

Industrial Policy, Skill Formation, and Job Quality
in the Danish, German and English
Offshore Wind Turbine Industries

LISA SCHULTE

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DECLARATION

“I certify that the work contained in this thesis, or any part of it, has not been accepted in substance for any previous degree awarded to me, and is not concurrently being submitted for any degree other than that of Doctor of Philosophy being studied at the University of Greenwich. I also declare that this work is the result of my own investigations, except where otherwise identified by references and that the contents are not the outcome of any form of research misconduct.”

Lisa Schulte
PhD candidate

Dr. Graham Symon
Supervisor

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ABSTRACT

This PhD thesis is a qualitative comparative case study of industrial policy, skill formation, and job quality in the offshore wind turbine manufacturing industry in Denmark, Germany and England. It engages with the comparative industrial relations, skill formation, and job quality literature and proposes an alternative analytical and theoretical framework to the widely-used Varieties of Capitalisms approach (Hall and Soskice, 2001). This alternative framework is based on Marxist regulation school (Aglietta, 2015 [1979], Boyer, 2005), the marketisation framework (Doellgast and Greer, 2013), and previous studies of the offshore wind industry. This thesis makes another theoretical contribution by extending the concept *investor capitalism* (Useem, 1996) to describe the underlying logic identified in the design and implementation of offshore wind turbine industrial policy.

This thesis also presents a number of important empirical findings, which suggest that theories that solely focus on supply side factors, miss half of the equation of what makes the “institutional foundations of the comparative advantage” of political economies and companies (Hall and Soskice, 2001). The way demand side policies incentivise investment decisions also plays an important part (cf. Aglietta, 2015 [1979]). This thesis shows how supply and demand side policies impact on skill formation and job quality in the offshore wind turbine industry.

In more detail, this thesis identifies specific characteristics of funding for skill formation by industrial policy: ‘permanent’ in Denmark, ‘ad hoc’ in Germany, and ‘post-hoc’ in England. The nature of skill formation providers and public funding provisions impact on the character of participants in training programmes, favouring disadvantaged applicants in Germany in contrast to favouring high performing ones in England. The way skill formation was funded impacted on employer engagement in the institutionalisation of vocational education and training (VET) programmes - employers in Denmark supported the institutionalisation of emerging occupational profiles and corresponding VET, whereas in Germany they argued against it, presumably because they would incur the costs of dual vocational training once it was established.

Short-term skills funding as part of ‘ad hoc’ and ‘post hoc’ industry policy had destabilising knock-on effects on skill formation providers in England as well as in Germany. This is a surprising finding, as both countries are usually characterised as examples of institutional complementarity and hence stability. This thesis shows that varying demand side policy impacts on work-based training and strengthens agencies. The combination of supply and demand side policies leads to a dynamic relationship between skills and job quality. Vocational skills may lead to stronger employment security, but not necessarily job security, and they are not a panacea against bad jobs. Active labour market policy (ALMP) training, when provided to directly employed unskilled workers during short-time work, and the lack of equivalent provisions for agency workers reinforced dualisation of the labour market.

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LIST OF ABBREVIATIONS

3F	Fagligt Fælles Forbund - Danish trade union for unskilled workers
ABP	Associate British Ports
ALMP	active labour market policy
AMRC	Advanced Manufacturing Research Centre
AMSCI	Advanced Manufacturing Supply Chain Initiative
AMU	Arbejdsmarkedsuddannelse – Danish Labour Market Training Centre
BETTA	British Electricity Trading and Transmission Arrangements
BIBB	German Federal Institute for Vocational Education and Training
BIS	Department for Business, Innovation and Skills
BMU	German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
BMWi	German Ministry for Economic Affairs
BOSIET	Basic Offshore Safety Induction and Emergency Training
BTEC	Business and Technology Education Council
BWEA	British Wind Energy Association
CASS	Centre for Adaptive Science and Sustainability
CCL	Climate Change Levy
CEGB	Central Electricity Generation Board
CfD	Contracts for difference
CILT	Chartered Institute of Logistics and Transport
CME	Coordinated Market Economy
CORE	Centre for Offshore Renewables Engineering
CVET	Continued vocational education and training
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
DGB	Deutscher Gewerkschaftsbund
DIN	German Institute for Normalisation
DTI	Department for Trade and Investment
DWP	Department for Welfare and Pensions
EC	European Commission
EEG	Erneuerbare Energien Gesetz – German Renewable Energy Act
EFA	Education Funding Agency
EMR	Electricity Market Reform
ERDF	European Regional Development Fund
ESF	European Social Fund
ESI	Electricity Supply Industry
EU	European Union
EU Skills	Sector Skill Council for Energy and Utility Skills
FFL	Fossil Fuel Levy
FiT	Feed-in-Tariffs
GPH	Green Port Hull
GWO	Global Wind Organisation
HEFCE	Higher Education Funding Council for England
HK	Handels og Kontorfunktionærernes Forbund - Danish trade union for white collar workers
HPWS	High Performance Work Systems
IEA	International Energy Agency
IG Metall	Industriegewerkschaft Metall – German Metal Workers Trade Union
IGBCE	Industriegewerkschaft Bergbau, Chemie, Energie – German Trade Union for the Mining, Chemical, and Energy Industries
ISO	International Organisation for Standardisation

IVET	Initial vocational education and training
JCP	Jobcentre Plus
KfW	Kreditanstalt für Wiederaufbau - German Development Bank
LCICG	Low Carbon Innovation Co-ordination Group
LEP	Local Enterprise Partnerships
LME	Liberal Market Economy
MAS	Manufacturing Advisory Service
MoU	Memorandum of Understanding
NAMTEC	National Metals Technology Centre
NETA	New Electricity Trading Arrangements
NFFO	Non-Fossil-Fuel Obligation
NPS	National Policy Statements
NSAP	National Skills Academy for Power
NSIP	Nationally Significant Infrastructure Projects
NVQ	National Vocational Qualification
OEM	Original Equipment Manufacturer
Ofgem	Office of the Gas and Electricity Markets
OFTO	Offshore Transmission Owners
OPEC	Organisation of the Petroleum Exporting Countries
OPITO	Oil and Gas industry training and professional standards organisation
OWIA	Offshore Wind Industry Allianz
OWIC	Offshore Wind Industry Council
OWIO	Offshore Wind Investment Organisation
OWPB	Offshore Wind Programme Board
R&D	Research and development
RDA	Regional Development Agencies
REC	Regional Electricity Company
RGF	Regional Growth Fund
ROC	Renewable Obligation Certificates
SEA	Marine Energy Strategic Environmental Assessment
SEMTA	Sector Skills Councils for Science Engineering Manufacturing Technologies
SFA	Skills Funding Agency
TINA	Technology Innovation Needs Assessments
UK	United Kingdom
UKTI	UK Trade and Invest
VDMA	Verband Deutscher Maschinen- und Anlagenbauer - Umbrella body of the German Machine Manufacturers
VET	Vocational education and training
VOC	Varieties of Capitalisms approach
WAB	Windenergie Agentur – Wind Energy Agency

CHAPTER I: INTRODUCTION

1. Introduction

This PhD thesis is a qualitative comparative case study of industrial policy, skill formation, and job quality in the offshore wind turbine manufacturing industry in Denmark, Germany and England. It engages with the comparative industrial relations, skill formation, and job quality literature and proposes an alternative analytical framework to the widely-used Varieties of Capitalisms approach (Hall and Soskice, 2001). This alternative framework focusses on the analysis of supply and demand side industrial policies identified in previous studies of the offshore wind industry, dialectical struggles of interest between stakeholders (Aglietta, 2015 [1979], Boyer, 2005), as well as the provision of entry and exit options from skill formation provided to employers by industrial policy (Doellgast and Greer, 2013 on marketisation). This framework is used to explore the question, how is skill formation and job quality shaped by industrial policy? This research question contains three sub-questions: How does industrial policy shape skill formation? How does industrial policy shape job quality? How does skill formation shape job quality?

