting to increase firm demand for skill. In the UK case this has resulted in arguments that the education and training system is increasingly statist in design, with state intervention being used as a substitute for regulation in labour and product markets (Keep, 2006b).

In addition to the role of the state, sub-national conditions for skill formation may exist that differ from the national skill formation systems, and therefore enable other institutions to play a role within skill formation for sectors or occupations. Sub-national variation is likely to exist as there is greater heterogeneity within countries than theories of national skill formation systems imply (see discussions by Crouch in Crouch et al., 2001, Crouch, 2005a). This critique suggests that theories of national skill formation systems indicate the 'dominant' institutional arrangements (Crouch et al., 2009) but that conditions may vary dependent on sector or region, as indicated by the continued existence of small highly skilled sectors in countries such as the UK (Crouch, 2005a).

In some accounts (e.g. Ashton et al., 2000), the strong role of the professions and professional associations in overseeing training and entry to their occupation are referred to. These institutions may also be part of certain sub-national skill formation systems, alongside universities, and the state if it administers occupational licensing (Sako, 2017). One of the few accounts of professional skill formation within the field of skill formation systems distinguishes between types of professionals¹, their modes of training, required qualification and standards enforcement. Engineers fall under ‘organisational professionals’ in this typology.

Engineers (it argues) are educated initially through higher education such as universities, and subsequently by the firm via on the job training. Engineers are argued to not require a license to practice, just certification, with enforcement of standards and ethical code undertaken by employers and clients (Sako, 2017, 602). However, the typology does not differentiate between different countries, even though, as discussed previously, conditions and institutions do differ. One possible area that might vary will be requirements for licensing.

The final critique that is particularly salient for this project is how firms are conceptualised, and what this means for our understanding of the role of multinationals in skill formation.

This will be addressed in the following section.

2.2.3 WHAT ROLE DO MULTINATIONALS AS AN ACTOR PLAY?

Theories of national skill formation systems typically treat firms as ‘bounded by’ that system, and assume that the institutional arrangements that exist constrain, or shape, firm behaviour towards skill formation in certain ways. These theories also tend to treat firms as a homogenous group, with similar interests in relation to skill development. However, one

¹Sako (2017) distinguishes between independent professionals, state-sponsored professionals, organisational professionals and knowledge professionals. Independent/State sponsored professionals include doctors, lawyers and accountants. Knowledge professionals include research scientists. For the purposes of this study, organisational professionals include ‘functional specialists’ such as engineers.

framework (Crouch et al., 1999) attempts to disaggregate firms into different categories, and identifies certain types of firms that are more likely to invest to a higher degree, and potentially in a broader range of skill formation activities.

In this account, firms are argued to be organisations with a ‘hierarchy of managerial authority’ who are therefore able to ‘develop strategies that include taking an active and creative approach to the formation of skills’ (Crouch et al., 1999, 196). This account theorises the firm as a quasi-institution: the ‘corporate hierarchy’. The authors distinguish three conditions that can influence the degree to which firms as ‘corporate hierarchies’ invest in skill formation activities: size, the level of competition such as whether firms operate in highly competitive or monopolistic markets, and sector or product market (Crouch, 2005b).

What this argument suggests is that firms in non-competitive labour markets sectors, large firms, and firms in sectors with ‘science or knowledge rich products’ (ibid, p.100) are more likely to train, as the character of the goods or services forces firms to train to succeed. As such, ‘the market’ can be conceptualised as both the source of problems with training, and also the provider of conditions that can incite firms to train, or incentivise them to use the mechanisms provided by other institutions (ibid; Crouch et al., 1999).

In the first scenario, firms are referred to as ‘labour market monopsonists’. These firms operate as the sole employers in a sector or region, requiring the type of skills that they do, or with distinctive approaches, such as a high skill product niche in a predominately low skill sector that makes them more attractive as employers (Crouch et al., 1999). The second are ‘institutional companies’. This type of firm is argued to require innovation, and so focuses on the development of strong corporate cultures and internal hierarchies that disincentivise workers from switching employers, and who tend to pursue a longer term employment agenda over numerical flexibility (ibid).

In another liberal market economy, the US (Crouch et al., 1999, 207-208), examples of what investment in skill formation from institutional firms can look like include: subsidising additional training chosen by employees such as university degrees, purchasing customised training from training providers such as universities, or the development of internal firm ‘universities’. In the US case, the growth of customised courses, through for example business schools, was argued to be driven in many cases by state government funding, and can be a one-off occurrence, or part of an ongoing partnership between the firm and the training provider (ibid). The latter, the development of firm ‘universities’, is argued to be restricted to large companies, due to the level of resources required (ibid).

Finally, the third type of firm likely to invest in training will be those ‘located in highly advanced product markets where it is absolutely necessary to have advanced skills to compete or lose market position’ (ibid, p.198). The authors argue that firms operating in these kinds of product markets, such as those in high-tech sectors, may choose to invest in ‘general’ skill development even if it is of value to other firms in the sector. The imperative for firms to train comes from the relationship between product market strategies and the subsequent need for high levels of skill in the workforce to design and produce the product (Ashton and Sung, 2006, Green et al., 2003, Mason, 2005).

This theory does indicate the importance of sector, size, product market strategy and requirements for innovation in potentially, though not definitively, increasing firm investment in skill formation. However, this may not always be the case. Analysis from the authors (Crouch et al., 1999) of firms in sectors requiring advanced product market strategies in the UK, suggested that firms with this form of product market strategy tended to rely on ‘the strong record of British elite education’ (Crouch et al., 1999, 215) as opposed to developing their own forms of firm-specific skill formation. Firms in the UK case then are depicted as operating within the remit of skill formation predicted by the Varieties of Capitalism

framework. In comparison, in the account of institutional firms in the US, there were examples of these firms operating against theoretical predictions by investing in skill formation that was portable to other firms.

In addition, there is no disaggregation within this framework of multinationals, from other nationally bounded firms. Actors such as multinationals are argued to operate on the “edge of a particular network of embedded relations [and] are likely to have access to other, adjacent networks” (Crouch and Farrell, 2004, 29). This provides them with the possibility of drawing on ideas and institutional arrangements from other varieties of capitalism. These actors from other institutional systems or ‘foreigners’ are argued to have more room for deviant behaviour (Streeck and Thelen, 2005, 28). Firms have been argued to be less bounded by national systems than these theories suggest (Crouch et al., 2009) and, if this is the case, it raises the question of whether multinationals are less bounded than other firms. This is another question that has not been answered within the existing work on skill formation systems.

2.2.4 MULTINATIONALS AND THEIR ROLE IN SUB-NATIONAL SKILL SYSTEMS

So how can the role of the multinational in skill formation, and within skill formation systems be understood? As mentioned, there has not been research that explicitly conceptualises the role of multinationals in skill formation systems. However, there is a small amount of evidence from adjacent fields of research, that have analysed the role of firms, and in a handful of cases, multinationals, in creating conditions at a sector or regional level that are distinct from the national architecture. While few of these examples are directly related to skill formation, they do indicate the potential for deviation from national institutional constraints and raise questions about the role that multinationals can play in this process.

In one such study looking at whether sub-national conditions can differ from national varieties of capitalism, the authors (Crouch et al., 2009) argue that this can occur for three

reasons. The first is that institutions and infrastructure may develop that support forms of economic organisation ‘that differ from and may even defy the overall national architecture’ (ibid, p.655). The second is termed ‘creative incoherences’ where firms utilise some of the contradictory incentives of national and local institutions. The authors refer to this as ‘a truly Schumpeterian form of innovation’ where something new is created from previously untried combinations of elements. The final reason that conditions can deviate is that firms may be, at times, less bounded by the national system than theory might suggest (ibid).

In the cases in the authors’ study, one example of multinationals engaging in sub-national variation in relation to skill formation was the case of Ikea, who utilised various parts of the Swedish system to build its brand while circumventing institutional arrangements related to skill. Ikea chose to finance its own expansion and train internally so it didn’t have to participate in school based vocational training (ibid). This example highlights that multinationals are in some cases able to benefit from certain parts of institutional arrangements while opting out or avoiding others.

In addition, all three firms in the study that fulfilled the criteria of firms being ‘less bounded’ by national systems than predicted by theory (ibid) were all large multinational firms: Ikea, and two multinationals in the automobile sector. However, the theoretical framework developed by the authors does not distinguish between multinationals and other firms. This again raises the question of whether multinationals may be less bounded by national architecture, and therefore national systems of skill formation than other ‘nationally bounded’ firms.

There are also small pockets of research that explore how sub-national conditions come to exist which are distinct from the national architecture (Almond et al., 2017, Almond, 2011), or in processes of institutional change (Streeck and Thelen, 2005, Crouch, 2005a, Morgan,

2016). Within this body of work are some concepts that may be useful when considering what role multinationals may play in skill formation. These concepts are used to describe the mechanism through which actors at a 'local' scale (e.g. regional or sectoral) respond to 'changing contexts [that] change the resources and power of actors and thereby create new constraints challenges and opportunities' (Hauptmeier and Morgan, 2014, 167). One mechanism that actors use is experimentation, whether organisational or institutional (Morgan, 2018, Kristensen and Morgan, 2012). A similar term, used to refer to the actors involved in such activities is institutional entrepreneurs (Crouch, 2005a, Crouch and Farrell, 2004).

All three of the above types of deviation discussed (Crouch et al., 2009) can be considered to be forms of organisational or even institutional experimentation (Kristensen and Morgan, 2012, Morgan, 2018). Both types of experimentation occur as a result of change or challenges that create new problems to be addressed, with institutional experimentation being argued to often emerge from organisational experimentation (Morgan, 2018). Organisational experimentation would be where firms (as one example) engage in practices that can shape the sub-national conditions for themselves, but not necessarily other actors, or where changes to sub-national conditions have not gained permanence (Morgan, 2018).

This becomes institutional experimentation if the resources for organisational experimentation become embedded, and are available for other firms in the sector to access, through bypassing, converting or destroying existing institutions, or reshaping the institutional landscape (Morgan, 2018). Firms, and other actors may develop:

new strategies and structures in response to changing circumstances, by drawing on existing institutions but bending them and evolving them in new ways

(Morgan and Kristensen, 2014, p.237)

Firms are identified as an actor who has the greatest capacity to drive experimentation, though other actors such as national and regional governments, unions and civil society may also play a role (Morgan, 2018).

Firms are argued to be able to enact change within institutional environments because:

Firms are strong...even within institutional constraints, they are centralized decision-making actors which have to make choices if they are going to develop. Institutions are 'weak' in the sense that they do not have a centre of decision-making

(Morgan, 2005a, 424)

Continuing this logic, this again raises the question of the role of the multinational, as it could be argued that these firms may be less bounded by national institutional constraints.

The final theoretical concept that may prove useful is that of institutional entrepreneurs. The term 'institutional entrepreneur' covers several criteria. Firstly, it refers to actors who have access to alternative ways of doing things, such as those who may be 'boundary spanners' operating across institutional environments (Crouch and Farrell, 2004). Second, the term refers to actors who are attempting to change the structure in which economic and other activities take place, by 'recombining' elements of institutions in unusual ways that result in the manipulation of elements of governance (Crouch, 2005a). There are similarities between institutional experimentation, and the type of activity undertaken by institutional entrepreneurs, though only the former refers to the need for resources to be embedded.

So how might multinationals engage with and shape institutions and engage in organisational and institutional experimentation? In part, the capacity for firms, as actors, to engage with and potentially shape institutions, is argued to depend on how national and sub-national institutional systems have evolved, and the existence of both institutional and organisational legacies, history and memories (Kristensen and Zeitlin, 2005, Morgan, 2016, Crouch and Farrell, 2004). The existence of institutional legacies and memory provides firms with diverse options or 'paths' open to them, beyond what is now institutionally dominant at a

national level (Morgan, 2005a, Crouch and Farrell, 2004, Crouch, 2005a). Multinationals may also have access to diverse options and paths from their own organisational memory across different subsidiary sites, alongside those available from the external skill formation system, should they choose to act as institutional entrepreneurs. None of the existing work explicitly focuses on the role of multinationals in skill formation systems, but these concepts may be useful in exploring how these firms engage with actors and institutions at a 'local' level.

The discussion throughout the first half of this chapter has raised several questions. First, the research on skill formation systems has not explicitly addressed the role of multinational firms in skill formation. These firms are acknowledged theoretically to be potential actors for institutional innovation and change (Crouch and Farrell, 2004, Streeck and Thelen, 2005), and are potentially less bounded by national systems than other firms (Crouch et al., 2009). This raises the question of whether these firms engage with skill formation systems, and what role they play within them.

Second, there are a small number of examples where large firms, such as 'institutional firms' and multinationals may choose to deviate from national 'varieties of capitalism' or skill formation systems (Crouch et al., 2009, Crouch et al., 1999). We do not know how extensive this activity is, or which multinationals have the 'choice' to be able to do so. We also know that it may be possible for firms such as multinationals to engage in forms of organisational or institutional experimentation, whereby they work in coalition with other actors to shape their sub-national conditions to better suit their needs (Kristensen and Morgan, 2012, Morgan, 2018). This raises the question of whether multinationals engage with and are able to shape the engineering skill formation system to better suit their needs. Concepts of organisational and institutional experimentation, and institutional entrepreneurs may help us to better examine the role of multinationals in skill formation.

The following section addresses the multinational as an actor, including the sole study that argues that these firms are engaged in skills capture and the building of global skill webs. These arguments are compared with the small number of studies that have also focused on multinationals and skill formation, and some of the parallel work on multinationals that may help us to understand the role of these firms in relation to skill.

2.3 THE MULTINATIONAL AND SKILL FORMATION

When considering the role of multinationals in skill formation, it is important to recognise that these firms are not a homogenous group. Some multinationals may have a greater capacity to participate in processes such as labour arbitrage, namely those whose operations are ‘mobile’ (Levi and Ahlquist, 2004) and so have the potential to regime shop. Then, the arguments from one study that has conceptualised the role of the multinational as an actor in skill formation are examined, including the claims that some of these firms are able to ‘capture’ skills through processes of standardisation such as building global skill webs.

Crouch (2010, argues that certain multinationals can be conceived of as ‘giant firms’. The multinationals considered to be ‘giant firms’ are those sufficiently dominant in their own markets to influence those markets, and who operate across multiple countries (ibid, pp.148-149). The giant firm is able to negotiate with and create competition between national governments (ibid) or the ‘competition state’ (Cerny, 1990) through the process of regime shopping. National and even regional governments conduct negotiations with individual multinationals and use micro economic and industrial policies (Cerny, 1990) to provide incentives and concessions for these firms to locate one of their subsidiary operations.

This process is sometimes termed a Dutch or reverse auction where workers are expected to do more for less, or labour arbitrage, where firms profit from the differences in labour costs around the world by playing different groups of workers against each other (Brown et al., 2010, Brown et al., 2008). The ability of multinationals to engage in global negotiations is

argued to depend on the sector conditions, the types of product and the skills the firm requires as a result.

The multinationals who are argued to be able to ‘capture’ skills are those who engage in labour arbitrage (Brown et al., 2008). These firms tend to produce products and services that are not geographically fixed, and so are considered ‘mobile’(Levi and Ahlquist, 2004). Being able to move production allows firms to broaden their search for a labour pool that has the appropriate skills to produce their products and services for the lowest cost. Multinationals who fall into the mobile category have been offshoring low skilled or highly standardised activities on a cost saving basis for decades (Morgan, 2005b). This process of labour arbitrage is argued however to be no longer restricted to low skill or standardised work (Brown et al., 2008).

Levi and Ahlquist (2004, argue in their typology that workers in such areas of ‘mobile’ capital are either localised, such as in manufacturing, or are themselves highly mobile, such as in knowledge work. As aerospace manufacturing involves a combination of physical manufacturing and knowledge work such as design, research and testing activities, this would suggest that multinationals may be mobile, as they have the capacity to manufacture parts of their products in different countries. Professional engineers as workers are also considered mobile, as professionals’ skills are highly portable (Sako, 2017). The following section discusses the literature that argues that multinationals may be able to capture the process of skill development through the standardisation of knowledge work and by building global skill webs.

2.3.1 SKILLS CAPTURE, GLOBAL SKILL WEBS AND STANDARDISATION OF SKILL PRODUCTION

Multinationals are presented as actors who are central to the disaggregation and fragmentation of production (Morgan, 2005b) due to labour arbitrage. However, as has been

discussed, only a small number of studies have focused on the role that multinationals may play in skill formation. One such study claims that a distinct new form of skill formation has emerged in multinational companies, termed strategic or global skill webs. These global skill webs are argued to emerge as a result of three drivers: globalisation, including increased flexibility in the organisation of production, global competitiveness pushing firms to reduce costs, and the emergence of new technologies (Ashton et al., 2010).

The concept of global skill webs refers to the shift from national to global sourcing of skills and talent, and has as part of its definition a movement away from companies' attachment to their country of origin (ibid). As such, the concept of global skill webs is held in contrast with much of the research on skill formation systems discussed earlier which has focused on skills being the product of national institutions. Even within work on multinationals, skills are often seen as a 'geographically specific' resource offered by a region or locality for these firms (Almond et al., 2014). Global skill webs, however, are argued to be a result of globalisation processes and therefore both represent and result in firms reducing their reliance on national business and skill formation systems (Ashton et al., 2010).

As a result of globalisation processes, multinationals are argued to have increased flexibility in their ability to strategically relocate production and to set their production strategies (Lauder et al., 2008). These firms are then subject to pressure from globalisation processes, pressures to reduce costs and advancements in technology, while still needing to be able to benefit from economies of scope and scale (Ashton et al., 2010). These three drivers are argued to have transformed how multinational companies build their global skill strategy, and have resulted in Human Resources being repositioned into a more strategic role with the emergence global skill webs.

The original authors describe three central characteristics of global skill webs that are argued to be central to this emergent phenomenon and explain the use of web as a metaphor. The first is a shift from nationally orchestrated pyramids to globally managed ‘webs’:

indifferent to national, functional and organisational boundaries as sourcing options have dramatically increased, including the use of outsourcing and offshoring

(Ashton et al., 2010, 842)

The authors argue that this shift from national to global can be seen in the relocation of highly skilled or ‘knowledge’ work. Instead of remaining located within developed economies, often the multinational company’s home country, knowledge work is argued to be increasingly globalised as firms seek to speed up and also reduce the cost of ‘innovation and other core activities’ (Ashton et al., 2010, 842).

The second characteristic of global skill webs is that webs have centres of power. The original authors contrast the web with other organisational forms such as the network organisation where power is diffused (ibid). The global skill web metaphor would seem to consolidate power within the headquarters of the multinational company. This characteristic of the concept of global skill webs raises some interesting questions in relation to the claims the authors make about global skill webs resulting in companies moving away from their countries of origin. There has been a significant strand of research that discusses the impact of country of origin on the operations of multinationals and their subsidiaries (which will be raised in the following Section 2.3.2). If as suggested by the authors, power is consolidated within headquarters, then tensions are raised if headquarters remain predominantly staffed with managers from the firm’s country of origin. This raises an important question of whether the presence of global skill webs does result in as far reaching a shift away from country of origin as the original authors imply.

The third characteristic of global skill webs is that, as ‘web-like’ organisations, multinational companies are seeking to:

Integrate, align and standardise various activities, procedures, and HR functions, to benefit from the economies of scope and scale that new technologies and global markets now offer (Ashton et al., 2010, 842)

These broader processes of standardisation are argued to include production practices, such as quality control. In one example, standardisation and benchmarking were argued to have resulted in German automotive multinationals reducing their reliance on Germany’s distinctive apprenticeship system, and, in fact, seeking to undermine it as their need for high levels of intermediate skill decreased (Lauder et al., 2008).

Through standardising, integrating or aligning various activities, multinational companies are argued to have been able to develop an ‘inside-out’ process of production rather than an outside-in (Lauder et al., 2008). Skills, it is argued, are no longer produced in national contexts and used by firms (ibid). Instead, multinational companies decide the production systems, standardise these processes and enforce quality control and benchmarking; they can then create ‘oases of production in areas where it was previously thought it would be impossible to create high quality products’ (ibid, p.25). As such, the central argument of global skill webs is that these processes result in both a reduced reliance on country of origin, and a reduced reliance on skill formation systems in the host countries where subsidiaries are located.

The research work that led to the development of global skill webs as a theoretical concept focused on the impact of emerging economies on multinational companies’ skill formation strategies. The authors argue that the three characteristics of global skill webs have been made possible by four changes at a global level: the internationalisation of skill formation,

the relocation of knowledge production, knowledge innovation and the rationalisation and management of knowledge work (Ashton et al., 2010). The four changes are intertwined and each is heavily influenced by the three drivers referred to earlier, globalisation, new technologies and global competitiveness resulting in a need to cut costs.

The outcomes of each of these four changes are argued to be that various forms of high skill work or 'head work' are being moved from developed to developing economies to overcome skill shortages, to benefit from cheaper labour costs, or to speed up innovation activities (ibid). The implicit implications for developed economies from these changes are that there is likely to be growing competition for highly skilled work from countries where labour costs are significantly lower. The types of work and jobs that are being relocated, and how these changes are argued to enable global skill webs are discussed below.

The internationalisation of skill formation refers to a growth in the availability of graduates in emerging economies. This has made it possible for multinational companies to move production including highly skilled knowledge work to developing economies. There are differences noted by the authors in terms of how easily certain types of work can be moved. Services may be easier to relocate because they are 'weightless' (ibid, p.845) while greater restrictions may exist for physical manufacturing. Heavier or more complex components such as engines may still need to be manufactured close to the final assembly plants as one example (ibid, p.848 see also Sturgeon and Van Biesebroeck, 2011). The relocation of knowledge production refers to the impact of technological changes and how these have enabled the offshoring of 'head work' to developing countries (Ashton et al., 2010). As a result, firms are able to offshore back-office processing work including higher skill jobs such as research and analytics to, as one example, India, where wage costs are significantly lower (Ashton et al., 2010, 844).

Knowledge innovation refers to the relocation (or decentralisation) of a specific sub-section of 'head work', namely research, design and development activities that have historically been concentrated in the multinational's country of origin (ibid). Part of the rationale for relocating this type of knowledge work is cost, as wages are significantly lower. However, there is also an argument that this process has enabled multinationals to speed up the process of innovation, by developing 'global teams' in research and design, who 'follow the sun', offering twenty four hour 'knowledge' production (Ashton et al., 2010). Following the sun involves offices located strategically across the globe to benefit from time differences. It requires digital technology that enables teams in different countries to all work on shared operational platforms, whether through intranet or internet, simultaneously. The authors argue that this process is most advanced in manufacturing, with examples found in both research and design work (ibid).

Finally, the rationalisation and management of knowledge work involves two separate processes. The first, rationalisation, refers to technological changes that have enabled firms to break down complex processes historically undertaken by occupations into component parts or tasks, and to outsource initially the easiest work (Brown et al., 2008). One example would be the use of outsourcing and offshoring in law firms (Kuruvilla and Noronha, 2016, Sako, 2009), resulting in firms in the US and UK reducing the number of paralegals and entry level associates they hire. These processes of standardisation that are reliant on technology are termed 'digital Taylorism' (Brown et al., 2010, Brown et al., 2008, Lauder et al., 2008, Ashton et al., 2010).

The second, the management of knowledge work involves attempts by firms to 'generate global competencies', and to classify their workforce by segmenting out those workers identified as 'talent' (Ashton et al., 2010). This process of classification is argued to require standardised HR practices such as appraisals, which then act as a means for HR managers to

identify their top people as part of their talent management strategies (ibid). The authors stress the emphasis placed on the development of soft skills for talent and managers, seen through firms developing ‘global’ behavioural competencies (ibid).

This phenomenon of workforce segmentation, and the emergence of a core group of employees (or ‘talent’) has also been raised in other research. Edwards et al (2013, p.610) as one example, raise as an area for future research that in their study of 1,100 multinationals, that 80% of respondents identified “a ‘key group’ of employees who were central to the firm’s success”. The authors raise the question of whether this group are seen as ‘a global resource’ within the firm, and therefore subject to distinct global requirements. Other arguments have been made that managers and talent are more likely to be subject to standardised practices, while other workers are not (Edwards and Kuruvilla, 2005).

One of the central arguments made above is that global skill webs represent a fundamentally new form of skill formation found within certain multinationals that has profound implications for the organisation and geographical dispersion of production. The arguments above suggest that global skill webs enable multinationals to become ‘self reliant’. They can produce their own skills ‘in-house’ and so are not reliant on skill formation systems in either their home or host countries beyond recruiting graduates. In one account the authors do acknowledge that the ‘country of origin’ of the multinational may influence how each firm builds their global skill webs, and whether they build relationships with actors such as universities in the skill formation system (Ashton et al., 2009). However, even within this account, the authors argue that these effects will reduce over time (ibid). There are a number of questions and critiques that arise from the above discussion. The first is whether global skill webs really do reduce the reliance of firms on national business systems to the extent that the authors suggest. If so, does the existence of global skill webs influence the extent to

which multinationals engage with actors in skill formation systems, or are constrained by institutions within them?

The second set of critiques centres on questions about the purpose and reach of the various characteristics of global skill webs. The authors talk about a movement from nationally managed pyramids to webs, a centralisation of power with headquarters, and the standardisation, integration or alignment of a variety of practices including production and HR. However, in the examples the authors later refer to, it is not clear how these three characteristics of global skill webs interact. For example the question of who has access to these standardised practices and processes is important. Is it, as has been found in other research, solely a small sub-sect of workers, those who are considered talent? If so, does this have implications for how these different groups of workers are managed, and whether this is at a national or global level? What does headquarters have control over and choose to standardise versus what is ceded to the management of the subsidiary? The authors have already acknowledged that some automotive firms in their study struggled to build global skill webs due to the size and complexity of their operations (Ashton et al., 2010), so this and the previous critiques do raise the question of whether global skill webs are as encompassing as theoretically depicted? These are important questions to answer to understand whether global skill webs actually do change the nature of work and the labour process for workers.

The following sections address alternative work on multinationals that critiques or raises additional questions about the role they may play in skill formation, and the operation of global skill webs, including the influence of country of origin, relationships between headquarters and subsidiaries, and the role of skills for subsidiary operations.

2.3.2 COUNTRY OF ORIGIN AND ITS INFLUENCE ON STANDARDISED PRACTICES

Research on the concept of country of origin and the strength of its effect on multinationals shares some similarity with research on the different varieties of capitalism across countries.

The premise of 'country of origin' effects are that multinationals are national firms that have expanded to operate internationally (Hu, 1992). Research on this topic has focused on how firms from different countries have adopted particular approaches that are distinctive and can be linked to their different 'country of origin' or variety of capitalism (Ferner, 1997, Smith, 1989, Edwards and Ferner, 2002, Ferner and Varul, 2000). These approaches are not necessarily linked to standardisation but can involve the transfer of individual practices across subsidiaries, or the replication of a broader management approach.

US multinationals, for example, are renowned for having highly centralised approaches to industrial relations, and a tendency to either avoid or marginalise unions (Almond et al., 2005). As a result, US firms are often found to be unwilling to participate in industry wide bargaining or in the VET system in subsidiary countries (Edwards and Ferner, 2002).

Examples include countries such as Germany (Muller, 1998, Royle, 1998) where American multinationals have attempted to avoid participating in the system of co-determination.

Another example might be evidence of Japanese multinationals replicating industrial relations practices in their UK subsidiaries, such as signing agreements with one union and encouraging high levels of membership amongst their workforce (Kneel, 1993).

Country of origin effects, then, can result in the diffusion of practices from one national institutional setting to another. If a multinational seeks to diffuse a practice from its country of origin across all its subsidiaries, this suggests that country of origin could influence the development of standardised practices. This discussion also raises the question of whether the country of origin/headquarters influences the development of standardised practices in relation to skill development. While no examples were found of this occurring for professional engineers, there have been studies that focus on intermediate skill development, though these are limited in number.

Kristensen and Morgan (2007) draw on a selection of studies (Oliver and Wilkinson, 1992, Morgan et al., 2002, Whitley et al., 2003) on Japanese multinationals operating subsidiaries in the UK to delve into the impact of both country of origin and the host country on subsidiary practices. They highlight that there are examples, such as the cases of Nissan and Toyota, where the multinational subsidiaries have developed a focus on training and development in the local context. This engagement includes building relationships with technical colleges and local authorities to develop courses for employees. Alongside these relationships each firm has also heavily invested in internal training schemes that are characteristic of Japanese firms, resulting in an upgrading of skills at worker, supervisor and management levels (ibid).

Another study, also on the automotive sector, focuses on intermediate skill production in subsidiaries for two automotive manufacturers. The study analyses the operations of Toyota and Volkswagen in Brazil, Russia, India and China (Jürgens and Krzywdzinski, 2016). The findings reveal a clear preference on the part of Toyota to invest in in-house training, mirroring the Japanese ‘firm based’ intermediate training system discussed earlier. In comparison, VW mirrored the German model, through its attempts to work with local VET providers to develop courses to train its workforce (ibid).

In the second study, both firms are argued to have globally standardised firm production systems, integrated HR practices such as structured career paths and ranking systems, and to have developed some standardised training practices (ibid); infrastructure that are reminiscent of theories of global skill webs (Ashton et al., 2010). However, the delivery mechanisms chosen by both multinationals, internal firm training versus working with local training providers, can be argued to be shaped by each firm’s country of origin. This raises the question of whether there are similar effects found in the standardisation of skill formation for professional occupations such as engineering, if global skill webs have been constructed.

2.3.3 HEADQUARTERS AND SUBSIDIARY RELATIONSHIPS

Another of the underlying assumptions within theories of global skill webs is that multinationals are cohesive entities, and that their headquarters can design and implement standardised practices in relation to production, HR and skill formation across all subsidiaries with relative ease. However, much of the empirical evidence on multinationals indicates that instead, the relationship between headquarters and each subsidiary can be more complex. This section considers this evidence, and asks whether it is as easy as described for headquarters to standardise production and HR practices, or whether there is potential for subsidiaries to resist these pressures.

Multinational headquarters have been found to utilise what have been termed ‘coercive comparisons’ (Morgan and Kristensen, 2006) or whipsawing (Greer and Hauptmeier, 2016). What these processes involve is some level of standardisation of production processes across sites so that subsidiaries can be compared in terms of productivity and cost. Headquarters are then able to make the allocation of work across subsidiaries a competitive process and use these comparisons to encourage or leverage subsidiary concessions. These concessions can come in the form of adoption of certain labour conditions or practices, even if these undermine local institutions, in the name of securing work within the internal value chain of the multinational.

Greer and Hauptmeier (2016, note in their study of the differences between whipsawing in Ford, General Motors and Volkswagen that there are different ways of implementing coercive comparisons. While all three firms utilised different forms of whipsawing, the German firm’s final approach was reliant on the integration of labour into management decision making processes, indicative again of the role of country of origin.

The process of developing intra-subsidary competition and/or coercive comparisons has been noted to cause distinct forms of resistance from subsidiaries. The first is the subsidiary

directly resisting headquarters, typically through the presence of unions. The second response is where the subsidiary attempts to develop non-replicable resources at a regional or national level that provide the subsidiary with competitive advantage. There are several examples detailing how subsidiaries can resist headquarters and protect their operations through developing distinct innovations that generate efficiency savings or competitive advantage for their site over other subsidiaries (see for example Edwards, 1998, or , Kristensen and Zeitlin, 2005).

In one example of this, Kristensen and Zeitlin (2001, 176) discuss a Danish subsidiary that was able to subvert the decisions by headquarters to close their plant and relocate manufacturing at the German subsidiary. The Danish subsidiary achieved this through intra-subsidary competition, by developing competitive advantage through promising to deliver the parts (pumps and valves) within a month, a much shorter timescale than the other subsidiary could match.

Subsidiaries can also resist headquarters by embedding themselves within local or national economies, such as by building political alliances, making use of regulations that may make it costly to close plants, through accessing subsidies or by building coalitions at the subsidiary level. In some examples of this, subsidiary managers and unions have entered discussions to negotiate, mediate or resist the implementation of broader change processes (Lucio and Weston, 1995, Lucio and Weston, 1994). Unions have been found to play an important role in resisting the implementation of standardised practices even in liberal market economies such as Canada (Edwards et al., 2013).

In other examples, subsidiary managers have been found to form coalitions and alliances with employees and other actors, and to build regional resources as a means of developing and leveraging their local advantage and to offset insecurity. Managers of US subsidiaries were found, in one example, to have made efforts to localise their supply chain, and to engage

more intensively with regional and national skill actors, politicians and development agencies to ensure they could develop appropriate resources to ensure their competitive position (Almond et al., 2014, 249).

These alliances may be built to secure more work from headquarters, or to improve their subsidiary's position within the internal value chain of the multinational (Almond, 2011, Almond et al., 2014), but may then also be used to resist the power of headquarters. In another example, a coalition of local actors such as unions, government officials and other institutions had even gone so far as to develop "local training institutions and public research and technology partnership bodies" (Kristensen and Morgan, 2012, p.419). Access to these bodies was used as an incentive to prevent managers from multinational subsidiaries from participating in whipsawing and coercive comparisons conducted by their headquarters (ibid). In such examples, would the existence of global skill webs, or the implementation of standardised practices actually result in subsidiaries reducing their reliance on national or 'local' institutional arrangements? Or might subsidiaries actually continue to engage at higher levels with actors in the skill formation system as a means of developing competitive advantage?

Research examining this phenomenon of whipsawing, and subsidiary resistance is not extensive, though it is growing. What this means is that there are a small number of examples of this form of activity, and that the evidence provided often focuses on a small number of multinationals across a handful of country cases. In some examples, institutional arrangements may be more malleable in the face of multinationals (Almond et al., 2014) than for other firms, and examples of resistance exist but are rare. Is it as easy as depicted for multinationals to build global skill webs, and to standardise production, HR and training practices? Can subsidiaries or actors such as unions resist the implementation of standardised practices, such as those that make up global skill webs?

Some examples would suggest that actors such as unions can resist the implementation of such practices, while others would indicate that they cannot. The position of the subsidiary in the internal value chain of the multinational, the subsidiary capabilities and resources, and the distinctiveness of worker skills may be important conditions here as they are argued to influence the level of autonomy a subsidiary has (Lévesque et al., 2015). For this reason, it may be easier for multinational subsidiaries higher up the internal value chain, or within high value sectors such as aerospace, who produce complex parts with high skill requirements to resist standardised practices.

This has not been found to be the case for industries with lower skill requirements. In one example, focussing on McDonalds and an Italian competitor in the Italian fast food industry (Royle, 2006), McDonalds transferred a series of standardised low road HR practices which actually breached an industry agreement, and undermined the Italian institutional system. Even in the face of substantial worker and union resistance, the dominance of McDonalds in the sector resulted not only in the successful transfer of these practices to its subsidiaries, but also to its Italian competitor causing widespread negative impacts for a whole sector.

2.3.5 MULTINATIONALS, SUBSIDIARIES AND SKILLS

One of the underlying premises of the concept of skills capture and global skill webs is that there is availability of appropriately skilled or ‘technically competent’ graduates for these multinationals to hire (see, for example Brown et al., 2010). The discussion in this section critiques this premise by examining work from several distinct fields of research that have analysed, to a greater or lesser extent, any relationships between multinational subsidiaries and actors within skill formation systems.

The original authors argue that, as multinationals have access to a large pool of ‘technically competent’ graduates, they are more concerned with the development of ‘soft skills’:

team working, communication, a willingness to learn and problem solving, which they can then build on to develop corporate-specific skills. For many positions the type of university degree obtained is not relevant; rather, given a base of intellectual competence, it is the soft skills that are crucial (Lauder et al, 2008, p.30)

The unspoken assumption is that these firms become less reliant on national skill formation systems as they are able to source graduates in international labour markets, and then develop their soft skills internally through the infrastructure of global skill webs. In one of the accounts of the phenomenon, the authors do acknowledge that multinationals may continue to develop long term relationships with actors in the skill system such as colleges and universities (Ashton et al., 2009), but do not explore what these relationships may look like, or how they may interact with global skill webs.

However, there is a small amount of evidence from other fields that delve into how multinationals may engage with actors in the skill formation system. In the UK case, in one of the few studies that focuses on the role of multinationals and skills institutions (Tregaskis and Almond, 2017), there are examples of one multinational subsidiary arguing that the strength of their site comes from their workforce skills. This firm sought to prevent poaching of their workforce by making some of their internal skill development activity a ‘public good’. The study examines two regional skills networks and presents some evidence to suggest that multinationals may engage with, and can shape university courses, albeit at an informal level. The firms studied used their engagement to influence the university curriculum by interacting with university staff at network meetings and discussing what skills they deemed were valuable.

These close relationships were argued to provide each multinational with a ‘recruitment pipeline with qualifications containing job-relevant content’ while universities increased their students’ employability (ibid, p.13). This study, while only one example, highlights first that multinational subsidiaries do engage with actors in the skill formation system. It raises

questions about what the relationships between multinationals and universities consist of, and the extent to which these firms engage, and may be able to shape course content.

Multinationals may also engage with some actors such as universities in relation to innovation activities. There is a substantial body of research that scrutinises innovation relationships between mainly large firms and universities (see Valentín, 2002, Valentín and Sánchez, 2002). Research in this area includes the role of policy innovation networks, the state, and relationships between firms and these institutions in relation to innovation (e.g. Block, 2008, Etzkowitz, 1994, Etzkowitz et al., 2000, Webster, 1994b, Webster, 1994a). One such study details how three multinationals, two in ICT and one in pharmaceuticals, have developed long-term strategic innovation relationships with a small number of universities in the UK (Lam, 2007).

The study primarily focuses on the knowledge production process, how boundaries have thinned between each firm and these universities resulting in hybrid work roles and recruitment and career paths across universities and industry. However, the study makes reference to strategic firm-university partnerships, that since the mid-1990s are being managed globally. These relationships include ‘linking mechanisms’ such as ‘research collaboration, industrial inputs into curriculum development, student sponsorships and placements, and exchange of scientific staff’ (ibid, p.1002) that relate primarily to PhDs and post-doctoral researchers.

The study highlights that multinationals may be able to develop relationships with actors in the engineering skill system such as universities, though questions remain about the scale and scope of these activities in relation to skill formation. The management of some of these relationships at a global level also raises questions about whether these innovation relationships may influence or be influenced by other global infrastructure, such as global skill webs. Other examples indicate that country of origin may also play a role in whether,

and how multinationals develop these forms of innovation relationships. Research comparing four US and Japanese ICT and pharmaceutical multinationals indicates that US firms have been able to embed themselves within local innovation networks in the UK to a greater extent than their Japanese counterparts (Lam, 2003).

The employability skill literature also focuses on the interaction of universities and firms, this time in relation to skill formation. This literature also indicates that relationships between firms and universities are not common in the UK context, though it is presented as a positive situation for universities, firms and students (see for example Marques, 2006). In her study of employability skill needs, applied to the London/Thames gateway, Marques (2006, p.644) argues that only 3% of engineering/manufacturing companies discuss course content with HE institutions, and only 18% have links with HE institutions². As a result, the author argues that universities need to adopt a ‘holistic approach integrating knowledge, work experience and technical and interactive skill development’ (ibid, pp.647-648).