In addition, this thesis proposes the extension of the concept *Investor Capitalism* (Useem, 1996) and to use it to name the underlying logic identified in the design and implementation of demand side policy for the offshore wind turbine industry. It is argued that, as the energy supply industry has been privatised across European countries, the realisation of public policy goals, such as offshore wind technology development and deployment and the creation of good jobs, depends on the state provision of incentives that accommodate the demands of private and institutional investors.

This thesis identifies specific characteristics of funding for skill formation by supply side industrial policy: ‘permanent’ in Denmark, ‘ad hoc’ in Germany, and ‘post-hoc’ in England. Findings suggest that the nature of skill formation providers and public funding provisions impacts on the character of participants in training programmes, favouring disadvantaged applicants in Germany in contrast to favouring high performing ones in England. The way skill formation was funded impacted on employer engagement in the institutionalisation of vocational education and training (VET)

programmes. Employers in Denmark supported the institutionalisation of emerging occupational profiles and corresponding VET, whereas in Germany they argued against it, presumably because they would incur the costs of dual vocational training once it was established. Short term skills funding as part of ‘ad hoc’ and ‘post hoc’ industry policy had destabilising knock-on effects on skill formation providers in England as well as in Germany, which is a surprising finding as both countries are usually characterised as examples of institutional complementarity and hence stability. Active labour market policy (ALMP) training provided to directly employed unskilled workers during short-time work, and the lack of equivalent provisions for agency workers seemed to reinforce dualisation of the labour market in Germany.

This thesis shows that varying demand side policy impacted on work-based training and strengthened agencies. The combination of supply and demand side policies led to a dynamic relationship between skills and job quality. Vocational skills have led to stronger employment security, but not necessarily job security, and they were not a panacea against bad jobs per se. All these findings suggest that employer behaviour is influenced by exit options provided by supply side policy, and pressures to cut and control costs induced by demand side policy (cf. Doellgast, 2012, Doellgast and Greer, 2013). This introduction gives a preview of the thesis: the industry, skill formation, and job quality context, the state of the literature, the propositions and key concepts, the methodology and data, and the key findings and their limitations.

2. Context

2.1. Offshore wind deployment and industry

Renewable energy deployment has become an important political issue in the context of climate change debates. The first offshore wind farm in Europe consisted of ten wind turbines, with a total capacity of 5MW. It was built in 1991 in Vindeby in Denmark (Danish Energy Agency, 2012). In the year 2000, offshore and onshore wind energy were 2.4 per cent of the European Union’s power mix. In 2014, their share increased to 14.1 per cent (EWEA, 2015a). By 2014, 2,488 offshore wind turbines had been connected to the grid in seventy-four wind farms in eleven European countries. They reached a total capacity of 8,045.3MW (EWEA, 2015a, p. 3). Denmark, Germany, and

the United Kingdom¹ had the largest amount of offshore wind turbine capacity. Roughly half the European capacity was installed in the United Kingdom. Between 1991 and 2010, twelve offshore wind farms, or roughly four hundred turbines, were built and connected to the electricity grid in Denmark (4coffshore, 2015). Between 2010 and 2014, four offshore wind farms, or 143 turbines, were connected to the grid and operating in Germany, while in the same period roughly one thousand one hundred wind turbines were connected to the electricity grid in the United Kingdom (EWEA, 2015b).

Vestas and Siemens Wind Power, the two most important suppliers of offshore wind turbines in Europe (EWEA 2010–2015), but also important service companies for the industry, had their origins in Denmark – the logistics, transport, and training company Maersk, and the health and safety training company Falck Nutec. Roughly five hundred supply chain companies were established in Denmark at the time of the data collection (lobbyist, June 2014). In the 2000s and 2010s, several equipment producers operated sites in Northern Germany: Senvion (owned by Suzlon), Weserwind (owned by Georgsmarienhütte), Areva Wind, Bard, Ambau, General Electric, and Vestas. The enterprises Rotec, and Reetec provided the industry with installation and maintenance services. About ten thousand people worked for the offshore wind energy sector in 2012 (EWEA, 2013). But in Germany the sector entered a severe crisis in 2013/2014. Although the United Kingdom had the largest amount of offshore wind turbines in Europe, the supply chain mainly consisted of manufacturers based in continental Europe (HM Government, 2013). There was no offshore wind turbine manufacturing site in England at the time of the field research (2012-2015). A blade factory had shut down on the Isle of Wight in 2009 and reopened in 2015; another manufacturer began staffing its new blade factory in the North-East of England in early 2016.

¹ This thesis refers to the United Kingdom not England, when citing numbers regarding wind turbine deployment from the European Wind Energy Association (EWEA, 2010-2015), as numbers were not available in disaggregated form.

2.2. Skill formation

In Denmark and Germany, a high percentage of school-leavers participate in vocational education and training (VET) (Helms Jørgensen, 2014, Hippach-Schneider et al., 2007). In England, the VET participation is low (ONS, 2014, p. 14). In England, vocational training through active labour market policy (ALMP) for the unemployed has traditionally been limited (Daguerre and Etherington, 2014, Greer and Symon, 2014), it is more broadly available in Denmark and Germany. Although, also in these countries ALMP increasingly prioritises employability and not vocational training (Andersen and Svarer, 2007, Greer et al., 2017). In Germany, vocational training is also used to up-skill workers during short-time work.²

This thesis focusses on skill formation for production workers at offshore wind turbine manufacturing sites: blade manufacturing, generator and nacelles assembly. Findings show that industrial policy impacts on skill formation in terms of training available through VET and ALMP providers, as well as training on the job. Skill requirements for the offshore wind industry have only been standardised since 2014 through the GWO (Global Wind Organisation), which created certificates for continued vocational training and health and safety for offshore wind service technicians (various interviews, 2013 and 2014). The findings presented here concern mainly the time before 2014, and do not focus on offshore wind service technicians but production workers. Research on skills and skill formation in the sector has so far been relatively limited, with a regional focus on Germany (Fornahl et al., 2012, Grantz et al., 2014, Jaax, 2016, Nicklich, 2014, Salot et al., 2010).

2.3. Job quality

Political debates have linked the development of renewable energy technology and its deployment with the creation of ‘good’ manufacturing jobs that would revive declining regions (Cedefop, 2010a, Cedefop, 2010b, Cedefop, 2010c). Often through favourable subsidy packages, offshore wind turbine manufacturers were encouraged to locate their

² Short-time work describes reduced working time combined with wage subsidies paid by the Federal Employment Agency for a maximum duration of twenty-four months. Short-time work needs to be agreed between employer and employee or works council, and applied for to the Federal Employment Agency (BMAS, 2016).

sites in regions with relatively high unemployment, low-skill labour supply and dominance of seasonal work (Bundesagentur für Arbeit, 2016, City Council, 2009, Magistrat der Stadt, 2013, Magistrat der Stadt, 2015, Nomis, 2016, Salot et al., 2010, Statistics Denmark, 2016). Hence, it is important to ask in how far these manufacturers were able to create good jobs. Here, the focus is on *objective aspects* of job quality such as: job security, the use of standard (direct) or non-standard (here: agency work) employment, pay, work organisation and social integration of agency workers (Muños de Bustillo et al., 2009, 2011). The next section gives an overview of the state of the literature.

3. State of the literature

3.1. Offshore wind industry

Offshore wind turbine industry studies have so far been limited to analyses of the varying extent of turbine deployment across European countries (Douve and Ehler, 2009, Söderholm and Pettersson, 2011, Sovacool, 2013, Swider et al., 2008, Toke, 2011), the technology development (Simmie, 2012, Simmie et al., 2014) and local economic development policy (Dawley, 2013, Pohl, 2013). Some publications have made tentative analyses of the relationship between locally available skill sets and the offshore wind manufacturing industry (Fornahl et al., 2012, Jaax, 2016, Salot et al., 2010). Others have explored the institutionalisation of VET for the German offshore wind turbine service and maintenance industry (Grantz et al., 2014, Nicklich, 2014). This thesis builds on this research, and advances the analysis towards a more extended and structured discussion of industrial policy, skill formation, and job quality.

3.2. Skill formation

Within the comparative industrial relations and sociology of work literature, Denmark and Germany are described as similarly coordinated skill formation regimes, as both rely on social partnership. Both regimes provide broad occupational skill-sets (Hanf, 2011) for high-road production models (Culpepper, 1996, Hall and Soskice, 2001, Streeck, 1992, Thelen, 2004, Thelen, 2014) and sector-wide portable skills (Marsden, 1999, Martin, 2011). England is characterised by a fragmented skill formation regime (Clarke and Wall, 1998, Grugulis and Lloyd, 2010, Sissons and Jones, 2014) that provides narrow task-related skills (Winch, 2011), and therefore only allows for a production

model that requires less occupational skills. This view has been challenged by others who find a polarisation between highly skilled jobs and very low-skill jobs (Brown and Hesketh, 2004, Goos and Manning, 2003, Lawton, 2009, Nolan and Wood, 2003 all in Grugulis and Lloyd, 2010) and a polarisation of investment into skill formation by employers (Gallie, 1991 for the 1980s, Lindsay et al., 2013 for the 1990s). These debates limit the explanation of the shape and extent of skill formation that takes place in each country to existing institutional relationships. For example, the governance of skill formation and the division of responsibilities between employers, state, and individual. These debates neglect the role of industrial policy within the provision of resources for skill formation.

3.3. Job quality

Job quality can be analytically divided into *employment quality* (pay, job security/insecurity, and flexibility), *work quality* (work organisation, job design, skill requirements and development, skill use, work intensity, autonomy, participation, social environment, physical environment), *subjective* (job satisfaction, stimulation, belief in usefulness of the job, work-life balance), and *procedural* aspects (workplace participation, and representation) (Muñoz de Bustillo et al., 2009, 2011).

Within the literature, Denmark, Germany and England are also distinct regarding job quality (Holman and McClelland, 2011, Holman, 2013): Denmark offers patterns of good job quality (Berglund, 2014), Germany is characterised by a dual labour market (Eichhorst, 2015, Hassel, 2014), and England is characterised by a polarised labour market (Goos and Manning, 2007, Green et al., 2013, Lindsay et al., 2013), with the North-East being dominated by low-skill and low paying jobs (Sissons and Jones, 2014). The comparative literature often explains these differences by distinct institutional models (Gallie, 2007, Holman and McClelland, 2011): Denmark and Germany are characterised as coordinated market economies with strong social partnership, England as a liberal market economy with weak social partnership (Hall and Soskice, 2001, Thelen, 2004, Thelen, 2014); Denmark and Germany with relatively generous welfare states, and England a residual one (Esping-Andersen, 1990).

In particular, across Germany dualisation – a gap in job quality between highly skilled workers in standard employment and workers in non-standard employment (Palier and

Thelen, 2010) – has increasingly come into focus. However, dualisation is not a phenomenon that is limited to Germany. In all three countries, agency work, one form of non-standard employment, has gained in importance over the past decades (on Denmark: Jahn and Rosholm, 2010; on England: Forde and Slater, 2005, Forde and Slater, 2016, Stanworth and Druker, 2000; on Germany: Eichhorst and Marx, 2011, Ferreira, 2016).

Furthermore, there is disagreement over the implications of dualisation for the future of job quality: The dividing line is between those who emphasise that dualisation strengthens job quality of the core workforce by the erosion of job quality at the margins of the labour market (Hassel, 2014, Palier and Thelen, 2010); and those who interpret the erosion of job quality at the margins of the labour market as a phenomenon that will increasingly concern current strongholds of core workers and good job quality (Benassi, 2016, Benassi et al., 2016, Doellgast et al., 2016, Dörre et al., 2013, Greer, 2016, Vidal, 2013a).

Factors commonly assumed to drive dualisation are: differentiated workplace representation (Eichhorst, 2015), different skill levels (Hassel, 2014), and workfare (Dörre et al., 2013, Greer, 2016). However, their effects are nuanced. For example, skill formation is not a panacea against bad jobs (cf. Benassi, 2016). Financialisation seems to be interlinked with industrial policy, and provides additional rationales for the use of agency work (cf. Nachtwey et al., 2015). One open question within this debate is how does industrial policy affect job quality? The next section introduces the propositions explored and the key concepts employed in this thesis.

4. Propositions and key concepts

This thesis makes a contribution to the above debates by developing and applying an analytical framework that allows the integration of industrial policy within comparative sector studies on skill formation and job quality. The next paragraphs introduce the propositions and key concepts that constitute the analytical framework, which is later applied to novel empirical material on industrial policy, skill formation, and job quality in offshore wind turbine manufacturing.

4.1. Propositions

In this thesis, it is argued that the creation, preservation, and quality of domestic manufacturing jobs is related to the way demand and supply side industrial policies are matched. Based on the literature review on skill formation and job quality three conventional propositions and an alternative proposition are discussed. The conventional propositions are: *Skill formation and job quality are shaped by a country's production model, in particular vocational education and training and organised labour* (cf. Doellgast, 2012, Holmann and McClelland, 2011, Thelen 2004, 2014). *Skill formation and job quality are shaped by active labour market policy (employment regime)* (cf. Dieckhoff, 2011, Gallie, 2007, Holmann and McClelland, 2011). *Skill formation and job quality are interdependent* (cf. Becker, 1994, Benassi, 2016, De Grip and Wolbers, 2006, Dieckhoff, 2008). The alternative proposition is: *Skill formation and job quality are shaped by industrial policy*.

4.2. Key concepts

4.2.1. Investor capitalism

In the late 1980s, scholars discussed the concept *investor capitalism* as a new form of concentrated shareholder ownership by large institutional investors. It was argued that the term in use, *managerialism*, did not sufficiently take into account the increasing dominance of institutional investors among shareholders (Conard, 1988). Whereas managerialism indicated the decision-making power of corporate boards, investor capitalism emphasised the control institutional investors had gained over boards (Conard, 1988, Useem, 1996). Analysts also hinted at the potential of institutional investors to take on civil society interests and pressure corporate behaviour (Harmes, 1998).