Relationships between firms and universities are typically presented as having positive outcomes in this literature. Firms can access the skills they need, universities have up to date courses, and students increase their employability (see Mason et al., 2009). The ways and extent to which firms shape skill formation are not really discussed. Work in this field also indicates that relationships between firms and universities in the UK context, such as those described earlier in work on innovation relationships, are not typical for the broader population of firms. Large firms, often multinationals, appear to have the capacity to build relationships with universities or other training providers that other firms may not.

These differing lines of research suggest that multinationals possess the capacity to and may engage with some of the institutions involved in skill formation, such as universities, in

² drawing on statistics from the London Skills Forecasting Unit, ‘Employers Survey 2002: Skills and Competitiveness in the London Economy’

relation to innovation and skills-based activities. Work within these differing strands of research has raised questions about whether these relationships are developed to support the subsidiary, or managed on a global level, and how these relationships may interact with other firm infrastructure such as global skill webs. While relationships between multinationals and universities may exist, what these entail, their scale and scope, and whether they enable firms to shape skill formation are all areas that would benefit from further research. Finally, there is the question of what impact these relationships may have on the broader skill formation system.

2.4 CONCLUSION

This chapter has raised some important questions about the role that multinationals play in the process of skill formation. First, the study seeks to identify the role that multinationals play in engaging with and shaping the engineering skill system. The above discussion has highlighted that, theoretically, multinationals are actors who can do this, and found empirical evidence showing that these firms have the capacity to engage with some institutions, but not to what extent. This study seeks to map out the extent of multinational engagement with each of the actors identified in the engineering skill system: universities, the state, professional institutions, employer organisations and unions.

The operation of the engineering skill system, and the role of multinationals within it will be compared to the broader theoretical framing of the skill formation systems in the UK and Australia to identify if sector-based conditions for skill formation exist. The role of multinationals, and whether they play a role in creating or shaping any sub-national difference in conditions for skill formation will be analysed using the concepts of institutional entrepreneurs, and organisational and institutional experimentation.

Second, the discussion above has highlighted an important tension between focuses on the role multinationals play in skill development: namely whether they have captured skills

through global skill webs, or if skills are a resource at a subsidiary level. This study seeks to examine whether global skill webs have been developed and to interrogate their reach: what engineers are subject to the webs of standardised practices, to what extent is training integrated, and is there any interaction between the relationships multinationals may build with actors in the skill system and global skill webs, if these exist. Does the existence of global skill webs influence the engagement of multinationals with the engineering skill system?

The following chapter addresses the aims of this project, including the research questions, methodology and research design.

CHAPTER 3 METHODOLOGY

3.1 INTRODUCTION

The phenomenon under observation in this project is the role of multinationals in skill formation. The study explores the tension between the different arguments that have been proposed about these firms, including whether they are engaging with the skill formation system to shape them to their needs, or disengaging from skill formation systems and developing their own skills through firm-specific infrastructure such as global skill webs. As such, this project studies this phenomenon through a cross-national comparative research design, as it has been argued that only comparative research allows a researcher to fully understand national systems such as industrial relations (Rojot, 2009, 26) or, in this case, skill systems. A comparative lens is a central component of the research, as comparison is argued to be ‘the engine of knowledge’ (Dogan and Pelassy, 1990, 8) enabling the researcher to ‘establish, and account for, similarity and difference in the cases investigated’ (Hyman, 2009, 4).

This chapter presents the rationale for the research strategy adopted for this project as the most feasible to address the research aims and objectives of this study and the research questions that have emerged from these. These are outlined first. Then the research strategy and design are discussed, starting with the sectoral focus and followed by the various comparisons chosen to best examine the role that multinationals play in skill development, their engagement with institutions in the skill system and the phenomenon of ‘skills capture’. These include the cross-national and intra-firm comparative elements. Finally, the methods, data analysis and ethical considerations are outlined.

3.2 RESEARCH AIMS AND OBJECTIVES:

The central tenant of this thesis centres on what role multinationals play in skill formation.

This topic is relatively under-researched and what research does exist is split across multiple distinct fields that do not always engage with each other. The contributions from these fields contain both complementary and conflicting analyses about the role multinationals play.

This project’s central aim then is to better understand the role that multinationals play in skill development, and it does so through two primary research objectives.

This research is firstly interested in the role that multinationals play within skill formation systems in the UK and Australia. The first research objective is to identify whether the multinationals studied engage with and potentially shape the engineering skill system in either the UK or Australia. The second research objective focuses on whether the multinationals studied have built ‘global skill webs’ or imposed centralised approaches for skill development in their subsidiaries (i.e. Krzywdzinski, 2014, Ashton et al., 2010). Has the development of global skill webs resulted in these firms dis-embedding from the skill systems of developed economies?

The overarching research aim that this project seeks to address, is as follows:

What is the role of multinationals in shaping skill formation?

Having identified two research objectives that support this aim, these objectives have been translated into three inter-related research questions:

To what extent do multinationals engage with the engineering skill system in each of the countries?

To what extent do multinationals shape the engineering skill system in each of the countries?

To what extent is there evidence of the development of global skill webs in the multinationals studied, and if these have been developed to what extent do they influence engagement with skill formation systems?

The next section moves onto discuss the rationale methodologically behind the comparative elements of the study.

3.3 RESEARCH STRATEGY AND DESIGN

To address the research aims and objectives, a qualitative, cross-national, sector-based research strategy has been adopted. There is a long history within the field of industrial relations of this form of research strategy (Strauss, 1998). Cross-national comparative research as a strategy or design enables the researcher to study processes of change. By this, I mean that changes such as the restructuring of production, the use of more integrated technologies or, in the case of this project, changes in relation to how multinationals develop and manage workforce skills are mediated by national institutions (Locke and Thelen, 1995) and so cannot be studied outside of national contexts. By exploring these processes across national contexts, a researcher can gain a greater understanding of the phenomenon in question.

The rationales for the various choices made during the research design are outlined below, including the choice of sector, the comparative cross-national elements including country

selection and qualitative approach and finally, a discussion about how the multinationals studied were selected.

3.3.1 SECTORAL FOCUS

The project follows in the tradition of a problem-centred orientation of industrial relations research, where the problem is ‘framed with a societal or public interest point of view in mind’ (Kochan, 1998, 32). In this project the ‘problem’ examined is whether multinationals have ‘captured’ the process of skill formation and if this leads to them dis-embedding from skill systems in developed economies. The unit of analysis is the multinational corporation and its role in relation to skill formation for a specific occupation, engineering, within a specific industry, aerospace.

Focusing at a sector and company level have been argued to be essential in comparative analysis (Locke and Kochan, 1995). Restricting the study’s focus to one high skill sector acknowledges that companies within a sector are likely to face similar economic and technological pressures (Strauss, 1998). This approach also acknowledges the impacts of product market and sector conditions on firm behaviour in relation to skill development (Crouch et al., 1999).

Multinationals in the aerospace sector are likely to have an imperative to invest in skills, meaning that as a sector it provides a ‘best case site’ to examine the role of multinationals in skill development. This includes exploring whether these firms engage with, and shape the engineering skill system and what their own internal training and development looks like: are they institutional entrepreneurs (Crouch, 2005a) engaged in institutional or organisational experimentation (Kristensen and Morgan, 2012, Morgan, 2018), or ‘oases’ or ‘islands of excellence’ in a broader low-skill system (Brown et al., 2010, Streeck, 1989)?

The study's focus on the occupational group of professional engineers is driven by the selection of the sector. Engineering was chosen for two theoretically driven reasons, the first being that skill formation in graduate occupations or those requiring higher levels of skill are argued to be amongst those being 'captured' by multinationals (Brown et al., 2010, Brown et al., 2008) in global skill webs (Ashton et al., 2010). The second reason is that skill systems in both countries are argued to be best suited to the production of graduates (Hall and Soskice, 2001, Ashton et al., 2000) as opposed to intermediate skills through vocational routes. For this reason, graduate occupations are an important avenue to interrogate the phenomena of global skill webs, and how they influence the engagement of multinationals with the skill systems in both countries, and the primary graduate occupation in the aerospace industry is engineering.

3.3.2 CROSS-NATIONAL COMPARISONS

Cross-national comparative research is the 'systemic cross-analysis of phenomena displaying both similarities and differences' (Hyman, 2009, 3). The cross-national element of the research design has been adopted because it allows the 'problem' of the multinational's role in skill development, and the phenomena of 'skills capture' and global skill webs to be analysed:

comparative analysis is necessary if we are to develop robust explanations and encompassing theories. The literature of industrial relations is littered with generalizations which are assumed to be universal, but which are in fact conditioned by time and place (Hyman, 2001, 204)

By comparing across countries, the role of multinationals in skill development and some of the generalisations in the theories of 'skills capture' and global skill webs can be interrogated, to see if these are universal or context dependent.

For the selection of countries, the UK and Australia are a 'close pair' comparison (Strauss, 1998), or a 'most similar systems design' (Teune and Przeworski, 1970), a term used to

describe country pairings that share similar economic, cultural and political characteristics. In terms of skill systems, as discussed in Chapter Two, the UK and Australia are regularly grouped together as liberal market economies, low skill equilibrium or as low skill market models (Hall and Soskice, 2001, Finegold and Soskice, 1988, Hall et al., 2002, Ashton et al., 2000). Nonetheless, both countries also have a small number of highly skilled sectors such as aerospace, requiring industry and occupationally specific skill development.

The advantages to comparing ‘close pairs’ in a cross national comparison are that the researcher is able to hold many characteristics constant and focus on a small number of differences (Strauss, 1998). For this study, the similarities in the national skill system characteristics between the UK and Australia enable a focus on how the engineering skill system is distinct from the national skill system (through sector influences) in both countries, and to identify the role of multinationals within the engineering skill system. As such, the research is underpinned by arguments that understand the variation within (as argued by Crouch, 2005a, p.26), and between countries often considered to be the same type of capitalism or skill system can offer value. The design draws on elements of a contextualised cross-national comparison in that the project is “underscoring significant differences between cases typically seen as ‘most similar’” (Locke and Thelen, 1995, 338).

As the aerospace sector as a high skill sector diverges from the broader national pattern, the combination of sector and country selection can also be argued to be based on the concept of the extreme or deviant case (Seawright and Gerring, 2008). By adopting this position, this project has sought to map how the engineering skill systems in the UK and Australia deviate from the ‘parsimonious’ categories (Crouch, 2005a) they have been aligned to at a national level, and what role, if any, multinationals play in this deviation. Therefore the research approach also questions ‘the plasticity’ of the institutional arrangements (Locke and Thelen, 1995, 338) in the face of the actions of the multinationals studied.

However, a ‘close pair’ or ‘most similar systems design’ does have limitations. Comparing two liberal market economies will not provide the same degree of difference as comparing, for example, a liberal market economy with a coordinated one. The strength of the close pair is the ability to control for the impact of certain characteristics, such as in this project the characteristics of the liberal market skill system. However, this same strength also limits the generalisability of the findings (Teune and Przeworski, 1970) and limits the scope of what the researcher can learn about the phenomenon; perhaps more would have been learned in a pairing focused on difference (Strauss, 1998).

The final important element of the research design is that the approach is qualitative and aligned with what has been argued to be ‘small N’ analysis: an in-depth study of a small number of cases, where the researcher focuses on theoretical questions involving ‘thick’ concepts that cannot be reduced to a single indicator (Coppedge, 1999, Hyman, 2009). A qualitative approach enables the researcher to:

understand the dynamics of a relationship – how it actually operates (what some call ‘getting into the little black box’) ... Qualitative research can often tell us something about causation. Further it typically yields a richer picture of actual behaviour

(Whitfield and Strauss, 1998, 15)

In this study, adopting this research strategy enables the researcher to focus on the process (in this instance of skill formation) and the relationships behind this process (Hyman, 2009). In this project these include relationships between multinationals and institutions in the skill system, or within the multinational such as between headquarters and subsidiary. One of the limitations is again that it is difficult to generalise findings using this form of research strategy (Whitfield and Strauss, 1998), though the focus on thick concepts, and the richer picture of actual behaviour that the researcher gains does aid the building of theory.

3.3.3 SELECTION OF MULTINATIONALS

The study seeks to understand the broader patterns of engagement of aerospace multinational corporations with the engineering skill system in both the UK and Australia. To best achieve this aim, the project focuses on several firms in each country. Hancké (1993, argues in his study of union membership in Europe, that we are likely to find as much variation within countries and industrial sectors as between them. This suggests that while focusing on one firm may provide a depth of understanding, by doing so you overlook that there can be significant variation in the practices of firms within the same sector, and that one firm can be an exception: an oasis or island of excellence (Streeck, 1989, Brown et al., 2010).

Variation amongst multinationals can be driven by, amongst other things, country of origin, subsidiary activity and position within the supply chain (e.g. Lévesque et al., 2015, Almond et al., 2005). A focus on several multinationals can indicate broader patterns of firm engagement both within and across countries. One of the limitations of this approach, however, is that while the study gains breadth, some depth of explanation or ‘thick description’ in relation to why individual firms make certain decisions is lost.

Variation was deliberately introduced into the sample of multinationals. In the previous chapter (sections 2.3.1 and 2.3.2) arguments about the influence country of origin can have on multinationals, and the that global skill webs result in firms reducing their reliance on their country of origin were raised. As such, in both countries an effort was made to include a variety in the country of origin of the firms chosen, and so the countries of origin include UK, US and French based companies. In addition, an effort was made to include companies operating within their home country, though this was only possible in the UK case as there are no Australian multinationals operating in the sector. By doing so, the study is able to explore whether there is evidence of firms reducing their reliance on their country of origin if

they had developed global skill webs, and to compare their operations with firms who operate as subsidiaries within the same country.

As a result the Australian case includes one US, one French and one UK headquartered firm, while the UK case includes two UK (country of origin), and two French headquartered firms. By doing so, the multinational selection process can be seen to be an example of ‘diverse’ case selection strategy as a means of representing the population of multinationals in an exploratory investigation (Seawright and Gerring, 2008, 300).

While a matched comparison of the same multinational in both countries may have been preferable, this was not possible as in many of the cases a firm operated in one country but not the other. However, the multinationals were matched across the two countries in terms of product to control for differences in firm engagement with the skill system or investment in skill driven by the product strategy itself (Crouch et al., 1999). As detailed in Tables 3.2 and 3.3, the study consists of two aircraft manufacturers, two software or systems manufacturers and one defence multinational with subsidiaries in both countries. In addition, in the UK case an engine manufacturer was also included although a comparator was not located in Australia. In the Australian case many of the firms selected had their primary subsidiaries in the state of Victoria, and so this became the primary base for the Australian research.

TABLE 3-1 THE MULTINATIONALS IN AUSTRALIA AND A SUMMARY OF THEIR ACTIVITIES

Company Pseudonym	Description of Activities	Position of MNC in the global aerospace/defence sector
Wings Corp AU	Subsidiary of US MNC Makes aircraft wing parts, internal first tier supplier. Commercial Largest manufacturing footprint for the MNC outside of the US.	Commercial aircraft manufacturer Also has a substantial defence operation.
Systems Corp AU	Subsidiary of French MNC Builds air traffic management systems.	Defence, information systems and security Both commercial and defence operations.
Defence Org AU	Subsidiary of UK MNC Aerospace operations involve defence contracts and maintaining both commercial and defence aircraft.	Substantial defence presence Size of aerospace activities in Australia were small in comparison to UK

TABLE 3-2 THE MULTINATIONALS IN THE UK AND A SUMMARY OF THEIR ACTIVITIES

Company Pseudonym	Description of Activities	Position of MNC in the global aerospace/defence sector
Flight Ltd	Subsidiary of French MNC Makes aircraft wing parts, shipped to other subsidiary for final assembly.	Large commercial aircraft manufacturer Also has substantial defence operations in Europe.
Engine Ltd	UK MNC, operating in country of origin Builds aircraft engines. Primarily a first-tier supplier for large aircraft manufacturers.	One of the main aircraft engine manufacturers for both commercial and defence aircraft.
Software Ltd	French MNC Subsidiary is specialist site for 'systems' development.	MNC by acquisition Operates across multiple sectors including aerospace, but also automotive, energy,

	One system is used by air traffic management providers in the UK to help air traffic controllers plan aircraft routes further in advance.	railway, finance, healthcare and telecoms
Defence Org UK	UK MNC, operating in country of origin Defence contracts and building/maintaining defence aircraft. The UK operation is the primary site for aerospace.	Substantial defence presence.

3.4 METHODS, SAMPLING AND DATA ANALYSIS:

As the project has adopted a qualitative research strategy, the primary methods that are employed are semi-structured interviews, supported by secondary methods of documentary analysis and observation. The secondary methods were used to support the primary method, and to increase the reliability of the findings through triangulation (Patton, 1990, Breitmayer et al., 1993, Knafl and Breitmayer, 1989), enhancing the data quality by confirming the findings (Baxter, 2008). The rationale for these choices is outlined, starting with choice of methods, and followed then by a discussion on how the data were analysed.

3.4.1 INTERVIEWS

Semi-structured interviews were chosen as the primary method for data collection. One of the strengths of interviews as a method is that as a researcher you are able to explore otherwise unobservable phenomena (Woodruffe-Burton and Bairstow, 2008). The primary research objective of this project is to understand the role of multinationals in skill development, both in terms of their relationships with other institutions in the skill system and their own internal practices in relation to skill development. These actions are not directly observable and so interviews were determined to be a versatile method capable of achieving these aims. Semi-structured interviews are often utilised in ‘theory-oriented approaches’ (Schmidt, 2004, Hopf, 1998). Semi-structured interviews are a flexible method,

enabling engagement with theory to develop the interview themes, and having scope for these themes to be tailored to meet the needs of a variety of interviewees. This was essential for the project, as a wide range of interviewees representing different institutions or in differing roles participated. The use of semi-structured interviews meant that the interview themes could be tailored for each interviewee, and samples of these interview guides are included in the appendix (see Appendix B).

The “active” nature of the interview as a method (Fontana and Frey, 2003, Holstein and Gubrium, 2004) involves acknowledging that the process of knowledge production is shared between the interviewer and interviewee, and so becomes a performative practice (Denzin, 2001). As interviewer, I practiced reflexivity, developed rapport and attempted to be mindful of the impact I had on the interviewing process. I also created space within the interview process for interviewees to redirect the conversation to areas that I may not have been aware of as an outsider to the sector, institution or company.

One of the primary challenges I faced as a researcher looking at the aerospace sector was a lack of specialist knowledge in relation to both the sector and the profession, including the varying STEM fields that engineering activities cover, or sector specific issues faced by the sector that might impact skill development for engineers. To be able to converse with participants about their work required what Laudel and Gläser (2007, p.101) describe as “creating ad-hoc pidgin”; this process involves learning the scientific language or trade vernacular of the interview participants well enough to converse with them about their work. This was an ongoing process and was made easier by a substantial amount of initial preparation conducted prior to each interview using document analysis. Preparation for interviews often included familiarising myself with the history of each organisation and different forms of engineering specialisms. This preparation made it easier to establish rapport with participants and to establish and negotiate levels of communication (ibid, 2007),

as well as enabling me to gather far richer data as I was able to develop more nuanced interview guides.

The interviews were conducted over three phases of data collection. The first phase of data collection was in Australia in 2015 followed by the initial phase of data collection in the UK in 2016, finished by follow up interviews in both the UK and Australia in 2017. Where possible, the interviews were conducted face to face, though some were undertaken by telephone or Skype for logistical reasons, including the follow-up interviews in 2017 with Australian participants. Seventy-six interviews were conducted with 82 participants across the two countries, 45 interviews in the UK and 31 from Australia. The interviews ranged from 40 minutes up to three hours long. All interviews were recorded, except a handful of cases where the interviewee requested notes only. In those instances, detailed notes were taken during and immediately following the interviews. All interview recordings were transcribed.

3.4.2 SAMPLING

The interviewees were selected based on theoretical sampling, a process where researchers ‘purposely seek to interview participants who occupy particular niches in their analysis’ (Baker et al., 2012). The discussion in Chapter Two outlined a number of institutions that are likely to play a role in the skill systems in the UK and Australia including corporatist organisations, the state (Crouch et al., 1999), professional associations and universities (Sako, 2017). Other organisations such as engineering specific or sector/industry bodies were also contacted if these were discussed by other interview participants as playing a role in engineering skill development. Tables 3.3 and 3.4 outline the interview participants in each country, their roles within their organisation and their time in that role and/or the sector.

The sampling of multinationals as the primary actor under research has already been discussed in Section 3.2.3. The selection of participants within these firms was in some ways

problematic and required a combination of cold-contacting and snowball sampling to gain access to both managers and engineers. One of the limitations of the Australian case, exacerbated by the time constraints imposed on the data collection was that I struggled to gain access to engineers. I attended one sector event while in the country, and met the two engineers interviewed, alongside several managers from the three firms who were subsequently interviewed. Subsequent to this, I used both online mediums such as Linked In, and negotiation with various managers, but was unable to access additional interviews with engineers. In the UK case I was able to overcome similar difficulties by attending various sector events over the course of 18 months, where I met a number of engineers working for the multinationals studied. This enabled snowball sampling, as these engineers recommended other engineers for me to contact. This route proved far more successful than ‘cold’ methods of contacting participants. Conversely, other institutions, and more senior managers were more accessible through ‘cold’ methods of contact.

TABLE 3-3 INTERVIEW PARTICIPANTS IN THE UK CASE

Interviewee	Organisation	Background: Time in role and/or sector
Union sector lead	Union - trades and engineers	3 years as sector lead, 20 years in the union
Engineering Union Representative	Engineers Union (Maintenance)	1 year in role, 8 in industry
National Secretary - Aviation, Defence & Security	Engineers Union (Maintenance)	9 years in role
President for regional branch and board member	Sector PEI	5 years in role
Head of Skills and Careers	Sector PEI	5 years in role
President of Sector PEI, ex Engineering Director Flight Ltd UK	Sector PEI/ Previously Flight Ltd UK	4 years in Sector PEI, 40 years in Flight Ltd UK
Head of Membership	Sector PEI	6 years in role
Head of Education and Skills	PEI	4 years in role
Technology Advisor	Sector Trade Association	7 years in role
Policy Officer	Sector Skill Council	4 years in role
CEO	Regional Trade Association	5 years in role
Industry Specialist	Regional Trade Association	6 years in role

Managing Director	Skills Body	4 years in role
Skills Specialist, Lead for National College	Catapult Centre	
Catapult Centre Representative	Catapult Centre	3 years in role
Sector Lead for aerospace	Government representative - Department of Industry	14 years in role
Sector Skill Council's AGP representative	Sector Skill Council's AGP representative	2.5 years in role with AGP
Technical specialist for programme	AGP funded programme for R&D	1.5 years with programme (since it started)
Working Group Programme Manager AGP (Engineer)	Another MNC/AGP representative	9 months in secondment, 4 years in role at firm
Working Group Programme Manager AGP (Engineer)	Another MNC/AGP representative	9 months in secondment 5 years in role in firm
Engineer	Another MNC	3 years in role
Engineer/Technician, repairs and maintenance	Another MNC	5 years in role
HR Director	Flight Ltd UK HR Director	23 years in role
Design Engineer - New Product Introduction	Flight Ltd UK	8.5 years at firm
Higher (degree) Apprentice	Flight Ltd UK	8 months into apprenticeship
Higher (degree) Apprentice	Flight Ltd UK	8 months into apprenticeship
Senior Buyer, Engineer	Flight Ltd UK	17 years at firm
Design Engineer	Flight Ltd UK	6 years at firm
Project Manager	Flight Ltd UK	6 years at firm
Head of Engineering	Defence Org UK	10 years in role, 25 years at firm
Engineer and Lead for Young Persons Network at sector PEI	Defence Org UK	2 years at the firm
Engineer	Defence Org UK	2 years at the firm
Engineer on accelerated leadership programme	Defence Org UK	18 months
Engineer	Defence Org UK	2 years in role, 8 years at the firm
Engineer	Defence Org UK	2 years at the firm
Director of Training	Engines Ltd UK	25 years in role, 40 years at the company
Apprenticeships Manager	Engines Ltd UK	4 years in role
Engineer	Engines Ltd UK	6 months - on the graduate scheme
		8 years at the company in a variety of roles including software engineer, then software development, software test, process improvement
Engineer	Engines Ltd UK	
Engineer	Engines Ltd UK	12 months on graduate scheme

Deputy Director of Engineering	Software Ltd UK	5 years, 20 years at the company
Resource Manager, HR	Software Ltd UK	3 years at Software Ltd, 10 years in sector, mostly in the US prior. Engineering background
Software Engineer	Software Ltd UK	8 years
Software and Systems Engineer	Software Ltd UK	Graduate Scheme - 6 months
Software and Systems Engineer	Software Ltd UK	Graduate Scheme - 18 months 3 years experience in the sector prior to this role
Software and Systems Engineer	Software Ltd UK	Graduate Scheme - 3 months at Software Ltd UK, 2 years sector experience
Software and Systems Engineer	Software Ltd UK	2 years at Software Ltd UK, additional 2.5 years experience in the sector before joining
Software and Systems Engineer	Software Ltd UK	Graduate Scheme - 8 months at the company
Professor, Director of Aerospace Research Centre	University	6 years in current role, 33 years in academia
Professor and Lead for Engines Ltd UK University Centre	University of	2 years as Lead, 6 years as Deputy Lead
Industrial Liaison Manager	University of	6 years at the university, 2 in this role

TABLE 3-4 INTERVIEW PARTICIPANTS IN THE AUSTRALIAN CASE

Interviewee	Organisation	Background: Time in role and/or sector
Chairman	Trade Union	7 years in role
Sector representative	Trade Union	20 years as union representative
Union representative Wings Corp AU	Trade Union	25 years as union representative
Skills Representative	Trade Union Skills Body	Over 10 years with union but exact time in role not known
Engineers Union representative	Engineers Union	3 years in role
Director Workplace Relations	Employer Association	35 years at organisation

Training Representative - including apprenticeships	Employer Association	5 years at organisation
Industry Liason	Industry Skills Council	No timeframe except over 4 years
Research Manager	Industry Skills Council	No timeframe except over 4 years
Senior Training Package Specialist	Industry Skills Council	15 months
Executive Director	Sector Trade Association	2 years
HR Partner	Wings Corp AU	3 years in role
Operations Manager	Wings Corp AU	6 years in role
R&D Director	Wings Corp AU	4 years in role, previously 11 years in research organisation partnered with Wings Corp
Quality Liason engineer	Wings Corp AU	18 months in Australian site, 9 years at firm (including US operations)
HR Director	Systems Corp AU	18 months in Australian operations, 15 years as HR Director in different countries
Operations Manager	Systems Corp AU	Not known
Recruitment Manager	Systems Corp AU	5 years in role
Engineering Director	Systems Corp AU	10 years in firm
Software Engineer	Systems Corp AU	5 years in role
Recruitment Director	Defence Org AU	14 years in firm

Industrial Relations Manager	Defence Org AU	Not known
Senior Learning and Development Advisor	Defence Org AU	9 months in role, 4 years with firm
Dept of Industry Victoria	Department of Industry Victoria	Not known
Minister for education	Department of Education Victoria	4 years in role
Research officer at ministry for education	Department of Education Victoria	Not known
Manager, Advanced Manufacturing	Department of Industry, Innovation and Science, Federal Government	15 years experience
Senior Policy Advisor	Department of Industry, Innovation and Science, Federal Government	10 years experience
Policy Advisor	Department of Industry, Innovation and Science, Federal Government	5 years experience
Msc Director on programme developed in collaboration with Wings Corp AU	University	4 years at the company
Associate Dean of Engineering and acting Director of Aerospace Research Centres	University	2 years experience at this University, but 10 years in a US instiution prior

For certain actors, such as the trade unions, employer associations, and skill bodies such as the sector skill councils, sampling often involved asking to speak to individuals who dealt with the aerospace sector or specifically with the multinationals under study. A similar approach was adopted for state representatives, and these included representatives from the department for business/industry who had experience with the aerospace sector, and those who were involved in any sector related industrial policy. For universities, sampling primarily included Professors running research centres funded by the multinationals, at universities that multinational managers discussed during interviews. Additional interviews were also undertaken using snowball sampling, where interviewees recommended participants or organisations for me to speak to. Examples would include representatives from one of the catapult centres in the UK.

When sampling managers from the multinationals, where possible, I attempted to speak to both Engineering and HR Directors and/or managers in each firm as each were able to provide different information in relation to skill formation. There is some variation in job roles, but where possible I maintained these divisions. At times ‘similar’ roles were used instead, such as Research and Technology general manager instead of Engineering Director, or a Recruitment or Training Director instead of a HR Director. HR Directors or managers had knowledge on performance development systems, HR and training practices, and recruitment efforts. In comparison, Engineering Directors and/or managers were more knowledgeable about current and emerging technical skill requirements and the production process.

When sampling engineers, I made a concerted effort to ensure that interviewees included female engineers. Engineering is male dominated, with between 9-11% of engineers in the UK being female (IET, 2015, WISE, 2017), and 12% in Australia (Nielsen, 2018). This

meant that gender was an important issue I had to consider during sampling. Prior to data collection, I identified research conducted on women in male dominated sectors (e.g. Turnbull, 2013) as well as within engineering specifically. This research indicated that gender can play a significant role in career development for women working in a male dominated environment, and can influence career aspirations (Bailyn, 1987), development opportunities (Bix, 2004) and generate issues related to visibility or ‘tokenism’ (Fløge and Merrill, 1986). Several of these areas are indirectly related to skill development, and so effort was made to ensure that the experience of female engineers and managers was included in the project. The gender split of these interviews is outlined in Table 3.4:

TABLE 3-5 GENDER SPLIT FOR ENGINEERS AND MANAGERS

	Male	Female
Engineers	11	7
Managers	12	9

3.4.3 SECONDARY RESEARCH METHODS: DOCUMENTARY ANALYSIS AND OBSERVATIONS

As mentioned earlier, one of the primary uses of documentary analysis was as a supportive method to underpin the primary method of semi-structured interviews. Documentary analysis was used to prepare for interviews, and to triangulate the data and to ensure the validity and reliability of the findings (Patton, 1990, Breitmayer et al., 1993, Knafl and Breitmayer, 1989). The use of document analysis included a search of newspaper reports over the last 20 years using a LexisNexis search to understand the sector history in each country and who the main stakeholders are within the sector. This study is not historical, but this process helped me to understand some of the historical context of the sector and the relationships between multinationals and institutions (such as, for example, publicised strike action). Through developing an understanding of these pre-existing relationships, albeit a “partial and superficial account” (Shaw et al, 2004, p.260), within my interviews I was then able to delve deeper to get beneath the superficial representations.

This process also helped me to become familiar with some of the terminology, concepts and rhetoric within the sector, aiding me in communicating in the language of my interview participants. I could present myself as an ‘informed layperson’ as opposed to a naïve observer (Laudel and Gläser, 2007). This was particularly useful when I needed to question technical language used by interviewees as it created some common understandings between us to aid their explanations.

Alongside the newspaper search, I also looked at government and sector body reports over the last 10 years. This provided a more detailed context for government initiatives, and what the primary concerns were for the main stakeholders. Additional documents were collected from promotional material available at sites during interviews, and through trade shows or events attended. Websites and further LexisNexis searches were also used to learn more about various organisations prior to conducting interviews, enabling me to refine and individualise the interview guides.

Observation was also used as a supportive method and to triangulate the findings (Breitmayer et al., 1993, Knafl and Breitmayer, 1989, Patton, 1990). Observations were primarily undertaken during industry events, including networking events, trade shows, exhibitions and conferences typically organised by trade associations, employer bodies or professional engineering associations. These events often included presentations from industry professionals, including managers and engineers from multinationals. I attended one event held by the sector trade association in Victoria, and five events in the UK including the national trade exhibition, presentations from participants in an innovation programme part funded by the AGP, and a national conference, a CEO presentation series, and a regional debate on Brexit held by national and regional branches of the sector PEI.

Observations were also relevant for site visits, and when visiting sites to interview representatives from various institutions. This included tours of facilities and engineering labs, where often my guide would explain the machinery and the types of techniques used. This form of formal observation enabled me to better understand the sector and to become an informed layperson.

3.4.4 DATA ANALYSIS

The process of data analysis was iterative, occurring after each period of data collection. The data were analysed thematically (Nowell et al., 2017) and also through process mapping. Rigorous thematic analysis is argued to be able to produce trustworthy and insightful findings (Braun and Clarke, 2006), while also providing a ‘highly flexible approach that can be modified for the needs of many studies’ (Nowell et al., 2017). The process of thematic analysis involved initial familiarisation with the data, followed by periods of initial coding and then refining of these codes. The period of initial coding included some expected codes generated from the literature, but was a flexible process allowing some codes to emerge directly from the data. Marshall (2002, discusses some of the pitfalls of data analysis including the tendency to ‘overcode’, referred to as ‘coding fetishism’ in her study on the use of software in qualitative analysis, and for this reason the transcripts and notes were coded by hand. As themes can be generated either inductively from the data or deductively from prior research (Boyatzis, 1998), following the period of initial coding themes for the project were generated through an iterative process of moving between the transcripts and the literature.

To aid the data analysis, process mapping was also used after the initial two phases of data analysis. Diagrams were built that were process oriented and descriptive in nature that were designed to recontextualise the data after they had been deconstructed and de-contextualised through the coding process. Examples of some of these diagrams are included below (see Figures 3A and 3B). These process maps were used to outline the relationships between the multinationals studied and the institutions within the skill system, trying to make sense of these relationships, and the variation in interactions between these multinationals and certain institutions. Another rationale for not using analysis software to support the data analysis was that these programmes are often argued to be predisposed to organise data and codes into hierarchies of classifications (Weitzman and Miles, 1995, Webb, 1999). As such, often the software is argued to be less capable in supporting a horizontal analysis of data such as process mapping (Atherton and Elsmore, 2007).

FIGURE 3:A RELATIONSHIP MAPPING COUNTRY ENGINEERING SKILL SYSTEMS

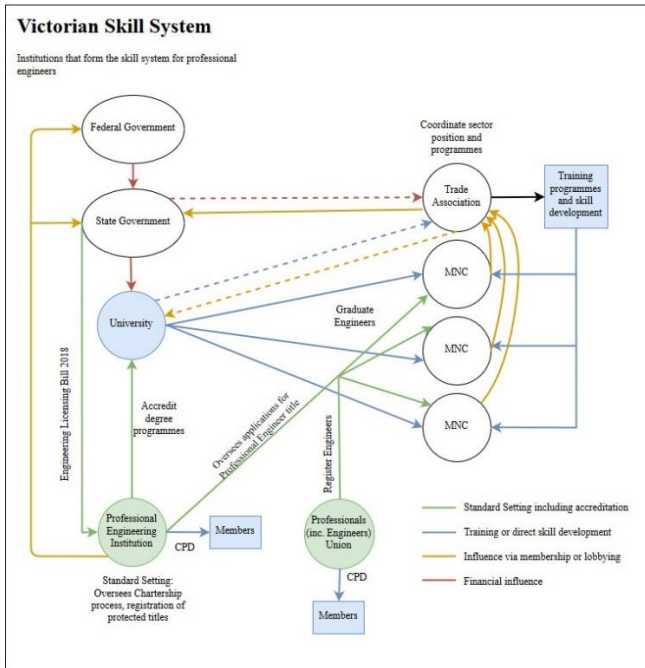
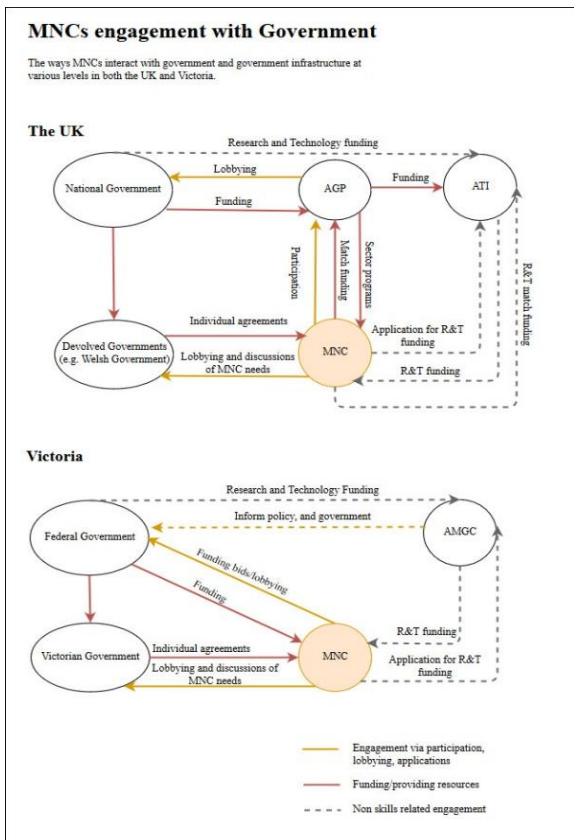


FIGURE 3:B EXAMPLES OF RELATIONSHIP MAPPING BETWEEN THE MULTINATIONALS AND INSTITUTIONS



3.5 ETHICAL CONSIDERATIONS

The primary ethical considerations emerged from the use of interviews and observations as methods.

The documents used were either freely available or designed to promote the company (websites/promotional materials) and so these posed few ethical challenges.

One of the first considerations was ensuring anonymity to interview participants. This has meant I have often broadened managerial titles to prevent individuals being identified and have had to remove possible identifiers from transcriptions and any quotes used. In addition, informed consent forms were signed during face to face interviews or emailed if conducting telephone interviews to ensure each participant was made aware of how I would use and store the information. Where transcription services were used, I made sure that they had confidentiality clauses in relation to any information in the audio files, and the finished transcriptions were stored on confidential university servers in compliance with the Data Protection Act and ethical approval.

Pseudonyms for companies were also employed, and no company names have been used in the research. Where possible, I have disguised some of the activities undertaken and the location of the company sites, but due to the nature of work and small number of multinationals in each area, it may be easy to narrow down a shortlist of which multinationals may have participated.

One of the factors I had to consider was how I would use information that was told to me during observations. While I readily explained that I was a PhD researcher looking at the sector, as these were networking events the participants often had discussions about their jobs or work. This led at times to those observed revealing issues that they may not have in other circumstances. Mason (2002, p.101) describes this as one of the 'difficult moral choices' we have to make about what is counted as data, and consent. What this has meant is that there have been occasions where I have not included some data that was particularly revealing, or that I have substantially edited my field notes to ensure I am not placing participants in a morally difficult situation.

3.6 CONCLUSION

This chapter has outlined the methodology that has been used in this project, and how the approach is integrated into a cohesive whole. The chapter has moved through the rationale behind and justifications for these methodological choices, in a hierarchical fashion starting with the research aims and objectives. The research aims and objectives, and the research questions emerging from these have led to the use of a specific form of research strategy and design that have then shaped the methods choices and the forms of data analysis that were undertaken. The chapter has also explained how this methodology has been put into practice, and any limitations that emerge based either on the choices themselves or during the course of the research. The following chapter moves on to discuss the context of this research, the aerospace sector in the UK and Australia, and the institutions that play some role in the engineering skill systems in each country.