The concept investor capitalism has not entered into the comparative debates on skill formation and job quality. Institutional authors predominantly rely on Hall and Soskice's (2001) distinction between Liberal and Coordinated Market Economies. Critical authors have used a variety of terms such as financialisation (e.g. Vidal, 2013a, 2013b), globalisation (Dicken, 2011), marketisation (Doellgast and Greer, 2013), neoliberalism (Jessop, 2002, Peck and Theodore, 2007, Peck and Tickell, 2002), to describe the economic context of industries. However, these terms stayed relatively vague in most analyses. Here, the term investor capitalism will be re-coined to describe

the contemporary capitalist setting that determines industrial policy and its impact on skill formation and job quality. The re-coining of the term is a contribution to the comparative industrial relations debate as well as to the original debate on investor capitalism, as it widens the meaning of *investor capitalism* to a more overarching characterisation of contemporary political economy dynamics.

It will be argued that, as the energy supply industry has been privatised across European countries, the realisation of public policy goals, such as offshore wind technology development and deployment and the creation of good jobs, depends on the State provision of incentives that accommodate the demands of private and institutional investors. Secondly, the case studies will show how investor capitalism fails in influencing companies to make decisions that might contribute towards the common good (Harmes, 1998 suggests this within the original debate on investor capitalism) without having a tangible financial incentive.

4.2.2. Regulatory institutions and dialectical struggles

French regulation school suggests that future power relationships within and across political economies derive from the interaction between *modes of regulation* and *institutional relationships* (Aglietta, 2015 [1979]). The market, company, community, and the State are the relevant "forms of coordination" or "modes of regulation" (Boyer, 2005, pp. 534–535). According to Boyer the five relevant institutional relationships are: "the wage-labour nexus, forms of competition, the monetary regime, relational configurations between the State and the economy, and the modalities by which the economy is inserted into the international relations system" (2005, p. 520). Institutions such as trade unions and labour contracts impact on "the direction and speed of technical change", and "affect the shape and the shift in time of the productivity regime" (Boyer, 1997, p. 8-10). The productivity regime is defined as "for any given rate of growth, the technological regime and the variables contributing to the rate of investment set the trend for productivity". Here the focus of study is on Boyer's *productivity regime*. Its *technological regime* aspect is influenced by what is here termed *supply side policy*. Its "variables contributing to the rate of investment" are here defined as determined by *demand side policy*.

Vidal et al. (2015) suggest to consider institutional drivers and agency or politics and ideologies (Delbridge et al., 2011, Smith and Meiksins, 1995). In line with this, it is here argued that change and the dynamic design and match or mismatch of supply and demand side industrial policies are a result of power struggles and interest coalitions within regulatory institutions and governance bodies. However, policies are dependent on meeting investors' needs in their aim to establish low-carbon technology industries and renewable energy provision. This thesis suggests an analytical framework that takes into account the international context of the sector, the regulatory institutions and governance bodies within each political economy, the importance of regulatory struggles, and how firms are provided with supply and demand side policies. The next section details how supply and demand side industrial policies are conceptualised.

4.2.3. Supply and demand side policy

Based on the comparative industrial relations literature, and previous research on the offshore wind industry, *supply side policy* has been defined as public support through public provision of infrastructure and tax credits for manufacturers (Lewis and Wiser, 2007, also Hall and Soskice, 2001), support for research and development (Lewis and Wiser, 2007, Simmie, 2012, Simmie et al., 2014), education and training (Bussemeyer and Trampusch, 2012, Hall and Soskice, 2001, Streeck, 1992, Thelen, 2004, Thelen, 2014), and supply chain and process optimisation (Lewis and Wiser, 2007). Supply side policy affects skill formation, *here* in particular vocational education and training, and active labour market policy, and hence, indirectly job quality.

Industrial policy goes beyond these supply side factors, for example, salient here are policies that determine the demand for offshore wind turbines, such as infrastructure grants for building offshore wind turbines (Lewis and Wiser, 2007), electricity price subsidies (Lauber and Mez, 2007, Sovacool, 2013, Toke, 2011), spatial planning and construction regulations for offshore wind turbines (Douvere and Ehler, 2009), target setting for carbon emissions and the use of renewable energy, and the support for marketing and offshoring (Lewis and Wiser, 2007) (all *demand side policy* dimensions). These policies impact on investment decisions by developers regarding offshore wind farm development and have repercussions for offshore wind turbine manufacturers, the effectiveness of skill formation in terms of labour market outcomes, and job quality.

4.2.4. Marketisation

The concept of marketisation highlights the importance of costs for investment decisions by developers and manufacturers. Moving away from political economy typologies such as proposed by the Varieties of Capitalisms approach (Hall and Soskice, 2001) and others (cf. Boyer, 2005, Dicken, 2011, Jessop, 2002, Peck and Tickell, 2002), Doellgast and Greer (2013) propose analysing transactions that involve marketisation, the introduction of price-based competition across institutions that have until recently relied on hierarchical or coordinated network relationships. Doellgast and Greer assume that firms are influenced by the way institutions shape their transaction costs (Doellgast et al., 2016, based on Williamson, 1985). According to Doellgast and Greer (2013), marketisation within the institutional context leads to inequality and new ways of social stratification, as the introduction of market mechanisms and competition provides firms with viable options to leave existing relationships, an idea based on Hirschman's *exit and voice theory* (1970). Marketisation, or the use of exit option based on cost calculations, provides an explanatory framework for investor behaviour on the one hand, but also employers' choices regarding skill formation and job quality (Doellgast, 2012). Industrial policy provides additional exit and entry options and therefore affects the interaction between skill formation and job quality.

4.2.5. Skill formation

This thesis explores and compares how skill formation in the offshore wind turbine industry was shaped by the countries' respective skill formation regimes and industrial policy. This thesis integrates the analysis of both, initial and continued VET and ALMP. Skill formation is compared in terms of flexibility of training delivery, employer participation in training and funding, type of course participants (Busemeyer and Trampusch, 2012), as well as the relationship between industrial policy and skill formation; and the possible impact of skill formation on the nature of the emerging turbine manufacturing industry.

4.2.6. Job quality

This thesis explores and compares how job quality in the offshore wind turbine industry was shaped by the countries' respective production and employment regimes, and how job quality was affected by industrial policy and skill formation. The focus is on objective aspects of job quality such as job security, in particular the use of standard

(direct) or non-standard employment (here: agency work), pay, work organisation, and social integration of agency workers, the impact of workplace representation, and skill formation (Muños de Bustillo et al., 2009, 2011).

5. Methodology and data

5.1. Methodology

This thesis is based on comparative in-depth case study methodology (Eisenhardt, 1989, Eisenhardt and Graebner, 2007, King et al., 1994, Yin, 2014). In-depth case studies seemed the best method to explore the *multidimensional* set of questions within this thesis (Eisenhardt, 1989, Eisenhardt and Graebner, 2007). Although this thesis does not employ ‘grounded theory’, it draws on the toolbox of classical grounded theory as in Glaser and Strauss (1967) for data collection and analysis as suggested by Yin (2014) and Eisenhardt (1989).