CHAPTER 4 THE AEROSPACE SECTOR AND PROFESSIONAL ENGINEERS IN THE UK AND AUSTRALIA

4.1 INTRODUCTION

Before we can address the role of multinationals in the process of skill formation, it is important to understand the context that they are operating in and what skill formation for professional engineers involves. Sector and product strategy have been argued to influence firm skill requirements (Crouch et al., 1999), and sub-national conditions for skill development may differ from the national skill system architecture. This chapter provides some of this context, to situate these firms within their broader operating environment, and identifies the main actors within the engineering skill system in both countries.

The discussion begins by outlining the main characteristics of the aerospace sector globally, and then in the UK and Australia. The chapter also includes an overview of what professional engineers do, what type of skills they need, the routes for entry into the profession and the main actors involved. The chapter also gives a brief overview of the role of the state in shaping the sector and engineering skill systems in both countries, and identifies that employer organisations, unions and government infrastructure may also play a role. Finally, the conditions in the engineering skill system as compared to the national skill formation system in each country are discussed.

4.2 THE AEROSPACE SECTOR IN THE UK AND AUSTRALIA

The global aerospace sector includes the research, development, and manufacture of flight vehicles including, but not restricted to, aircraft. The sector also includes the research, development and manufacture of engines, any sub-systems such as propulsion and avionics, any materials needed for manufacture, and any sub-systems necessary for the testing, operation and maintenance of flight vehicles and their sub-systems. As such, the sector is

reliant on technological progress, and it is an ‘R&D intensive and knowledge intensive manufacturing industry’ (Hartley, 2014, 8). The sector is seen as both politically and economically prestigious (Weiss and Amir, 2018). Benefits for countries with an aerospace sector are argued to include technology spill-over to other sectors, and high quality jobs, even though these two conditions are difficult to quantify and define (Hartley, 2014, 8).

The sector can be broadly split into three categories: manufacturers, who are the primary focus of this project; ‘service providers’ such as airports and air traffic management firms, or ‘customers’(Baumgartner and Finger, 2014), such as governments for defence and airlines for commercial aircraft. The submarkets for selling aerospace products are niche and highly specialised, with a small population of potential buyers. As a result, the aerospace sector is characterised by a relatively small number of large firms (Weiss and Amir, 2018), and a greater number of medium and small firms who operate within the supply chains of the larger firms.

The aerospace manufacturing supply chain is normally split into various supplier tiers (Aboulafia and Michaels, 2018). At the top of the supply chain are the original equipment manufacturers (OEMs), such as aircraft or engine manufacturers (ibid). All of these firms are large multinationals. Tier 1 suppliers supply either entire systems or component modules to the OEMs, often on a ‘design and print’ contract (ibid). This type of supplier relationship involves the supplier taking responsibility for the research, design, development and manufacture of a specific system or component module, such as propulsion or avionics. Most of these Tier 1 suppliers are large multinationals.

As a result, there are a small number of OEMs or Tier 1 suppliers who are typically multinationals who control supply chains that encompass much of the rest of the sector. In commercial aircraft manufacture, as one example, two multinationals form a duopoly with

approximately 80% of the market share (Penton, 2016). In air traffic management systems manufacture, four multinationals account for more than 50% of demand, with one providing 15% in 2013 (HEXA Research, 2015).

Tier 2 suppliers produce and assemble parts of the systems or modules for the Tier 1 suppliers (Aboulaflia and Michaels, 2018) and can be a mixture of large multinationals and small or medium sized firms (SMEs). Firms often outsource or ‘risk share’ in relation to research and development. They collaborate with suppliers (Figueiredo et al., 2008, Goldstein, 2002, Jordan and Lowe, 2004) to reduce the risks and costs associated with these activities. These relationships typically take place between OEMs, Tier 1, or Tier 2 suppliers. Multinationals who are not ‘lead firms’ have also ‘reconstructed’ themselves (Danford et al., 2002) as specialist producers of complex components to secure work within the supply chain of those multinationals who are.

Tier 3 suppliers typically operate on ‘make to print’ contracts (Aboulaflia and Michaels, 2018), where they build components based on research, design and development undertaken by firms higher in the supply chain, while Tier 4 suppliers provide raw materials, castings, forging or hardware (ibid). Many Tier 3 and 4 suppliers will be SMEs.

As of 2017, the industry globally is worth £643 billion, and the US accounts for 49% of this and is the largest country in the industry (Aboulaflia and Michaels, 2018). By virtue of sheer size, the US sector has been dominant for decades, supported by the US government in what has been termed the ‘hidden developmental state’ (Block, 2008). The case of the US is partially responsible for role of multinationals in the sector. The integration of privately owned US aerospace firms and their large size triggered many of the coalitions, mergers and acquisitions amongst the primarily state-owned European aerospace firms in the 1970s, to compete with the much larger US firms for contracts (Hartley, 2014). The shift towards large

firms was distinct, particularly in the UK where prior to the 1950s, sector composition included a greater mixture of SMEs supported by trade associations who coordinated between firms and operated like cartels (Mowery and Rosenberg, 1991).

4.2.1 THE UK AND AUSTRALIAN AEROSPACE SECTORS

In comparison to the US, the UK is ranked fourth comprising 6% of the industry globally, and Australia is ranked 18th and makes up 1% of the industry globally (Aboulafia and Michaels, 2018). Table 4.1 outlines the key characteristics of the two countries:

TABLE 4-1 THE UK AND AUSTRALIAN AEROSPACE SECTORS

Sector Characteristics	UK	Australia
Turnover	£32 billion* - £36 billion***	£2.17billion**- £3.46 billion***
Employment	120,000*	14,000**
Number of firms	2,500*	830**

*Figures published by ADS (2017a, and UK Government (2017,

**Figures published by Australian Federal Government (2018, , and converted from AUD

*** Figures quoted in Aboulafia and Michaels (2018, and converted from USD

In the UK and Australia, any state-owned aerospace firms underwent privatisation during the 1980s. As a result, the Australian federal and State governments retain no ownership of any aerospace firm in the country. In the UK case, the UK government retains a single ‘golden’ share in two (previously state-owned) British aerospace manufacturers and one air traffic management provider to prevent them entering foreign ownership (Smith and Wright, 2015).

As displayed in Table 4.1, the UK aerospace sector is larger than the Australian sector, though both are considered advanced. The Australian sector has the potential to become larger, with increased investment from multinationals as it is close to the Asia Pacific region. The Asia Pacific region is where the greatest predicted growth is projected to occur for

aircraft sales within the next ten years, and so location in Australia enables firms' easier access into the biggest growing market for aerospace.

While the aerospace sector operates internationally, firms tend to be located in regional clusters (Hickie, 2006). This project has focused on firms in the northwest and southeast of England in the UK, and the Melbourne cluster in Australia, though a handful of interviewees operated across sites in Victoria and Queensland. Table 4.2 compares the employment figures of the multinationals studied with their global employment figures. All the firms are either OEMs or Tier 1 suppliers or both. Some may operate additionally as Tier 2 suppliers for certain products or components. As can be seen, these firms make up a substantial amount of sector employment in each country.

TABLE 4-2 EMPLOYMENT FIGURES GLOBALLY AND BY COUNTRY IN THE MULTINATIONALS STUDIED

Company	Global employment*	UK/Australia Employment*
Wings Corp	140,000	A = 3,000
Flight Ltd	136,000	UK= 14,000
Systems Corp	64,000	A= 3,600
Software Ltd	45,000	Not available
Defence Org	83,000	UK= 34,000 A= 3,100
Engines Ltd	50,000	UK = 22,500

*Figures taken from company websites so no references provided

4.3 PROFESSIONAL ENGINEERS

The project focuses on professional engineers. The types of work undertaken by professional engineers include activities such as inventing, designing, building and testing machines, systems, structures and materials, and ensuring these meet safety, cost and legislative requirements. As such, the work undertaken by professional engineers is 'predominantly

intellectual in nature’ and they are responsible for applying theoretical knowledge from multiple sources to complex problems and issues to develop solutions (Bradley, 2011, 3). Professional engineers are therefore not only expected to have a base of technical and theoretical knowledge, but are also expected to possess tacit or ‘process’ skills(Woods et al., 2000), such as problem solving, ‘know what and know how’, and practical ingenuity (Sheppard et al., 2008). They are expected to be able to link what should happen in theory and design with what occurs in practice (i.e. the problem) and draw on this knowledge to create a solution (Burns and Chisholm, 2005, Sheppard et al., 2008).

Comparing the number of professional engineers across the two countries is problematic, as directly comparable figures are not publicly available. Table 4.3 has, however, compiled several figures that, while not directly comparable, give a sense of the size of the engineering population in both countries.

TABLE 4-3ENGINEERING POPULATION IN THE UK AND AUSTRALIA

Number of Professional Engineers	UK	Australia
Professional Engineers	*3,631,636 prof. eng and technicians *385,700 across manufacturing industries	**202,470 prof. eng **40,848 across manufacturing industries in 2011
Professional Engineers in Aerospace sector	***31,000 approx.	Not available

* Total number of professional engineers and technicians published by Engineering UK (2017, 49). Number of professional occupations in manufacturing (not specific to engineers) taken from ONS (2018, data sets).

** Number of professional engineers outlined by Kaspura (2017, 13;21). Figures taken from 2011, and taken from ‘The Australian Census Longitudinal Dataset, 2006 to 2011’

*** Figures taken from ADS (2017b, 12)

In the UK and Australia, the title of Engineer is not protected at a national level and so there is no formal distinction between professional engineers who undertake the above activities and engineering technicians. Engineering technicians are tradespeople who maintain or

repair machinery, systems and structures. In the aerospace sector, maintenance engineers who maintain or repair aircraft and other sub-systems are often trained via apprenticeships, while professional engineers are responsible for the design, testing and overseeing the manufacture of aircraft and associated sub-systems.

At a regional level in Australia currently two States, Queensland and Victoria have protected the title of engineer by requiring registration for professional engineers. Queensland passed the Professional Engineers Act in 2002, requiring any professional engineering services to be completed by a Registered Engineer (Queensland Parliamentary Counsel, 2014), while the State of Victoria has passed a registration bill for engineers that has been in discussion since 2016 and then passed in 2018 (Victoria State Government, 2018).

Entry level requirements for professional engineers in both countries are primarily undergraduate or post-graduate degrees through universities. Professional Engineering Institutions (PEIs) also play an important role in accrediting courses and influencing curriculum design (King, 2008, Meek, 1994, Brennan and Shah, 1994). In Australia, these standards are outlined by the sole PEI, whereas in the UK, these are set by the Engineering Council, and accreditation is a voluntary process that universities can participate in. There are some routes in the UK case for those who have completed technical apprenticeships to become professional engineers, but these involve either an equivalent course outlined by the Engineering Council, taking a university degree, or undertaking a higher apprenticeship, offered by participating universities.

As the title of engineer is not protected in either country at a national level, differentiating professional engineers from other trades who refer to themselves as engineers has often required the use of protected titles. The title of Chartered Engineer is one such title. To achieve chartership, professional engineers have to undertake an accredited course at

university and have several years' experience. This can be anywhere between four and eight years of professional practice, requires some form of mentorship from a chartered engineer, evidence of experience and continued professional development.

In Australia, the sole PEI sets the standards for course accreditation and awards protected titles, supported by a number of affiliated technical associations who provide other member services. In the UK, the Engineering Council controls the awarding of protected titles, and licenses approximately thirty-six PEIs to award these. The Engineering Council was set up by the UK government as a voluntarist alternative to registration. The role of the Engineering Council has been to set, oversee and ensure the standards and quality of both engineering education and protected titles since 1981, and to ensure that competition between the multiple PEIs did not lead to a deterioration in standards (Chapman and Levy, 2004).

PEIs also play an important role in quality assurance internationally. There are various international accords that exist that are designed to create a base line standard for professional engineering education across countries. These are often negotiated by the PEIs and some involve universities. Examples include the International Professional Engineers Agreement (IPEA) which both the UK and Australia are members of, and the APEC Agreement which Australia is a member of (Washington Accord, 2017, International Engineering Alliance, 2019a, International Engineering Alliance, 2019b). International agreements attempt to outline an international standard of competence for professional engineering. Protected titles such as chartered engineer can then be used to, at least in part, demonstrate competence across countries.

4.4 OTHER INSTITUTIONS IN THE ENGINEERING SKILL SYSTEMS IN THE UK AND AUSTRALIA

Universities and PEIs, as outlined above, play an important role in quality assurance for professional engineering education, and have been identified theoretically as important

institutions in skill development for professional engineers (Sako, 2017). The state has also played an instrumental role in both the development of the aerospace sector, and on actors and institutions within the engineering skill system in both countries.

While the state in both the UK and Australia are argued to have adopted neoliberal policies and approaches in relation to labour law, employment relations and skill development, this has not always been the case. The state in the UK has historically cultivated a voluntarist or 'laissez faire' system with implicit state support (Meiksins and Smith, 1993). The state in Australia has historically been more interventionist at a State (Logan, 1966) and federal level. It has cultivated a 'unique Award system founded on conciliation and arbitration', including the development of State level industry agreements called industry and occupational Awards (Mitchell et al., 2010, Barry and Wailes, 2004).

In the period following World War Two, in both countries the state provided support for the aerospace sector and there were state-owned aerospace firms. In the UK, state funded investment in innovation (Sayers, 1950) was followed by the corporatist experiment of the 1960s, including the establishment of the engineering training board and other tripartite bodies (Keep and Rainbird, 2009). During the 1960s -1970s, examples of state support in the UK case include contributing funding towards various aircraft projects, the most famous being Concorde, and the bailout and nationalisation of Rolls Royce. During this same period, the state in both countries also oversaw the rapid expansion of higher education, and the set-up of additional universities (McCaig, 2011) as a way of transforming systems of elite university provision into mass higher education systems.

Following this period, during the 1980s in the UK, and the 1990s in Australia, governments in both countries adopted an approach that has been referred to as the 'neoliberal interventionist state' (Marchington et al., 2011, 45). Nationally owned industries and firms

were sold, including nationalised aerospace companies in both countries. In the UK, support for collective bargaining by the state was removed, and legislation concerning union rights were dismantled. This was achieved through the introduction of legal changes and legislative reform that reduced union scope for action and power (Purcell, 1993, 29 , Greenwood and Traxler, 2007, 320), and has resulted in the collapse of multi-employer collective bargaining (Brown, Bryson and Forth, 2009).

The impact of the aggressive anti-union legislation has been the amalgamation of smaller unions into larger bodies as a survival mechanism. As a result, there is one major union that serves the aerospace sector, and one smaller union that represents maintenance engineers. Employer associations have also declined in the UK context (Goberman et al., 2017a) with large firms often being the first to leave collective agreements and employer associations (Purcell, 1991), preferring to negotiate with unions on a site or company basis. While the majority of training boards and tripartite skill bodies were abolished (Mayhew and Keep, 1999), the engineering training board continued. It has since become the sector's skills council, though it no longer has levy powers, is employer led, and is primarily responsible for shaping skill development for trades, and engineering roles below the level of professional engineer (SEMTA, 2013).

In Australia, just prior to the neoliberal shift, a restructuring of the awards system was undertaken to reduce the rigidity of occupation classifications and their associated training arrangements (Goozee, 2001). This process directly linked qualifications to wage negotiations and by doing so, the role of unions and employer associations in skill development was formalised. Following this, a series of legislation passed at federal government levels in Australia between 1993 and 2009 that heralded the shift towards a neoliberal ideology for 'the state' (see Catanzariti and Sullivan, 1993, for more detailed

accounts of this legislative change , Reitano, 1994, MacDermott, 1997, Riley, 2001, Riley and Sarina, 2006, Sutherland and Riley, 2010).

This legislation included a shift of award setting from individual states to federal level (Riley and Sarina, 2006) and a decentralisation of the awards system from industry to enterprise level. The legislation also significantly limited union powers to organise (Colvin and Darbshire, 2013), though some of these restrictions were overturned by the Fair Work Act in 2009. In the aerospace sector this has meant a movement from the Metal Industries Award covering tradespeople in the sector, and the Professionals Award covering professional engineers at a State level to enterprise bargaining agreements (EBAs).

EBAs are negotiated between employers and individual unions for each group of workers at each site, above the terms and conditions outlined in the federal award, the Manufacturing and Associated Industries and Occupations Award, and the Professionals Award (Australian Federal Government, 2018, Australian Federal Government, 2010). While these legislative changes have resulted in the decline of collective bargaining and union membership, as well as a fragmentation of wage determination and wage outcomes across different sectors (Barry and Wailes, 2004) within aerospace, the industry awards system still provides a base line of terms and conditions (Oliver, 2016). State branches of the manufacturing industry employer association, the trades union, and the professionals' union that represents professional engineers still play a role.

This shift towards a neoliberal ideology also impacted state approaches to higher education and innovation funding in both countries. In Australia, the federal government unified the skill system, moving from State based control to federal. In both countries divides between the traditional and teaching focused universities have been abolished (McCaig, 2011), and policies related to marketisation, deregulation and privatisation have been introduced

(Goedegebuure et al., 1994b). Successive waves of forced or voluntary mergers have reduced the number of universities operating, and state funding has been used as a mechanism to increase competition in the sector (Sokodvin, 1999, Harman and Harman, 2003, Brennan and Shah, 1994). As a result, it has been argued that these changes have resulted in ‘market based coordination’ (Brennan and Shah, 1994) within higher education and that this, coupled with the autonomy of universities, has inhibited their ability to respond to the changing needs of employers (Ashton et al., 2000).

In both countries during the introduction of neoliberal policies, state funding for innovation and subsidies for the aerospace sector were reduced. In the Australian case, innovation funding was reinstated in the 1990s with the introduction of cooperative research centres designed to strengthen the links between research and industry (Meek, 1994). More recent initiatives include the Growth Centres initiative designed to support innovation collaboration between firms and universities (Department of Industry, 2018), with the Advanced Manufacturing Growth Centre supporting the aerospace sector.

In the UK case, ‘the state’ restricted innovation funding and subsidies for the aerospace sector for a longer period. Until 2013, the state chose not to provide financial support for innovation infrastructure or applied and industry-based research (Webster, 1994a), though the launch of the Industrial Strategy in 2013 (BIS, 2014) marks a shift in this approach.

Arguably, however, the neoliberal ideology about the role of the state still remains (Bentham et al., 2013). Various government funded infrastructure and institutions have been set up including the Aerospace Growth Partnership, the Aerospace Technology Institute and catapult centres (Aerospace Growth Partnership, 2012) that are designed to support, amongst other areas, skill development activities in the sector.

Finally, sector trade associations exist in both countries. In the UK, as mentioned earlier in the chapter, trade associations have historically and continue to play an important role (Mowery and Rosenberg, 1991), though whether they influence skill development is an important question. In the Australian context, there is also a sector trade association but this is a relatively recent phenomenon, as it was set up within the last decade.

4.4 CONDITIONS IN THE ENGINEERING SKILL SYSTEM IN THE UK AND AUSTRALIA

In both the UK and Australia, there are concerns about the number of professional engineers being produced by the engineering skill system. Concerns about skill shortages for professional engineers and in some cases other engineering related trades, are referred to in various government or industry reports in both countries (e.g. Engineering UK, 2017, Engineering UK, 2018, Engineering UK, 2016, Engineers Australia, 2016, Sainsbury, 2016). In the UK, skill shortages have been linked to the aging workforce, and this phenomenon has been referred to as a ‘retirement cliff’ (Ahmed, 2014) that is likely to affect the aerospace sector. The notion of skill shortages has become a well-defined discourse within sector, profession and government reports. In Australia, shortages in professional engineers have been combated using skilled migration with some reports stating only 30% of demand is met by Australian engineering graduates (Engineers Australia, 2016). While this has combated shortages, there are concerns that overreliance on migration is problematic, and the PEI has called for government policies to encourage more Australians to take engineering courses, and for policies and programmes designed to retain experienced engineers (ibid).

In both the UK and Australia, government backed reviews into engineering and technical education have been funded (see as examples King, 2008, Sainsbury, 2016) which highlight some of the weaknesses of the engineering and technical skill systems in both countries. These reviews detail, amongst other issues, the disconnect between industry and higher

education, and an acknowledgement that there needs to be more interaction between firms and universities to combat this (Webster, 2000, Markes, 2006).

There is also an emerging discourse around the importance of soft skills, sometimes referred to as ‘employability’ or behavioural skills (Spinks et al., 2006, 3). Employers in engineering in the UK report a perceived skills ‘gap’ or shortage in soft skill areas (Engineering UK, 2016, 13, Harding, 2016, IET, 2016), and similar debates have emerged in the Australian case about a growing need for ‘soft’ skills (Webster, 2000, 149): these include communication, teamwork, management, the capacity to acquire and apply information from many sources, collaboration, and managing relationships within and between firms.

Previous research in the UK context on the aerospace sector in the 1990s also indicates that firms in the sector suffered from poaching, skill shortages and high employee turnover and combated these with the use of contractors and international recruitment (Lloyd, 1999).

Research on the Australian aerospace sector is sparser. Migration, as mentioned above, is commonly used to combat shortages for professional engineering. There has been concern expressed for shortages in certain engineering specialisms, though there is no evidence that these shortages will directly affect the aerospace sector (King, 2008) and there is less of a defined discourse about sector skill shortages for professional engineers.

In both countries, one of the responses to the perceived future shortage of engineers has been to focus on increasing the number of female engineering graduates (Engineering UK, 2016, Engineering UK, 2017, Engineering UK, 2018, Nielsen, 2018). As briefly touched on in Chapter Three, engineering is a male dominated occupation, with only 9-11% of engineers in the UK being female (IET, 2015, WISE, 2017), and 12% in Australia (Nielsen, 2018).

Attracting more women into engineering is seen as one solution to the predicted future skill shortages, and shortages of engineering graduates that have been discussed.

4.5 CONCLUSION

This chapter has outlined the context for this project before we can begin to delve into the role of multinationals in skill formation. This includes that the sector is globally dominated by multinationals, reliant on technological innovation, that governments want to retain or attract investment in the sector, and that in both the UK and Australia the sectors operations are considered advanced. The skill requirements for professional engineering have also been discussed as have the institutions that are involved at a national level in their skill formation such as universities, PEIs and ‘the state’. What emerges from policy and sector reports in both countries are concerns about shortages of professional engineers, skills gaps or mismatches in relation to soft skills, and an acknowledgement that not only are there gaps between universities and industry, but that this distance may be problematic.

The following two chapters address the role that the multinationals studied play in skill formation, by looking at how these firms engage with the engineering skill systems in each country. Chapter Five outlines the extent to which these firms engage with the state (public authorities such as governments and government infrastructure), PEIs, employer organisations and unions. Chapter Six focuses on whether the multinationals studied suffer from skill shortages and mismatches, and the extent of engagement between these firms and universities.

CHAPTER 5 THE MULTINATIONALS AND THE ENGINEERING SKILL SYSTEM

5.1 INTRODUCTION

This chapter draws on the research data to identify the extent to which the multinational companies studied engage with and shape the engineering skill systems in the UK and Australia. As discussed in Chapter Two, sectors that require different conditions from the prevalent national business system can generate their own distinct sub-national conditions (e.g. Crouch et al., 2009). This chapter outlines whether this has occurred in the aerospace sectors in the UK and Australia and whether the multinationals studied, as dominant firms in the sector, are responsible for shaping skill development outcomes in relation to the skill development of professional engineers. The most important institution in the skill system in both countries, universities, are addressed separately in Chapter Six, and so are only briefly referred to in this Chapter in relation to how they interact with other institutions.

The data is arranged in country cases, first the case of the UK, then Australia, looking at how the multinationals studied engage and shape the skill system in each country, and variation between these firms. In both country cases, the analysis focuses on the multinationals' engagement with government and other sector or professional institutions that make up the engineering skill system. Then, the chapter moves to compare the country cases, looking at the similarities and differences raised by the chapter discussion, and how these influence the skill outcomes that have been outlined.

5.2 THE AEROSPACE ENGINEERING SKILL SYSTEM IN THE UK

This section addresses the extent to which the multinationals studied engage with institutions that make up the engineering skill system in the UK, and how and why these firms attempt to shape skill development for professional engineers. The actors fall into three groups:

professional associations, the state and finally, collective organisations - those more traditionally involved in collective action, such as employer organisations, unions or sector skill councils. Each group is reviewed in turn, identifying if the multinationals studied engage with each group in relation to skill development for professional engineers, and, if so, whether these firms are able to shape the skill system and in what ways.

5.2.1 PROFESSIONAL ENGINEERING INSTITUTIONS

The data supports the discussion in Chapter Four (Section 4.3), that professional associations play an important role in the engineering skill system (Sako, 2017). The primary role of the PEIs in the UK engineering skill system appears to be standard setting for engineering skill development, whether through accrediting graduate and post-graduate courses or through the awarding of protected titles. Each of the multinationals studied engages with at least one PEI, typically either the sector PEI, the Royal Aeronautical Society (RAeS), the Institute of Mechanical Engineers (iMechE) or the Institute of Engineering and Technology (IET).

Three of the firms, Flight Ltd, Defence Org UK and Engines Ltd UK are ‘corporate’ members of RAeS, meaning they pay membership fees to access the PEIs’ services, while the other multinational, Software Ltd, is a member of IET. First, the role that multinationals play, if any, in the standard setting activities of the PEIs are explained. Following this, the other activities undertaken by these professional associations such as soft skill development, and the role multinationals play in these activities are considered.

5.2.1.1 THE MULTINATIONALS, PEIS AND STANDARD SETTING

As noted in Chapter Four (Section 4.3), the PEIs undertake a standard setting role in the engineering skill system by accrediting undergraduate and post-graduate degrees and awarding protected titles. The first part of this activity, course accreditation, ensures a certain level of quality for skill development in engineering and science degrees. There is no

evidence from the data that the multinationals studied engage with PEIs in relation to this part of their activity.

The second way that the PEIs shape existing skill development for engineers is through the awarding of protected titles, particularly Chartered Engineer. There is some evidence that the Chartership process is one of the ways that the multinationals studied engage with PEIs. All four firms have formal programmes to support their engineers to achieve Chartership. PEIs are invited to accredit these, and other company programmes such as apprenticeships and graduate schemes, supporting the four firms to help their engineers achieve chartership:

you've got Flight Ltd, Engines Ltd, Defence Corp etc. They will have a graduate program... We look at the program they have set out, talk to people already on scheme, to mentors, to HR. We make sure that there's enough within that scheme that, at the end of it, the engineers are able to apply for professional registration.

B8, Professional Engineering Institution, UK

These firm-specific programmes support engineers to achieve chartership through assigning mentors, often senior managers who are chartered, and helping engineers to gain experience in various areas needed to evidence their competence.

Engineers who are applying for chartership have to demonstrate that they have achieved a certain level of technical experience and skills in various areas; chartership in essence accredits their informal or experiential learning in addition to their qualifications which indicate their theoretical knowledge. The process of applying for chartership, while voluntary, acts as a form of standard setting for entry into the engineering profession, indicating that individual engineers have achieved a certain level of competence.

The multinationals studied invite one or several of the PEIs into their firms to accredit these courses and advise them on their content. One representative of RAeS argued that one of the multinationals engages because Chartership is a form of standard setting:

Flight Ltd UK understand and believe in professional registration because it helps to uphold standards. It means that there's a code of conduct that engineers have to adhere to as individuals working for Flight Ltd.

B8, National representative, Aerospace PEI, UK

The four multinationals do not seem to take part in the process of setting the standards for chartership or accreditation. Instead, these firms seem to use the process of chartership and the PEIs to support them in quality assurance in relation to engineering skill development.

In Chapter Two (Section 2.2.2), one of the roles of the firm as an institution in engineering skill development was argued to be to enforce standards (Sako, 2017). It could be argued here that the standard setting activities of the PEIs gain legitimacy through the engagement of these firms and other firms in the sector. These firms appear to be using the awarding of protected titles such as Chartered Engineer as a form of quality assurance for engineering skill formation. This raises the question of whether these firms are using Chartership as a mechanism to enforce standards for engineering skill formation within their firm. The interviews with engineers suggest they also value chartership, with several stating they planned to ensure they have the necessary technical skills and experience to achieve the protected title before they focused on their career progression.

There is also evidence of more experimental behaviour by one of the multinationals studied in relation to standard setting. One of Flight Ltd UK's subsidiary sites has developed a regionally based project with the local branch of RAeS to encourage SMEs in their supply chain to put their engineers through the chartership process. Flight Ltd UK is providing engineers to act as chartership mentors and supporting the SMEs to develop internal chartership programmes:

Flight Ltd UK want to bring that ethos through to the SME community ... whether you're an engineer from an SME or an engineer from Flight Ltd UK or Engines Ltd, competence-wise you've all been scrutinised by somebody outside of those organisations.

B8, National representative, Aerospace PEI, UK

This project extends the standard setting activities already undertaken by Flight Ltd UK with RAeS into the firm's supply chain, and acts as a form of quality assurance for engineering skill development. This is important as it supports other research that suggests that large firms at the head of supply chains can encourage (if not enforce) the adoption of voluntarist forms of standard setting (Holman et al., 2012, Scarborough, 2000), but on this occasion in the realm of quality assurance for skill formation, as opposed to HR or production practices.

The project is also an example of organisational experimentation, with Flight Ltd UK as a 'lead firm' within the sector expanding the realm of its enforcement of standards (Sako, 2017) outside of its own 'corporate hierarchy' (Crouch et al., 1999) and out into its suppliers, and using the PEI, and chartership process as an institution to do so. The examples in relation to chartership suggest that the multinationals studied are users of standards, and encourage others to use them, but are not actually shaping these standards themselves.

5.2.1.2 THE MULTINATIONALS, PEIS AND SOFT SKILL DEVELOPMENT ACTIVITIES

In addition to standard setting activities, all three of the PEIs offer continuous professional development (CPD) that aims to develop the soft skills of engineers. The importance of soft skills and their development was discussed in Chapter Four (Sections 4.3 and 4.5) as these are often areas where employers report mismatches or skills gaps. PEI CPD activities occur at both national and regional branch levels and include branch meetings, lecture series, opportunities for members to present on their technical specialisms and conferences for special interest groups (e.g. young engineers) or on technical areas (e.g. autonomous aircraft).

Participating in these activities can be used as evidence of CPD for chartership and tend to focus on developing engineers' behavioural skills more than technical ones, such as networking, presenting and project management as engineers can also get involved in organising events. The more technical events such as specialist courses provide context (or domain) specific knowledge as opposed to technical specialism, alongside the development of behavioural skills.

The three multinationals who are corporate members of RAeS are heavily involved in relation to these CPD activities; the firms sponsor events, give engineers and managers funding and time off to attend, and multinational managers often participate by giving presentations, chairing sessions or participating in panel discussions. Managerial participation includes senior management, with one example being the CEO of Engines Ltd, giving a lecture at the RAeS headquarters (Event Notes). The interview data does not indicate why these firms participate in these activities to such an extent. However, through their participation the multinationals are supporting activities that enable engineers who attend to develop soft skills. The engagement by the multinationals may be a response to the perceived soft skills gaps or shortages for engineers in the sector.

One of the avenues also discussed in Chapter Four (Section 4.5), was the focus on increasing the number of women in engineering as a way of addressing concerns about future skill shortages. A mentoring scheme had been developed which was aimed solely at female engineers. An engineer at Flight Ltd UK developed the initiative with an academic as a way of supporting female engineers in career development. Flight Ltd UK was one of the initial funders of the scheme which has been developed into a sector programme through collaboration with RAeS:

For the moment it's only open to the funding members... [RAeS], because of their neutrality, and as we want to make this a service available to all women in the sector, will take it on as one of their services, much as they do career mentoring.

B26, Engineer, Flight Ltd, UK

The mentoring scheme provides female engineers with female mentors to support them with career progression.

Mentoring activity often focuses on developing soft skills that can help engineers progress alongside providing support around issues that directly affect women, such as balancing the demands of work and family. This scheme is an example of firms and RAeS collaborating on soft skill development for a specific group of engineers (in this case women) as a partial 'collective good' (Crouch et al., 1999), as discussed in Chapter Two (Section 2.2), and restricting access to this collective good to those firms who are pooling resources.

In summary then, PEIs play an important role in the UK engineering skill system through standard setting. There is little evidence that the multinationals studied engage with PEIs in relation to setting standards for degrees or titles such as chartership, or the accreditation process. Instead, the multinationals engage with the PEIs, and use them as a way of enforcing standards in relation to engineering skill development (Sako, 2017). By doing so, the multinationals legitimise the standard setting activities of the PEIs, and there is evidence of one firm experimenting with extending this form of standard setting into their supply chain. There is also evidence of three of the multinationals participating in the production of soft skills as a collective good (Crouch et al., 1999) through their involvement in CPD activities offered by the PEI and through the more experimental example of developing a mentoring programme for female engineers.

5.2.2 THE STATE

‘The state’ is used to refer to public authorities such as representatives from the UK government and also to representatives from the government funded infrastructure discussed in Chapter Four (Section 4.4). Most of the government funded infrastructure has been set up within the last decade and includes the Aerospace Growth Partnership (AGP), Aerospace Technology Institute (ATI) and the catapult centres (typically attached to universities). These bodies form part of successive governments’ industrial strategies, even though these institutions operate separately from government. First, the way that the multinationals studied interact with ‘the state’ using this infrastructure, and then the impact these firms have had on skill formation for engineers through their interaction with ‘the state’ are examined.

The UK government’s role in the engineering skill system is that it funds universities, and therefore engineering courses (see Chapter 6). In addition to funding universities, the UK Government also funds government infrastructure developed for the sector, and uses this infrastructure to fund, design and deliver one-off supply-side focused programmes, some of which target engineers. The parts of the government infrastructure that influence engineering skill development include the Aerospace Growth Partnership (AGP) and the catapult network, as the ATI is solely responsible for allocating funding for applied research.

5.2.2.1 THE RELATIONSHIP BETWEEN THE STATE AND THE MULTINATIONALS

The evidence from interviews with multinational managers and government representatives indicate that the firms in this study do not engage with the UK government individually in relation to subsidies for skill formation but do so as a collective through the AGP. The UK government has encouraged this by making the AGP the main mechanism to access sector targeted government funding (except for devolved governments). This form of engagement

diverges from the more individualistic negotiations described in Chapter Two in relation to ‘giant firms’ and governments (Crouch, 2010).

The interviews with government representatives indicate that while the UK government has deliberately avoided this form of individual negotiation with multinationals, these firms have played a significant role in shaping the collective infrastructure that the government has funded and developed. The ideas for AGP emerged out of an initial roundtable of CEOs and government representatives, and the development of the policy initiative for the catapult centres also can be traced back to the influence of aerospace multinationals:

[It wasn't about] that company coming in with a list of demands. It wasn't about [government] telling the industry how to run itself ... We got initially a small group of CEOs in to start to outline what the key challenges were.

Some of [the catapult centres] were going before but a lot of them were driven by the aerospace sector in terms of industry coming along with ideas about catapult centres and what they could do... a lot of aerospace companies have been the pioneers of those centres.

B42, Government representative, UK

Various multinationals in the sector have engaged with government through the AGP since this initial round table, and of the four multinationals studied, three are involved with the AGP, Flight Ltd, Defence Org and Engines Ltd. These three firms have managers sitting on various AGP working groups, one of which is skills. These multinationals also engage with at least one of the catapult centres for a range of activities from project work, research and technology (R&T) or innovation activity, through to skill development. The fourth, Software Ltd UK has applied for R&T funding through a programme designed and funded by the AGP but in general engages at much lower levels with the government infrastructure. One reason for this could be the smaller size of its aerospace operations in the UK.

The AGP has become as an employer led institution whose role is to advise government on sector needs and design and oversee government funded programmes for the sector. The catapult centres are research centres, often attached to universities. These centres receive

government funding to undertake applied research on emerging areas of technological innovation, such as composites or advanced manufacturing (e.g. automation and industry 4.0), and to disseminate practices related to these areas to businesses.

Interviews with government representatives, and representatives based at the catapult centres indicate that the design of the catapult initiative was directly influenced by multinationals and modelled on the Fraunhofer Centres for applied industry research in Germany. The Fraunhofer Centres form part of an institutional network of actors who undertake economic development activities (Charles, 2006) and who can operate as brokers between firms in collaborative activities (Cooke, 2001). However, unlike the Fraunhofer Centres, the catapult centres seem to operate primarily as service providers to individual firms, and as a way of disseminating information related to innovation.

The involvement of multinationals in the design of government funded infrastructure, and the influence of institutions in other countries where all four of these firms have subsidiaries does seem to indicate that multinationals, by being boundary spanners operating across countries, can facilitate the transfer of ideas and practices at an institutional level (Crouch and Farrell, 2004).

5.2.2.2 SKILL FORMATION: COLLECTIVE AND EMBEDDED VERSUS FIRM-SPECIFIC

The government funded infrastructure such as the AGP provides government funding that is matched by industry for both collective and private goods, two of which are skill formation and innovation. Skill formation activities are harder, in part, to classify as either a collective or private good, because even in firm-specific training, the product of skill formation, the skills themselves become socialised, as discussed in Chapter Two (Section 2.2). However, there are distinctions between how the multinationals studied engage with both the AGP and catapult centres, that might be best described as collective or individual. There are also

distinctions between forms of skill formation activity, with collective endeavours often being those that produce embedded resources in relation to engineering skill formation that are available to other firms. In comparison, individual engagement tends to produce training activities that are only accessible by the individual firm themselves.

Not all the firms engage with the same levels of intensity for skills programmes that are collective and that produce embedded resources. Engines Ltd, as one example, engages heavily with the AGP in relation to innovation funding, and with the ATI:

Engines Ltd UK have fully embraced the ATI. From the top down they're saying, "This is the strategy." They've made sure the proposal strategy of the ATI aligns with the Engines Ltd UK strategy. Everything is stacked up to match what they want so they can make a proposal for a technology program that, if you pressed it, it fits perfectly

B32, Ex Director, Flight Ltd, UK

While Engines Ltd UK engage for individual (or private) innovation funding, they tend not to participate as much on collaborative endeavours through the skills working group of the AGP. Interviews with representatives from various parts of the government funded infrastructure also indicate that as a firm, they are known for not collaborating on projects with other multinationals.

Instead, Engines Ltd UK engage more extensively with the catapult centres, where they essentially purchase formal training or the centre's specialist services for bespoke projects tailored to their skill needs. One example would be a project where Engines Ltd UK collaborated with a catapult centre, designing production methods for a new composite component, and developing the training for (and skills of) their engineers and production workers at the same time:

they are embedding electronics into a composite project. In the Catapult they developed the means, but also trained a team of people who were going to go on and manufacture the product

B25A, Skills Expert, UK

In these examples, Engines Ltd UK engage to access firm-specific training, as opposed to funding skill development that can be accessed by other firms in the sector, and so could be considered a collective and/or embedded resource for skill formation.

Both Flight Ltd UK and Defence Org were also reported to have made use of some of the catapult centres in similar ways. In many ways, the use of the catapult centres to deliver bespoke training suitable for these multinationals is reminiscent of the activities of ‘the institutional firm’ as a corporate hierarchy in Chapter Two. However, these activities essentially act as government subsidies for firm-specific training activities for these firms. This raises the question of whether the catapults contribute to what has been described as the problem of government subsidised training as employer ‘welfare dependency’ in the UK (Keep, 2006b, 53).

There are some examples of the AGP and the multinationals studied collaborating on skill initiatives that can be considered to produce engineering skill development as a collective and embedded resource. Two of these will be discussed, an MSc Bursary scheme and a proposal for an aerospace ‘National College’. The former programme was successfully funded while the latter has not been. The masters bursary initiative was a ‘supply oriented’ programme designed to ‘put a quick injection of skills and graduates into the sector’ (B3, Trade Association, UK) by funding 500 specialist engineering masters places between 2013 and 2016. This approach is congruent with the voluntarist and neoliberal ideology adopted by the state in the UK, as supply oriented approaches focus on increasing the ‘supply’ of skills in the market as opposed to the demand for and utilisation of skills (Lloyd and Payne, 2003).

Ten of the largest companies in the sector, including Flight Ltd, Defence Org UK and Engines Ltd UK, contributed £300,000 and each received 15 masters places for their employees, totalling 150 places. Government matched the three million raised by industry

and created the additional masters places through universities. The funding available enabled the stakeholders (government, multinationals and PEIs) to shape course provision through getting universities to offer new specialist masters courses, and to increase the supply of specific engineering skillsets. RAeS and the Royal Academy of Engineering provided the list of accredited courses and were asked to oversee the programme, to ensure that courses were of an appropriate standard and accredited.

One of the primary criticisms of the programme by one of the regional trade associations was the narrow focus on highly specialised engineering skill sets, driven in part by the involvement of the PEIs and multinationals. There were predictions at the time that demand would be rapidly increasing for aerodynamics skills sets. By the time the programme was launched, the expected demand for aeronautics specialists had dissipated due to changes of plans by the two main aircraft manufacturers. When the predicted future demand did not materialise, one interviewee explained that the post-graduates were too specialised to be able to easily apply for other engineering positions.

It went myopic on Msc or Ceng. Pure Msc and geared towards aerodynamics... Uptake wasn't huge from industry because it was so narrow. It all stemmed out of a shortage of aerodynamicists... [Now the Msc students are graduating] The big companies turn their backs as they don't have the need. There is now pressure to find them jobs in the SMEs.

Interviewee asked to remain anonymous

The MSc bursary scheme, shaped by three of the multinationals studied, can be considered to have produced engineering skills as an embedded (if temporary) skill formation resource.

However, the programme has focused on developing narrow skill sets and courses to supply those skills rather than broader industry skills that meet the needs of other firms in the sector (such as SMEs). This raises the question of whether multinationals as dominant actors in the AGP and the sector are shaping these programmes to produce more specific skills as opposed to general and more portable skills. This tension in terms of the types of skill development

firms invest in, such as specific versus more portable, was discussed in Chapter Two, Section 2.2.1 (see for example Becker, 1962, Hall and Soskice, 2001, Crouch, 2005b, Crouch et al., 1999, Estevez-Abe et al., 2001).

Interviews with representatives from the catapult centres, the AGP and the national trade association indicate that the second programme, the Aerospace National College initiative, was developed in collaboration with several of the multinationals studied. The Aerospace National College was envisioned as a virtual institution that designed standards, training materials, training for educators and had the necessary equipment; essentially shortcutting the time innovation activities and knowledge take to diffuse into the skill system and skill development activities. These courses were meant to span from school through to PhD level, through both academic and vocational paths. The proposal focused on developing standards that bridge VET and academic routes, as well as focussing on developing industry level skills for the sector. The trade association representative reported that there was significant support for the proposal across multinationals in the AGP.

The proposal had to compete with proposals from other sectors and subsequently did not secure government funding, and the support of the multinationals and other AGP representatives did not extend to supplying industry funding when the application for government funding was refused. One reason suggested as to why the multinationals did not supply funding for the initiative was that these firms have already developed their own firm-specific routes for planning how they will ensure their future skill needs are met:

We [with the National College] are talking 4 - 10 years away... the only people that know what is happening there are [companies like] Engines Ltd UK with their University Centres who have a vision of that, as does Flight Ltd, but the middle-sized companies, haven't got a clue.

B25 A, National College Representatives, UK

The multinationals are argued to have built their own, firm-specific routes to ensure they have access to the skills they need, and so have less incentive to fund more wide-reaching sector standard setting activities in relation to skills as a collective, and embedded resource. These firm-specific routes are discussed in greater detail in Chapter Six.

One of the catapult representatives responsible for the initiative described it as an attempt to ensure quality of and standards for skill development and training across the ‘fragmented’ UK skill system. This fragmentation was described as a proliferation of discrete, government funded initiatives and programmes that are not designed to interact with each other, and which sometimes undermine or duplicate one another. The project aimed to address this fragmentation by imposing skill standards that standardised training across the various segments of the skill system, from further education through to universities. The voluntarist approach of the UK government, as discussed in Chapter Four (Section 4.4), was also argued to be one of the reasons the project didn’t receive funding as it would have required state intervention in the skill system:

There are five national [sector] colleges funded and for most of them [the government] are really funding buildings... what we didn't do was ask for buildings, we wanted revenue to build a curriculum...

the National College was naive in many respects, mainly political, but was an engineers’ solution to the problem... What prevents it happening is not the quality of the response, but the acceptability, politically of the answers. We don’t call it the National College anymore, we just discuss the principles of it, we have meetings with ministers who are very enthusiastic about it and pass it onto civil servants who can’t fit it into this box or that box.

B25B, National College Representative, UK

The ideology of the project, that skills and standards for skill formation should be standardised and made available as a collective and embedded resource was distinct from other sector bids. While other sector colleges that have received funding wanted physical sites or equipment, the Aerospace National College proposal wanted funding for standards and curriculum design and would require government intervention in the further and higher

education sectors to be implemented. This is due to the autonomy of universities, and other training institutions within the skill formation system, as discussed in Chapter Four (Section 4.4). The project's reliance on state intervention challenges the neoliberal ideology of the role of the state as non-interventionist except in instances of market failure.

5.2.3 COLLECTIVE ORGANISATIONS

Chapter Four identified several organisations operating in the engineering skill system including one union covering the sector, national and regional trade associations and the engineering skills council. Interviews with representatives at these organisations revealed that none of these organisations play a direct role in skill development for professional engineers. The multinationals studied engage with these institutions in relation to their primary activities. These include negotiating with the union where sites are unionised, being members of the national trade association and supporting the regional trade associations whose members are typically SMEs in the supply chain. However, none of this engagement was in relation to skill development for engineers.

Interviews with representatives from the sector skills council indicate that it focuses on intermediate skill development below the level of professional engineer, such as engineering technician, typically attained through vocational education and training or apprenticeships. There was also some indication that in terms of representation, the PEIs play a greater role in terms of engineering skill development in the UK case than the union, as suggested in Chapter Two, Section 2.2.2 (Sako, 2017). The union representative has a seat on several working groups of the AGP including skills but has not attended any of these meetings, indicating that skill development is not seen as a priority activity within the union's remit. In addition, interviews with engineers suggest that while most engineers are members of one of the PEIs, only those engineers whose workplaces are unionised are members of a union. Of

those engineers who are union members, many reported that the union did not play a role representing them in relation to skill development activities.

5.2.4 VARIATION WITHIN THE UK CASE

Table 5.1 outlines the variation across the multinationals in terms of how each firm interacts with the different actors in the engineering skill system, and examines whether there is variation within the UK case. When analysing how each of the firms engaged with each group of actors within the engineering skill system, there were similarities found across several of them in both how much, and how they appeared to engage. However, across the group outliers were identified. Here I use the term outliers to refer to firms who either engaged with certain groups through more routes and/or with greater intensity or, who in contrast, did not engage to the same degree or via as many routes as the other firms. To try and represent this as clearly as possible, the terms low, medium and high have been used to describe, overall, this variation between firms in terms of the intensity and types of engagement that they have developed with each of the groups.

All four multinationals engage at medium or heavy levels with a PEI, in relation to standard setting/enforcement through Chartership, and three engage at similar levels with RAeS in relation to soft skill development. Medium has been selected for three of the firms in relation to chartership, as they all have developed relationships with either the sector or another PEI, have internal chartership programmes which a PEI accredits and encourage their engineers to apply for chartership. The fourth, Flight Ltd UK has been denoted as heavy as, in addition to this, the firm has worked with the sector PEI to expand Chartership into its supply chain.

In relation to soft skill development activities, two of the firms, Defence Org UK and Engines Ltd UK engage with the sector PEI's events, financing them, and sending managers and engineers as contributors and participants. Flight Ltd also engages in these ways, but has again, in addition worked on other initiatives such as the women's mentoring programme,

showing a greater number of routes for engagement. Software Ltd UK has been categorised as low in relation to its engagement with PEIs for soft skill development, as there was no evidence found that the subsidiary finances, or gets management to contribute to these events, though the firm does encourage its engineers to attend.

The same three multinationals engage with ‘the state’ at heavy levels through the government infrastructure. Their engagement has been categorised as heavy as all three firms sit on working groups of the AGP, participate in AGP programmes, provide engineers who help to run the AGP and engage with the catapult centres. Each of the three firms seem to have significant influence within this infrastructure, and over programme design. No evidence was found through the interviews of individual subsidies agreed between the firms studied and ‘the state’ directly. No formal processes for the multinationals to apply for subsidies or funding at an individual level with the UK government were uncovered, though, of course, individual negotiations and agreements may still occur.

Where the three firms who do engage at high levels have funded skills programmes, there is evidence that these have been narrow and produced highly specialised engineering skills that meet their needs but not necessarily those of the sector. There is also evidence that these firms have developed firm-specific routes to support their future skill needs, meaning that while they may support broader programmes aiming to shape the engineering skill system, there is no imperative for them to fund them. The multinationals studied engage with collective organisations, but not in relation to the engineering skill system.

Variation was found within the country case, in the degree to which individual firms engage with each of the actors in the engineering skill system. Software Ltd UK appears to be an outlier in this respect. While there was evidence that the subsidiary has taken part in some of the subsidised programmes, there was no evidence found that any of its managers sit on any of

the working groups, or have sought to develop influence within any of the government funded infrastructure and so it has been categorised as low engagement. This could be due to the small size of the multinational’s aerospace operations in the UK in comparison to the other firms studied. This variation could indicate that multinationals gain influence via their dominance within the sector. The size of their workforce operations may be one contributing factor that makes these firms dominant.

TABLE 5-1 VARIATION ACROSS THE MULTINATIONALS

Variation in interaction across the multinationals with different institutions				
	PEIs for Chartership	PEIs in relation to ‘soft skill’ development	‘The state’ Government/Government infrastructure	Corporatist Organisations
Defence Org UK	Medium Aerospace PEI	Medium Fund, contribute to and attend	Heavy Sit on AGP working groups, participate in AGP programmes, some engagement with Catapults	None in relation to professional engineering skill development
Flight Ltd UK	Heavy Aerospace PEI, extend into supply chain	Heavy Fund, contribute to and attend. In addition, designed one initiative	Heavy Sit on AGP working groups, participate in AGP programmes, some engagement with Catapults	None in relation to professional engineering skill development
Engines Ltd UK	Medium Aerospace PEI	Medium Fund, contribute to and attend	Heavy Sit on AGP working groups, some participation in AGP programmes, heavy of engagement with Catapults	None in relation to professional engineering skill development
Software Ltd UK	Medium Another PEI	Low Attend	Low Do not sit on AGP working groups, light engagement through participation in some AGP programmes	None in relation to professional engineering skill development

5.3 THE AEROSPACE SKILL SYSTEM IN AUSTRALIA

5.3.1 THE PROFESSIONAL ENGINEERING ASSOCIATION

The data in the Australian case differs from that of the UK case in relation to the role of professional associations in the engineering skill system, and in the ways the multinationals studied engage with the PEI. As discussed in Chapter Four, the sole PEI, Engineers Australia, is responsible for setting the standards for engineering education, accrediting undergraduate and post-graduate degrees and awarding of protected titles. The PEI also lobbies government at both Federal and State levels and is supportive of legislation requiring professional registration, such as that being brought into effect in Victoria.

The interviews with managers at the multinationals indicate that there is less engagement between these firms and the PEI than was the case in the UK. There was no evidence found that the PEI accredits firm training programmes such as chartership or graduate schemes (Email exchange, A27, PEI representative, Australia), or that any of the multinationals are members. One reason for this could be that Engineers Australia is a general engineering professional association rather than a specific aerospace one.

Evidence from the interviews with managers at each firm suggests that the multinationals are less supportive of the role of the PEI and chartership than those studied in the UK. This is not to say that engineers in the sector do not apply for chartership, simply that there is less focus from the multinational representatives on encouraging engineers in their firms to apply. This indicates that in the Australian case the multinationals may have found alternate forms of quality assurance, or means of enforcing standards (Sako, 2017) in engineering skill formation, whether internal to the firm, or through other institutions in the skill system.

Engineers Australia offers CPD activities though no evidence was found in the interviews that the multinationals are involved with these. Though the PEI offers formal and accredited

training, none are specific to the aerospace sector. Engineers Australia is currently considering developing some courses for the defence sector (Email exchange, A26, Training Specialist, PEI, Australia). Interviews with representatives from the PEI indicate that where the multinationals engage, though still not at the levels of the multinationals in the UK, is with the affiliated technical society, the Australian division of RAeS. RAeS is one of 40 technical societies affiliated to the PEI and the firms engage in relation to activities that build engineers' soft skills.

The Australian division of RAeS organises events at a regional branch level such as workshops, lectures and factory tours. Wings Corp AU allowed the technical society to offer a tour of its manufacturing operations in Victoria in one example. Similar to the UK case, these CPD activities provide opportunities for engineers to develop soft skills (e.g. presenting, networking, organising events) and some lectures provide attendees with contextual knowledge about certain technical areas. There is less evidence of multinational managers participating in events or shaping the content of the CPD activities that are designed to develop soft skills in engineers. This suggests that the multinationals studied may be less embedded within the engineering skill system in Australia than in the UK.

5.3.2 THE STATE

Public authorities in the Australian case to refer to the federal and Victorian State governments, and representatives from the government funded infrastructure termed the advanced manufacturing growth centre (AMGC). As outlined in Chapter Four (Section 4.4), the federal government's role in the engineering skill system includes funding higher education, and standard setting through its role in the industry awards system.

The Professional Employees Award 2010 (Australian Federal Government, 2018) is the award covering professional engineers and sets the minimum level of terms and conditions of

work, including outlining four broad job classifications for professional roles that influence engineers' career progression and pay. Interviews with union representatives indicate that enterprise bargaining agreements are then negotiated by firms and unions above those prescribed in the Award. The federal government also funds the government infrastructure for advanced manufacturing. Interviews with representatives from the AMGC indicate that currently, the government funded infrastructure has no impact on skill formation activities for professional engineers.

Finally, the Federal government also funds one-off supply side initiatives using specific funding pots. One example would be SADI funding ('Skilling Australia's Defence Industry') that firms can apply for in relation to skills initiatives in the defence sector. One of the multinationals studied, Defence Org AU, has used this funding to design training aimed at certain engineering specialisms:

There has been some use of the SADI [Defence] funding to do some development to build expertise in things like systems engineering and support engineering.

A10, Resourcing Director, Defence Org AU, Australia

This benefits the individual multinational, but due to its specialised nature, it is unlikely to have wider applicability in the sector. There was no evidence found during the interviews with either government representatives or the managers of the multinationals of government funding pots available for a broader sector approach, except for the Industry Growth Centres. Instead, the interviews with government representatives indicate that the multinationals studied engage with both Federal and State governments on an individual firm level, with much of the funding being agreed at a State government level. In this respect, the Australian case more closely mirrors the discussion of 'giant firms' (Crouch, 2010). The Victorian State government provides the majority of the funding available for multinationals, and the funding available can be split into three types: open sector funding that firms from any sector can bid

for, agreements designed to attract or retain multinational subsidiaries in Victoria, or government contracts for work.

Interviews with union representatives revealed that Wings Corp AU has received funding designed to retain multinationals, after it initially purchased its Australian sites including its Victorian subsidiary from two other multinationals. Wings Corp AU received a combination of Federal and state funding to supplement its upgrading of one of the factories, as part of an individual agreement to retain part of its manufacturing activity in Australia. While these funding streams subsidise the multinationals who receive them, there is no explicit skills component.

Throughout all the interviews with multinational managers, government and union representatives, there was only one example provided of State government funding to a multinational which has influenced skill development for engineers, and even in this case the influence was indirect. The funding was a government contract for work from the Federal and Victorian State government awarded to Systems Corp AU to design a new air traffic management system. As part of the contract terms, the Victorian State government placed a requirement on Systems Corp AU to create a certain number of permanent engineering positions. These positions have to contain a certain level of technical capacity and type of skill set:

Part of the key deliverables in the program was that they will create technical capacity ...in terms of numbers of employees and the kind of skill set that the program will produce... [however] we'd like the company to work on their own mechanics. Otherwise, it becomes too much of a government intervention.

A18, Department of Industry, Australia

As a result of this project, Systems Corp AU was preparing to recruit 150 to 200 engineers over the next few years. Interviews with several managers from Systems Corp AU, including the HR and Engineering Directors, indicate that as a result the firm is in the process of

redesigning its initial training, including introducing a formal training programme to be able to meet the State government's skills requirements. Currently, Systems Corp AU has no formal training programme outside of a graduate scheme, relying on more informal methods such as coaching, mentoring and buddy systems but senior managers are concerned these will not be sufficient when recruiting in high numbers.

During the course of the research these examples were the only evidence found of engagement between the multinationals and various public authorities was in relation to both individual contracts or engineering skill development. This indicates that engagement between the multinationals studied and Federal and the Victorian State governments is lower than in the UK case. Where engagement does occur, there is little evidence to suggest the multinationals are seeking to shape the skill system. Instead, in the examples that have been found, any skill interventions have been at a firm level, suggesting narrower skill development initiatives.

The Victorian State government has historically been more interventionist. Interviews with Victorian State government representatives indicate that government intervention includes the recently passed legislation that requires the registration of engineers, and a higher level of engagement between government and universities:

We are very closely aligned with universities, [University C, and two others] we have constant engagement at different levels: at the ministerial level and at the department level with universities. We suss out what kind of program they will be working on and find ways and methods in which we can assist.

A18, Department of Industry, Australia

The State government intervenes and financially supports certain universities in Victoria in one-off projects including developing new courses, partnering with businesses or disseminating research. These efforts are often tied to attracting and retaining industry investment in Victoria and supporting firms within sectors.

The Victorian State government has also funded the set-up of the trade association, and encouraged multinationals and other firms in the sector to join:

The government saw the need to have an industry lobby group put together from different places in the industry ... we have frequent meetings with them, they also do meet with the Minister. We like to have that open consultation process in terms of how we design our programmes that are better suited to help the industry.

A18, Department of Industry, Australia

The sector trade association was designed and envisioned to be a mechanism through which the State government could align its programmes to the needs of firms in the aerospace sector. The Victorian State government's intervention in setting up the trade association could be interpreted then as a regional government acting as a 'competition state' (Cerny, 1990) using industrial or micro-economic policies, and attempting to retain multinational investment by embedding these firms at a local level.

State government representatives depicted the role of the sector trade association as a means for multinationals to negotiate collectively with State government representatives and ministers. It should be noted that the need for a trade association, or other interventions did not seem to be actively encouraged by the multinationals studied. While these firms do not play an active role in shaping skill formation activities funded by government, they appear to influence this provision indirectly. This 'indirect' effect may be caused by their dominance within their sector. Other interviews with representatives from the sector trade association suggest that lobbying activity has not been as high a priority in the trade association as the provision of other services, and this will be discussed in more detail in Section 5.3.3 looking at Collective Organisations.

In summary, engagement between 'the state' and multinationals is lower in the Australian case than the UK. Where the multinationals studied have engaged with public authorities, this has been at the level of individual agreements, supporting the claims that multinationals

are likely to engage with governments at an individual firm level (e.g. Crouch, 2010). The Victorian State government has adopted a more interventionist approach, funding projects with universities, legislating for the registration of engineers and funding the set-up of the sector trade association. The State government operates in many respects like a ‘competition state’ (Cerny, 1990), attempting to embed the multinationals within local skill systems, and sector and micro-economic policies targeted at these firms are often designed to attract and retain investment within the State of Victoria. This is indicative of the historic role State governments have played in intra-state competition in Australia, discussed in Chapter Four (Section 4.4). The ‘indirect effect’ of the multinationals does indicate that these firms are able to access subsidies and resources because of their dominant position in the sector. This occurs even though they do not actively attempt to shape provision by the State or federal governments.

5.3.3 COLLECTIVE ORGANISATIONS

Interviews with representatives from trade unions, employer associations, the sector trade association and the industry skill council/skill service organisations (ISC/SSOs) indicate that only the engineers’ union and the sector trade association have direct influence over skill development for professional engineers. The ISC/SSOs and employer association play a role in intermediate skill development, either through setting standards for vocational education and apprenticeships or training apprentices, but neither has a direct role in engineering skill development.

5.3.3.1 THE SECTOR TRADE ASSOCIATION, THE MULTINATIONALS AND SOFT SKILLS

Interviews with representatives of the trade association, Aviation Aerospace Australia, suggest that lobbying activities have not been a priority in recent years, and there is no evidence of lobbying activity currently in relation to engineering skill development:

Early on, there were directors that were speaking with the government, encouraging them to take certain directions. We've since been going through consolidation, event growth, membership growth, not focusing on the talk but focusing on the action... [now] we're starting to get a bit more into the policy area.

A22, Sector Trade Association, Australia

Instead, the sector trade association has developed services for member firms as a means of becoming financially self-sufficient.

The services Aviation Aerospace Australia provides for its member firms include conferences, networking events and formal training programmes aimed at developing the 'soft skills' of engineers in the sector:

[Engineers] get the technical at university, but it's the soft skills, getting them to think about leadership elements early in their career and networking... in our industry, and particularly for engineers, it's not their natural tendency to go to networking events

A22, Sector Trade Association, Australia

The conferences and events held by the trade association are similar in content to those organised by RAeS in the UK, coordinated around special interest groups (e.g. women in aerospace) or technical areas. In addition, Aviation Aerospace Australia offers formal training programmes for soft skill development such as 'personal branding' or 'quality in communication'. Training provision is primarily targeted at engineers in manufacturing firms in aerospace and aviation, and eight sessions are held on average per year, alongside the trade association's other events.

All three of the multinationals studied are members of Aviation Aerospace Australia, and interviews with the trade association and State government representatives indicate that these firms play a prominent role. Senior managers from these firms are in formal management roles for the institution, either on the Board of Directors or steering group, and have close relationships with representatives from the trade association:

There are some very heavy names there, for example the Chairman at the moment of [the Trade Association] is the [one of the senior leaders in Australia] for Systems Corp

A18, Department of Industry, Australia

They're [the CEOs of the multinationals] always on the other end of an email or phone for me, we have a fantastic relationship

A22, Sector Trade Association, Australia

Again, this indicates the dominance of these firms within the sector. There was no evidence found that the multinationals attempted to directly shape the activities of the sector trade association. However, representatives of the firms studied hold positions of power within the organisation, and are likely to have, at the very least, an indirect effect on the activities that the sector trade association undertakes.

The three multinationals studied also engage at high levels with the soft skill activities the trade association offers. Observations and notes taken at one such event show that managers and engineers from all three multinationals were in attendance, and managers from each of the three multinationals participated, giving presentations, chairing sessions, participating in roundtable discussions and sponsoring the event.

The trade association representative also indicated that the focus on soft skill development was one supported by some of their multinational members, describing how one multinational explained that they have applicants with great technical skills and so the firm focuses on soft skills:

One major global company said, "Well, obviously, we have the luxury of having the best and brightest lining up to work with us, but what we then look for is those that do have those soft skills, can they interact and communicate really well?"

A22, Sector Trade Association, Australia

This indicates that the focus on soft skills is supported by some of Aviation Aerospace Australia's member firms who are multinationals and reflects some of the skill mismatches discussed in Chapter Four (Section 4.5) in relation to soft skills in engineering. Aviation

Aerospace Australia has also built relationships with certain universities, and on occasion, academics from specialist universities in Victoria are invited to speak at events on areas of technical specialism.

In summary, the evidence suggests that the multinationals studied engage with the sector trade association in relation to activities that develop the soft skills of engineers as ‘a collective good’(Crouch et al., 1999) available to member firms. Multinationals are a dominant actor within the institution, making up the steering committees, and supporting the institution’s focus on soft skill development.

5.3.3.2 THE ENGINEERS’ UNION

The engineers’ union’s primary role is representing engineers in enterprise bargaining and workplace disputes, and they have good coverage within multinationals in the sector; as an example, a third of the engineers at Wings Corp AU are members. All three multinationals engage with the engineers’ union in relation to enterprise bargaining agreements. These negotiations do not explicitly involve skill development, beyond the classification structure which outlines routes for progression and pay, influenced by the Professionals Award.

The union acknowledged that their members tend to complain about skill development and progression when they have reached the top of one classification and are seeking to move to the next. The union argued that the clauses linked to firms’ responsibilities in skill development are not explicit enough:

It's very basic clauses, ‘we will train and progress’... It’s up to the managers to make sure that the staff participate in training and development, and some managers don't really see that as a priority... it’s not laid out in black and white in the agreement what they [the engineers] are entitled to every year

A3, Engineers’ Union, Australia

While the classifications provide a base line for progression for early career engineers, movement between classifications is more dependent on front line management and firm skill needs.

The interviews indicate that two out of the three multinationals, Wings Corp AU and Defence Org AU, have had difficult, and at times hostile, relationships with the trade unions representing their trades workforce. This has impacted on the negotiations between the engineers' union and the multinationals. One example is that during the last round of EBA negotiations, the engineers' union attempted to negotiate for the classification system for member engineers at Wings Corp AU to be brought in line with the firm's global engineering classification system alongside associated benefits such as performance related pay. As noted above, one of the primary complaints of engineers is the difficulty in moving between the classifications outlined in the Award. Wings Corp AU refused unless it could also align the trades workforce, a process resisted by the trades' union.

Chapter Four (Section 4.3) and Section 5.3.2 have also discussed the implementation of registration for engineers in Victoria (Engineers Bill 2018). Interviews with the engineers' union indicate that not only does the union support the legislation, but it also was planning to roll out a registration service offering engineers a registered professional engineer status at a much lower cost than chartership. In this respect the Union is supplementing, but not directly competing with the PEI, as engineers who previously would not have applied for Chartership now have to be registered.

The union is also looking into offering training and CPD for its members to support them in registering, though as the legislation is recent, these services are still being developed. By supporting legislation requiring registration, and through its enforcement of the industry award and EBAs, the union is supporting hard regulation that sets standards for skill development that it can enforce. These focus on technical skill development, combining theoretical and experiential skills, which makes for a broader approach as opposed to a narrowing of skill development. There was no evidence from the interviews with

multinational managers of any plans to engage with the union in relation to registration activities.

5.3.4 VARIATION WITHIN THE AUSTRALIAN CASE

Table 5.2 outlines variation across the multinationals in terms of how they interact with the different actors in the Australian engineering skill system, and outlines whether there is variation within the Australian country case. It should be noted that the analysis undertaken exploring variation across the three firms to identify the intensity of their engagement with each group of actors also compares these three firms to those in the UK case. There is less engagement found between the three multinationals and the Australian PEI, and the firms are less supportive of chartership than in the UK case. For this reason all three firms have been categorised as low. One reason for this could be that the PEI's standard setting role in relation to Chartership is seen to be less central by these firms, in the Australian case. Unlike the UK, in Australia hard regulation and mechanisms to enforce standards in relation to engineering skill formation exist through the Awards system and, more recently, the requirements for registration.

A lower level of engagement between the multinationals and Federal and State governments was also indicated across all three multinationals, with there being a focus on individual negotiations between firms and government representatives (Crouch, 2010). As a result, there were few examples of skill interventions, and where these did occur, they tended to be firm-specific, and so had no effect on the outputs of the engineering skill system. As such, both Systems Corp AU and Wings Corp AU have been categorised as low, while Defence Org AU, due to its engagement with the federal government in relation to funding for engineering skill development has been categorised as medium.

There is less evidence of variation within the Australian case, most likely because there is, in general, less evidence of the multinationals studied engaging with actors within the

engineering skill system than in the UK case. These firms do not actively shape the engineering skill system, or to work collectively on skill formation that becomes an embedded resource for professional engineers, with the exception of the soft skill provision offered by the sector trade association. All three multinationals interact with the sector trade association's services related to soft skill development, through similar routes as those seen in the UK case with the PEI's soft skill development activities. As such, each of the three multinationals has been categorised as medium engagement with the trade association. Their engagement indicates that these firms may be prepared to support and, in some cases, fund these types of activities. This is the only example of any of the multinationals studied participating in sector-based activities that actively shape the engineering skill system, or that are 'collective' and that could be considered an embedded resource.

TABLE 5-2 VARIATION ACROSS THE MULTINATIONALS

Variation in interaction across the multinationals with different institutions			
	Professional Association	The State	Collective Organisations
Wings Corp AU	Low Some evidence of engagement with technical society	Low in relation to skills Evidence of engagement with State government, but not engineering skills related	Union: Low in relation to skills Trade Association: Medium Fund, contribute to and attend
Systems Corp AU	Low Some evidence of engagement with technical society	Low in relation to skills Evidence of engagement with State government, some impact on engineering skills, but not direct	Union: Low in relation to skills Trade Association: Medium Fund, contribute to and attend
Defence Org Au	Low Some evidence of engagement with technical society	Medium Federal funding recipient for defence, for engineering skill development	Union: Low in relation to skills Trade Association: Medium Fund, contribute to and attend

5.4 COMPARING INSTITUTIONAL CONFIGURATIONS IN THE UK AND AUSTRALIA

In both countries there are a number of actors within the engineering skill system that are involved in skill formation for professional engineers. These actors appear to create conditions at a sector level for skill formation that differ from the national architecture expected in liberal market economies as outlined in Chapter Two (Section 2.3). This differentiation includes the role of PEIs in accrediting university provision, as argued in Chapter Four (Section 4.3).

Drawing on the analysis of the routes and intensity with which each of the multinationals engages with each group of actors (in Sections 5.2.4 and 5.3.4) that were summarised in Tables 5.1 and 5.2, this section draws comparisons across the two country cases. There are some similarities in the role of the multinationals studied across the two countries, particularly in relation to soft skill formation. However, there is also variation between countries, in terms of how much the multinationals studied engage with each group of actors, the types of skill formation activity they engage in, and whether the skill formation activities result in ‘embedded’ resources that are available to other firms in the sector.

Table 5.3 provides an overview of broad cross-country differences in the way that the multinationals engaged with different groups within the skills system. As there was variation within the previous categories (high/medium/low) between firms, the criteria used to describe how these firms engage in each country case are split into categories of high or low. Where most of the firms engaged mostly at a combination of high and/or medium levels with a group in one country, this has been termed high. Where firms engaged at mostly low, or low/medium combinations these have been termed low.

One of the main differences across the two country cases is in the engagement of these firms with the PEIs, and Chartership versus collective organisations and state intervention. In the UK case, the role of the PEIs and chartership seem to be legitimised by the firms studied, and the PEIs play a greater role in engineering skill formation than unions. The UK government’s approach has been to continue to increase the supply of skills and rely on soft (or voluntarist) regulation such as chartership. This approach is a continuation of a historic approach in the UK discussed in Chapter Four (Section 4.4) which saw the creation of the Engineering Council as opposed to mandatory registration.

The multinationals studied all actively support and, in many ways, legitimise the chartership process within their organisations as part of their enforcement of standards as a corporate hierarchy (Crouch et al., 1999, Sako, 2017). This indicates that where hard regulation is absent, these dominant firms may utilise other institutions to support them in enforcing standards inside their firms in relation to skill development.

In comparison, collective organisations and ‘the state’ play a greater role in Australia. Federal and State governments in Australia and Victoria have continued to rely on hard regulation, enforced through the Industrial Relations system through modern awards and EBAs, and new legislation calling for registration of engineers. This approach externalises some standard setting activities and enforces these onto the multinationals studied, such as job classifications, pay structures and training practices.

TABLE 5-3 THE MULTINATIONALS AND INSTITUTIONS IN THE ENGINEERING SKILL SYSTEM

Institutions	How do the multinationals interact with these institutions in relation to skills?	
	UK	Australia
The State	Through government infrastructure: High Skills as collective good: narrow technical skills, and a dominance of needs of multinationals	Individual negotiations Low in relation to skill development

	Individual firms: firm-specific skills	Few skills examples, but those found focus on firm-specific skills
Corporatist Organisations	No engagement in relation to engineering skill formation	Union: Low Individual disputes or EBA negotiations Trade Association: High Participation (via membership and services), financial, managerial, lobbying/coordinating
Professional Associations	High Chartership used as a form of quality assurance. Activities are also supported by the multinationals	Low Less engagement with chartership process, some with events held by affiliated technical society

This approach also places skills within the negotiation remit of the engineers' union. The use of hard regulation may be one reason why the multinationals in the Australian case engage at much lower levels with the sole PEI.

The second difference between the two countries is that the multinationals interact or engage with 'the state' in different ways, though in both countries the dominance of these firms as actors has been highlighted. In the UK, the multinationals have been encouraged to engage with the UK government collectively through the AGP and to engage in funding skill programmes for the sector as a collective resource. The skills produced from these programmes tend to be narrow in focus and technically specialist and designed to meet the needs of the multinationals but not necessarily other firms in the sector. There is also evidence of the multinationals using government infrastructure such as the catapult centres for firm-based training.

In comparison, in the Australian case there was less evidence of the multinationals engaging with either Federal or State governments. Where the multinationals did engage with either government, this was done on an individual firm level, supporting other research suggesting that 'giant firms' prefer to negotiate with governments in this way (e.g. Crouch, 2010).

Engagement between the multinationals and government at both levels resulted in firm-specific training (whether technical or soft) and there were no examples found of the multinationals seeking to shape the broader engineering skill system through this engagement.

In both countries, the multinationals also interact with some actors in relation to the production of soft skills as a collective good (as indicated in Table 5.3), though the institutions themselves differ: the aerospace trade association undertakes these activities in Australia while the sector PEI is responsible in the UK. In both cases, this soft skill provision becomes a collective resource available either to other firms or engineers who are members of the partner organisation.

The different institutional configurations in both countries are depicted in Figure 5A (looking at the UK) and Figure 5B (Australia) below. The diagrams visually depict the different actors within the engineering skill system in each country, how the multinationals tend to engage with them, and whether the skill formation activities are collective or individual.

FIGURE 5:A THE UK ENGINEERING SKILL SYSTEM

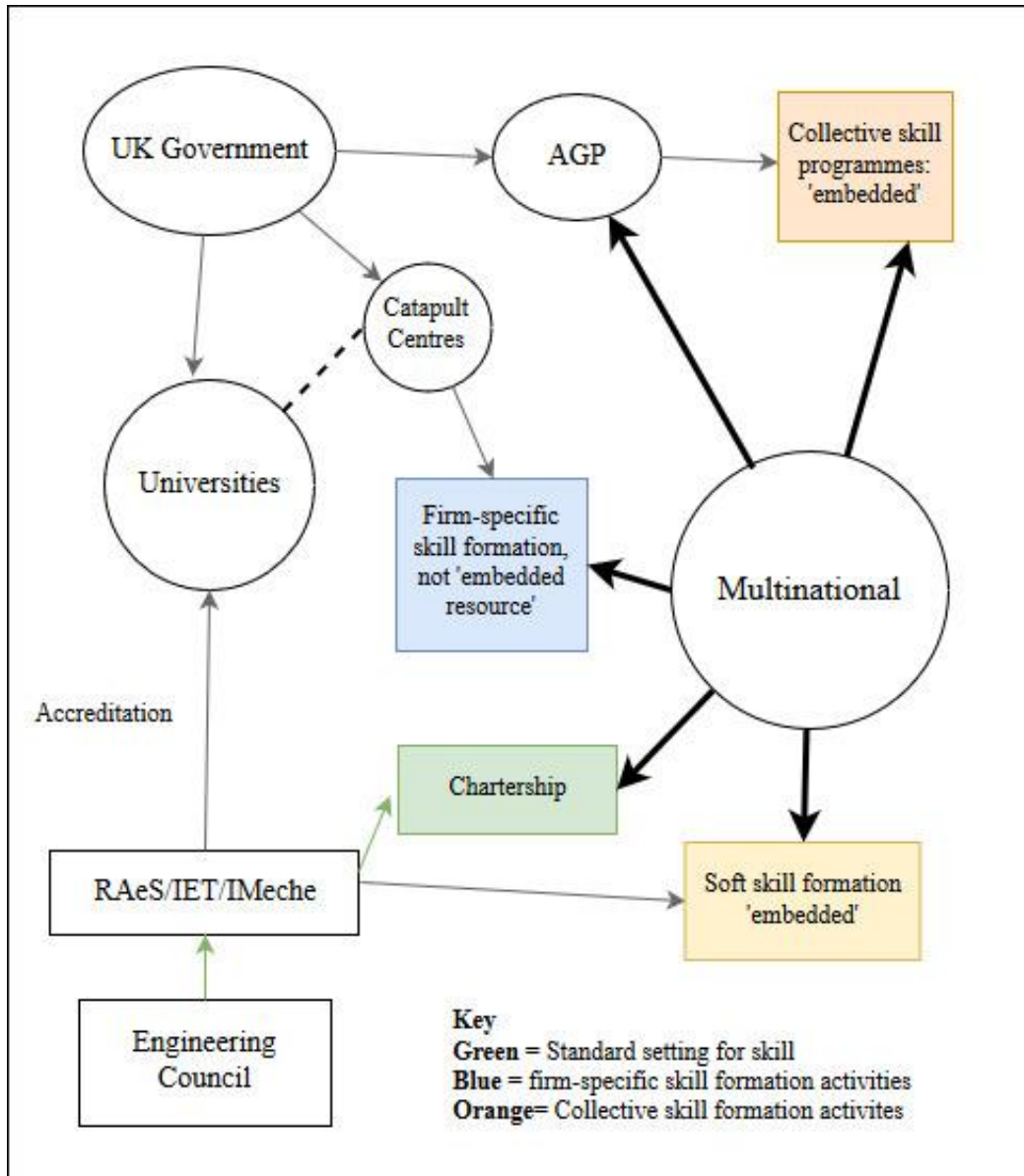
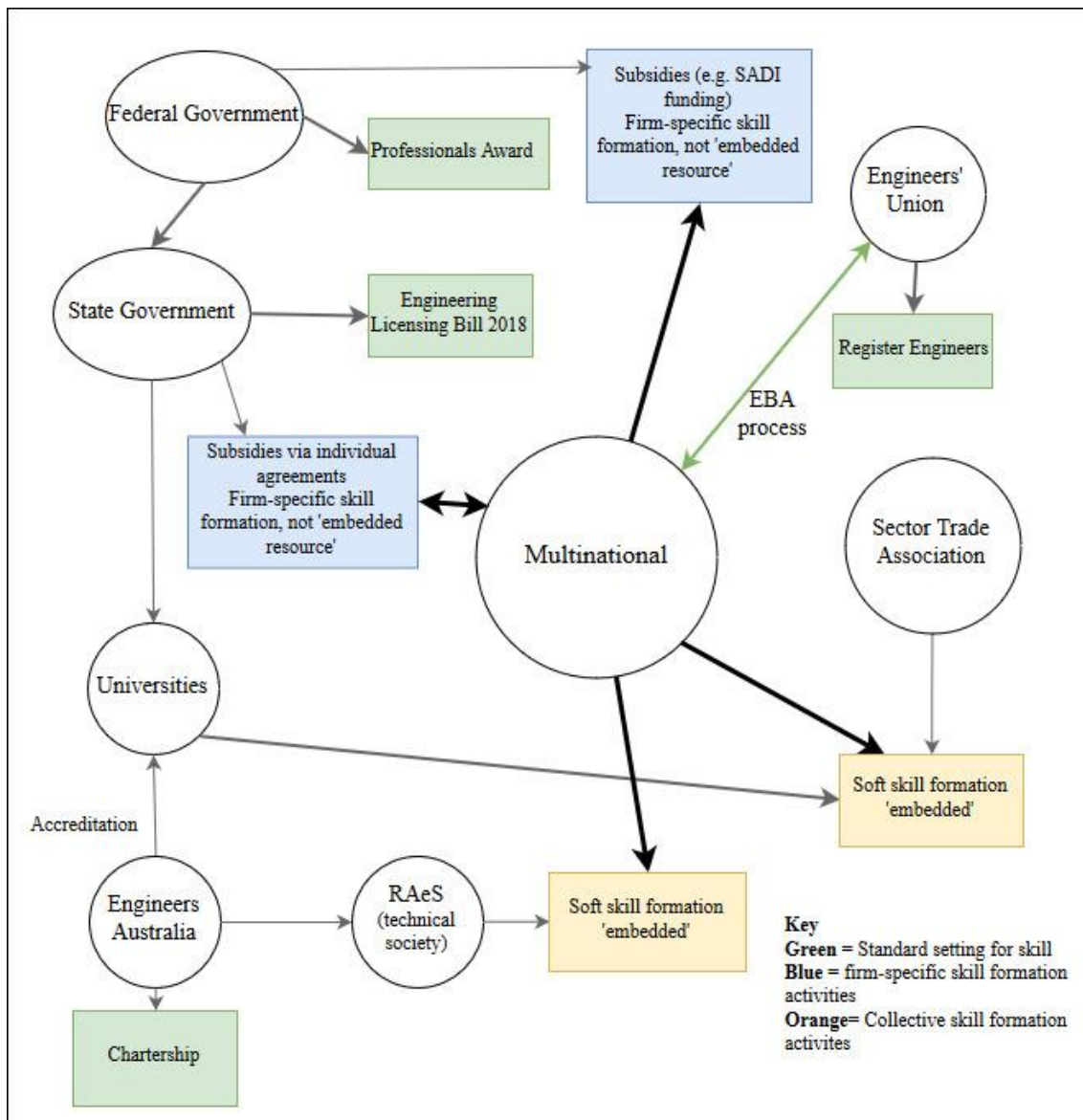


FIGURE 5:B THE AUSTRALIAN SKILL SYSTEM



5.5 CONCLUSION

There are several similarities between the two country cases, and some distinct differences.