5.2. Data

The country cases were selected by theoretical sampling (Glaser and Strauss, 1967), for assumed variation on their independent (skill formation, employment and production regimes; deployment of offshore wind turbines, presence of a domestic manufacturing industry) and dependent variables (skill formation and job quality) (King et al., 1994). Commonly Denmark and Germany are defined as coordinated market economies, whilst England is defined as liberal market economy (Hall and Soskice, 2001). These three countries represent three different welfare capitalisms (Esping-Andersen, 1990) or employment regimes (Gallie, 2007). They also have distinct skill formation regimes (Brockmann et al, 2008; 2009; Martin, 2011; Thelen, 2004; 2014).

Industrial policy in Denmark, Germany, and England, ten manufacturing sites, and ten skill formation providers were studied. In Denmark two sites and two skill formation providers, in Germany four sites and four skill formation providers, and in England two sites and four skill formation providers. Data was collected between early 2012 and early 2015 and came from a variety of sources, qualitative face-to-face and phone interviews with eighty individuals and document analysis. The next section summarises the key findings.

6. Key findings

6.1. Industrial policy

Chapter IV identifies tensions between national level industrial policy and local economic development policy. The analysis of supply and demand side policies and the sector's evolution in each country show that only Denmark has achieved a match between supply and demand side policies favourable to the durable expansion of its offshore wind turbine manufacturing industry. Germany has, by the nature of its supply side structure, a strong basis for supply side industrial policy and established a domestic manufacturing industry, but struggled to maintain a consistent demand side policy for conflicts of interests within its electricity supply industry. The United Kingdom, here in particular England, by the nature of its weak supply side structure had difficulties developing a domestic manufacturing industry. Yet due to its centralised governance system, it was able to impose a strong demand side drive, which resulted in large scale deployment of offshore wind turbines, and later, under political pressure for domestic content in its offshore wind farms, engaged in 'post-hoc' supply side policy, closely collaborating with the large developers and their equipment suppliers.

6.2. Skill formation

Findings on skill formation are discussed in chapter V. The exploration of skill formation in turbine component manufacturing revealed that skill formation is not exclusively provided by vocational education and training (VET) institutions, but also by providers of training as part of active labour market policy (ALMP). Findings on the impact of industrial policy on skill formation suggest that skills funding as part of industrial policy is 'permanent' in Denmark (cf. Daemmerich and Bredgaard, 2013), 'ad hoc' in Germany, and 'post-hoc' in England. The way industrial policy was shaped impacted on skill formation providers, on the participants of the different types of training, and on employer engagement in skill formation. Skill formation had knock-on effects on job quality.

6.3. Job quality

Findings presented in chapter VI show that demand side policy directly impacted on job quality by strengthening the use of private employment agencies. Industrial policies also contributed to the dynamic relationship between skills and job quality. Supply side policy drove the deskilling of the labour process, but VET and ALMP also buffered

redundancy and reinforced dualisation. Volatile demand side policy that enforced the use of agency work undermined the potential beneficial effects of ALMP and VET.

7. Limitations

The focus on one sector allowed for an empirically strong in-depth study (Eisenhardt and Graebner, 2007, Yin, 2014), but might limit the applicability across sectors of the suggested analytical framework and the generalisability of the findings. However, it is suggested that the theoretical framework developed and the findings presented here might be valid for sectors with similar characteristics in terms of dependence on State support.

The findings may be limited by the type of data collected and analysed, here mainly interview data and data available in the public domain, which served as proxies for more detailed and direct observation of decision-making processes across actors. Obstacles in terms of operationalising the research design were in particular financial and time resources, as well as access. For example, it was impossible to interview policy-makers at regional, national, and European level.

8. Outlook on this thesis

Following this introduction this thesis is structured as follows: Chapter II contains the literature review. Chapter III explains the methodology. Chapter IV through VI present the findings on industrial policy, skill formation, and job quality. Chapter VII concludes the thesis with a discussion of the findings and contributions. Next, Chapter II, reviews the literature and details the theoretical and analytical framework.

CHAPTER II: LITERATURE REVIEW

1. Introduction

The comparison of Denmark's, Germany's, and England's energy and industrial policy for renewable energy technology shows that policies were diverse, and that equipment production was established to different degrees in these countries. A common rationale for changing energy generation from fossil fuel-based technologies to renewable sources was not only climate protection, but also the creation of jobs, often specified as manufacturing jobs (Dawley, 2013, Fornahl et al., 2012, Jaax, 2016, Pohl, 2013, Salot et al., 2010). In reality, the number and types of jobs created varied, and job creation was accompanied by different industrial policies.

Given that debates on renewable energy technology and related industrial policies increasingly focussed on offshore wind technology, and that job quality and skill formation in this sector were relatively under-researched, the observed variation of industrial policy across Denmark, England, and Germany motivated the research question: How are skill formation and job quality shaped by industrial policy? This question was subdivided into: How does industrial policy shape skill formation? How does industrial policy shape job quality? How does skill formation shape job quality? The conventional propositions are: Skill formation and job quality are shaped by a country's production model, in particular vocational education and training and organized labour (cf. Doellgast, 2012, Holmann and McClelland, 2011, Thelen 2004, 2014). Skill formation and job quality are shaped by active labour market policy (employment regime) (cf. Dieckhoff, 2011, Gallie, 2007, Holmann and McClelland, 2011). Skill formation and job quality are interdependent (cf. Becker, 1994, De Grip and Wolbers, 2006, Dieckhoff, 2008). The alternative proposition suggested here is: Skill formation and job quality are shaped by industrial policy.

This thesis suggests that industrial policy consists of supply and demand side policies that are aimed at incentivising private sector companies to deliver public policy goals (chapter IV). The public policy goals discussed here are low-carbon electricity supply from offshore wind turbines, production of corresponding technologies, and the creation of good jobs. Supply and demand side policies are designed and implemented at

different governance levels. They are the expression of diverse interests within the political economies of Denmark, Germany, and England. Based on previous studies of the offshore wind industry (Lewis and Wiser, 2007, Dawley, 2013, Pohl, 2013, Simmie, 2012, Simmie et al., 2014) and the Varieties of Capitalisms approach (Hall and Soskice, 2001), supply side policies are defined as policies that are aimed at facilitating the market participation of domestic producers, through public provision of infrastructure and tax credits for manufacturers, support of research and development, provision of skills, and support of supply chain and process optimisation. Based on previous studies of the deployment of offshore wind turbines, *demand side policies* are defined as policies that support the demand for offshore wind turbine technology, through infrastructure grants for building offshore wind farms, price subsidies for electricity from offshore wind turbines, favourable spatial planning and approval regulations for offshore wind farms, allocation of seabed for wind farm construction, domestic and international targets for renewable energy technology deployment and reduction of carbon emissions, and support for marketing and establishment of production sites in other countries (*offshoring*). Where the match between supply and demand side policies dynamically accommodated the offshore wind industry's and investors' needs, the offshore wind turbine industry successfully developed.

The effects on skill formation and job quality however are ambiguous, and this is what is explored in the second half of this thesis. Vocational skill formation is a component of supply side industrial policy, but is also impacted by other industrial policy dimensions (chapter V). Denmark and Germany developed genuine domestic turbine industries, partly because of the available skill set (cf. Hall and Soskice, 2001, Streeck, 1992, Thelen, 2004, Thelen, 2014), but also long-term support of research and development and marketing (Simmie, 2012, Simmie et al., 2014). Local policy-makers supported different approaches to embedding industry specific skill formation into the regular vocational education and training (VET) and active labour market policy (ALMP) regimes across Denmark, Germany, and England, hoping that these would open up routes into employment at the growing industry.