The historically divergent approaches by governments in each country can be argued to have resulted in different mechanisms for standard setting, such as soft or voluntarist versus hard regulation. These differences have impacted how the multinationals studied engage with

different actors in the engineering skill system. Finally, whether any of the skill formation activities have become ‘embedded resources’ that may indicate institutional experimentation has been analysed, though there are very few examples that meet these criteria.

In both countries, there is evidence that the multinationals do engage with some of the actors within the engineering skill system, but little to no evidence of them shaping skill formation for engineers more broadly. There are some examples where firms have attempted to shape skill formation in the UK, though this type of activity seems relatively limited, but there is far less evidence of this type of activity in the Australian case. In the UK, these efforts have resulted in collectively developed and embedded resources for engineering skill formation where the skill outcomes are narrow and better suited to the needs of the multinationals than other firms. The multinationals studied in both countries have also participated in the development of soft skills as a collective good, with the offerings by RAeS (UK) and the sector trade association (Australia) being shaped by the multinationals, and available to other firms in the sector.

The following chapter considers whether the multinationals studied suffer from the skill mismatches, shortages and gaps predicted in Chapters Two and Four, and the extent to which these firms engage with universities. The chapter also identifies whether, as indicated in this chapter, these firms have developed their own firm-specific solutions to their future skill needs through their relationships with universities.

CHAPTER 6 THE MULTINATIONALS AND UNIVERSITIES

6.1 INTRODUCTION

The primary route of initial training for professional engineers in both the UK and Australia is through graduate and post-graduate study at university. In both countries, there are concerns about shortages of engineering graduates, and an acknowledgement that the disconnect between universities and firms may result in a lag in terms of curriculum content, and perceived soft skill mismatches, although the discourse in relation to sector-based skill shortages is greater at a sector level in the UK (Section 4.5). This chapter analyses whether these conditions affect the multinationals studied. Do these firms suffer from skill shortages in relation to recruiting graduate engineers?

There is also the question of whether the multinationals studied have developed relationships with universities in the UK or Australia, and whether these firms potentially shape skill formation for professional engineers? Examples were recounted in Chapter Two (Section 2.3.5) where multinationals have developed innovation relationships with universities, or have embedded themselves within regional skill networks (Tregaskis and Almond, 2017, Lam, 2007). These studies illustrate that it may be possible for multinationals to shape skill formation activities at universities through these forms of activity, though questions remain about the extent to which this occurs. This chapter draws on the research data to examine whether the firms studied have developed any form of relationship with universities in both countries, and then if so, the extent to which these relationships may be used to shape skill formation for professional engineers.

First, the chapter addresses the question of whether the multinationals studied suffer from skill shortages in relation to graduate recruitment, and if not, whether, and why they may have developed relationships with universities. Then the chapter looks more closely at whether the firms studied have developed innovation relationships with universities in either country, whether these formal relationships are managed at a ‘local’ level by the subsidiary or at a ‘global’ level by headquarters, and if there are any skill components. Finally, the chapter looks in greater depth at the relationships discovered, and the degree to which they enable these firms to shape skill formation activities.

The discussion throughout the chapter analyses the country cases together, as not only are there similarities across the higher education systems, as discussed in Chapter Four (Section 4.4), but also a high level of homogeneity across the multinationals in terms of how they engage with universities regardless of country. Any differences across the countries are highlighted where they exist.

6.2 THE MULTINATIONALS, RECRUITMENT AND SKILL SHORTAGES?

Are the multinationals in each country suffering from skill shortages in relation to graduate recruitment, and is recruitment the sole driver of their interaction with universities? While none of the managers spoken to explicitly stated that their firms did not suffer from skill shortages, for the most part, these firms do not seem to be struggling to recruit graduate engineers. In many cases the firms reported having more applicants than places:

We have a graduate intern programme for our engineers that is quite well established and very successful. We do get very highly capable – best in class – engineers into our graduate programme.

A4, HR Partner, Wings Corp, Australia

In the UK, where higher apprenticeships form an alternative route to a graduate degree, the three multinationals who offer these, Engines Ltd UK, Flight Ltd UK and Defence Org UK,

also receive higher numbers of applications than they have places. The volume of applicants for graduate schemes and higher apprenticeships that these firms receive, indicates that they do not appear to be suffering from any shortages in relation to entry level engineering positions. Other interviews, such as with one of the regional trade associations in the UK, highlighted that this was not the case for SMEs in the sector.

In the UK context, there are also a number of examples that challenge the claims that the aerospace sector is facing a shortage of graduate engineers. For one, a number of actors in the sector, including academics, do not believe there to be a shortage, and one respondent pointed to the contradictions within the figures quoted in the sector reports:

We finally pulled together a number of [higher education institutions), by the headline level the country is short of 40,000 engineers and scientists, technologists each year, yet none of the academics in that room believed there was a shortage of people.

B25 A, Skills Programme, UK

If you look at [Sector body] annual report, 70% of companies say that skills will be a barrier to growth. It might be 60%, but it's always over 50%. In the same report, for advanced engineering companies, 5% report a skills gap due to lack of advanced engineering skills. Square that circle.

B25 B, Skills Programme, UK

In another example, the sector PEI, RAeS, anecdotally recounted that they are still receiving a significant number of requests through their careers service from engineering graduates who are struggling to find jobs (B17, Sector PEI, Interview notes). These examples triangulate each other, and illustrate that in the UK case there is scepticism about the veracity of the claims that the aerospace sector is facing an engineering skills shortage. A similar lack of evidence of a shortage was found in the Australian case.

However, in both countries, all of the multinationals studied have developed some form of relationship with a small number of universities. This prompts the question, which universities have these firms developed relationships with and why? There are a small

number of examples where these firms engage with some universities purely as a means to recruit graduate engineers. One such example would be Defence Org AU/UK where the firm has subsidiary sites located outside of major urban areas. Interviews with Defence Org managers in both countries identified that the firm has built relationships for recruitment with a small number of universities who are located in close geographical proximity to these subsidiaries, as a means of recruiting the graduates needed:

We've entered into an agreement with [One regional university near a Defence Org AU subsidiary], and we are funding a number of scholarships. ... And we will aim to have that relationship with other universities around Australia.

A10, Resourcing Director, Australia

A lot depends on the universities in those regional areas as well. What we tend to do is, when we are recruiting, especially when we are after graduates, we will link up to those universities.

B35, Engineering Director, Defence Org, UK

However, a regionally driven need for recruitment was only found in a small number of cases.

In the many of the other examples of firm/university relationships, interviews with managers from both countries indicated that their engagement was driven by teaching specialisms and whether each university offered graduate and post-graduate courses developed for the aerospace sector. In the Australian case, only a small number of universities offer specialist courses that meet the sector's skill needs:

In Australia there are not that many universities ... where you can get a degree or higher degree in the aerospace field... I think it's about eight or nine that have dedicated training in our areas of interest

A6, General Manager R&T, Wings Corp, Australia

While there have always been a smaller number of universities that have specialised in these areas, this has likely also been exacerbated by the waves of mergers within the higher education sector discussed in Chapter Four (Section 4.4). Several of these universities were previously either technology institutes or newer, teaching focused institutions.

In comparison, in the UK case, many of the universities (though not all) that the multinationals engage with are part of the Russell Group, which tend to be the most research intensive. There are indications that this may be changing in the future for some of the firms:

It's probably fair to say we tend to focus on the Russell Group of universities, but we are increasingly starting to think differently ... now we are orientating our graduate recruitment processes to actually start relationships with new universities - and when I say universities the full range, everything that was a polytechnic and all the colleges and so forth.

B35, Engineering Director, Defence Org, UK

Part of what is driving the changing approach in the UK context to university engagement is a concern by some of the multinationals about emerging skill needs linked to technological innovation.

A similar concern was not explicitly stated in the interviews with managers in the Australian context, most likely because of the smaller number of universities that offer specialist graduate and post-graduate courses for the sector. However, it should be noted that the universities with specialist engineering programmes also tended to undertake a high level of applied, and collaborative research with industry, and so could also be argued to be at the vanguard of technological innovation. This link between innovation activities and skill needs will be considered in more detail in the next section.

6.3 THE MULTINATIONALS, UNIVERSITIES, INNOVATION RELATIONSHIPS AND EMERGING SKILL NEEDS

Technological innovation is an important characteristic of the aerospace sector (Section 4.2), and the associated product market strategy is likely to mean firms require advanced skills to compete (Crouch et al., 1999). As technological advances in products and processes are implemented, these changes are argued to lead to firms requiring different skills, and so to remain competitive firms must invest in skill formation. The sector requirements for high levels of innovation and research and development have resulted in all of the multinationals

developing some form of relationships with universities in relation to innovation activities.

The following discussion examines whether these firms have also developed relationships with these same universities in relation to skill formation to meet their future skill needs.

The interviews with multinational managers in both countries indicate that all of the multinationals studied engage with universities for innovation. Several of these respondents, primarily Engineering Directors at each firm, describe varying levels of engagement between their firms and universities in relation to innovation; there is evidence of firms collaborating with universities and providing funding for early stage research through to heavily applied commercial research contracts. All of the multinationals have expanded a small number of these innovation relationships to include some elements of skill formation. These will be referred to as ‘innovation plus skills’ relationships.

Variation across the firms has emerged in relation to the number of ‘innovation plus skills’ relationships each firm had developed, and how these are managed. The Engineering Director at Software Ltd UK described only one or two such relationships, developed by himself or his management team. These are managed by the subsidiary which operates with a high level of autonomy. Interviews with a Recruitment Director at Defence Org AU revealed that the Australian subsidiary has only recently begun to convert a small number of its innovation relationships to include skill formation components. These were all also managed at the subsidiary level at the time of research. In both of these cases, these relationships typically include building relationships with certain universities to recruit graduates with specialist skills.

All the other firms have a higher number of ‘innovation plus skills’ relationships that are more mature. Some of these remain managed by the subsidiary, but those considered more ‘strategically’ important are now being managed by headquarters. These ‘strategically

important’ relationships could be considered to be managed globally, and are reminiscent of those found in other high skill sectors such as pharmaceuticals and ICT (Lam, 2007). Table 6-1 indicates which multinationals manage their largest ‘innovation plus skills’ relationships with universities through their headquarters.

TABLE 6-1 MULTINATIONAL ENGAGEMENT WITH UNIVERSITIES

MNC	How is this engagement managed?
Wings Corp AU	Headquarters and subsidiary , network of University and research organisation partnerships
Systems Corp AU	Headquarters (and some subsidiary) , currently two Universities in Australia managed at HQ level
Defence Org AU	Subsidiary
Defence Org UK	Headquarters , this launched in last 12 months and innovation engagement reduced to six universities (all in UK) and a skills component included
Flight Ltd UK	Headquarters and subsidiary , the multinational has global partnerships with four Universities in the UK
Engines Ltd UK	Headquarters and subsidiary, multinational has a network of multinational University research centres
Software Ltd UK	Subsidiary , engagement is driven at subsidiary level

For those multinationals who have developed ‘innovation plus skills’ relationships that are globally managed, these relationships are part of a broader strategy by headquarters to meet a variety of future skill needs. For Engines Ltd UK, Flight Ltd UK and Wings Corp AU, these relationships are more mature and broader in scope and scale, while Defence Org UK has only recently shifted from managing these relationships at subsidiary to a headquarters level.

There is an underlying understanding that the curriculums for graduate and post-graduate programmes at these universities are informed by the content of technological or research programmes that they undertake:

We have got special relationships with about six universities ...we'll make a big contribution to their technological centres, we'll do bursaries, sponsorships, because they have technological or research programmes that are of interest to us.

B35, Engineering Director, Defence Org, UK

At [5 universities in Australia] we have research projects for slightly different areas of interest but equally all of them are important talent pipelines for us, graduates coming out of those universities end up working for us either in our engineering group or our research group.

Research and Technology Manager, Wings Corp, AU

Scholarships and bursaries seem to be used to support this targeted recruitment.

Globally managed 'innovation plus skills' relationships appear to be highly specialised. A multinational may have a relationship with one university for manufacturing engineering, another for composites, aerodynamics or combustion. Together, these relationships cover the range of each firm's research interests, and at a subsidiary level enable some of these firms to target recruitment for certain engineering specialisms:

We're very close to [one university] because they are manufacturing engineering specialists... We have [Engines Ltd] R&T university centres. We get to know the teaching staff well, the research staff well, they are briefed and understand what our training programs are. We should do well at recruiting from [the above university] for manufacturing.

B41, Training Director, Engines Ltd, UK

What this form of 'innovation plus skills' relationship indicates is that these multinationals are not relying on market coordination to supply the skills that they require. Instead, these firms, driven by their product market strategy (Crouch et al., 1999), are not only investing in skill development within their firms, but are also using their innovation relationships to ensure they have access to the future skills they need.

The following section considers the content of these 'innovation plus skills' relationships further, looking at how these firms are using these relationships to directly shape skill formation within these universities for engineers.

6.4 TO WHAT EXTENT DO THE MULTINATIONALS SHAPE ENGINEERING SKILL FORMATION WITHIN UNIVERSITIES?

The following sections delve into the skills components that are part of these ‘innovation plus skills’ relationships, and how they provide means for these firms to shape the curricula for graduate and undergraduate courses, to recruit graduate engineers and provide them with firm-specific knowledge and skills, and to engage in skill formation activities for their existing workforce.

6.4.1 THE MULTINATIONALS, UNIVERSITIES AND SHAPING COURSE CURRICULUM

All the multinationals studied excepting Defence Org AU and Software Ltd UK (details of this and other variation are outlined in Table 6.2 in Section 6.3.4) have developed routes to advise the universities they have developed ‘innovation plus skills’ relationships with about their skill needs. Interviews with managers from these firms, and academics at some of these universities indicate that these firms either communicate their skill needs via formal routes (e.g. through sitting on various boards) or informally (e.g. through meetings with academics). Both formal and informal routes are used to communicate firm skill requirements, and for the managers from these multinationals to provide their opinions on the curriculum. The formal routes include industry advisory boards set up by the universities, and the research boards attached to the research centres that undertake innovation activities funded by the multinationals.

One of the primary differences across the UK and Australia is that the multinationals in the UK use these formal routes to advise academics of their skill needs:

We have a representative from Defence Org and Flight Ltd UK on the external advisory panel of the institute. The institute keeps them informed of what's happening across the campus and they advise us and keep us informed of future needs in the sector.

B36, Director of Aerospace Research Centre, University B, UK

In comparison, the multinationals in Australia tend to use more informal means to convey their firm's skill needs to universities. Representatives from two of the multinationals, Wings Corp AU and Systems Corp, openly discussed meetings between their managers (often engineering directors) and academics from the universities, where the firm representatives discussed their skill needs and how courses could be adapted to better match their firm's requirements:

I am on the industry advisory board for the [University C's] research centre, but that's more around the research activity that they're doing, not so much the graduate activity ... There have been two recent meetings where he's [The engineering manager] been able to dictate, no not dictate, convey ... information back through the Universities to say, we think that the curriculum needs a stronger emphasis on X or Y.

A6, General Manager, R&T, Wings Corp, Australia

In both formal and informal routes, the multinationals seek to shape the content of the curriculum for engineering courses (both under- and postgraduate).

The curricula of engineering courses typically focus on the content of theoretical and technical knowledge. The implication is that by seeking to shape the curricula, these firms are seeking to shape the technical and theoretical skill development that students receive to better suit their firm's needs. The interviews indicate that this form of input from the multinationals is valued by academics at these universities, as tailoring their curricula to better suit the multinationals' skill needs is seen to make these graduates more employable for these firms:

They [the multinationals] can advise you also on the teaching program, modules, syllabus, so your syllabus remains up to date, providing your graduates with the appropriate skills which then means they have preferential treatment when they apply for jobs.

B36, Director of Aerospace Research Centre, University B, UK

The interviews suggest that the engagement of the multinationals with universities is mutually beneficial as engineering graduates' and post-graduates' learning is more closely tailored to the needs of industry, or at least the dominant employers in the sector. These findings support other research discussed in Chapters Two and Four focusing on employer involvement in course design (amongst other engagement) and how this can improve the employability of students (Mason et al., 2009).

However, the interaction between these firms and this small number of universities may also suggest a narrowing of the content of engineering courses as technical and theoretical skill formation is tailored to the needs of the multinationals. In Chapter Five (Section 5.2.2), the discussion of the UK case indicated that there are distinct differences in skill needs between the multinationals and other firms in the sector, specifically in relation to how specialised technical skill formation becomes (e.g. the MSc bursary scheme). Applying a similar logic to engineering skill formation at universities, it raises the question of whether the tailoring of courses to the skill needs of the multinationals impacts on other smaller firms in the sector.

The ability of the multinationals to influence curriculum content at some universities could also explain why in Chapter Five (Section 5.2.1; 5.3.1) these firms were not found to engage with the PEIs in relation to their course accreditation activities. These multinationals are able to shape the curriculum prior to the accreditation process, within universities they have built 'innovation plus skills' relationships with. Therefore, there is less impetus for them to try and influence the accreditation of or standard setting for other engineering courses.

6.4.2 THE MULTINATIONALS AND THE DEVELOPMENT OF FIRM-SPECIFIC SKILLS

In addition to using informal or formal routes to advise universities of their skill needs and to shape the curriculum content, there is evidence that the multinationals in both countries also engage with universities to develop firm-specific knowledge and skills in engineering graduates. The interviews from both the UK and Australia suggest that this happens in three

ways: through the multinational managers giving lectures as part of the course, through the firms offering a variety of internships, and through enabling predominantly masters level or above students to work on research projects funded by the multinationals as part of their degree.

All the multinationals studied engage in at least one of these activities, while several engaged in all three (see Table 6.2 in Section 6.3.4):

Some of our senior managers are working closely with the universities to adjust or contribute to their course offerings, by doing projects within Systems Corp, lecturing or providing information on, for example, mission critical systems ... We try and get Industry Based Learning internships and then hopefully they join us, move into a graduate programme.

A12, Resourcing Manager, Systems Corp, Australia

There is evidence that Software Ltd UK participates in lectures and internships, Defence Org (UK and AU) offers internships, and some participation on research projects, while Wings Corp, Engines Ltd, Systems Corp AU and Flight Ltd UK participate in all three types of engagement though to varying degrees.

The multinationals whose managers participate in lectures argue that doing so raises their firm's visibility with students, aiding recruitment, as well as providing students with some (if basic) firm-specific knowledge:

We try and get a lecture that's part of the course. If they are teaching something about formal methods or high integrity, or real-time or security, then we can go and talk about our approach and how that applies to that particular problem... I think it at least gives students more of an opportunity to understand us and make an informed decision

B15, Engineering Director, Software Ltd UKUK

The evidence suggests that the lectures provided by the multinational managers are in areas of specialism for the multinationals. This is illustrated in the quote above, as Software Ltd UK designs high integrity systems used in air traffic management, so their lecture would talk about this topic in relation to their firm's approach. While this only provides basic knowledge about each participating multinational, it does also serve to start to interlink the theoretical knowledge taught on graduate programmes with application of that knowledge in practice. The direct contributions of these firms to the curriculum through delivering lectures also shapes the understanding of certain topics for the students and contributes to their technical skill development. Engineering students' first understanding of the application of theoretical knowledge in these areas is thus through the lens of the activities of these multinationals as opposed to the broader industry.

The second way that the multinationals studied in both countries recruit engineering graduates and develop firm-specific knowledge and skills is through offering a variety of internship programmes ranging from several-week placements to a year. These programmes are not compulsory so only benefit successful applicants but provide a form of tacit or experiential skill development for graduate engineers, as well as providing students who participate with firm-specific knowledge.

If graduate engineers perform well, the interviews indicate that the multinationals often seek to recruit them at the end of their course:

[Defence Org] had summer internships [for first years] to do a 10-week placement. I applied for that...after my second year I did a year placement at the company and that consists of four different placements. I went from R&T, I did some testing, I looked at designing fuel systems and some customer support ...and then I came back to do my final summer placement

B21, Engineer, Defence Org, UK

These internships are offered at various points during the degree and are meant to provide the graduates with (potentially) their first experience of putting their theoretical engineering knowledge into practice, and can allow the engineering students to develop a range of technical and soft knowledge and skills that are primarily firm-specific.

While internships are common outside of engineering, it is important to reiterate the role of experience and tacit knowledge within engineering, and the level of engagement from the multinationals studied, offering sometimes not one but several types of internship. The multinationals use of multiple internships is reminiscent of sandwich course design (periods of study interspersed with occupational placements), though in these cases it is not mandatory for graduates to undertake work experience.

Doing so, however, is acknowledged in the interviews with managers and engineers from the multinationals in both countries to make graduates more employable. This supports other studies where structured work experience and employer involvement in degree course design and delivery were found to result in higher employment for graduates in graduate level jobs (Mason et al., 2009). The discussion about skill shortages and mismatches in both countries in Chapter Four (Section 4.5) also highlighted the importance of soft skills for engineers to employers. As internships develop both technical and soft skills that are firm-specific, their use by the multinationals studied may be another route for these firms to ensure the engineering graduates they hire have the appropriate skills.

The final way that the multinationals recruit and develop technical and firm-specific knowledge and skills is by enabling masters and PhD students to work on research funded by their firm, often through the university research centres. This form of engagement only occurs at universities where the multinationals have innovation relationships, as this requires

these firms to be working in collaboration with researchers or a research centre on either applied research for the firm or a series of research projects funded by the firm.

One illustration of this would be that both Engines Ltd UK and Flight Ltd UK fund applied research projects at University A. It is common practice for both PhD and Masters students to work on these projects, and be assigned both an academic and industry supervisor, typically one of the multinational managers (Interview Notes, B39, Academic, University A, UK). The interviews with academics at universities indicate that for masters students these research projects are often applied, (e.g. testing products for the firm) and so the content of the research projects provide the students with some firm-specific knowledge. In both countries, the multinationals who participate in this activity also provide managers to co-supervise, and this can result in direct recruitment of masters students who perform well (i.e. impress the industry supervisor).

For PhD students, this process is even more widespread. The interviews indicate that nearly all of the multinationals (except Software Ltd) offer some form of sponsorship for PhDs as part of their 'innovation plus skills' relationships. In many cases, the multinationals not only sponsor the student but encourage them to spend time at their firm, provide one of their engineers as co-supervisor, and have the PhD student working on a multinational funded research project that has direct interest for their firm:

We have a centre for doctoral training on materials [composites] ... These are four-year PhD programs and you have industrial sponsors... You spend time with the company and you work on a project of direct value to them. Of course, after four years of investment, they would like to retain you.

B36, Director of Aerospace Research Centre, University B, UK

In these instances, the multinational is funding and so sets some of the parameters on the research project, and has input into the skill formation of the PhD researcher through co-supervising and having the student spend time at their sites. This suggests that during the

process of the PhD research, the multinational is able to shape some of the skill development activities and experiences that the PhD student undergoes, meaning the skill needs of the firm and the technical skill-set and knowledge of the student are more closely aligned.

For several of the multinationals studied, funding PhD students alongside their innovation activities at these universities provides a means to recruit highly skilled and specialised STEM workers, who through working on firm-funded research projects have highly specialised knowledge that is both firm-specific, and of direct interest to the multinational:

It's around the expertise of a certain professor, [who] will often have PhDs and post docs working for them. Having that little solar system of activity... that is interesting and tailored for us, brings their expertise up. Any one of those PhD graduates become interesting talent for us.

A6, General Manager R&T, Wings Corp, Australia

The interviews indicate that for PhD students, this process involves the development of firm-specific knowledge alongside highly specialised technical skills and it is this combination that makes the PhDs working on the multinational funded research projects such attractive recruitment prospects.

Managers at the multinationals referred primarily to the recruitment of PhDs working on research projects they have funded. These examples support and expand on the findings from previous research on innovation relationships between multinationals and universities (Section 2.3.5) and show that in addition to these relationships resulting in the emergence of hybrid career paths (Lam, 2007), they may also be used by firms as a means to both recruit and to tailor the skill formation of highly specialised engineers to meet their firm's needs. The recruitment of PhDs and masters students who have worked on firm research projects may also be one way that these firms have developed to access skills related to emerging areas of technological innovation. The use of research projects may be a means of tailoring

technical skill development in emerging areas of technological innovation, and one way of planning for future recruitment needs.

All three routes, and the broader implications of the way these enable the multinationals to shape technical and soft skill formation for graduate and post-graduate engineers, raise again the impact of employer involvement in training and development. The impact of the involvement of multinationals may be positive, such as increased employability, and potentially also negative, resulting in a narrowing of skill development.

6.4.3 'INNOVATION PLUS SKILLS' RELATIONSHIPS AND SKILL FORMATION FOR THE EXISTING WORKFORCE

The above forms of engagement have discussed how the multinationals are able to shape skill formation for engineering graduates and post-graduates at universities. This section discusses how these firms use their 'innovation plus skills relationships' to engage in primarily technical skill formation in relation to their existing engineers. The interviews with managers from the firms in both countries indicate that, when this occurs, it is often in relation to emerging areas of technology. The three firms where these relationships are the most mature, Engines Ltd UK, Flight Ltd UK and Wings Corp AU, engage the most in these forms of skill formation, typically including bespoke or customised training, more ad-hoc forms of skill formation such as inviting academics to give lectures on subsidiary sites, or the use of formal training programmes such as masters or PhD programmes.

Engines Ltd UK's Training Director described how the firm has shifted from accepting "off the shelf" courses towards bespoke training programmes designed specifically to meet their skill requirements. Bespoke training courses are often contracted through the firm's network of 'university centres', their terminology for the 'innovation plus skills' relationships they have developed, and tend to be shorter in duration:

We started treating things differently. We don't go to the university and say, "Let's have a look at your catalogue. Have you got something that might do X." We say, "We need XYZ knowledge in this context to these types of people. Can you do it?" And usually, they say yes.

B41, Training Director, Engines Ltd, UK

This shift is reminiscent of some of the discussion in Chapter Two (Section 2.2.3), on the role of the firm as a corporate hierarchy where 'institutional firms' were described in the US case as using both "off the shelf" and government subsidised custom training through universities as a way of increasing the skills of and retaining employees (Crouch et al., 1999). However, here, in the UK case, these bespoke training programmes are not subsidised by the state, and are driven by the skill needs of Engines Ltd UK as they relate to innovation, and reflect a movement away from broader skill formation, towards narrower and more firm-specific requirements.

The second form of skill formation activity is the ad-hoc use of academic staff from these universities to deliver lectures on areas of emerging innovation that relate to the firm-funded innovation projects. In one example, academics from one research centre receiving funding from Flight Ltd UK are invited to the multinational subsidiary sites to provide lectures on specialist areas such as composites, and findings from the research projects funded by the firm:

We can give invited lectures, we go to their company [to advise about composites], or it can be to keep them up to date with the research that we do, the findings.

B36, Director of Aerospace Research Centre, University B, UK

In this instance, Flight Ltd UK has been able to develop the technical skills and knowledge of its engineers in relation to composite materials through these lectures, ensuring that the knowledge generated by the research activity it is funding is disseminated to its subsidiary sites. There is evidence that these forms of bespoke training activities happen at several of the multinationals for engineers in both countries, and again typically focus on technical skill formation in areas of emerging technology.

Third, several of the multinationals in both countries discussed how they encourage some of their engineers to undertake formal training programmes at these same universities, including masters and PhD:

We'll plug into university programmes, we do PhDs, some of our folks are doing PhDs that are then co-supervised and supported by the company in universities that we work with.

A6, General Manager R&T, Wings Corp AU, Australia

Interviews with both managers and some engineers indicate that access to this form of skill formation is controlled by multinational managers and driven by business requirements for certain technical skill sets:

I would like to further my technical knowledge on the aerodynamics side... potentially doing a masters... aerodynamics, it's quite a technical area. You need people that are trained in it to do it... there will be a, not necessarily budget but a need in the business to have more aerodynamicists. That will also come into my business case.

B43, Engineer, Defence Org, UK

The quote above illustrates how the engagement between the multinationals studied and universities for their existing engineers is driven by technical skill needs and is often highly specialised. Arguably, as the multinationals already engage with this small number of universities and have developed various routes of engagement that enable them to shape (and potentially narrow) skill formation to better suit their skill needs, it would make sense for these firms to then use these same courses they have shaped to upskill their own engineers (albeit in small numbers).

From the data it could be argued that many of the multinationals studied have embedded themselves within a handful of universities in both countries through a mixture of innovation and skills-based activities. They use these relationships to shape skill formation for engineering students (graduate, post graduate and PhD) and some of these firms' own engineers. The universities that the multinationals have these relationships with tend to be

those where the firms have developed ‘innovation plus skills’ relationships, some of which are managed by the multinationals’ headquarters.

The evidence suggests that the multinationals studied embed on multiple levels, financially with scholarships and research programmes, politically by engaging with senior management (through formal innovation contracts), pedagogically through contributing to course content and managerially by sitting on advisory boards. While the multinationals only have complete control over the skill formation of their existing engineering workforce, the evidence presented does suggest these firms also have influence within this handful of universities who are willing to adapt their curriculum and course content to meet the multinationals’ requirements. The discussion has highlighted that these firms tend to focus on narrower or more bespoke technical skill formation, or on building firm-specific soft skills with their interventions.

6.3.4 IMPACT ON THE REST OF THE SKILL SYSTEM AND VARIATION ACROSS THE MULTINATIONALS

Many of the ways that the multinationals develop influence within these universities involve financial or employee resources (such as managers’ time). This suggests a level of embeddedness from the multinationals into these Universities, although the director of one research centre argued that this embeddedness isn’t strong enough to shape multinational production decisions such as where to locate manufacturing (Interview Notes, B39, Director of Research Centre, University A, UK). None of the other universities interviewed admitted this, and in fact, rarely discussed their influence over the multinationals. In interviews with academics from these universities, their focus was often instead on the services they provide these firms, such as bespoke skill formation or innovation activities, suggesting that while these firms have significant influence over the universities, this influence appears to be primarily one way.

One other important question raised is what occurs for the multitude of other universities in both countries where the multinationals do not engage. The engineers interviewed from the multinationals studied, who have attended universities where these multinationals do not engage, claimed there is a greater gap between the theoretical knowledge that graduates are taught and in how that knowledge is applied in industry (or at least, within the multinationals):

Some courses provide that during their degree, mine didn't, and it was very much a theoretical course. I guess [University A] guys go in aircraft all the time.

B28, Engineer, multinational not studied, UK

Engineers from these universities noted a lack of integration of more practical elements into the course curriculum with one example being looking inside an aircraft cockpit, to see how various theoretical knowledge is translated into the finished product.

In addition, some of the engineers interviewed who are undertaking higher apprenticeships in the UK context, where the multinationals have not yet built this level of engagement, suggested that there can be a lack of alignment between the theoretical knowledge learned at university with the work they are then actually undertaking at the multinational:

The problem is building the skill. It mainly comes from the fact that obviously in university, we do technical stuff but I don't think it's quite related to what we actually do in Flight Ltd...Even though we do look at stress analysis in university...[when] compared to the stress analysis we do within work, and to try and bridge the gap between the two, there's quite a disparity.

B20, Engineer on Higher Apprenticeship, Flight Ltd, UK

The above quote suggests that, for those universities where the multinationals do not engage, there is a greater focus on theoretical knowledge formation as opposed to application of knowledge, and (perhaps due to a broader curriculum) a greater gap between the course content and what occurs in industry.

Comparing these examples to those relationships cultivated by the multinationals with a small number of universities in each country provides a counterpoint narrative. It highlights that the weaknesses of the engineering skill system (Section 4.5) that have been identified in academic and government reports, such as the disconnect between universities and industry (Webster, 2000, Markes, 2006), still exist for universities where these firms have not developed such relationships. In these instances, there may be a larger gap between the broader theoretical knowledge taught in graduate or post-graduate courses and how this knowledge is applied in the workplace.

In comparison, where the firms studied have built sub-national and firm-specific pockets of demand-led skill development, these relationships produce narrower and more industry specific technical skills, alongside soft skills and firm-specific knowledge. The increased employability of the graduates, and the hiring power of the individual multinationals due to their size and dominance in the sector, seem to overcome the tensions and conflict inherent in individuals paying for their own industry-oriented skill development.

In summary, the multinationals studied appear to be able to shape engineering skill formation at the handful of universities that they engage with and there are significant similarities in the approaches of these firms across both countries with few differences. One such difference is the types of universities these firms engage with, primarily Russell Groups in the UK, versus a larger number of previously teaching oriented universities in Australia. These can be explained by the different historical trajectories of the higher education system. There are also differences across countries in relation to whether the firms prefer formal (UK) or informal (Australia) routes in shaping curriculum content.

The larger variations occur between the multinationals within both countries. There is variation in the number of 'innovation plus skills' relationships, how mature these

relationships are, and in their scale and scope. Table 6.2 summarises this variation which has been outlined throughout Sections 6.3 and 6.4. The two firms who had a smaller number of these types of relationships were Software Ltd UK and Defence Org AU. In both cases, these relationships were also less mature, and narrower in scale and scope, in terms of how each firm shaped skill formation for graduates and post-graduates. As an example, Software Ltd UK contributes to course content through lectures and internships, while Defence Org AU uses internships and scholarships.

The remainder of the multinationals have all begun to manage their ‘innovation plus skills’ relationships at a global level (i.e. through headquarters). Again, there was variation in the maturity of these relationships. Defence Org UK has only recently shifted towards this approach. Their relationships were slightly narrower in scale and scope, with no evidence of them contributing to course content through lectures, and less evidence of them using these relationships to engage in skill formation for their existing engineers. Engines Ltd UK, Flight Ltd UK and Wings Corp AU had the most mature examples of firm/university relationships in the study, that were the broadest in scale and scope, and had the most examples of skill development for engineers in their existing workforce.

TABLE 6-2 VARIATION ACROSS THE MULTINATIONALS STUDIED IN HOW THEY SHAPE SKILL DEVELOPMENT FOR ENGINEERS

MNC	The ways that the multinationals shape skill development				
	Fund scholarships	Influence curriculum	Contribute to courses	Internships	Provide research projects for masters/PhDs
Wings Corp AU	Yes	Informally	Yes	Yes	Yes
Systems Corp AU	Yes	Informally	Yes	Yes	Yes
Defence Org Au	Yes	No evidence that this takes place	No evidence that this takes place	Yes	Yes, but minimal
Defence Org UK	Yes	Formally	No evidence that this takes place	Yes	Yes
Flight Ltd UK	Yes	Formally	Yes	Yes	Yes
Engines Ltd UK	Yes	Formally and informally	Yes	Yes	Yes
Software Ltd	No evidence that this takes place	No evidence that this takes place	Yes	Yes	No evidence that this takes place

6.5 CONCLUSION

This chapter has sought to answer whether and to what extent the multinationals studied engage with and shape engineering skill development for professional engineers in universities in the UK and Australia. The discussion has highlighted that the multinationals have built relationships with universities, often in combination with innovation activities that enable them to shape university provision. This occurs only for a handful of universities, and not for the broader skill system. The multinationals studied do not seem to do so due to skill shortages, but rather for recruitment, and for emerging skill needs linked to their innovation activities. There are many similarities in the approaches that the multinationals in both countries undertake to shape skill formation at universities. While there is some variation across the firms within each country, all firms engage in several routes, whether financial, experiential or pedagogic. As a result, students at these universities are argued to be more

employable (by these multinationals), though the discussion did note some less positive implications, such as that it may result in a narrowing of skill development.

In many respects, the multinationals have developed a number of routes to build relationships with, and influence skill formation activities at these universities in each country, resulting in pockets or clusters of demand-led and firm coordinated skill development for engineers. The next chapter discusses how these firms develop the skills of existing engineers, examining whether they have developed global skill webs and if so, what impact these have on engineering skill development.

CHAPTER 7 THE MULTINATIONALS, GLOBAL SKILL WEBS AND SKILL DEVELOPMENT

7.1 INTRODUCTION

This chapter discusses whether the multinationals studied have attempted to shift towards global skill webs. If so, the discussion also examines whether the development of this global infrastructure is shaped or mediated by national institutions. The phenomena of global skill webs are argued to have three characteristics: a movement from national pyramids to global webs, the consolidation of power at the centre (i.e. with headquarters), and firms seeking to integrate, align and standardise activities, procedures and HR functions (Ashton et al., 2010). Firm reliance on national skill formation systems is argued to reduce as they are able to use firm-specific global production systems, standardised production, HR, and training practices, and forms of quality checking and benchmarking instead (ibid; Lauder et al., 2008).

A number of questions were raised in Chapter Two (Section 2.3.1) in relation to the scale, scope and operation of global skill webs, and whether they are as encompassing as theoretically predicted. This chapter considers a number of the questions raised, starting with whether there is evidence of the operation of global skill webs across the firms studied. First, whether each firm has adopted any of the three characteristics of global skill webs is discussed. The discussion focuses primarily on those four firms who have developed all of the characteristics of global skill webs. The chapter then examines the drivers of global skill webs: globalisation, global competitiveness resulting in pressure to cut costs and emerging technology. Using these drivers, the chapter questions whether the purpose of global skill webs in the aerospace sector in the firms studied differs from those suggested in the original theory.

Throughout the chapter, any influences from skill formation systems, whether country of origin or host country effects are identified, as are any examples of subsidiary resistance.

The concepts and phenomena being explored within this chapter are firm-specific, and so the analysis focuses primarily on comparing between the multinationals, as opposed to comparing across the two countries. The influence of country level institutions are highlighted where these occur throughout the chapter, through the references to country of origin and host country effects.

7.2 THE MULTINATIONALS AND THE CHARACTERISTICS OF GLOBAL SKILL WEBS

This section analyses whether the multinationals studied have adopted any of the three characteristics of global skill webs: a shift from national pyramids to global webs, a consolidation of power with headquarters, and attempts to integrate, align and standardise activities, procedures and HR functions. Table 7.1 summarises these findings and indicates that all three characteristics were found in four of the multinationals studied, Wings Corp AU, Systems Corp AU, Flight Ltd UK and Engines Ltd UK. For the other two firms, Defence Org (UK and AU) and Software Ltd UK there was either minimal or no evidence found for each. The following sub-sections (7.2.1, 7.2.2 and 7.2.3) then focus on each characteristic of global skill webs in turn.

There are, of course, variations across these four firms in terms of how they have adopted each of the three characteristics of global skill webs, how encompassing these are and what engineers have access to them. These issues are explored in greater detail in the following sections, as is the question of the impact of national institutions.

TABLE 7-1 THE MULTINATIONALS AND BUILDING GLOBAL SKILL WEB INFRASTRUCTURE

Multinational	A shift from national pyramids to global webs	Web like centre of power, or signs of consolidation of power with HQ	Signs of seeking to integrate, align or standardise activities, procedures and HR functions
Wings Corp AU	Yes: Some examples but dependent on types of work and only for certain engineers	Yes: Innovation relationships Industrial relations activities Control over what practices/activities/procedures get standardised. Location of Leadership centre in country of headquarters	Some: For management/talent Leadership centre in country of HQ that oversees some HR practices incl. development and training. Company technical conference. Evidence of attempts for some HR practices for engineers and trades but resisted by trades union at subsidiary level
Systems Corp AU	Yes: Some examples, but dependent on types of work and only for certain engineers	Yes: Innovation relationships Control over what and how practices/activities/procedures get standardised. Control over content.	Yes: HR practices including appraisals. Emergence of job classification schemes. Some training integrated. Some production practices standardised.
Defence Org AU	No: Functions are nationally oriented with minimal overlap between sites	Some: All subsidiaries have significant autonomy	No: No evidence of attempts to standardise, align or integrate practices
Defence Org UK	No: Functions are nationally oriented with minimal overlap between sites	No: All subsidiaries have significant autonomy. HQ attempting to take control of innovation relationships in UK	No: No evidence of attempts to standardise, align or integrate practices
Flight Ltd UK	Yes: Some examples but dependent on types of work and only for certain engineers	Yes: Innovation relationships Control over what practices/activities/procedures get standardised. Location of Leadership centre in country of headquarters.	Some: In the process of setting up a leadership centre in country of HQ that will standardise HR practices incl. appraisals, development, training, coaching for management and talent
Engines Ltd UK	Yes: Some examples but dependent on types of work. For a broader group of engineers	Yes: Innovation relationships Control over what and how practices/activities/procedures get standardised. Control over content.	Yes: Examples of production, HR and training practices standardised/integrated or aligned for the widest group of engineers
Software Ltd UK	Minimal: One project across two sites. Driven and managed by UK subsidiary.	No: Subsidiary has a significant amount of autonomy, and is driving standardisation practices itself.	Minimal: Signs of embryonic cross subsidiary production. One team, using the same production practices/training programmes.

7.2.1 FROM NATIONAL PYRAMIDS TO GLOBAL WEBS?

One of the three characteristics of global skill webs is argued to be multinationals shifting from nationally orchestrated pyramids, to webs, that are indifferent to national, functional and organisational boundaries (Ashton et al., 2010). In the interviews, some examples of indicators used to identify this shift are evidence that firms use cross-nationally organised functions, and evidence of the presence of global teams, where knowledge work is managed across geographically dispersed locations. For two of the multinationals, Software Ltd UK and Defence Org (UK and AU), there is minimal to no evidence of a shift to managing functions, teams or production at a 'global' level as opposed to a national one. In both firms, functions are still primarily organised at either a national or subsidiary level.

As depicted in Table 7.1, interviews with HR Directors or Engineering/Research Directors at each of the four multinationals, Engines Ltd UK, Flight Ltd UK, Systems Corp AU, and Wings Corp AU, indicate some form of shift towards managing some functions on a global as opposed to a national basis. What emerged from these interviews, and other interviews with some of the engineers themselves, is that there is a clear distinction between what might best be described as 'global' work, and physical manufacturing activities. 'Global' work is a term used to describe activities where engineers work in globally organised functions and cross-subsidiary teams.

Research and design are two areas where engineers often operate within global teams, and the four firms employ global research and design teams to speed up, and reduce the cost of, innovation and manufacturing. These teams are built to maximise the number of hours in a day that can be used to work on urgent problems. In one example, research and design engineers at Wings Corp AU work in partnership with engineers in the US on various projects:

The work they [the research engineers at Wings Corp AU] do is a lot different to manufacturing work - it's called Global. It reaches out the other parts of the business as well.

A3, Engineers Union, Australia

We've got design systems where somebody in the UK could be working on this turbine blade today. Somebody in America could pick that up later on today. Somebody in Asia could pick it up after that. In theory, if we've got an urgent problem to solve, we could have round-the-clock or daylight hours always working on this model.

B48, Director, Engines Ltd, UK

One of the defining features of 'global' work is that it involves working closely with other engineers located in other countries. The use of global teams in product design enable the firms, such as the example above from Engines Ltd UK, to work 24 hours a day on a design problem if needed. This has been described as 'chasing the sun' (Ashton et al., 2010).

Another example of 'global' work that was only identified at Systems Corp AU is virtual manufacturing, where teams in the Australian subsidiary work closely with another subsidiary in France. Software engineers from both countries are working as part of a 'global team', designing and coding an air traffic management system for Australian Airspace. The interviews with the Engineering, and HR, Directors at Systems Corp AU indicate that this virtual manufacturing activity occurs primarily for one function within the firm, and that this type of work is as mobile as design work. The eight-hour time difference between the country sites means that the multinational can continue manufacturing from one site to the other, with brief periods of overlap.

While the concept of global teamworking may seem seamless, there is evidence to suggest that the operation of global work undertaken by global teams in virtual manufacturing can be problematic:

It's a massive project, it's very software heavy... lots of code to be developed, there are inherent problems anyway. Where you've got that being developed across two continents with an eight-hour time difference, language differences, and cultural differences you're going to run into problems.

A7 HR Director, Systems Corp, Australia

This raises an important point about the challenges for firms in moving from operations organised, and managed within national pyramids, sharing cultural expectations, language, and the same time zone, to global teams operating across very different conditions. These challenges have been identified in other fields of research such as IHRM or in work on expatriates (e.g. McDonald, 1993), where international placements or work organised across countries can result in problems caused by cultural differences. This example highlights how, even in ‘weightless’ knowledge work (as described in Ashton et al., 2010), such as virtual manufacturing, firms face constraints in integrating engineers across countries.

Virtual manufacturing does appear to be far easier for firms to assimilate into global skill webs than other forms of manufacturing. In part this may be due to the work itself being more mobile (Levi and Ahlquist, 2004), only requiring a shared technological platform and standardised coding practices for engineers to be able to collaborate across countries. In contrast, the three other multinationals have physical manufacturing operations in either the UK (Engines Ltd UK and Flight Ltd UK), or Australia (Wings Corp AU). For these firms, relocating physical manufacturing operations requires a significant financial investment, and there are geographical constraints for the manufacture of large components.

Interviews with both managers and engineers across the three firms indicate that many of the engineers working in physical manufacturing operations do not work within globally organised teams. The experience of work, including hierarchies, are nationally orchestrated, though some practices and procedures that the engineers are exposed to may be standardised. However, across the three firms with physical manufacturing operations there was evidence that production had become more integrated across subsidiary sites. As a result of greater integration of production, some engineers within the manufacturing environment have roles that are strategically important positions within each multinational’s internal supply chain.

In Flight Ltd UK, these engineering roles are referred to as interfaces. Engineers in these roles may be in daily contact with engineers in other subsidiaries as part of their day to day work. The engineers in these job roles connect the subsidiaries in different countries (namely the UK/France or the UK/US), and either link back to design offices or forward to final assembly. Their roles link the different points of the internal value chain, and they engage in problem solving as issues arise at different points of production:

I speak to a guy every day from France who's our representative over there, and he liaises with other French colleagues and acts as the interface... [his role is that] if they find a problem in [another site with our components] they come back to us saying you've done this wrong or we aren't sure about this, can you advise us.

B19, Manufacturing engineer, Flight Ltd, UK

Other examples of this type of work would be amending designs, and the order of production, such as when a component gets painted. These decisions must be negotiated between design engineers, who have produced the original drawings, and design engineers, overseeing production at the site where the component is manufactured. Typically these interactions occur most frequently in the early stages of the manufacturing process.

In Flight Ltd UK, technology has been an important driver in transforming how engineers in interface roles operate day to day:

its majority video calls. If we have a meeting with five of us, we go into these special video suites. We can see each other, share documents on the screen... You're trying to explain something, you're sharing a screen and you can see them and they can see you.

B19 Manufacturing Engineer, UK

Engineers operating as interfaces have access to technology suites, that enable them to share screens, and documents, and to see the other engineers, meaning they can communicate non-verbally as well as verbally. Except for face to face interactions, these video conferencing suites were argued by engineers to be much easier than conference calls, as a way of building

relationships with your team, communicating complex ideas, and engaging in problem solving which typically involves the transfer of tacit knowledge.

Interviews with the Operations Manager and one engineer at Wings Corp AU indicate that the firm has a similar role, referred to as ‘liaison engineers’. Liaison engineers oversee the production of parts and aircraft to the original designs, and sign off changes when there are errors in manufacture. While the ‘interfaces’ in Flight Ltd exist to interlink subsidiary sites, the liaison engineers at Wings Corp are viewed as a mobile resource. The multinational’s headquarters regularly moves these engineers between sites, particularly from the multinational’s main operations in the US to its other subsidiaries. These short term placements take place when production problems arise. Wings Corp operates just in time production, and so any hold-ups of components in subsidiaries delay production in other sites:

The job I was doing [in Australia] was essentially the same as what I was doing in [in the US], there’s just more specific parts... they do that quite often, where they’ll send people to Singapore, the Middle East or the UK, all within our same job skill.

A20, Liaison Engineer, Wings Corp, Australia

The engineer above was transferred to the Australian subsidiary when there was an issue in producing the wing components that halted production in the multinational’s two US-based final assembly plants. Wings Corp AU’s headquarters sent 100 Liaison Engineers from the US plants to the subsidiary plant in Australia as a way of fixing the backlog quickly.

The emergence of a small number of engineering roles whose function is to more closely interlink sites, and/or to resolve problems that occur in production seems to be driven by the closer integration of production across subsidiaries. In the three firms with physical manufacturing, firm based production networks are becoming more integrated. All three firms also operate using some variation of lean or just in time production, which relies on parts and components arriving when scheduled. If subsidiaries or suppliers are late in

sending them, activities such as final assembly production can be delayed. The engineering roles identified act to resolve production issues, or to share tacit knowledge across subsidiary sites; these engineers become a 'global' resource, and a means of firms circumventing the geographical constraints faced by physical manufacturing work.

In summary then, the evidence found in this study indicates a partial shift from national pyramids to global webs for those four firms who have adopted global skill webs. This shift seems to be easier for certain types of knowledge work, such as research and design, or 'weightless' activities such as virtual manufacturing. However, cultural issues and language barriers can create problems in the operation of these teams, and time differences may be problematic even as they may help firms reduce production or innovation timescales. The firms studied who engage in physical manufacturing, and many of their engineers operating in these environments remain within nationally orchestrated pyramids. A small number of engineering roles have become more global, interlinking these sites or moving between them.

7.2.2 GLOBAL SKILL WEBS, CENTRES OF POWER AND THE ROLE OF HEADQUARTERS

The second characteristic of global skill webs and their development is argued to be the consolidation of power with headquarters (Ashton et al., 2010). This section first explores examples where the headquarters of the multinationals studied have consolidated power, and how they choose to exert it that emerged from the interviews. In doing so, the discussion also explores the tension identified in section 2.3.1 where I questioned whether the consolidation of power with headquarters can actually coincide with a reduction in the influence of country of origin.

Two of the firms studied, Defence Org (UK and AU) and Software Ltd UK showed minimal signs of a consolidation of power with headquarters. One Engineering Director at Defence Org (UK) described the firm as 'federated' with each subsidiary having a significant amount of autonomy, which was echoed by interviews with an industrial relations and HR manager in

the Australian subsidiary. Similarly, the Engineering Director at Software Ltd UK reported having a significant amount of autonomy in terms of decision making around production, HR and training practices and procedures.

For the four remaining multinationals studied, Engines Ltd UK, Flight Ltd UK, Systems Corp AU and Wings Corp AU there is evidence of power being consolidated with headquarters.

One of the first ways that this occurs is that a small number of ‘innovation plus skills’ relationships developed between these firms and universities have shifted to being managed by each firm’s headquarters. This was discussed in Chapter Six (Section 6.3). This is the only area where Defence Org’s UK operations also show signs of consolidating and exerting power, and it should be noted that these relationships are those in the country of headquarters. This centralised approach has not spread to other subsidiary countries for Defence Org, in the same way as it has for the other four firms which suggests that the firm’s headquarters has not consolidated power at a global level.

In addition to the management of ‘innovation plus skills’ relationships, the consolidation of power with headquarters in the four remaining firms is also seen through the power exerted over standardisation processes. The content of those procedures and practices that have been standardised, integrated or aligned and which engineers have access to them will be discussed in more detail in the following section (7.2.3). However what has emerged from interviews with Engineering, and HR directors, at all four of the multinationals (Engines Ltd UK, Systems Corp AU, Flight Ltd UK and Wings Corp AU), is that headquarters tend to have control over the standardisation processes. They control not only what procedures or practices are centralised, versus what each subsidiary has autonomy over, but also who has access to them and how they are standardised.

In all four firms, there has been movement by headquarters to control the content of both the standardised or integrated HR practices, such as appraisals, and other standardised practices such as training. In one example Engines Ltd UK has integrated some of its training programmes. The content of these training programmes are overseen by a training team based in the UK, and managed by the heads of each function who are typically based in headquarters in the UK:

You have to have some control over what goes into this catalogue... You've got to have a named person at the head of each function who is running the development for all of his people, who can buy off the catalogue, sign off the standardised delivery for each of the roles at the various levels. You have to manage function by function and get ownership there.

B41, Director, Engines Ltd, UK

Through this structure, Engines Ltd UK's headquarters control the design and content of technical and leadership training. An interview with the HR Director at Systems Corp AU revealed a similar process, with the Australian training team reporting to one in France who oversees the content of both standardised training, and HR practices such as appraisals.

Interviews with the Research and Technology Director at Wings Corp AU and the HR Director at Flight Ltd UK reveal that, rather than using online portfolios, both firms have chosen to set up Leadership Centres in their country of headquarters. In both company cases, these leadership centres are responsible for the delivery of standardised or integrated training and for the delivery of standardised performance development activities such as coaching for managers and 'talent'. The location of these centres and their remit suggest a high level of control from each firm's headquarters.

In all four cases, headquarters having oversight over the standardisation processes involving HR and training practices. The design, content, and then the delivery of these practices is likely to be costly, both in terms of financial and human resource. In an example of why firms may make this initial investment, interviews with the Training Director at Engines Ltd

UK indicate that the firm started to standardise these processes about twenty years ago, as part of a broader cost cutting and globalising regime. Prior to this, much of the multinational's manufacturing still took place in the UK:

I had to move to globalising my team without growing. The challenge became something like 50,000 people in 60 countries. At this stage I had about 400 - 500 [in the training team] in the UK. When I left, this was done by 20.

B41, Director, Engines Ltd, UK

At the time, Engines Ltd UK was seeking to rapidly expand its global operations. For the Director responsible for training, this meant expanding the reach of training programmes without hiring any more training staff, and many of the standardised HR practices were also introduced under this regime. This example supports the discussion in Chapter 2 (section 2.3.1), which suggested that two of the drivers of global skill webs developing are processes of globalisation, and global competition that results in pressure to cut costs.

What also emerged from the interviews, in relation to the increased control exercised by headquarters, is that country of origin (or headquarters) still plays a role in shaping how some of these practices are standardised. Two examples that demonstrate this are that of Engines Ltd, and Systems Corp. Both firms have integrated some of their training programmes using an online portfolio. In the case of Engines Ltd UK, the firm chose to outsource training to three external consultancies that, between them, cover all subsidiary sites. This choice was subsequently imposed on all Engines Ltd UK subsidiaries:

In the UK, there's a culture of outsourcing and using partners. In America, this is a normal way of working... Europe, France, "We don't do things like that here. You give us some money, we'll find the provider," it's the French way. In Germany, "No, you need to employ these people. We don't do this" ... Europe, it was always a big challenge because they were very reluctant to let go of that site-based stuff.

B41, Director, Engines Ltd, UK

Even though the European subsidiaries of Engines Ltd initially resisted the implementation of standardised training practices, the firm has since implemented them across all their sites.

Systems Corp AU's online training portfolio, which it refers to as the company 'university' has also been shaped by the firm's country of origin. The firm university was developed initially due to training legislation in France (A9, Engineering Director, Systems Corp, Australia), where firms have to pay a training levy, and can then claim back the money to pay for training. The firm 'university' has subsequently been scaled up, and transformed into a global offering. In these examples, country of origin, or headquarters has a clear influence over the ways each firm has chosen to implement these standardisation processes: namely whether external providers have been used, or if instead the firm prefers to develop a training team in-house. This supports other research finding that multinationals tend to prefer training practices, or approaches, stemming from their country of origin, and may choose to replicate these in subsidiary countries, as has been seen in intermediate skill development (Jürgens and Krzywdzinski, 2016).

Other examples of the continuing impact of country of origin, and how this may be reinforced by standardised practices, can be seen in the case of Wings Corp AU. Wings Corp rotate their senior management across their subsidiaries. In Australia, this is seen in the practice of moving members of the senior management team, a number of whom may be from the US every four years:

Wings Corp have a habit of doing similar to Toyota, every four years they will rotate their General Manager ... In terms of local management it's virtually a revolving door... In the past a lot of those people came through the shop floors, supervisors, became management, had that rapport and respect. They could be difficult, challenging, but they would respect the workforce in terms of understanding their commitment – if somebody has been there 25 years, you acknowledge that. The managers today, it's not an issue.

A14, Trades Union representative at Wings Corp, Australia

While this might be argued to result in shared leadership goals amongst the managers of all the various subsidiaries, what also emerges is the centralisation of decision making with head office. The trades union representative argued that the rotation of US managers into senior

management roles at the subsidiary, and their approaches to negotiation, were heavily influenced by the US headquarters not wanting to negotiate with worker representatives. As a result, the Australian subsidiary, which operates within a more tripartite institutional setting, has adopted anti-union tactics.

The trades union claims these include threatening behaviour, such as following union representatives home during an industrial dispute, and deliberately targeting union representatives during redundancies:

The workforce made a collective decision to go on strike. The company took the workforce and the union to the federal commission... it got quite nasty, the company engaged private security to follow the union delegates home...

About 450 people were made redundant ... They'd [Wings Corp management] made a decision and clearly they knew who they wanted to keep in the business and who they wanted to get rid of ... whilst they reduced the workforce by 50% they got rid of 100% of our union delegates, not one of the union delegates survived...

A14, Trades Union representative, Wings Corp, Australia

Representatives from the engineers' union noted that while their relationship with management was less conflictual, there was minimal attempt by the firm to negotiate with them outside of the legally enforceable scope of enterprise bargaining.

The case of Wings Corp AU echoes previous research on the effect of country of origin on US multinationals and their subsidiaries. Wings Corp AU is similar to these examples, in that US firms tend to be antagonistic in their relationship with unions, and in their attempts to marginalise them (Almond et al., 2005), and to have highly centralised decision making in relation to industrial relations (Edwards and Ferner, 2002). These features are seen in the Australian subsidiary:

Wings Corp AU have some pretty good managers at [the Victorian site], but the problem is that they aren't decision makers, they're messengers for others from other parts of the world... They're going out of their way to upset workers over the most ridiculous issues.

A14, Trades Union representative, Wings Corp, Australia

The antagonistic relationships between the subsidiary management (and by proxy the firm's headquarters), and the trades union, have resulted in resistance at a subsidiary level to attempts to introduce standardised practices, such as performance related pay. The trades' union has resisted these attempts, as they argue it is an attempt by management to erode the EBA and Award agreements.

The example of Wings Corp AU indicates that constraints, such as resistance at a subsidiary level, can prevent the implementation of standardised practices, and highlights that unions, as worker representatives, are likely to play an important role in subsidiary resistance efforts.

The example also highlights the importance of country of origin and host country effects even within firms who have adopted some characteristics of global skill webs. The use of 'global' approaches to management, and the utilisation of global skill webs and integrated training can be seen to, in some cases, create resistance at a subsidiary level to the implementation of standardised practices. The examples also indicate that country of origin or headquarters shape processes of standardisation, and that this may become more visible as control is consolidated at headquarters.

7.2.3 GLOBAL SKILL WEBS, AND THE STANDARDISATION OF ACTIVITIES, PROCEDURES AND HR FUNCTIONS

This section examines whether the multinationals studied have adopted the third characteristic of global skill webs, by seeking to integrate, align and standardise any of their activities, procedures and HR functions. It is within this characteristic of global skill webs that the highest amount of variation occurs across all the multinationals studied. All four firms who have adopted the first two characteristics of global skill webs show signs of seeking to implement standardisation processes, albeit to varying degrees, and in a variety of ways. In comparison, the other two firms, Defence Org (AU and UK) and Software Ltd show either limited or no attempts to implement similar standardisation processes.

One similarity across the four firms who have made attempts to standardise practice, that emerges across the interviews with Engineering or HR Directors at the four firms is who has access to standardised practices. Rather than full shift to ‘webs’, these firms have instead introduced such practices for a small group of engineers so they can better manage knowledge production. The engineers who have access to standardised, aligned or integrated practices are primarily managers, talent and those engineers undertaking ‘global work’ discussed in Section 7.2.1. Only one of the firms, Engines Ltd UK, has made any of its standardised or integrated practices available for engineers outside of this group, and these will be discussed in more detail later in this section. For all other engineers at these firms, the HR practices and development activities they have access to are often nationally organised, though some production practices may be standardised.

There is variation, seen across the four firms, first in terms how long standardised practices have been operational, and second in terms of which practices have been standardised, and in how each firm has chosen to integrate or standardise these practices. Engines Ltd UK and Systems Corp AU appear to be operating more established standardised or integrated HR practices, while Wings Corp AU and Flight Ltd UK were seeking to integrate some of their HR practices, though these were not all in operation at the time of research. Interviews with the Training, and HR Directors at Engines Ltd UK, and Systems Corp AU, indicate that these two firms have also standardised more production and HR practices that the other firms studied have not. As one example, both firms have developed an integrated system of ranking jobs, and assigning them to a global classification system:

What would a system engineer who is operating at level ten level be required to be able to undertake, what level of expertise should he have? The whole job family, that’s a bible on its own. That’s every single role in the group and they try to standardise it as much as possible... he should be competent in the following areas, almost a position description but not quite.

A7, HR Director, Systems Corp, Australia

I looked at every function, so I looked at all 55,000 ...every level in every function; engineering, HR, manufacturing, and defined their standard roles to run that function. From the entry-level roles, through to the executive roles. We did that by describing each role in technical and behavioural competence terms.

B41, Training Director, Engines Ltd UK

This process does not fully standardise job roles across subsidiary sites. However, it does enable some form of comparison between engineers in different countries by job function or family.

In the case of Engines Ltd UK, the Training Director acknowledged that this process enabled the multinational to reduce costs, by removing 'shadow jobs' that had developed at different sites, and reduced pay discrepancies across sites, and countries. It should be also be noted that the illustrative quote from Engines Ltd UK indicates that the multinational seems to have included every job role within the firm, into its global classification system. The HR Director at Systems Corp AU indicated that the engineers who are captured within the global classification system are typically those in more senior roles, including management and engineers identified as talent. This is the same group that is also managed using integrated HR practices.

In all four firms there is evidence of some HR practices, typically performance development activities, and some training being standardised or integrated. Variation occurs however, across the firms in terms of how these standardised practices are implemented. In Wings Corp AU and Flight Ltd UK, these standardisation processes are (or will be) being undertaken through each firm's leadership centre:

Senior executive leadership training and executive coaching all the way through to project managing training, specialist project management skills training ...that's all been tailored to Wings Corp, and the Wings Corp Culture... It's obviously more difficult for international employees to get access but certainly that does happen - in fact one of my managers is there this week, doing a senior managers' training program there.

A6, R&T Manager, Wings Corp, Australia

We've got our own leadership university which we've developed, which is being inaugurated very shortly. It's responsible for all aspects of leadership development across the company, whether that be programmes for first line management right through to programmes for high potential and talents within the organisation. That includes everything from coaching, 360 degrees, mentoring, learning expeditions, just about everything.

B14, HR Director, Flight Ltd, UK

As these centres are located in the country of headquarters, a limited number of engineers will have access to them. In the case of Wings Corp AU, interviews with the Research and Technology Manager revealed that the leadership centre sends a training team, once a year, to the Australian subsidiary to implement some training programmes, such as those for front line management.

Systems Corp AU and Engines Ltd UK have also integrated some of their HR practices, primarily those related to performance development activities. These are more closely intertwined with the global classification systems each firm has developed. In Systems Corp AU, two practices are integrated across subsidiaries, the annual appraisal and development review. These two practices are implemented by multinational headquarters:

There are two main interventions that are mandatory per year. One is the review of the previous year's performance... Then in the middle of the year, we have what we call a people review, and that's really looking at the upper grades, senior engineers, management, senior management, executive management ... we will place everyone in the grid, it just gives a bit of context when you are sitting with the top executive of the country, they can get a quick picture and say 'ah, okay, that guy, he's one of our key players, we need to be watching him'.

A7 HR Director, Systems Corp Australia

Information from the 'people review' is filtered up through various review meetings, from the subsidiary, to national, regional and finally, global management meetings. These integrated practices seem to enable the multinational's senior managers to get detailed information about the senior engineers and managers working across their subsidiary sites, and to manage talent at a global, as opposed to national, level.

Training in both firms is managed via an online portfolio (as discussed in Section 7.2.2), and certain engineering job roles have predetermined training courses that engineers in these roles must take:

Management courses, specialist courses, for instance, contract negotiation, project management, system engineering...take a project manager from Australia, who has done the Passport to Project Management... you know that you've got that and if you plug him into Brazil, New Zealand, China or anywhere, there's going to be a certain level of competency that you get.

A7, HR Director, Systems Corp, Australia

Interviews with the Training Director at Engines Ltd UK indicate that integrated training is accessible for a broader group of engineers, including new engineers such as graduates and apprentices. The broader coverage could be linked to the firm's inclusion of a wider range of engineers in its global job classification system.

The training modules disseminate a firm-specific approach to various activities such as design, process improvement, problem solving and product knowledge, through formal compulsory training programmes:

There is a five days engine familiarisation course to make sure that everyone has the same level of understanding of our engines... a three day observe, deduce and analysis course that is used for failure classification mostly... There is a one-day robust design course ... a half-day yellow belt course which is about process improvement.

B24, Graduate Engineer, Engines Ltd, UK

We started putting into the learning management system things you are to do on the first day, in the first week, in the first month, in the first six months... You'd have an individual learning plan with a round of standard catalogue solutions and what we expect.

B41, Director, Engines Ltd, UK

Standardised training plans are generated for new engineers joining the firm and for a wider range of engineers (including apprentices and graduates) than at Systems Corp AU, and this training is again linked to job roles in the firm's global classification system.

Systems Corp AU, Flight Ltd UK and Wings Corp AU have standardised, aligned or integrated HR practices, procedures and some training that focus on the development of ‘soft’ skills for managers and ‘talent’, as opposed to technical skills. This supports existing research on global skill webs, where the authors argue that multinationals have standardised such practices as integrated behavioural competencies as a way of aligning managers with company objectives across the globe (Ashton et al., 2010, p. 846). In all three firms, interviews with senior managers indicate that managers and engineers identified as talent are encouraged to take international placements, are managed via global targets with behavioural components, and are the group who have access to standardised HR and training practices. These practices are used as a means of aligning these engineers and managers with each firm’s ‘global’ approach.

In comparison, at Engines Ltd there seem to be broader processes of standardisation in relation to production. As part of the shift from production being located in the UK to globally, the Training Director revealed that the firm also standardised factory layouts, machinery and many of their production processes. This was part of a process of rationalisation, and so standardisation of various practices was argued to be a way of reducing the complexity of the firm’s operations, with HR procedures being shared across sites:

There was a huge problem with my HRD who was saying ... “Go and think through how we are going to run this with no more people that you've got today because we're going to do more engine deliveries but with less people. That's the same with you and training.”

B41, Director, Engines Ltd, UK

As soon as you've got standardised roles, recruitment becomes easier, grading for jobs becomes easier, comparison across sectors become easier. You can start putting payroll systems in, you can start putting advertising systems in, assessments systems in.

B41, Director, Engines Ltd, UK

As a result, integrated training programmes that have been standardised are aimed at a broader group of engineers, and focus on technical, firm specific skills that are directly related to production processes, and firm approaches to applying technical knowledge, such as problem solving. These are short courses (up to five days long) on topics such as product familiarisation or firm-specific ways of undertaking certain activities (e.g. design or problem solving), although there are some training programmes that develop soft skills. This method for integrating training could therefore be argued to be one way of reinforcing standardised production processes across subsidiary sites.

What does emerge from the interviews is that standardising, aligning or integrating practices across subsidiaries may be difficult, could result in resistance at a subsidiary level, and at least initially is costly and time intensive to introduce and oversee. Due to these costs there appears to be little rationale for firms to expand access to these standardised practices for workers who are otherwise managed via national pyramids, production and HR practices. Where firms have standardised production practices, as in the case of Engines Ltd, there may be a stronger case for broadening the access to some practices such as firm-specific technical training.

As a result, in the four firms where there is evidence of the existence of standardisation processes, the global skill webs are more limited than implied in the original theory by Ashton et al. (2010, . Rather than a full shift to webs, what emerges is a set of global practices, or interconnected 'global' infrastructure that operate alongside nationally orchestrated pyramids and practices. These 'global' practices are accessible primarily by managers and talent, while the remaining workforce are mostly managed by nationally orchestrated systems of production and HR. This finding supports previous arguments that a core group of employees are emerging that are viewed as crucial to a multinational's success (Edwards et al., 2013) and that managers are a group most likely to be exposed to

standardised practices (Edwards and Kuruvilla, 2005). Where practices were standardised outside of this group of employees they seem to reinforce standardised production practices, as in the case of Engines Ltd UK.

7.3 DRIVERS OF GLOBAL SKILL WEBS IN THE UK AND AUSTRALIAN AEROSPACE SECTORS

The discussion above has touched on all three of the drivers of global skill webs. Global competitiveness and globalisation influence where firms have set up their subsidiaries and how they organise work, while emerging technology has made new forms of global team working possible. These three drivers are also present more broadly within the global aerospace sector. Emerging technology is changing both products and production processes, while an increasing number of countries want to enter the supply chain, and firms are under pressure to reduce the cost of production.

Some of the important questions raised in relation to theories of global skill webs in Chapter 2 (Section 2.3.1), including whether their development actually results in a reduced reliance on home (country of origin or headquarters) and host skill formation systems, have been addressed in part during the earlier discussion. This section addresses how the three drivers of global skill webs seem to influence the operations of the firms studied. The discussion raises the question of why some of the firms studied have developed global skill webs, and questions their purpose across these firms' UK or Australian operations.

In the original theories of global skill webs, technology as a driver has enabled standardisation processes (such as digital Taylorism), that have supported offshoring and outsourcing activities (Ashton et al., 2010, see discussion in Section 2.3.1). Emerging technology, coupled with globalisation and global competitiveness is argued to result in the relocation of knowledge work from developed to developing economies. This shift has

occurred in the aerospace sector, but interviews with sector actors such as unions reveal that this shift is seen primarily through the process of offsetting. This is where, in the process of governments, or companies, in developing countries buying aircraft they negotiate a percentage of the manufacturing work to be located in their country.

Offsets, coupled with the geographic constraints of manufacturing (ibid) mean that a number of the firms studied such as Engines Ltd, Flight Ltd, Defence Org, Wings Corp, and Systems Corp, have subsidiary sites in strategic developing markets, such as China, Singapore, or Saudi Arabia. However, there is limited evidence in interviews with managers or engineers in either country, of work being offshored solely due to cost. Instead, access to markets and offsetting seeming to be the primary reason for relocation. As a result of these globalisation and competitive pressures, sector actors in the UK and Australia argue that for each countries sector to continue to flourish, they need to remain at the forefront of emerging technology and innovation:

It's just a strategic decision to be close to the markets...the ambition of the UK industry is that we ride the crest of the wave of technology, and build things that are right on the cutting edge that no-one else can do. The best guarantee of highly skilled, high value jobs is doing things that no-one else can compete with

B1, Sector Representative, Union, UK

One of the arguments that emerged though interviews with union representatives was that, due to the long product cycles in the sector, any relocation of manufacturing would be likely to result in a slow decline rather than an immediate collapse of manufacturing in both countries. In Australia, there was a greater focus on labour costs, with 'worst-case' comparisons being drawn with the automotive sector in Victoria, that had recently collapsed. However, changes in technology in relation to manufacturing processes such as Industry 4.0, and developments in automation, were argued by some respondents to reduce the incentives of lower labour costs:

This big argument about moving to low-cost countries, what they mean is low-cost wages. East Europe or Mexico or wherever. The more you automate, you eliminate that low pay element. Then you start hearing much more of an argument about wanting those highly technically driven factories or processes close to your ‘brains’ which would be your core sites, the UK, Germany, America. Because you can't afford that to be in Mexico if you can't help them quickly... you probably need them to be closer to your thinkers, technical experts, brains closer to home.

B41, Director, Engines Ltd, UK

This raises questions about if, for the firms studied, and in the aerospace sector, the pressures of globalisation and competition, such as the appeal of highly skilled, low cost labour may be being tempered by emerging technologies. These technologies are argued to be used to reduce the cost of manufacturing, making developed economies more competitive.

Comparable examples of how technology can make developed economies more cost-competitive than developing, have been found in the automotive sector. In one such example, an Indian supplier, with lower cost labour, was under-bid by a European supplier who had invested in technology that increases quality, while reducing costs (Tewari, 2018).

The interviews suggest that, for the four firms where characteristics of global skill webs have been identified, that the accounts of their operation supports, extends and in some small ways challenges the original accounts of their purpose. The accounts of global skill webs across the four firms support the original theory in that they are argued to speed up production ‘from innovation to invoice’ (Ashton et al., 2010). In this respect, what emerged out of the discussion in the previous section was that, one focus of the global skill webs that have been developed has been cost saving, via speeding up innovation and integrating production activities across subsidiaries. In some instances, namely research, design or virtual manufacturing, this has been achieved via global teams. In others, usually physical manufacturing operations this occurs through specific engineering roles that bridge subsidiary sites.

In all instances however, there is a focus on the movement of certain engineers between sites. The quote above referred to the movement of some engineers, referred to as ‘brains’, who are located in ‘core’ sites for Engines Ltd UK in developed economies, to subsidiary factories to fix problems as they occur. These ‘brains’ are likely to be engineers identified as talent, or those in strategic roles, such as those discussed in Section 7.2.1 who ‘bridge’ geographically bounded sites. These examples could be one means for firms to overcome some of the geographical constraints of physical manufacturing. The role of these engineers appears to solve problems in each firm’s integrated production system, often through the transmission of tacit knowledge and expertise. Interviews with both Engineering and HR directors and engineers at the firms studied reveals that these types of engineering roles require both technology, and the physical movement of engineers between sites, to be able to operate effectively. Examples of these would be international placements, and the use of technology, such as video conferencing suites.

A similar situation is seen in innovation activities. In all the firms studied who have developed some of the characteristics of global skill webs, examples of knowledge innovation, including strategic location to benefit from ‘chasing the sun’ in research and design or virtual manufacturing have been discussed. However in each of the firms who have these types of global team working, there are also routes to move engineers identified as ‘talent’ around each firm’s operations.

In one example, a small number of research and design engineers at Wings Corp AU are encouraged to attend the multinational’s technical conference. The Australian subsidiary sends 20 engineers on average per year to the conference, which is always held in the US. Engineers who attend are encouraged to connect with, and build relationships with their US counterparts:

We can talk about all the proprietary information within the company quite freely, it's such a strong development opportunity for presentation skills, for technical sharing, for networking...they usually top or tail their trip, meeting or networking with whoever else they might be working with in their area of expertise.

A6, R&T Director, Australia

The example of the company conference highlights the importance of face to face interaction for the sharing of tacit knowledge within the firm, and that global team working for highly skilled work such as research and design requires some form of relationship between engineers.

A similar movement of engineers between France and Australia on short term placements was referred to in Systems Corp AU's virtual manufacturing operations. Interviews with the Engineering Director at Systems Corp AU suggested that these placements were an attempt to combat some of the challenges that emerged from cross-site working, such as cultural, and language barriers. Managers and engineers who work in the 'global team' designing the ATM system can undertake short term placements in the other site:

It's developed on both sides, we've often got a lot of French people coming across. If I look at the culture in ATM and compare it to the rest of the organisation [in Australia] it's a very French culture... long working hours come from the fact that you're trying to cross time zones.

A9, Engineering Director, Systems Corp, Australia

International placements may be one route that the firms studied use to overcome these challenges, and to create similar points of reference between engineers working on the same project. The examples also highlights the importance of face to face interaction. In addition, the Engineering Director also referred to regular video conferencing across the sites, as did engineers at Flight Ltd who operated within global teams, showing that technology can also support relationship building within global teams.

These examples confirm in part, some of the claims in the original theory, such as that global skill webs are used to speed up the entire process of production. However, the examples from this research raise questions about the extent to which highly skilled knowledge work

can be codified. To what extent can companies employ processes of standardisation such as those referred to as digital Taylorism (Ashton et al., 2010) to these types of knowledge work? These examples indicate that not all engineering knowledge is codifiable. Instead, technology and movement of certain workers may be an important part of the process of speeding up production, by aiding relationship building and the transfer of tacit knowledge.