Third, industrial policy impacted on job quality (chapter VI). Workplace representation mediated the effects of economic slumps on the core workforce. The effect of skill formation on job quality was limited. Demand side policy that was perceived as instable

by manufacturers, and pressures to cut production costs, motivated manufacturers to rely on large amounts of agency work. Regulatory changes had repercussions on job security, not only of agency workers, but also of core workers.

This literature review builds a framework for the analysis of industrial policy, skill formation, and job quality. Based on the Varieties of Capitalisms approach, regulation theory and a review of earlier studies of the offshore wind turbine industry and offshore wind turbine deployment this chapter suggests the use of and defines the concepts supply and demand side industrial policies. The chapter explores the impact of industrial policy on skill formation and job quality. The overall argument is that industrial policy, skill formation, and job quality are impacted by the increasing influence of large private and institutional investors as a result of the privatisation of the electricity supply industry and the liberalisation of energy markets.

Skill formation and social partnership are assumed to impact positively on job quality. Many studies have suggested that reforms of the welfare state have weakened social partnership and undermined high standards of skill formation and job quality. Hence, the second half of this chapter engages with comparative analyses of skill formation, and the impact of social dialogue institutions, skill formation, and active labour market policy on job quality. This thesis suggests that in addition to these institutional factors, the dynamic between supply and demand side industrial policy and investment decisions impacts on skill formation and job quality.

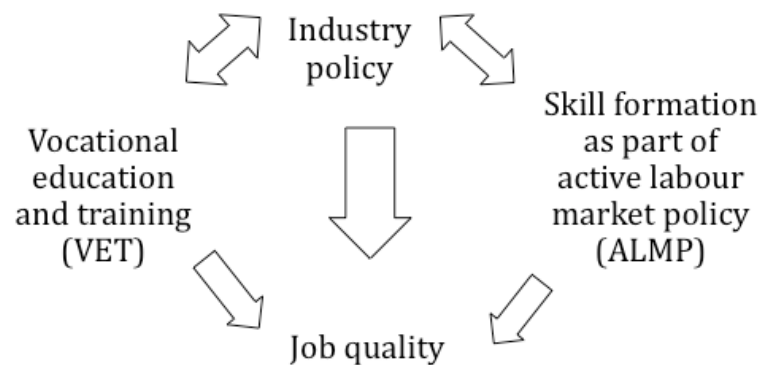
Understanding the determinants of job quality is important, because job quality affects the wellbeing of workers, the performance of firms, and society at large (Leschke et al., 2008, Muñoz de Bustillo et al., 2011). Skill formation is assumed to impact on the quality of jobs (Becker, 1994, De Grip and Wolbers, 2006, Dieckhoff, 2008).

Furthermore, as stimulus packages are targeted at renewable energy technology industries (Cedefop, 2010a, Cedefop, 2010b, Cedefop, 2010c, EUROFOUND, 2009, Osterman and Chimienti, 2012), the question arises as to how far these are designed to create ‘good jobs’ (Lehndorff, 2012, Osterman and Chimienti, 2012). For example, Osterman and Chimienti (2012) suggest that ‘weatherization jobs’, thus jobs in the home

insulation sector that were publicly subsidised under the American Recovery and Reinvestment Act, and aimed at stimulating job creation in a sector relevant to the reduction of carbon emissions, should be more strongly regulated. Because of a lack of mechanisms that ensure that the newly created jobs are ‘good’, weatherization jobs are still low-wage and insecure.

Industrial policy for offshore wind has been discussed as a tool to economically revive regions struck by deindustrialization and unemployment (Dawley, 2013, Fornahl et al., 2012, Pohl, 2013, Salot et al., 2010). Skill formation is seen as a means for jobseekers to access jobs in subsidised industries (Salot et al., 2010). Contributing to these debates, this thesis explores the links between industrial policy, skill formation, and job quality in the offshore wind turbine industry. This chapter provides a framework for the comparative study of these topics and of how they interrelate. Figure 1 illustrates the analytical framework that will be further explained in this chapter.

Figure 1 The analytical framework



2. Industrial policy in investor capitalism

It is argued that industrial policy consists of supply and demand side policies that are designed and implemented at different governance levels. They are the expression of diverse interests within the political economies of Denmark, Germany, and England. Where the match between supply and demand side policies dynamically accommodated the offshore wind industry's and investors' needs, the offshore wind turbine industry successfully developed. This thesis proposes a framework for analysing industrial policy that builds on the Varieties of Capitalisms approach, regulation theory and previous studies of the regulatory framework of the offshore wind sector. It is suggested to term the underlying economic dynamic *investor capitalism*.

In the late 1980s, scholars discussed the concept *investor capitalism* as a new form of concentrated shareholder ownership by large institutional investors. The argument for the new concept was that the term in use, *managerialism*, did not sufficiently take into account the increasing dominance of institutional investors among shareholders (Conard, 1988). Whereas managerialism indicated the decision-making power of corporate boards, investor capitalism emphasised the control institutional investors had gained over boards (Conard, 1988, Useem, 1996). Analysts also hinted at the potential of institutional investors to take on civil society interests and pressure corporate behaviour (Harmes, 1998).

The concept investor capitalism has not entered into the comparative debates on skill formation and job quality. Critical authors have used a variety of terms such as financialisation (*for example* Vidal, 2013a), globalisation (Dicken, 2011), marketisation (Doellgast and Greer, 2013), neoliberalism (Jessop, 2002, Peck and Theodore, 2007, Peck and Tickell, 2002) to describe the economic context of industries. However, these terms stayed relatively vague in most analyses. Here the term investor capitalism will be re-coined to describe the contemporary capitalist setting that determines industrial policy and its impact on skill formation and job quality. The next section details the concept of political struggles over the design of industrial policy and the concepts of demand and supply side industrial policies.

2.1. Political struggles

French regulation school is based on the Marxist analysis of capitalist dynamics (Aglietta, 2015 [1979]): The fundamental conflict of interest between capital and labour inherent to capitalism leads to dialectical change (Marx, 2013 [1867]). The school proposes a multi-level analytical framework for studying state regulatory policy (Aglietta, 2015 [1979], Boyer, 2005), but no comprehensive framework for the analysis of sectors and firms. It studies the “regulation of the capitalist mode of production” and the mechanisms of innovation, i.e. reproduction and change (Aglietta, 2015 [1979], p. 17). The mechanisms of innovation define the future power relationship between the social classes and the capacity of capitalism to survive economic downturns.

Future power relationships between state, capital, and labour derive from the interaction between *modes of regulation* and *institutional relationships*. The market, company, community, and the state are the relevant "forms of coordination" or “modes of regulation” (Boyer, 2005, pp. 534–535). According to Boyer the five relevant institutional relationships are “the wage-labour nexus, forms of competition, the monetary regime, relational configurations between the state and the economy, and the modalities by which the economy is inserted into the international relations system” (p. 520). Institutions such as trade unions and labour contracts impact on "the direction and speed of technical change", and "affect the shape and the shift in time of the productivity regime" (Boyer, 1997, p. 8). Aglietta’s (2015 [1979]) case study of the historical emergence of US American capitalism provides many substantial examples.