Finally, as suggested in the original theories, the findings support the claims that multinationals use global skill webs as a way of managing knowledge work, and of developing the skills of those engineers identified as talent and management. The development of global firm-specific infrastructure that is used to manage knowledge work, is then used as a tool to develop this 'core' group of employees (managers and engineering talent). As the management of knowledge work appears to be one of the main purposes of the global skill webs studied, this challenges some of the assumptions in the original theory about how encompassing global skill webs can be. In the firms studied who have developed global skill webs, only a small 'core' group of the workforce are subject to this global infrastructure, and any standardised HR practices such as appraisals and ranking systems, integrated targets and behavioural competencies. The remainder of each firm's engineers and workforce are managed through nationally organised practices and pyramids.

7.4 CONCLUSION

This chapter has examined the extent to which the multinationals studied have built global skill webs, by examining whether each firm has adopted any of their three characteristics. Four of the firms studied have developed global skill webs, though the accounts of their operation seem to indicate that they may be less encompassing than theoretically depicted. Further to this, the accounts suggest that the consolidation of power with headquarters has

resulted in the continued influence of country of origin/headquarters, while resistance to standardised practices shows that host country actors may also play a role in shaping global skill webs. In each of the four firms, a small group of engineers and managers have access to the infrastructure of global skill webs and seem to be managed by any standardised or integrated practices that are produced by them. The evidence indicates that other engineers are still managed at a subsidiary level in terms of HR practices and training programmes.

The global infrastructure seems to operate parallel to more traditional nationally organised HR and training infrastructure, and those who are captured in these webs (managers and engineers identified as talent) often have access to both. Finally the discussion has touched on the drivers of global skill webs. These include how emerging technology may be affecting the dispersion of production, and could mitigate cost pressures within global skill webs in the aerospace sector. The research has also highlighted the importance of technology and international placements or movement of the 'core' group of engineers and managers in enabling the transfer of tacit knowledge across subsidiaries, raising questions about how easily certain types of knowledge work can be codified.

The following chapter draws together the main findings from Chapters Five, Six and Seven and explores how these can be understood in relation to the existing literature.

CHAPTER 8 MULTINATIONALS, SKILL FORMATION SYSTEMS, AND GLOBAL SKILL WEBS

8.1 INTRODUCTION

The fundamental question this thesis has sought to address is the role of multinationals in skill formation in the UK and Australian aerospace sectors. The research draws on previous work on skill formation systems, the sparse literature on how multinationals develop skills and the extent to which they are capable of shaping institutional conditions. These were used to develop three research questions: the extent to which multinationals engage with and potentially shape skill formation systems, whether there is evidence of the development of global skill webs, and, if so, whether this global infrastructure influences engagement with skill formation systems.

While Chapters Five to Seven have recounted the findings from the two country cases in relation to these research questions, this chapter integrates these findings to discuss their significance and their relationship with previous research. Section 8.2 outlines whether the firms studied operate within distinct sub-national conditions, and how their role within the engineering skill system can be understood in relation to the discussion of organisational or institutional experimentation.

Section 8.3 addresses the second point of analysis, whether there is evidence of the development of global skill webs, and how the findings of this project add to the debates about the changing role of multinationals in skill formation. Section 8.4 then situates this analysis within the broader debates from the skill formation system and varieties of capitalism debates, and outlines what the findings from this project add to this body of work. Finally, Section 8.5 concludes the chapter discussion.

8.2 THE MULTINATIONALS AND SKILL FORMATION

One of the central aims of the study has been to explore the extent to which multinationals engage with and potentially shape the skill formation systems that they operate in. Although there are small variations across the two countries, the findings indicate that there are three broad areas where the multinationals studied have developed distinct sub-national conditions that differ from the national architecture, and in more subtle ways from the sector architecture. These include the development of tailored and demand-led graduate training, the development of routes for state-subsidised bespoke, customised or firm-specific training, and finally the development of soft skill training as a collective good. In addition, in the UK case the multinationals have also developed forms of quality assurance using Chartership as a means of enforcing standards within their firms for ongoing engineering skill development. This form of quality assurance supplements the sector-based role of the PEIs in both countries in terms of standard setting for graduate and post-graduate education.

8.2.1 ORGANISATIONAL OR INSTITUTIONAL EXPERIMENTATION

The existence of sub-national conditions that are distinct from the national and, in some cases, sector architecture raises questions about how the role of these firms, and their behaviour can be understood. Framing the activities of these firms and exploring their role in the engineering skill system with our understanding of sub-national organisational change as either organisational or institutional experimentation can aid theorising. Organisational experimentation occurs as a result of change or challenges that create new problems to be addressed. These organisational forms can become institutional experimentation only when the resources needed to support and normalise certain forms of organisational experimentation are embedded within the national or sub-national architecture (Morgan, 2018). Institutional experimentation can be considered to have occurred when these resources are embedded and are available for other firms in the sector to access, through

bypassing, converting or destroying existing institutions, or reshaping the institutional landscape (Morgan, 2018). Any other activities would be considered organisational experimentation, available primarily to the firm but not beyond.

A similar concept is developed of the actors such as firms who undertake this form of activity: institutional entrepreneurs. Institutional entrepreneurs are actors who are argued to be ‘boundary spanners’ (Crouch and Farrell, 2004) concerned with changing the structure in which economic and other activities take place, by ‘recombining’ elements of institutions in unusual ways and manipulating elements of governance (Crouch, 2005a). Therefore, the multinationals can be considered to be institutional entrepreneurs in relation to skill development, only when their efforts result in innovating and changing the structure, institutions or governance of the engineering skill system. It should be noted that, in this case, the concept of institutional entrepreneurship does not require the embeddedness of these resources within the engineering skill system.

As a result, we can argue that many of the ‘adaptions’ that have resulted in the aerospace multinationals studied having access to markedly different conditions than the national skill system architecture, and even the sub-national conditions of the engineering skill system, are examples of organisational experimentation.

8.2.2 INSTITUTIONAL EXPERIMENTATION

Based on the definitions above, only two activities undertaken by the multinationals in both countries produce conditions that are accessible to other firms in the sector and that therefore meet the ‘embeddedness of resources’ criteria of institutional experimentation. These are the tailored graduate curriculum available from a small number of universities and the soft skill provision as a collective good available through either the sector PEI or the sector trade association. The activities of the multinationals studied do not destroy or bypass the universities, sector PEI or sector trade association who offer these activities as a ‘collective

good'. The firms could be argued to 'convert' these institutions, though perhaps this is too strong a statement. Indeed, the efforts of these firms may be instead to more closely orient the skill outcomes produced by certain universities, and the sector PEI (in the UK) to meet their own requirements.

In the Australian case, there is a stronger argument for the conversion of the sector trade association to meet the needs of the firms studied. The sector trade association's activities have shifted from the initial purpose of lobbying state government to the production of soft skills for engineers. However, the offering of skill development activities is not outside the typical realm of activity for employer organisations. There exist a number of studies that indicate employer organisations have turned to the provision of training as a means of retaining firms as members (Gooberman et al., 2017b, Behrens, 2004).

These two activities can then be loosely considered to be institutional experimentation of some kind, as they produce embedded resources that are accessible to other firms within the sector. Whether these two forms of skill development activities meet the skill needs of other firms in the sector is a separate question. It is one that should be considered carefully, in light of the findings that the engagement of these firms seems to result in the narrowing in content of technical engineering skills.

In the case of the UK, there are additional resources available produced through the government infrastructure, the AGP, that also meet these requirements and the AGP itself might be considered an example of institutional experimentation. In this case, it would be the creation of a new institution by multinationals in collaboration with government that is designed to shape skill development (amongst other areas) at a sector level, or to create sector specific conditions that vary from the national architecture. The activities undertaken by the skills group of the AGP are funded through a mixture of government subsidies and funding

from industry, primarily from the multinationals themselves. However, the findings (Section 5.2.2) indicate again that programmes designed for engineers are narrow in scope and focus, designed to meet the needs of the multinationals who are funding them and not necessarily the broader skill needs of other firms in the sector.

8.2.3 ORGANISATIONAL EXPERIMENTATION

All the other conditions created by the multinationals studied would be best described as organisational, as opposed to institutional experimentation. The evidence indicates that these firms are engaging with institutions and using their relationships to create distinct and firm-specific sub-national conditions that differ from the national, and in some cases sector skill system architecture. The multinationals studied, when faced with the ‘problem’ of whether the engineering skill systems in both countries are producing skills that meet their needs, have used their relationships with the state or with universities as routes to tailor the training available.

In one such example, several of these firms use the ‘innovation plus skills’ relationships they have developed with universities to access bespoke or customised training for existing engineers. These activities are reminiscent of those undertaken by ‘institutional firms’ (Crouch et al., 1999) in the US discussed in Chapter Two (Section 2.2.3). In addition, some of the firms in both countries have sought to provide graduates, at universities where they have built ‘innovation plus skills’ relationships, with firm-specific knowledge and skills by delivering lectures and offering internships. The focus on firm-specific skills and knowledge is indicative of a broader trend within both country engineering skill systems, of the firms developing routes to narrow technical skill development.

Much of the variation between the two country cases occurs in the relationship between the multinationals and the state. In both countries, these firms are able to access state-subsidised training for their existing workforce. In Australia, this appears to primarily take the form of

firm-specific or in-house training. Subsidies are available through the federal government in the form of specific funding pots for defence firms. The State government interacts with the multinationals as ‘giant firms’ (Crouch, 2010) and negotiates individual agreements and subsidies for various areas that can have skills components. In the Australian case there are two distinct points to note, the first being that there was less evidence of these firms utilising these routes for subsidies in relation to skills than in the UK case. In the second, again reminiscent of the preference of multinationals as ‘giant firms’ for individual agreements (Crouch, 2010), efforts by both the federal (via the AMGC) and the State (via the trade association) governments to set up routes for collective negotiations with these firms have either received less engagement from the multinationals than expected or been turned to other purposes.

In the case of the UK, there is more evidence of the multinationals studied engaging with the state, typically through government infrastructure, and being able to access subsidised technical training for existing engineers. One example of this is the MSc programme, shaped by the multinationals on the AGP skills working group, and another is the use of the state funded catapult centres to purchase bespoke, or customised training in emerging areas of innovation. The higher levels of engagement by these firms with the government infrastructure could in part be accounted for by the historic ‘non-interventionist’ position of the state in the UK. Another reason could be that, when the government made the decision to invest in creating the sector specific infrastructure, multinationals were instrumental in shaping what these institutions would do and how they would operate. The involvement of several of the firms (excepting Software Ltd UK) in this initial developmental phase could explain the higher levels of engagement in the present day.

It should be noted that the AGP is the only instance of ‘collective’ activity. The AGP operates in many respects like a Williamsonian institution (Streeck, 2009). It is a form of

governance through private ordering, involves voluntary or self-enforced agreement, and, through the provision of government funding as a form of subsidy, lowers transaction costs of market exchanges for skill formation activities (ibid). The AGP is the only avenue where the conditions for skill development developed by the multinationals in collaboration with the state and other actors become resources that can be accessed by other firms in the sector, even if the viability of these programmes for smaller firms has been questioned. The ‘collective’ activity in the AGP occurs through individual company representation rather than social partnership. This also is indicative again of ‘giant firms’ (Crouch, 2010), how their presence may change the institutional landscape.

The final point of organisational experimentation is found in the UK case, in the use of the PEIs and Chartership as a form of quality assurance. This is also another point of variation across the two countries that can, in part, be attributed to the state. In the UK, the voluntarist approach of the state resulted in the promotion of chartership as a voluntary alternative to registration, but the issue of the enforcement of quality of engineering skill development has remained the remit of individual firms. This means that more broadly the engineering skill system conforms to the expectations outlined by Sako (2017, in Chapter Two (Section 2.2.3).

However, the multinationals studied in the UK have all built relationships with one or more of the PEIs and actively promote and legitimise Chartership as a means of enforcing standards for ongoing engineering skill development for early career engineers. This activity is primarily restricted to their organisations but in the case of one firm includes their supply chain. The PEIs may be another form of a Williamsonian institution (Streeck, 2009), whereby firms are able to voluntarily agree to self-enforced standards for engineering skill development. By doing so, firms participate in quality assurance activities with lower transaction costs than they might receive on the market, and for a lower cost and with greater expertise than developing a quality programme in house.

By doing so, these firms can ensure a certain level of quality in engineering skill development. Engineers are also (through the renewal of protected titles) sharing the costs of this quality assurance activity. As Chartership is valued and promoted by these firms, one of the side effects is a focus by early career engineers on achieving chartership. As a result, early career engineers may be less likely to leave these firms until they have achieved chartership, and as this process can take several years, an indirect effect of the promotion of chartership may be reducing the effects of poaching.

In the Australian case, there is far less engagement between the multinationals studied and the engineering PEI in relation to Chartership activities. This could, in part, be indicative of lower levels of engagement of these firms more generally with institutions in the Australian engineering skill system than in the UK case. However, if we return to the assumption that organisational and indeed institutional experimentation is driven by a ‘problem’ (Morgan, 2018), such as a concern about the enforcement of standards for skill development, then an alternative explanation for the lack of engagement by the multinationals studied can be developed.

In the Australian case, the state is and has historically been more interventionist. Standards for ongoing engineering skill development are enforced in part through the Awards system and EBAs, and at a State level through the Engineers Registration Bill. As a result, enforcement of standards is undertaken by the state, unions and employers as opposed to the firm alone, contradicting in some respects the expectations for engineering skill development argued by Sako (2017, .

The impact of the hard regulation could therefore be argued to solve the ‘problem’ of quality assurance in engineering skill development, meaning that the multinationals in Australia are not facing the same ‘problem’ as their UK counterparts. In addition, the association between

skills and wage bargaining through the Awards and EBA system arguably reduces poaching in a more traditional way through regulating wages (Estevez-Abe et al., 2001), using collective bargaining and employer organisations.

In both country cases then, there exist institutions that undertake standard setting and enforcement activities that mimic in some regards one of the characteristics of skill systems designed to create industry skills (Estevez-Abe et al., 2001). These institutions have been supported by governments in each country in different ways and this has resulted in some level of path dependence in the trajectories of the engineering skill formation systems, particularly in relation to hard and soft legislation.

What emerges is a picture of these firms being able, through organisational experimentation, to circumvent some of the conditions of the national skill system in each country, with one example being demand-led relationships as opposed to market coordinated. Through engaging with other actors in the skill system and undertaking organisational experimentation, these firms have been able to create distinct sub-national conditions that are 'firm' or 'multinational' specific. These 'multinational-centric' conditions result in conditions within the engineering skill system that are coordinated at a firm level. As a result, these firms can access conditions for skill formation that include demand-led training, with a focus on narrow, bespoke or firm-specific technical skills, some soft skill development, and in the UK, routes for quality assurance for early career engineering skill development.

These firms appear to be able to tailor skill development for engineers to better meet their needs, even when these needs differ from other firms in the sector. While some of these efforts can be argued to be as a result of the multinationals operating as institutional entrepreneurs, they are not engaged in institutional experimentation, beyond a small number

of examples. Instead, the multinationals, while still subject to some of the institutional constraints of the national skill systems in either country, benefit from a certain level of plasticity within the relationships they develop with institutions. By so doing, the firms create their own sub-national operating conditions that are distinct from the national architecture, and in more subtle ways are also distinct from the sector architecture.

8.3 FROM 'NATIONALLY PRODUCED' SKILLS TO GLOBAL SKILL WEBS?

The third research question posed in this project sought to understand the extent to which the multinationals studied have developed global skill webs and whether the development of global skill webs impacts on how these firms engage with the engineering skill systems in each country. The work of one group of researchers suggests that fundamental changes have occurred in how multinationals develop skills. These changes are argued to be best understood as a shift from multinationals being passive receivers of skill produced within national skill systems, to active participants who now control the process of skill production via skills capture and the development of global skill webs, and so have, or will reduce their reliance on national skill systems (Lauder et al., 2008, Ashton et al., 2010, Ashton et al., 2009, Brown et al., 2008).

In essence, theories of global skill webs have initially focused on theorising the shift at a global level and understanding how skill production has moved from being a national to a global and firm-specific product. The findings from this research have aimed to consider the phenomena of these global skill webs from this perspective and contribute to the debates in two ways. First, the findings indicate that while global skill webs do exist in the aerospace sector, this global infrastructure is not as encompassing as theoretically predicted. Second, the research suggests that global skill webs are influenced by the relationships between the multinationals and nationally bounded institutions and can be shaped or resisted by them.

8.3.1 HOW ENCOMPASSING ARE GLOBAL SKILL WEBS?

Evidence from this project, such as the emergence of multinational-centric conditions for engineering skill formation, supports some of the arguments within theories of global skill webs about the ability of these firms to ‘capture’ skills. However, there are limited differences in terms of whether those firms with global skill webs engage more or less with actors and institutions within skill formation systems than firms without. What has emerged strongly through the discussion in Chapter Seven is that the development of global skill webs or ‘global infrastructure’ as a process is not as encompassing as predicted. Instead, adoption of standardised production and integrated HR and training practices hinge on the use of global teams or globally integrated production systems. Implementation of standardised practices can vary significantly across the firms, and seems easier for certain types of work than others.

The term ‘global work’ has been employed to indicate the types of work that may be easiest to assimilate into global skill webs. This term includes research and design activities and virtual manufacturing, supporting the initial hypothesis of the importance of the portability of work and workers (Levi and Ahlquist, 2004). In these cases, the findings support many of the claims within the initial research, such as the existence of 24-hour research and design activities, or ‘chasing the sun’ (Ashton et al., 2010).

For other types of work such as physical manufacturing, even when subsidiaries are integrated into global production systems, only a small number of engineers in connecting roles have access to the standardised or integrated practices that make up global skill webs. Those engineers were found to either be responsible for quality, or to oversee and resolve problems within the production process. In the initial theories of global skill webs, the authors highlight the important role played by quality checking and benchmarking processes in enabling firms to reduce their reliance on skill formation systems (Lauder et al., 2008,

Ashton et al., 2010). The inclusion of these engineers could be argued to be a physical representation of how the development of firm-specific and integrated quality assurance practices discussed in the initial theory have translated into day to day operations. The use of some of these engineers by the multinationals across subsidiaries also supports arguments that firms are focused on developing a core group of employees as a 'global resource' (Edwards et al., 2013).

As such, the findings from this research add to the theories of global skill webs, by suggesting that they do not seem to be replacing nationally based systems of practices and management (as indicated in Ashton et al., 2010), but instead operate alongside them. The evidence from companies in both countries confirms the previous arguments that each firm's global skill webs typically target employees (in this case engineers) identified as talent, and management (Ashton et al., 2010, Ashton et al., 2009). This finding also supports other work arguing that managers as a group are the most likely to be managed by standardised practices (Edwards and Kuruvilla, 2005).

Of the engineers who did have access outside of this small group, most were undertaking 'global work'. Examples might include having access to certain 'standardised' practices within the global infrastructure, such as company conferences and training. However, across the four firms who have developed global skill webs and global teams, the integration of HR and training practices is uneven, and the remainder of the workforce are subject to nationally organised practices. Their purpose, and whether they actually reduce firm reliance on national skill formation systems is brought into question when, even at an organisation level, nationally managed systems of HR, training and even production practices remain in operation.

Why is there such variation across firms, both in terms of the practices that have been integrated, and how these have been integrated? The findings from this project suggest that the development by individual firms of global skill webs can be bounded by institutional constraints. Unions, in particular, emerge as actors who can resist the implementation of standardised practices, such as in the case of Wings Corp AU resisting the implementation of performance related pay, and integrated job classification systems. This example highlights how certain changes to practices are mediated by national institutions (Locke and Thelen, 1995), as in this case, the introduction of these practices was interpreted by the trades union as an attempt by the multinational to undermine the awards system. In this instance, the resistance was also influenced by the hostile relationship between management and union, a country of origin effect driven by the US headquarters.

As such, this example highlights how actors can use institutions within subsidiary countries to mitigate or influence how multinationals integrate practices within global skill webs, and how broad their scope is, even in countries identified as liberal market economies. While there were limited examples of resistance found in the study, it is likely that more exist, and so this raises questions for future research about the extent of resistance at a subsidiary level to the introduction of practices that form parts of global skill webs, and the groups of workers that are enveloped into these global networks.

The example also indicates how the multinationals studied are not only constrained by the institutional systems in subsidiary countries, but also how country of origin effects can both drive resistance efforts in subsidiaries and influence the development of standardised practices, particularly in terms of integrated training. While the potential for this was noted in one piece of work by the original authors (Ashton et al., 2009), they argued that the effects of country of origin would decline over time. However, in all four firms studied who have developed global skill webs, there was clear evidence found of both the influence of country

of origin practices, but also the continued influence of country of headquarters in terms of the design of and oversight over practices integrated within global skill webs.

The findings of this project in many ways support some of the broader claims that multinationals, by developing global skill webs, can reduce their reliance on one dominant national skill system. Notably though, the global skill webs in the multinationals studied appear to be less encompassing, can be resisted, and perhaps most importantly, are more problematic and resource intensive to introduce and oversee at a subsidiary level. The evidence suggests that country of origin or headquarters still plays an important role, as design and control over the global infrastructure remains with headquarters. However, these firms remain embedded within national skill formation systems, even as the development of global skill webs gives them greater control over the process of skill development. If global skill webs are difficult and costly to build, implement and oversee, perhaps their use can be seen as a means for multinationals to build and utilise the skills of a small core of global ‘human resource’, whose role is to ensure the smooth operation of global production systems, and not to reduce firm reliance on national skill formation systems.

So how can the relationships between the multinationals studied, the introduction of global skill webs and engagement with subsidiary skill systems be understood? This research suggests that the multinationals still require national or sub-national skill formation systems to produce the graduate engineering skills they require. Nearly all of the initial skill formation for professional engineers still takes place within universities, and the firms studied engage with other actors in relation to ongoing engineering skill formation. Evidence from this research suggests that these firms are creating firm-specific or multinational-centric conditions for skill development that are distinct from the national and sub-national architecture. Some of these relationships, such as those ‘innovation plus skills’ relationships

with universities that are managed by headquarters, can be considered anchor points for global skill webs.

These relationships not only provide the subsidiary sites with necessary graduate or more specialist engineering skills, supporting previous research (Tregaskis and Almond, 2017), but also provide bespoke skill development opportunities for those engineers identified as ‘talent’ who are seen as a ‘global resource’. This suggests that some of the relationships between multinationals and universities can have a dual role of providing skills and/or skill development at a subsidiary level but also at a global level for those engineers captured within global skill webs. This extends the work on global skill webs, such as the acknowledgement that some multinationals may attempt to continue to build long-term relationships with universities (Ashton et al., 2009), by indicating that some of these relationships may actually be transformed, as universities become resources within a firm’s global skill web.

Other relationships with the state or the sector PEI/trade association can be argued to support the earlier claim that even if the multinationals studied have reduced their reliance on skill formation systems, they remain embedded within them. The findings would support the argument that changes to production have resulted in these firms being able to indirectly influence institutions at a national level, and that, as a result, these firms take a more active role within skill formation systems in terms of organisational experimentation than has previously been accounted for. In addition, the argument that global skill webs are less encompassing than theoretically predicted, and the existence of a large percentage of subsidiary workforces who remain managed by nationally orchestrated HR or training systems, means that multinational subsidiaries still need to engage with actors within the skill formation system in relation to engineering skill development.

8.4 MULTINATIONALS, SKILL FORMATION AND SKILL FORMATION SYSTEMS

How can the role of multinationals in skill formation be understood in light of the existing debates about national and sub-national skill formation systems, and global skill webs? One of the arguments made in Chapter Two (Section 2.3.3) was that while the importance of the multinational has been explored in terms of how they have been able to shape or circumvent employment practices or industrial relations institutions at either a national or a sub-national level (e.g. Royle, 1998, Royle, 2006, Greer and Hauptmeier, 2016), research on the role of multinationals in relation to skill formation is sparse. It would, however, be overstating the evidence to suggest that the difference and the resulting incoherence between the national skill system architecture and the sub-national conditions developed by the multinationals studied challenge the theories of national skill systems and varieties of capitalism.

Theories of national skill systems or the varieties of capitalism focus on ‘delineating the dominant model’ (Crouch et al., 2009, 658) within a country, and the conditions expected from skill formation systems in liberal market economies still exist in the UK and Australia, even though they are not experienced as strongly by the multinationals studied. Instead, the approach of this study has been to explore how the conditions experienced by these firms differ from this national architecture, and what role these firms play in creating this differentiation. This approach falls in line with arguments that there is greater variation within national systems than the parsimonious categories theories such as Varieties of Capitalism might suggest (Crouch, 2005a). Instead, institutional arrangements may be more ‘loosely coupled’ and so allow for the creation of more ‘autonomous sub-systems at a sectoral or local level’ (Crouch et al., 2009, 657).

One such account of sectoral varieties of capitalism argues that incoherence between national architecture and sub-national conditions can be ‘creative’ (Crouch et al., 2009). Firms can

develop distinct sub-national conditions by accessing local or extra-national institutions that differ from the national institutional structure, if national institutions fail to provide the conditions needed for a sector (ibid). However, even within the theoretical model developed in this account (ibid), multinationals are still not differentiated from other firms. Firms are treated as a homogenous group, even though, as discussed in Chapter Two (Section 2.4), the only examples within the study of firms being 'less bounded by national institutions' than theory would assume (one of the central premises and findings of the study), were the three cases involving multinationals.

This research seeks to extend this model, and to apply it specifically to the role of multinationals in skill formation. The original study (ibid) focuses on all the conditions of national institutional systems across both liberal and coordinated market economies, and therefore variation within the conditions for skill formation are discussed only as a component of the national architecture, or as one means by which sub-national conditions have been created that deviate from national institutions. From the findings in this research, multinationals as actors are distinguished from other firms in terms of their access to what can be referred to as 'firm-specific' extra-national institutions that are controlled by headquarters (where this is located outside of the national context), such as global skill webs. The multinationals are also differentiated from other firms in terms of their dominance and resources, and the effect this has on institutions within the national skill formation system. The dominance of most of the multinationals studied within the aerospace sector globally, means that these firms fit the definition of a 'giant firm'. They are dominant within their own markets, and capable of regime shopping within a global economy where governments are 'relatively weak, and corporations have more autonomy' (Crouch, 2010, p.156). In both the UK and Australia, there is evidence of 'the competition state'. There are examples in both countries of the shift by governments from a focus on macro-economic policies to micro-

economic, and the resurgence of the use of targeted industrial policy to alter some of the conditions of operation for favoured sectors (Cerny, 1990, pp.222-223), in this case aerospace. As aerospace is a 'favoured' sector in both the UK and Australia, this means that the 'dominance' of the multinationals studied at a national level is likely to increase. These firms have had access to additional resources for many years, and may have access to local (or sector) institutions and resources that may not be available for other sectors.

Another important finding from this study that forms an important part of the proposed extension of the theoretical model is that actors and institutional arrangements appear to be malleable in the face of the dominance of these multinationals. The firms studied have been able to closely orient the activities or skill outcomes of other actors within the engineering skill system to meet their own requirements. This finding supports other research that has highlighted the malleability of institutions in the face of multinationals. One such example is work that identified how multinationals in a region in Spain were able to 'opt out' of institutional arrangements in relation to skills to a degree that would not be possible for nationally bounded firms (Almond et al., 2014).

The 'plasticity' within the institutional arrangements (Locke and Thelen, 1995, 338) of the engineering skill system found in both countries in this study, can be seen in the way that these firms have created distinct firm-specific operating conditions. These firms are invited to sit on various boards and working groups, their opinion is sought on what the strands of industrial policy should look like and on what government infrastructure should do, and they have the financial and human resource to both participate in, and fund the development of the various forms of organisational experimentation in relation to skill development discussed in the previous section.

FIGURE 8:A THE MULTINATIONAL AS AN ACTOR WITHIN THE ENGINEERING SKILL FORMATION SYSTEM³

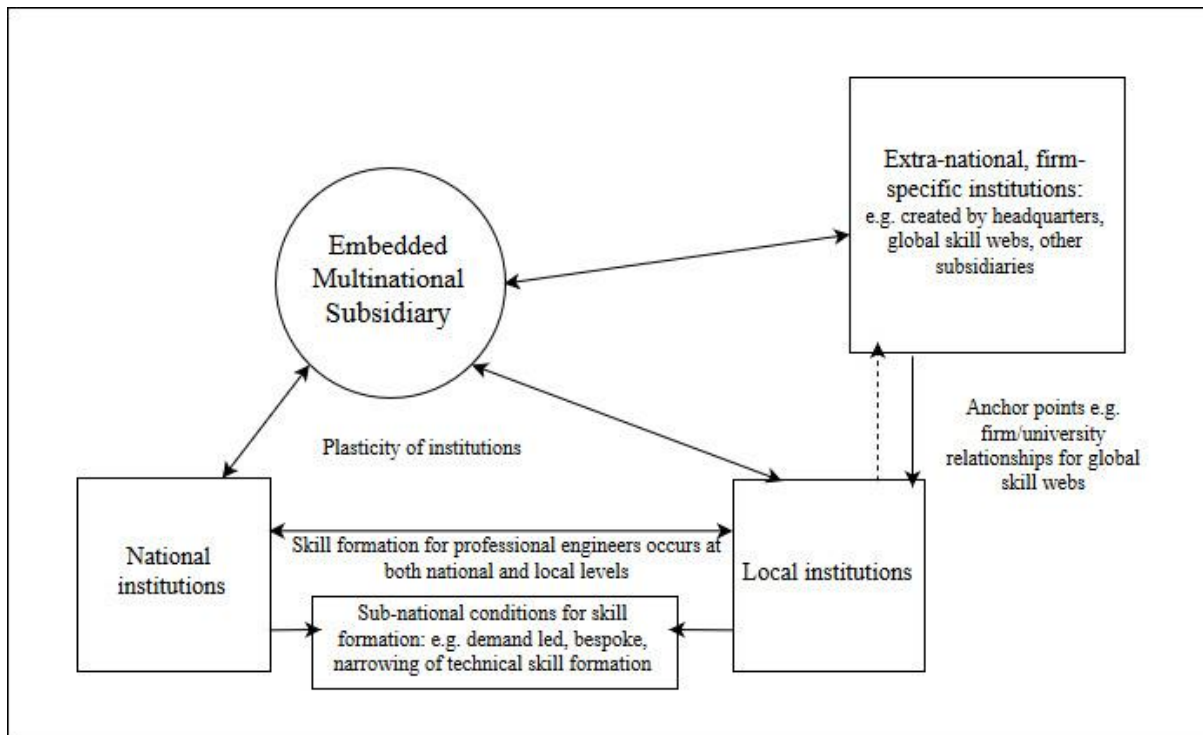


Figure 8:A models the relationships between ‘the multinational’ as an actor, or differentiated type of firm, and the national and local institutions within the skill formation system. In the case of the firms studied, the subsidiaries appear to be embedded within the engineering skill systems, so in the model the subsidiary is referred to as embedded. The interaction of the multinationals with both national and local institutions, and the relationships that they build are likely to be dependent on each firm’s skill requirements. The malleability or plasticity within national or local institutions in the skill formation system may also depend on the financial and human resource the subsidiary is willing to invest in building demand-led, or firm-centric conditions for skill formation. The multinationals studied have created these sub-national conditions in relation to skill by building relationships with actors at both national and local levels.

³ The relationship between the multinationals and those universities that they have ‘innovation plus skills’ relationships with that are managed by headquarters are depicted in the model as ‘local’ institutions. While universities are part of the national infrastructure, they are typically local in their relationships with companies.

All of the firms studied also have access to what I have termed ‘firm-specific’ extra-national institutions. These can include decisions made by headquarters where this is based in another country, global skill webs if these exist, and experiences from other subsidiaries, for example where these operate in countries with different varieties of capitalism. The decisions made by headquarters in relation, for example, to the development of global skill webs, may influence how subsidiaries engage with or potentially shape local or national institutions within the skill formation system. In one example recounted in this research, one firm (Engines Ltd UK) enforced the use of external training consultancies for firm training programmes within their European subsidiaries, irrespective of the different institutional arrangements in relation to training in the subsidiary countries.

In the case of the multinationals studied, the research has also identified examples of these firms being able to both indirectly and directly shape the development of ‘local’ or sector specific institutions, and use their access to firm-specific extranational institutions to do so. One example would be in the UK case, where multinationals’ recommendations for the development of the catapult centres were based in part on some of these firms’ experience of the German Fraunhofer centres through their German subsidiary operations. This example indicates how these firms as ‘boundary spanners’ can aid the transfer of ideas and practices from one institutional context to another (Crouch and Farrell, 2004). Another example might be the interaction between global skill webs, and the ‘innovation plus skills’ relationships with universities that are managed globally by the firm headquarters, and act as anchor points for this firm-specific global infrastructure.

What Figure 8:A attempts to convey is that the role of the multinational in skill formation, and within skill formation systems occurs at three scales: local, national and global. The importance of these differing levels of analysis has been raised in research on the role multinationals play in global production systems (Dicken et al., 2001). While a small number

of studies exist that explore the role of multinationals in skill formation, these studies tend to focus on one of these analytical levels. The discussion here has attempted to use work by Crouch et al. (2009, that distinguishes between these analytical levels in terms of institutions, and to extend and apply this model to the problem of the role multinationals play in skill formation, using the case of the firms studied in the UK and Australian aerospace sectors. Theoretically, focusing on the interplay between skill institutions operating at these different levels may also aid understanding of when, how and why subsidiaries engage in particular ways with national or local skill institutions, or in cases where local actors such as unions resist the implementation of standardised practices that make up global skill webs.

This model will require further refining, preferably through research on a variety of sectors and skill requirements. This would enable the ideas suggested within the extension and application of the model presented here to be tested and refined. One such idea might be the notion of institutional plasticity or malleability of institutions within the skill formation system in the face of multinationals. The findings raise important questions about whether it is easier, for example, for multinationals in sectors such as aerospace to shape certain institutions. One example might be universities. The firms studied require high levels of innovation, and therefore allocate significant financial resources to innovation expenditure and then leverage those innovation relationships as a way of shaping skill provision at universities. Work on innovation relationships between firms and universities in other high skill sectors (Lam, 2007) indicate that potentially similar conditions may be possible in other innovation-centric sectors, such as ICT or pharmaceuticals. However, it is unlikely that multinationals in sectors that require less innovation or lower skills would invest to the same extent.

8.5 CONCLUSION

One of the main themes that has permeated the discussion throughout the previous three sections is that the multinationals studied emerge as an active participant in the process of skill formation. These firms have the capacity to potentially shape skill formation systems, whether directly or indirectly, but also are constrained by them. When multinationals participate in collective activities in particular, these are heavily constrained by national institutions and influenced by the approach of actors such as the state. In comparison, when these firms engage in individual negotiations with actors, institutions in the skill formation system may be more malleable.

As a result examples were found of firm-specific demand-led conditions for skill formation, with narrower, bespoke/customised or firm-specific skills for individual firms. However, for collective activity the multinationals were more constrained to engaging with actors or participating in institutions in both countries that appear to be Williamsonian (Streeck, 2009). These include the AGP, PEIs/trade association that emerge from the market and are shaped by national institutions, actors and operating conditions.

This dissertation has also attempted to explore the phenomenon of global skill webs. This research has found that, while several of the firms studied have developed characteristics of global skill webs these have not resulted in a reduced reliance on national institutions.

Instead, national and local institutions may be able to shape the development of global skill webs through country of origin, to resist the implementation of parts of these webs such as standardised practices, and to shape how these are operationalised. In addition, a smaller number of engineers (typically managers and talent) have access to the standardised, integrated or aligned practices. As a result of these two findings, global skill webs appear to be less encompassing than theoretically depicted.

The multinationals studied have also continued to engage with and remain embedded in skill formation systems. Some of the relationships they have developed with actors such as universities have been assimilated into their global skill webs, while others remain important sources of support for the continued operation of nationally bounded subsidiary training systems. To explain these findings, this chapter has extended a theoretical model looking at how firms can use local or extra-national institutions to shape conditions in ways that differ from the national institutional architecture (Crouch et al., 2009), and applied it to the question of the role multinationals, as a distinct category of firm, play in the process of skill formation. The model does not prioritise one level of analysis, but highlights how the interplay between institutions at local, national and extra-national levels can influence how multinationals engage with skill formation systems.

The following chapter addresses the main contributions and limitations of this project, avenues for future research, and any concluding thoughts.

CHAPTER 9 THE ROLE OF THE MULTINATIONAL IN SKILL FORMATION

9.1 INTRODUCTION

This project has addressed the question of the role of multinationals in skill formation. This is an important question in light of the role that some of these firms, those who operate global production systems, have played in the fragmentation and disaggregation of production. This group of multinationals fulfil the definition of ‘giant firms’ dominant within their own markets and capable of regime shopping (Crouch, 2010). National or regional governments acting as ‘competition states’ (Cerny, 1990) may then attempt to use their skill formation systems and other forms of industrial policy as a means to attract and retain these firms. Tension occurs between this regional or national response by the state, and arguments that these firms have reduced their reliance on nationally bounded skill systems, through ‘skills capture’ (Brown et al., 2008, Lauder et al., 2008) by building global skill webs (Ashton et al., 2010, Ashton et al., 2009).

This dissertation has addressed this tension by exploring the extent to which multinationals engage with, and potentially shape skill formation systems, whether they have developed global skill webs and, if by doing so, these affect their engagement with national or sub-national institutions. This chapter summarises the main findings from the project and their contribution to existing research on skill formation systems, the role of multinationals in shaping institutions and the small body of research on the role multinationals play in skill formation. It then outlines the limitations of the research and any avenues for future research.

9.2 MAIN FINDINGS

The aerospace multinationals studied engage with the engineering skill system and appear to shape various institutions to meet their needs. Shaping of the engineering skill system

appears to primarily occur via organisational experimentation, though there are a small number of examples of these firms acting as institutional entrepreneurs and undertaking institutional experimentation.

Across both countries, the evidence suggests that these firms have developed multinational-centric and firm-specific conditions for engineering skill development that diverge from both the national and sub-national skill system architecture. It supports the idea of the 'competition state' (Cerny, 1990), and sector based policies that support and encourage the development of sub-national conditions for skill formation. Institutions also appear to be more malleable and have increased plasticity (Streeck and Thelen, 2005, Almond et al., 2014) in response to the multinationals studied, making it easier for these firms to create sub-national and firm-specific conditions for skill formation. While institutions appear to be more malleable to these firms, there was less evidence found to suggest they are 'less bounded' by national institutions and architecture than theory would suggest (Crouch et al., 2009) when it comes to skill formation activities.

Instead, the firm-specific conditions developed by the multinationals studied are still mediated and/or shaped by the institutional system and constraints specific to each country. These institutional constraints appear to be driven by logics of path dependence of other actors within the engineering skill system. One important institution that appears to have enacted influence over the choices of the multinationals would be the role of the state. The role and approach of the state in each country, namely interventionist in the Victorian state government in Australia versus voluntarist by the national government in the UK has impacted other institutions and actors within the skill system.