Opposing the conventional assumption that low unemployment rates result from flexible wages, and high unemployment from inflexible organisational or institutional variables, Boyer (1997, p. 4) argues: "The *variability of employment patterns in time and space* has to be related to the internal features of the growth regime”. The growth regime is determined by the "productivity regime” and the “demand regime”. The productivity regime is defined as "for any given rate of growth, the technological regime and the variables contributing to the rate of investment set the trend for productivity" (p. 10). The demand regime is defined as "income distribution and demand formation determine how productivity sharing affects aggregate demand growth" (p. 11). Both regimes are influenced by institutions, which mediate” between technological opportunities and individual preferences". Here the focus of study is on Boyer’s *productivity regime*. Its

technological regime aspect is influenced by what is here termed *supply side policy*. Its “variables contributing to the rate of investment” (p. 10) are here defined as determined by *demand side policy*.

In line with Vidal et al. (2015), institutional drivers’ and agency (Delbridge et al., 2011, Smith and Meiksins, 1995), as they take shape in politics, are taken into account. Based on this, it is suggested that changing design, and match or mismatch of supply and demand side industrial policies are the result of power struggles and interest coalitions within governance bodies and regulatory institutions. In addition, these political power struggles do not take place independently of the economic context: Faced with a privatised energy supply industry, to establish low-carbon technology industries and renewable energy provision, policy-makers depend on meeting investors’ needs. The next section details how demand and supply side industrial policy are conceptualised.

2.2. Demand and supply side policies

It is suggested to conceptualise the relevant demand and supply side policy factors closely within the industrial context. The following paragraphs give an overview of the studies on industrial policy for offshore wind, which inform the concepts of supply and demand side policies used in this thesis.

The deployment of offshore wind turbines in the United Kingdom and other parts of Europe, and the historical evolution of the wind turbine manufacturing industry in particular in Germany and Denmark, have been studied in detail, mostly by economic geographers (Dawley, 2013, Fornahl et al., 2012, Karnøe and Garud, 2012, Kern et al., 2014, Simmie, 2012: on Denmark, Simmie et al., 2014: on Britain and Germany). They chose to explore and enhance path-dependency theory.

Analysts of offshore wind turbine deployment show that industrial policy in a variety of forms has enabled, but sometimes also slowed down, the development of this new manufacturing industry (Karnøe and Garud, 2012). The establishment and expansion of the offshore wind turbine industry are a result of many different events, actors, and policies coming together at the right time, often by luck.

Inventions by single individuals initiated the development of wind turbine technology (Karnøe and Garud, 2012, Simmie, 2012, Simmie et al., 2014). The successful commercialization depended on state support in research and development, cooperation between often geographically clustered workshops and companies, and the incremental development of a market for electricity from wind turbines. Large-scale deployment depended on more important state intervention such as feed-in-tariffs (Söderholm and Pettersson, 2011, Sovacool, 2013), the shift of political support from fossil fuel and nuclear to renewable technologies (Karnøe and Garud, 2012, Lauber and Mez, 2007), and the creation of a stable environment for investments (Kern et al., 2014: on the United Kingdom).

Offshore wind deployment depended strongly on marine spatial planning regulations (Scott, 2006, Toke, 2011), which on the one hand determined the scale of wind farm projects, and on the other, the technical requirements for installation, and service and maintenance (Douvere and Ehler, 2009). Also, approval procedures for wind farm projects played a role (Portman et al., 2009). More salient issues were the distribution of the costs of grid connection of offshore wind turbines (Esteban et al., 2011, Karnøe and Garud, 2012, Sovacool, 2013, Swider et al., 2008), the capacity of the existing grid to integrate new capacity (Esteban et al., 2011, Söderholm and Pettersson, 2011), and the political and legislative resolution of conflicts regarding liabilities in the case of late connection (Fornahl et al., 2012, Pohl, 2013).

The expansion of domestic industries initially depended on the location of innovators, but also on state subsidies targeted at specific geographical regions such as tax credits, and research and development support (Lewis and Wiser, 2007, Pohl, 2013, Simmie, 2012, Simmie et al., 2014). Available deep-sea ports and subsidies for the accommodation of infrastructure were attractive for offshore wind turbine manufacturers, which transplanted their operation to new regions or diversified into the offshore wind turbine sector (Dawley, 2013, Fornahl et al., 2012, Pohl, 2013).

In their comparison of twelve countries, Lewis and Wiser (2007) identify several support mechanisms that have been given varied importance in later studies: Companies that find stable and sufficient support in their domestic markets are likely to perform well on international markets. The Danish offshore wind turbine manufacturers seem a case in

point (Andersen et al., 2014, Karnøe and Garud, 2012). The industry can be directly supported by local content requirements, financial and tax incentives, favourable customs duties, export credit assistance, quality certification, and research and development support (Lewis and Wiser, 2007). Indirect support comes from feed-in-tariffs, mandatory renewable energy targets, government tendering, and financial and tax incentives.

Dawley (2013: on North-East of England), Fornahl et al. (2012: on Northern Germany), and Pohl (2013: on North-West Germany) illustrate the willingness of local policy-makers, stakeholders such as training providers, research institutes, universities, and local populations to accommodate the needs of industrial development, but also their limits within the national and international market and policy context. For the Northern German offshore wind turbine industry, unresolved conflicts over liabilities and grid connection, as well as changing priorities and regulations in energy policy at the federal government level, resulted in investment instability and economic difficulties (Pohl, 2013). Dawley (2013, p. 91) describes the changing policy support in the English North-East region as ‘policy-on’ and ‘policy-off’ dynamic that provided a difficult framework for the development of domestic industrial capacities.

The continued resolution of conflicts of interest between all parties, civil society, utilities, government, manufacturers, suppliers, and research bodies, as well as the lucky coincidence of endogenous and exogenous factors, determined the successful evolution of the Danish offshore wind turbine industry (Karnøe and Garud, 2012). Individual inventors that found support. The growing lobby for wind power technology towards government continuously shaped and reshaped the regulatory environment that in the long-term helped the industry to emerge. Governmental policies not only directly supported the industry and provided price subsidies; they were also targeted at making the public, individuals, and large utilities equally interested in the deployment of wind turbine technology.

The United Kingdom was for long a ‘laggard’ in terms of renewable energy deployment (Toke, 2011). But eventually the alignment of interests of the Crown Estate (manager of the seabed for the Crown), governmental bodies, and large utilities in the large-scale deployment of offshore wind turbines provided a large political coalition that simulated

an almost ideal investment environment and was at the root of the massive deployment of offshore wind technology (Kern et al., 2014), despite the lack of a domestic industry and the high production, installation and maintenance costs of offshore wind turbines. Industrial policy played a varied role for the emergence of offshore wind turbine manufacturing, but important overall seems to be that it provided both, the “demand pull and technology push” (Karnøe and Garud, 2012, p. 733).