The impact of hard versus soft legislation has also resulted in Chartership and the PEIs playing a much more central role for the multinationals operating within the UK engineering

skill system in comparison to the Australian. The historic impact of the role of the UK national government in encouraging a voluntarist approach appears to have resulted in a form of path dependence, that has shaped how PEIs have developed into what was referred to in Chapter 8 as Williamsonian institutions (Streeck, 2009). The PEIs offer a form of governance of, and lower the transaction costs for, quality assurance for engineering skill development, while also offering services such as skill development activities at a lower than market rate.

In the Australian case, much of this regulation has been undertaken via hard regulation by both the federal and state governments, and enforced by unions through collective bargaining arrangements. As a result there is less evidence of any of the firms studied engaging with any actors in relation to quality assurance activities. However soft skill activities are still undertaken by a Williamsonian institution (*ibid*), the sector trade association. The expansion into services such as training by trade or employer associations has been noted in previous research (e.g. Behrens, 2004). However, examples of this have typically been provision for small and medium sized firms that do not have internal capability for training or HR, as opposed to multinationals. In the Australian case, the central role that multinationals have played with the sector trade association can still be attributed to the role of the ‘state’ however. This is due in part to the role of the Victorian State government played in its creation, and its initial role as a route for firms to shape government policy and subsidies for the sector. In both countries then, variations in the approaches of governments can and have been argued to account for much of the variation between the two countries found in this thesis.

The firm-specific conditions for skill formation were also found to be driven by each of the multinational’s skill needs, which are heavily influenced by sector and product market as predicted by theory (Crouch et al., 1999). The existence of the ‘competition state’ and

industrial policy designed to change conditions for a small number of sectors can be argued to be a response to the implicit threat of labour arbitrage. Multinationals operating in these preferred sectors, such as aerospace, may have access to more resources through industrial policies, such as state subsidies, than their counterparts in other sectors. The findings raise the importance of sector in shaping how multinationals engage with the skill system.

Engagement of multinationals in preferred sectors such as aerospace, and their ability to tailor conditions for skill formation through their engagement with skill systems, may result in increased heterogeneity between sectors within the same country.

The third research question in this project addresses whether the multinationals studied have ‘captured’ skills by building global skill webs, and whether this results in them disengaging from, or reducing their reliance on national or sub-national skill systems. The findings and subsequent discussion indicate that four of the six multinationals studied have developed global skill webs. In these four firms, this global firm-specific infrastructure appears to be used to speed up innovation as predicted (Ashton et al., 2010) and to resolve problems in production across subsidiary sites. The building of global skill webs also indicates that these firms are taking an active role in skill development for engineers and managers across their subsidiary sites.

However, the global skill webs of these four firms are not as encompassing as theoretically depicted. This is particularly the case in terms of what groups of engineers and what types of work are assimilated into this global infrastructure. Typically, access to the integrated or standardised HR and training practices are restricted to managers and engineers identified as talent. Global work, whether design or virtual manufacturing, also appears to be easier to assimilate than physical manufacturing. What both these findings indicate is that global skill webs do not appear to be so encompassing that they replace nationally organised and managed systems of HR and training as indicated in the original theories (ibid). Instead, this

global infrastructure appears to run alongside each firm's national systems, due to there being a large number of the workforce who are still managed at a national level.

In addition, global skill webs at each of these firms reflect that this global infrastructure is both shaped and mitigated by nationally bounded institutions, sometimes referred to as country of origin or home, and host country effects (e.g. Almond et al., 2005, Edwards and Ferner, 2002). Country of origin was noted to have influenced the choices made during the design of standardised practices, such as in the use of contractors versus the use of in-house training teams. In addition, the importance of country of headquarters was highlighted in terms of the design and management of standardised and integrated HR and training practices. Host country effects, or national institutions within subsidiary countries, appear to be able to be used by actors to resist the implementation of standardised practices. In the research, unions were found to do so, but other research on multinationals indicates that there is potential for a broader coalition of actors to be involved (e.g. Almond et al., 2014).

There was also variation found amongst the four firms in terms of what practices have been standardised or integrated. In many respects, the level of oversight required by headquarters, both in the design and management of this global infrastructure, coupled with potential resistance at subsidiary level and the challenges in assimilating certain forms of work and workers, suggests that building global skill webs is more resource intensive and problematic than initially predicted. Instead of global skill webs resulting in reduced reliance on national skill systems and a distancing from country of origin (Lauder et al., 2008), this global infrastructure appears to exist for a core group of workers who are considered a 'global resource' (Edwards et al., 2013).

Finally, there was no evidence found that the development of global skill webs resulted in any of these firms disembedding from the engineering skill system in either country.

Instead, several of the multinationals have developed global skill webs and continue to engage with the engineering skill systems in each country, in some cases at a higher level than the two firms without this global infrastructure. Some of the institutions that the firms engage with, such as universities, also appear to be able to be connected by multinationals to their global networks. These ‘innovation plus skills’ relationships are reminiscent of the innovation relationships studied in other research (e.g. Lam, 2007) where close relationships exist between the firm and university. In the examples of those firms with global skill webs, a small number of these relationships were being managed by headquarters and included within each firm’s strategy as a means to develop the skills from areas of emerging technology and innovation that each firm requires.

The research reveals that these multinationals are taking an active role in terms of skill formation for engineers. This active role can include engaging in organisational experimentation to develop firm-specific conditions, institutional experimentation which directly shapes the engineering skill system, or the building of global skill webs. The multinational as an actor appears to play a central and active role in the process of skill formation, whether at a sub-national, national, or extra-national level.

9.3 CONTRIBUTIONS

This research provides much needed empirical evidence on the role that multinationals can play in skill formation. Research in this area is sparse and tends to focus on one level of analysis - local, national or global. This study is, if not the only, then one of the few that attempts to integrate these three distinct levels of analysis. There is also little systematic comparative study of highly skilled occupations within work on skill formation systems (see for example, arguments by Sako, 2017). This thesis demonstrates how skill formation systems may operate for highly skilled occupations such as professional engineering, and the role that multinationals may play in this process.

The research also advances previous work by showing there are differences in how multinationals may engage with actors, across countries considered to have the same type of skill formation system. One important empirical contribution the thesis makes is that it shows how historical differences in skill formation systems may influence what actors, and the types of activities, multinationals participate in. One important finding that evidences this within the two country cases is the approach of ‘the state’, which has been argued to have influenced whether multinationals engage in collective quality assurance activities versus just soft skill development, and whether they engage with PEIs. The study also highlights that there is variation within sectors in terms of how some of these firms have built and implemented global skill webs, and in how encompassing these are. The research also indicates that national and local institutions may shape the development of, or mediate the implementation of global skill webs.

The research also raises questions for industrial policy. Is it acceptable for industrial policy for ‘preferred sectors’ to prioritise the needs of multinationals in relation to skill development, and effectively subsidise these firms in ways that result in narrower technical, or even multinational specific skill development for engineers? What impact does the influence of these firms, and their focus on shaping skill formation towards narrower as opposed to broad skills have on high skill occupations, or on the skill formation system and other firms who rely on these broader skills? Should governments instead be encouraging multinationals to engage in institutional as opposed to organisational experimentation, and if so, what might this entail?

The second contribution that this dissertation makes is conceptual. The research has argued that multinationals should be conceptualised as a distinct type of firm within skill formation systems. Multinationals are typically grouped with other firms in most national and sub-national accounts of skill formation systems (Hall and Soskice, 2001, Estevez-Abe et al.,

2001, Thelen, 2004, Ashton et al., 2010, Crouch et al., 1999, Sako, 2017, Crouch et al., 2009). However, as this research indicates, multinationals may be less bounded by institutional constraints than other firms, as they potentially have access to ‘firm-specific’ extra-national institutions (such as global skill webs) and enjoy a greater level of institutional plasticity than other firms.

It could be argued that multinationals, therefore, have a far greater potential capacity to act as institutional entrepreneurs (Crouch, 2005a, Crouch and Farrell, 2004), if they so choose, though occasions of this may be infrequent. Multinationals may also have a far greater capacity to avoid institutional constraints, or to engage in organisational or institutional experimentation (Kristensen and Morgan, 2012, Morgan, 2018), to shape sub-national conditions in relation to skill development at a firm, regional or sectoral level. The question raised by this research is whether these conditions can be replicated to other sectors, and if so, which and under what conditions?

As such, I propose an extension of existing theory, developed by Crouch et al. (2009, , to focus on multinationals as a specific type of firm and their interaction with local, national and, what I have termed ‘firm-specific’ extra-national institutions, such as global skill webs that are involved in skill formation. Such an approach differentiates multinationals from other firms, and incorporates their dominance as giant firms (Crouch, 2010) which potentially operate alongside ‘the competition state’(Cerny, 1990). The theory could also be extended to include the concepts of the increasing plasticity or malleability of institutions in the face of some of these firms that may aid multinationals should they choose to engage in organisational or institutional experimentation in relation to skill formation.

Including theories of global skill webs as a ‘firm-specific’ extra-national institution that operates alongside national and local institutions, reflects an approach that multinationals

who have built global skill webs do not exist in a vacuum. Instead, while global skill webs might be considered firm-specific global infrastructure, they may be mediated by national institutions (Locke and Thelen, 1995). In the aerospace sector, global skill webs have been demonstrated to be influenced by country of origin/host country effects, to be resisted at least in part by unions at a subsidiary level and appear easier to implement for certain types of ‘global work’ than others. These conditions have implications for the reach, and uptake of global skill webs, and may explain why they do not appear to be as encompassing as theoretically depicted. This research extends the previous theory by showing how, in the aerospace sector, national and local institutions can mediate or be connected into global skill webs, and, in the cases studied, do not appear to reduce subsidiary reliance on national skill formation systems. These findings raise questions about whether this is the case for other sectors. Are global skill webs more encompassing under certain conditions? Or, under further empirical study are there also limitations to their scale and scope? Further research is needed to explore these questions in greater detail, and in a variety of sector contexts.

The research also highlights the possible limitations of global skill webs. In the aerospace sector, these appear to include the small number of workers who have access to this global infrastructure, variations across firms in terms of what practices have been integrated, and that the operation and management of this global infrastructure appears more resource intensive and problematic than predicted. Subsidiaries may remain embedded to a greater or lesser extent within national skill formation systems. Another limitation emerging from this research is that the subsidiaries studied appear to continue to engage with and shape institutions, driven by their skill requirements, as a significant number of the workforce still require skill development organised and managed at a national level. These possible limitations may apply to other sectors, or multinational subsidiaries, particularly those with higher skill requirements.

Finally, by examining the relationships between these multinationals and actors within the skill formation system, the model outlines how relationships with certain actors may become connected to the firm's global infrastructure. These relationships are described as anchor points, as the research indicates that they do not necessarily embed these firms. Instead, they provide resources for the firm, such as knowledge or skilled workers. One example from this study would be the 'innovation plus skills' relationships developed with certain universities. These anchor points appear to enable multinationals to access specialist skills at masters or PhD level, and graduates with more tailored and firm-specific skills. This engagement can also provide the subsidiary with skills as a resource (Tregaskis and Almond, 2017). While other research indicates that multinational subsidiaries may use these links to embed themselves at a local level, or to gain negotiating power internal to the firm (e.g. Almond et al., 2014), no evidence was found of this in this study.

More work is needed to test and further refine the proposed extension to the theoretical model that has been developed, as there are a variety of contextual conditions that may influence the role that multinationals play in skill formation and within skill formation systems. These include firm skill requirements, which are likely to be driven by sector, product market strategy, and whether they adopt a firm-strategy similar to that of the 'institutional firm' (Crouch et al., 1999) with high-road HR practices and high-skill production practices. Skill requirements may influence whether these firms choose to engage with skill formation systems or seek instead to 'opt out' of them.

The institutional arrangements within the national skill formation system, and how these compare to the skill requirements of each firm, may also shape whether multinationals build relationships with actors. The country of origin or headquarters, and what forms of firm-specific extra-national institutions exist may potentially influence firm behaviour. Finally, whether the sector is a 'preferred sector' could also affect what resources exist at a national or

local level that these firms can access. These areas all require further research to fully examine the role that multinationals play within skill formation, and whether the model that has been extended is fit for purpose by exploring other sectors and countries.

9.4 LIMITATIONS

There are, as with any research project, significant limitations to this study. Four of the primary limitations will be discussed, as will the questions and avenues these leave open for future research. The project focuses on six multinationals, from one highly skilled sector, across two countries which are both liberal market and developed economies. There are significant gaps within the literature in relation to the role of multinationals within skill formation systems. This necessitated the exploratory qualitative approach that has been adopted, and the decisions made in relation to sector and country. However, the first three limitations stem from these decisions.

First, the decision to choose a sector where these firms would, due to product market (Crouch et al., 1999), be required to invest in skill development. Aerospace is a sector reliant on technological innovation, which requires high levels of, and continued investment in skill. Firms in sectors with these conditions may be more likely to engage in organisational and institutional experimentation in relation to skill formation, due to their skill needs. This raises the question of how we can understand organisational or institutional experimentation in this context (Fairbrother, 2018). Are the findings from this study, on such a sector, in any way applicable to multinationals operating in other sectors?

Second, the research focuses on six multinationals, a relatively small sample size. The research design for this project was to interrogate, refine and extend the theories that have been developed, and so theoretical sampling was employed. For this reason, the results are not generalisable to the broader population of multinationals across other sectors.

Third, the country selection. Both countries are developed economies, and a close pair, both liberal market economies. Both countries being developed economies produces certain limitations in relation to fully interrogating the concept of skills capture, as a central assumption within the theory is the offshoring of high skilled work to lower cost locations.

The decision to focus on two liberal market economies strove to highlight not only similarities across the cases but also the importance of small differences, and how these can impact on how multinationals engage with skill formation systems. This approach has strengths, in that it highlights the variation both within countries and also between those grouped as ‘liberal market economies’ (Crouch, 2005a). This is an issue that has been gaining greater attention in research looking at the standardisation or transfer of practices within multinational firms (Edwards et al., 2013). It creates limitations, as discussed in Chapter Three, the primary one being that perhaps more would have been learned in a pairing focused on difference (Strauss, 1998).

These three limitations raise important questions about how generalisable the findings from this research are. There may, for example, be some crossover with multinationals in other high skill sectors with similar product market imperatives, such as a reliance on innovation. However, there may also be some sectors that operate under very different conditions, and therefore, further research is required using different sectors and country pairings, to identify how the role of multinationals in skill formation may change in these different contexts.

The fourth limitation relates to the data collected within each company. There were difficulties with access, and one of the challenges was interviewing key decision-makers in relation to the design and implementation of global skill webs. Access to these decision-makers was particularly challenging in companies who were headquartered in another country. As a result, and as noted in Chapter Seven, I have only been able to present the

rationale behind the decision-making for this global infrastructure for one firm. As a result, there are still questions that could be examined in relation to why multinationals may choose to build and implement global skill webs, why this global infrastructure takes the shape that it does, and who has access to it.

9.5 AREAS FOR FUTURE RESEARCH

The limitations discussed above also indicate that there are significant avenues for future research on the phenomenon of the role of the multinational in skill formation. One of the main contributions of this research discussed above has been to argue that multinationals should be differentiated from other firms when exploring their role within skill formation systems. The discussion above highlighted the role of local, national and ‘firm-specific’ extra-national institutions, and each firm’s dominance and skill requirements in influencing the degree to which they engage with the skill formation system, and the ease with which they are able to engage in organisational and institutional experimentation. The extension to the model that has been proposed could be refined and tested in future research to better understand how local, national and ‘firm-specific’ extra-national institutions interact, and how contextual factors such as sector can impact on the role that multinationals play in skill formation.

Other areas for future research can also be identified from the limitations of this research. As an example, there are significant avenues for research exploring cross-national pairings focused on difference. These include, but are not limited to, exploring whether there are variations in how multinationals engage with the skill formation system in a coordinated versus a liberal market economy, or across developed and developing economies. Further research could also be undertaken to understand some of the questions raised about the scope and scale of global skill webs, and how these might differ based on, for example, sector. This could include variation between high and low skill sectors (i.e. skill requirements), between

sectors which are ‘winners’ in terms of industrial policy versus those who are not, or by exploring sectors where internationally one or a small number of multinationals are more dominant, versus those where they are less so.

There is also the question of comparing skill formation and skill formation systems for occupations, such as professional engineers, with workers whose role requires intermediate skill development. Understanding the broader process of whether multinationals are engaging more heavily with one part of the skill formation system, or for some occupations over others, is important, and some areas, such as how to understand professional skill formation systems for higher skill occupations, have been argued to be under-researched (Sako, 2017). Comparisons of different worker occupations could also explore how skill development for different groups of workers are being affected by the global processes of standardisation, and the impact this has on their skill formation systems, skill development and opportunities for resistance. Is it easier, for example, for multinationals to standardise practices for some groups of workers over others?

9.5 CONCLUSION

The thesis has sought to examine the role that multinationals play in skill formation in highly skilled occupations and sectors. In doing so the project has drawn upon disparate strands of previous research, some of which has analysed whether and how national institutions constrain the activities of multinationals, while other strands argued these firms have instead developed global skill webs that result in reduced reliance on national business systems.

This thesis has developed findings and contributions that contribute to the debates within these differing strands.

First, the thesis indicates that multinationals are likely to remain constrained by institutions within the skill formation system in relation to collective activity, and their choices and behaviour are likely to be influenced by actors such as the state. Where these firms appear to

have the greatest agency occurs in individual interactions with actors within the skill formation system. In these interactions, the resources (time, people and financial) that some multinationals have access to may result in the increased plasticity of institutions.

Second, the thesis demonstrates that while some of multinationals studied have developed characteristics of global skill webs, that these do not appear to have resulted in these firms moving away from their country of origin or reduced the impact of institutions within subsidiary countries. As a result the second contribution of the thesis challenges the original theory of global skill webs in terms of how encompassing they are, and their central purpose.

These contributions have been used to extend an existing theory (Crouch et al., 2009), to first distinguish multinationals as an actor from other firms, and second to position the characteristics and development of global skill webs as ‘firm-specific’ extra-national institutions. By doing so, this theory now encourages analysis to take into account the impact of institutions that are operating at the various scales, and acknowledges that while global institutions such as global skill webs exist, they are still mediated by national and local institutions both in their development, implementation and operation. National or local actors still have the potential to play an important role in shaping, constraining or resisting these firms’ activities in relation to skill formation.

Previous research on the role of multinationals in skill formation is sparse. As a result, this project makes important empirical and conceptual contributions by helping to explain the role these firms play in engaging with skill formation systems, and how they continue to be constrained by some of the institutions within them even if they have developed global skill webs. There are limitations to this research, however, and there is significant scope for additional research to further develop our understanding of the role of these firms in skill formation. One such area raised by this project would be how are multinationals across

various highly skilled sectors and their global skill webs being driven by issues such as emerging technologies. Could emerging technologies reshape debates about the role of outsourcing and offshoring as a way of reducing costs, and what impact do they have on the skill needs of multinationals?

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APPENDICES

APPENDIX A ETHICAL APPROVAL FORMS

SURNAME: BOWKETT
Student Number: C0701019
(if applicable)

1. Describe the methodology to be applied in the project

Qualitative semi-structured interviews will be the primary methodology. This will be supplemented by document analysis of available internet information, newspaper articles (via lexis nexis), as well as internal documents made available by the organisation and observation.

PLEASE ATTACH COPIES OF QUESTIONNAIRES OR INTERVIEW TOPIC GUIDES TO THIS APPLICATION

2. Describe the participant sample who will be contacted for this Research Project. You need to consider the number of participants, their age, gender, recruitment methods and exclusion/inclusion criteria.

Hr managers, operation managers, line managers, engineers, nurses, union representatives (of the sector and preferably union representatives of the organisation) at the selected firms will be interviewed. In addition sector learning providers (who have links with the organisation) and public officials will be interviewed, along with any partners in skills initiatives.

Recruitment of interviewees will be conducted using a mixture of snowball sampling and people will be contacted through a variety of media but primarily via email, letter and linkedin. This means it is difficult to give a firm number but weighting should be between 25-40 per case study.

Within each sector because of the heavy gender disparity effort must be made to ensure that some of the participants are female engineers or male nurses to ensure that all perspectives are considered.

3. Describe the method by which you intend to gain consent from participants.

Depending on route of initial contact (whether through online identification, linked in or through interviewee recommendations) potential participants will be contacted either by letter, email or other online methods. The initial contact will include a project overview, and the researchers contact details. If participants are willing to take part and contact the researcher, an interview will be arranged. Once this initial consent to take part in the project has been arranged, and the method of interview (face to face or phone/skype) has been decided further consent measures will be taken.

Face to face participants will be provided with an informed consent document, detailing the project information, the researcher's contact details, confidentiality and their ability to withdraw from the study at any time. A copy of this document has been attached. The consent form will be signed, and the slip kept by the researcher to confirm participant consent.

Phone or skype participants will be emailed an informed consent document, detailing the same information without a slip to sign.

PLEASE ATTACH A COPY OF ALL INFORMATION WHICH WILL BE GIVEN TO PROSPECTIVE PARTICIPANTS (including invitation letter, briefing documents and, if appropriate, the consent form you will be using).

ETHICS 2

SURNAME: BOWKETT
Student Number: C0701019
(if applicable)

1. Describe the methodology to be applied in the project

Qualitative semi-structured interviews will be the primary methodology. This will be supplemented by document analysis of available internet information, newspaper articles (via lexis nexus), as well as internal documents made available by the organisation and observation.

PLEASE ATTACH COPIES OF QUESTIONNAIRES OR INTERVIEW TOPIC GUIDES TO THIS APPLICATION

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Phone or skype participants will be emailed an informed consent document, detailing the same information without a slip to sign.

PLEASE ATTACH A COPY OF ALL INFORMATION WHICH WILL BE GIVEN TO PROSPECTIVE PARTICIPANTS (including invitation letter, briefing documents and, if appropriate, the consent form you will be using).

ETHICS 2

4.
 5. *Please make a clear and concise statement of the ethical considerations raised by the project and how you intend to deal with them throughout the duration of the project. (Please use additional sheets where necessary.)*

Informed Consent:

Any face to face interview participants will sign a written consent form, and any telephone or skype interviews will be emailed an informed consent form.

Deception and Harm:

At the beginning of the interview, alongside asking the participant to sign the consent form, they will be given an overview of the project and the purpose of the research. To prevent harm to the participants they will be assured that any information that could identify them (including job title if they are few in number) will be replaced with pseudonyms/or grouped together with a larger group to prevent easy identification. This will be particularly important for gender as both sectors are heavily weighted to a particular gender. As this research is focussed on the firm and how it develops the skills of its workers, there is less chance that the information provided may harm respondents but reassurance will be provided that if the organisation asks for feedback that no information will be provided that will identify, risk or harm them in any way.

Privacy and Confidentiality:

Participants will be assured that any information they provide will be anonymised using pseudonyms, and that they will not be identifiable in any written documentation. Further ethical considerations will be ensuring that participant information is stored securely on university servers, and is anonymised during the transcription process. Ethical considerations relating to interviewing will be to ensure the participants are made aware that the information they provide will be anonymised, and stored securely, that they are able to contact the researcher and/or supervisors for further information or any concerns, or withdraw from the project at any time.

RESEARCH APPROVED
 Research Ethics Committee
 Cardiff Business School
 Cardiff University

6. *Please complete the following in relation to your research project:*

		Yes	No	n/a
(a)	Will you describe the main details of the research process to participants in advance, so that they are informed about what to expect?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b)	Will you tell participants that their participation is voluntary?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c)	Will you obtain written consent for participation?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d)	Will you tell participants that they may withdraw from the research at any time and for any reason?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e)	If you are using a questionnaire, will you give participants the option of omitting questions they do not want to answer?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
(f)	Will you tell participants that their data will be treated with full confidentiality and that, if	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SURNAME: BOWKETT
 Student Number: C0701019
 (if applicable)

	published, it will not be identifiable as theirs?			
(g)	Will you offer to send participants findings from the research (e.g. copies of publications arising from the research)?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(h)	If working with children and young people please confirm that you have visited this website : Working with children and young people and vulnerable adults please go to web link - http://www.cardiff.ac.uk/racdv/ethics/guidelines/index.html	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
(i)	DATA PROTECTION: (A) Will any non-anonymised and/or personalised data be generated? (B) If "YES" will it be stored beyond the end of the project/archived? http://www.cardiff.ac.uk/socsi/research/researchethics/destructionofdata/index.html	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

PLEASE NOTE:

If you have ticked No to any of 5(a) to 5(g), please give an explanation on a separate sheet.
 (Note: N/A = not applicable)

If there are any other potential ethical issues that you think SREC should consider please explain them on a separate sheet. It is your obligation to bring to the attention of the Committee any ethical issues not covered on this form and checklist.

Signed: _____
 (Principal Researcher/Student) *Amie Bartlett*
 Print Name: CASSANDRA BOWKETT
 Date: 09/07/2015

SUPERVISOR'S DECLARATION (Student researchers only): As the supervisor for this student project I confirm that I believe that all research ethical issues have been dealt with in accordance with University policy and the research ethics guidelines of the relevant professional organisation.

Signed: _____
 Print Name: PETER TURNBULL
 Date: 9/7/2015

TWO copies of this form (and attachments) MUST BE OFFICIALLY STAMPED BEFORE any research project work is undertaken -

STATEMENT OF ETHICAL APPROVAL

This project has been considered using agreed School procedures and is now approved.

SURNAME: BOWKETT
Student Number: C0701019
(if applicable)

Stamped by School :
Date:

[Handwritten signature]
28/7/2025

APPLICATION APPROVED
Research Ethics Committee
Cardiff Business School
Cardiff University

ETHICS 2

Cassandra Bowkett, MSc
PhD Researcher
Cardiff Business School
Cardiff University
Aberconway Building, Colum Drive
Cardiff
CF10 3EU
Bowkettcv@cardiff.ac.uk

DATE

Recipient Name, Job title
Address of recipient

Dear [NAME]

I am currently undertaking a research project examining how multinational organisations in the aerospace sector/private healthcare sector define, develop and maintain the skill sets of their employees (engineers/nurses). I understand that you currently work for (organisation) as a (job title), and was hoping that you could spare some time to talk to me about how (organisation) develops the skills of its workforce. (Organisation) is seen as a leader in the aerospace sector, and understanding the way that it shapes skill development across sites in different countries is of particular interest.

This is part of a larger PhD research project, this research will explore the role of operations and HR practices, job structure, training and development in the skill development of engineers/nurses.

The interview should take approximately 45 minutes and your time would be greatly appreciated.

Please feel free to contact me with further questions, and if you are happy to proceed with an interview I can arrange this in a time or location to suit you.

My contact details are as follows:

Telephone: (this may change dependent on country)

Email: Bowkettcv@cardiff.ac.uk

Yours sincerely

Cassandra Bowkett, MSc

APPLICATION APPROVED
Research Ethics Committee
Cardiff Business School
Cardiff University

**CARDIFF BUSINESS SCHOOL
RESEARCH ETHICS**

Consent Form –

Researcher information:

Cassandra Bowkett, Msc; PhD Researcher
Cardiff Business School
Cardiff University
bowkettev@cardiff.ac.uk

APPLICATION APPROVED
Research Ethics Committee
Cardiff Business School
Cardiff University

Research project overview:

This research will be examining how multinational organisations in the aerospace sector/private healthcare sector define, develop and maintain the skill sets of their employees (engineers/nurses). It will explore the role of operations and HR practices, job structure, training and development in the skill development of engineers/nurses. This will be compared within the industry across sites in different countries. By doing so, the way the firm interacts with each country's regulations, education system and industrial relations system will be explored. This will allow for analysis of how skill sets are developed in the organisation across national boundaries. This research project is being conducted as part of a PhD, and outputs will include a thesis and related publications in academic journals and other related academic channels.

Participant Information:

I understand that my participation in this project will involve an interview lasting approximately 45 minutes.

I understand that participation in this project is entirely voluntary and that I can withdraw from the study at any time without giving a reason.

I understand that I am free to ask any questions at any time. If for any reason I have second thoughts about my participation in this project, I am free to withdraw or discuss my concerns with either Professor Peter Turnbull or Doctor Deborah Hann (emails: turnbullpj@cardiff.ac.uk; hanndj@cardiff.ac.uk)

I understand that the information provided by me will be held confidentially and securely, such that only the researcher can trace this information back to me individually. The information will be retained up until the end of the project and will then be anonymised, deleted or destroyed. I understand that if I withdraw my consent I can ask for the information I have provided to be anonymised/deleted/destroyed in accordance with the Data Protection Act 1998.

I, _____ (*NAME*) consent to participate in the study conducted by (Cassandra Bowkett, Msc) of Cardiff Business School, Cardiff University, under the supervision of Professor Peter Turnbull and Doctor Deborah Hann.

Signed:

Date:

APPLICATION APPROVED
Research Ethics Committee
Cardiff Business School
Cardiff University

Research Overview

This research will be examining how multinational organisations in the aerospace sector/private healthcare sector define, develop and maintain the skill sets of their employees (engineers/nurses). It will explore the role of operations and HR practices, job structure, training and development in the skill development of engineers/nurses. This will be compared within the industry across sites in different countries. By doing so, the way the firm interacts with each country's regulations, education system and industrial relations system will be explored. This will allow for analysis of how skill sets are developed in the organisation across national boundaries.

Main research themes:

Business strategy (product market, competitive strategy, business organisation and networks)

In particular this theme is focused on firm strategies, such as innovation or cost reduction and how these manifest into policies and practices. In addition it looks at how firms develop business networks or organise their operations in particular ways, such as their choice of country of operation (why was it selected), and how they interact with national level institutions and industrial relations systems, through their acknowledgement (or not) of unions, collective bargaining agreements, relationship with regional or central governments and policy makers etc. In addition the relationships the firms have with other businesses, such as shared training programmes will be explored.

Institutional and policy frameworks firm operates in – both vocational education and training and non VET

This theme explores how the firms engage with the national and regional frameworks they operate in. Do they utilise national training systems (eg. VET systems) or have relationships with local training providers? If yes what do these relationships look like and what role do the firms take in shaping skill development?

Modes of engaging labour (e.g. labour hire, sourcing, types of contracts i.e. full time/part time/ agency, recruitment practices, apprenticeship schemes)

How do firms create the skills of their employees, and in particular how they recruit new employees and the routes and forms these sourcing practices take will show how skill is defined and created in the organisation.

Structure of jobs (e.g. job design, work organisation)

The structure of the jobs, the type of activities undertaken, and the operations and HR practices employed will all influence on the job skill development, and will shape what skills are maintained post training. In addition training offered by the firm whether internal training or external will be identified to see what additional skills are developed (and whether the existing practices will ensure these are maintained).

The role of certain operations identified with high performance work organisations (e.g. lean production, team-working, autonomy, control over activities) or HR practices (e.g. performance related pay and criteria, appraisals and development practices) will be explored to discover employee perceptions of the impact of these on the development of particular skills.

Main research questions:

RQ: How does the organisation define develop and maintain skill?

RQ2: How are skill sets developed within different institutional contexts?

Example questions that will be asked, though these will vary dependent on the job role of each participant:

RQ: How does the organisation define develop and maintain skill?

How is skill defined?

- Within the organisation, through job specs, 'brand values', do they have behavioural criteria for roles as well as technical?
- interviews, what criteria do they use? (Profiles, qualification and experience requirements, personality types) What sort of questions do they ask, and how do they grade responses (i.e. do they have particular qualitative criteria?)
- Are there systems that monitor skill levels? (eg. Rotation software) If so how are skills defined on these systems?

How are skills developed?

- Do they recruit skills into the organisation? What routes into the occupation do they offer? (eg. Apprenticeships, career ladders, internal progression routes)
- what training do they offer internally? Is it primarily technical, firm skill focused, do they have partnerships with other learning organisations (colleges, schools, private learning providers)
- do they have formal/informal mentor or coaching programmes?
- Are there career ladder routes, and if so what are the criteria? Do they offer routes for workers to 'upskill' as part of progression?
- How is work organised? (i.e. teams) if so how are these formed? Do skills/experience play a part in team structure? Are there different job roles within the team?
- Are there any site agreements with unions? If yes, what are the agreements? Do these contain any reference to training or job structure?
- Are there union reps on site? Do they get consulted before any changes to job structure or work organisation?
- Are there any alternative partnership agreements or worker groups that are consulted on company change? If yes how do they operate? What issues do they cover?

How are skills maintained?

- What reward systems do they use? Are they individual/team focused, on hard targets (technical) or behavioural or mixed?

-what management systems do they employ? Are annual reviews/1:1s used, and if so what is discussed? Are they managed against team or individual targets? What are the criteria? What does good performance look like? If underperformance is found how is it managed? What support is offered, and is any of that training focused (formal courses, coaching)

-Does the job structure offer opportunities for workers to try new tasks, does it offer autonomy, control, task variation and discretion?

RQ2: How are skill sets developed within different institutional contexts?

Standardised (or firm level):

What is standardised?

-Are there firm level training guidelines/competencies? Is there training offered that is the same in both locations? If so what does it entail?

-Are the job profiles/specs the same for the same level job across countries?

-Are the management/ops/HR practices the same in multiple sites? If so are they flexible so that the sites can implement them differently?

- Are the technological systems the same? (ie. Staffing systems, communication systems etc)

Institutional/contextual?

-What are the relationships with external training providers?

- Are there relationships with other firms relating to skill development? If so what do these look like?

-Are there different routes into profession? (i.e. apprenticeships or not?) if yes, do these different routes mean different internal systems in place?

-Are there different legislative requirements in different countries?

More specific stakeholder q here – eg. Unions, learning providers

- What are their relationships with the firm?
- Does the firm allow unions to negotiate around skill development, job structure or conditions?
- Does the firm provide specific guidance relating to skill provision to the learning provider? Do they provide an overview of what key skills are important to them as a company? (this may be through company specific modules, or adapted training programmes)

APPLICATION APPROVED
Research Ethics Committee
Cardiff Business School
Cardiff University

APPENDIX B EXAMPLE INTERVIEW GUIDES

EXAMPLE 1: REGIONAL BRANCH OF THE SECTOR PEI

PROJECT INFORMATION



Researcher information:

Cassandra Bowkett, MSc; PhD Researcher

Cardiff Business School

Cardiff University

bowkettcv@cardiff.ac.uk

+447967432998

Project Supervisor

Professor Caroline Lloyd

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Research project overview:

Developing and managing skills and skilled workers is challenging in an increasingly global context. Skills play an increasingly central role in driving innovation and productivity, and how companies manage and develop skills are particularly crucial in high value and research and development activity.

This project explores how multinationals develop and manage skills, with a particular focus on how they adapt their training strategies in different countries, why they might need to do this and most

importantly how. In particular this research looks at how training programmes are designed and delivered, whether ‘in-house’ or in partnership with other agencies (e.g. educational institutions).

A crucial element of this research focuses on the relationships between aerospace MNCs and other stakeholders in the sector, including education providers, unions and professional associations, employer groups, and professional and sector bodies.

This research project is being conducted as part of a PhD, and outputs will include a thesis and related publications in academic journals and other related academic channels.

What would participation involve?

Participation in this project would involve an interview lasting approximately 45 minutes. All interviewees are offered anonymity, and the pseudonyms will be used in place of organisation names in any outputs by the researcher.

Any organisation that participates will receive a written report of the project findings.

Interview overview:

N.B. The overview below includes the main themes of the research and not all will be relevant for each interview. These themes are broad, and the questions and information below each theme is indicative of the interview content but as this research is exploratory these are not fixed. In addition, each interview will start with some brief biographical questions about the interviewee’s experience in their role and in the sector more broadly.

Theme 1: RAES, its role in the sector and history

What role does the RAES play in the Bristol aerospace cluster, and what activities does it undertake for its members? Can you tell me more about the events RAES runs in Bristol and how the topics are decided upon? Do members shape the association itinerary?

Theme 2: Skill development in the aerospace sector

This can include challenges, gaps and examples of good or bad practice. In particular what role does your organisation play in terms of skill development, regulation of knowledge and experience and standard setting in the sector?

How central are MNCs in this process, and what role do they play? In your experience (anecdotal experience is welcome) does training and development typically take place 'in-house', or through collaborations between MNCs and education providers? Is there a tension between firm-specific and industry accredited training?

Theme 3: Relationships and collaborations

Collaborations seem to be crucial, particularly in relation to innovation and policy development. Does RAES have collaborations with any other organisations in the Bristol aerospace cluster and if so what do these involve? Are you aware of whether collaborations are common in relation to skill development?

Theme 4: Policy and skills

Does RAES undertake any policy related activity linked to the Bristol Cluster, and if so is any of this linked to skills?

EXAMPLE 2: ENGINEERS

PROJECT INFORMATION



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Research project overview:

Developing and managing skills and skilled workers is challenging in an increasingly global context. Skills play a central role in driving innovation and productivity, and how companies manage and develop skills are particularly crucial in high value or technologically driven environments and in research and development activity.

This project explores how multinationals and large firms in the aerospace sector develop and manage the skills of engineers. In particular this research looks at how training programmes are designed and delivered, whether 'in-house' or in partnership with other agencies (e.g. educational institutions). Another central focus is on how firms manage existing skillsets and requirements while planning for future skill needs. A crucial element of this research focuses on the relationships between large aerospace firms and other stakeholders in the sector, including education providers, unions and professional associations, employer groups and sector bodies.

This research project is being conducted as part of a PhD, and outputs will include a thesis and related publications in academic journals and other related academic channels.

What would participation involve?

Participation in this project would involve an interview lasting approximately 45 minutes. All interviewees are offered anonymity, and pseudonyms will be used in place of organisation names in any outputs by the researcher.

Participation in this project is entirely voluntary and participants can withdraw from the study at any time without giving a reason. Any information provided will be held confidentially

and securely, such that only the researcher can trace this information back to any individual. The information will be retained up until the end of the project and will then be anonymised, deleted or destroyed. If any participant withdraws consent they can ask for the information provided to be anonymised/deleted/destroyed in accordance with the Data Protection Act 1998. Any organisation/individual that participates can request a copy of a written report of the project findings.

Interview Outline

Each interview will be based around the individual's experience and role, so there are no set questions. However, the interview covers five sections, detailed below and indicative questions have been included to provide a sense of what will be asked. Not all the questions will be relevant in each interview.

Section 1 : Biographical information

Indicative questions would be as follows

Can you tell me about your current role, and background? How long have you worked here, and in what capacity?

Section 2: Day to day activities

Indicative questions would be as follows

Can you talk me through a typical day for you, and what that involves? What are the biggest challenges that you come across? Have you noticed a change in the skills and competencies you need to do your day to day work?

Section 3: Formal training

Indicative questions would be as follows

Can you tell about some of the formal training you've received? Can you walk me through one of the training programmes you've attended, what was it for and what did it involve? Was this training delivered internally, or have you received training through external companies? If you think you need formal training to develop your skills or as part of your development how do you request this?

Section 4: Informal training

Indicative questions would be as follows

Have you ever had or been a mentor? Can you tell me what this involved? Did this support your skill development and if so how? What other informal support do you receive (i.e. coaching and development opportunities)?

Section 5: Professional membership and external training

Indicative questions would be as follows

Are you a member of any engineering institutions? If yes, have you attended any workshops/events/seminars through them? Are you a member of a union? If yes do they offer any support related to training or skills? Do you attend any sector events or conferences?