Also the international context of the political economies and exogenous factors such as the OPEC oil embargoes in the 1970s, nuclear catastrophes like in Chernobyl in 1986 and in Fukushima in 2011, international climate targets in the 1990s, and the EU regulatory framework on carbon emissions and renewables share in energy consumption in the 2000s, the liberalisation of the electricity markets, and state aid rules are included in the narratives that retrace the origins of policies for renewable energy technology (Lauber and Mez, 2007, Sovacool, 2013, Toke, 2011). These exogenous events and international regulations translated into domestic policy-making but in varying ways across the political economies. Hence, it is argued that the power struggles and interest coalitions of regulatory institutions and governance bodies impact on industrial policies.

Analysts of the development of the offshore wind turbine industry do not distinguish between supply and demand side industrial policies. However, the comparison of Denmark, England, and Germany suggests that a specific combination of industrial policies and institutional factors led to different outcomes in terms of offshore wind turbine deployment and domestic industry development in the short and long run.

Here it will be argued that the dynamic combination of supply and demand side policies over time led to distinct outcomes in terms of domestic industrial development and offshore wind turbine deployment. Adequate demand side policies led to the deployment of offshore wind turbines; supply side policies led to the establishment of domestic industries. The long-term sustainability of domestic industries depended on demand side policies that shaped investment decisions.

Two concepts are proposed for the analysis of industrial policy: Based on previous studies of the offshore wind industry (Lewis and Wiser, 2007, Dawley, 2013, Pohl, 2013, Simmie, 2012, Simmie et al., 2014) and the Varieties of Capitalisms approach

(Hall and Soskice, 2001), supply side policies are defined as policies that are aimed at facilitating the market participation of domestic producers, through public provision of infrastructure and tax credits for manufacturers, support of research and development, provision of skills, and support of supply chain and process optimisation. Based on the regulation school's theoretical framework (Aglietta, 2015 [1979], Boyer, 2005) and previous studies of deployment of offshore wind turbines, *demand side policies* are defined as policies that support the demand for offshore wind turbine technology, through infrastructure grants for building offshore wind farms, price subsidies for electricity from offshore wind turbines, favourable spatial planning and approval regulations for offshore wind farms, allocation of seabed for wind farm construction, domestic and international targets for renewable energy technology deployment and reduction of carbon emissions, and support for marketing and establishment of production sites in other countries (*offshoring*).

Within the open market other factors such as trade tariffs on components can be neglected. Here it is argued that the combination of industrial policies determines the economic stability of offshore wind turbine producers and therefore affects skill formation and job quality at the production sites. Institutions of the production model and the welfare state regime, in particular those concerned with skill formation (vocational education and training, active labour market policy), mediate these effects, but may themselves be affected by industrial policies. The table below summarises the elements of supply and demand side policy. The next sections introduce the comparative debates on skill formation and job quality, and define skill formation and job quality for this thesis.

Table 1 Supply and demand side dimensions of industrial policy

<i>Supply side:</i>	Public provision of infrastructure and tax credits for manufacturers Provision of skills through education system and active labour market policy Support of research and development Support of supply chain and process optimisation
<i>Demand side:</i>	Public provision of infrastructure grants for wind turbine developments Price subsidies for electricity from renewable sources Favourable spatial planning and approval regulations Allocation of seabed for wind farm construction Domestic and international targets for renewable deployment and reduction of carbon emissions Support for marketing Support of offshoring

3. The institutional context of skill formation and job quality

One of the Varieties of Capitalisms (VOC) approach's (Hall and Soskice, 2001) key assumptions is that national level institutions determine firms' access to skills and knowledge, investment capital, labour markets, and relationships to other firms (supply side factors). Hence, institutions within a political economy, defined at the national level, determine how firms operate, what they produce, what technologies they use, and how competitive they are. Comparative research in the VOC tradition has often used vocational skill formation to illustrate the complementarity of VET institutions and firms' production and political strategies (Crouch et al., 1999, Culpepper, 1996, Culpepper, 2001, Estevez-Abe et al., 2001, Thelen, 2004, Thelen, 2014).

The VOC approach suggests that, as firms realise their institutional comparative advantage, political economies will develop towards one of two models: coordinated market economy (CME) or liberal market economy (LME) (Hall and Soskice, 2001). Institutions are therefore seen as self-perpetuating (North, 1990). CMEs are built on cooperative relationships between state, labour, and capital. LMEs are built on market-mediated relationships. Denmark and Germany are generally defined as CMEs, England is defined as a LME.

But institutions change and are not necessarily complementary (cf. Streeck, 2010). Also, they are not homogeneous across one national political economy, but may spread across national boundaries, as well as they might differ at sub-national level. To analyse change

and diversity, Doellgast and Greer (2013) propose looking at *transactions*. Doellgast and Greer assume that firms are influenced by the way institutions shape their *transaction costs* (Doellgast et al., 2016, based on Williamson, 1985). To illustrate this effect, both authors study institutional change that involves *marketisation*, the introduction of price-based competition across institutions that have until recently relied on hierarchical or coordinated network relationships (e.g. Doellgast, 2012; Doellgast et al., 2016, Greer et al., 2017). According to Doellgast and Greer (2013), marketisation within the institutional context leads to inequality and new ways of social stratification, as the introduction of market mechanisms and competition provides firms with viable options to exit from existing relationships, an idea based on Hirschman's *exit and voice theory* (1970).

The marketisation framework highlights the importance of how market or transactional mechanisms promote change and affect interaction at the firm level, for example skill formation and job quality. Marketisation and exit options represent an explanatory framework for the effects of changes in countries' employment regimes and production models. Researchers however have so far only focussed on these supply side factors: the change of trade union strategies (Doellgast et al., 2016), and the liberalisation of the labour market (Benassi, 2016, Benassi et al., 2016), and the marketisation of welfare state provisions (Greer et al., 2017). How changes of demand side policy affect skill formation and job quality at sectoral level, and how demand side and supply side policies interact, have not been in focus of 'marketisation' researchers. The next sections refine the analytical framework for the analysis of vocational education and training (VET) and active labour market policy (ALMP) training.

3.1. Skill formation as part of VET and ALMP

The focus of this thesis is on skill formation by organisations that are part of the Danish, English, and German vocational education and training (VET) and active labour market policy (ALMP) regimes. This section first defines VET and ALMP in each country. Then it reviews the comparative debate on skill formation.

3.1.1. Denmark

VET and ALMP are strongly intertwined in Denmark. The regulation of initial and continued VET is centralised (Olofsson and Panican 2008 in Helms Jørgensen, 2014), but leaves flexibility to local provision. The “single national system” organises training curricula “along sector [and] occupational lines” (Jørgensen, 2009, p. 1). Its governance involves state, trade unions, and employers at local, regional, and national level. Governance by the social partners promotes dialogue about technology, production, and employment (Dobbins and Busemeyer, 2014).

As employers are strongly involved in the governance of the VET system, they feel “ownership” and “in control” over skill formation (Helms Jørgensen, 2014, p. 14).

Handelsschoole (hereafter technology colleges) provide VET for unskilled and skilled workers in and out of work under 25. Labour Market Training Centres (or *Arbejdsmarkedssuddannelse*, hereafter AMU centres) vocationally train mainly unskilled, but increasingly also skilled workers over 24. As public funding of initial and continued VET for jobseekers is seen as a ‘national investment strategy’ (Daemmerich and Bredgaard, 2013), VET is almost entirely state-funded (Jørgensen, 2009).

VET in grade ten to twelve qualifies apprentices for skilled jobs and supports their personal and social development (Helms Jørgensen, 2014, p. 6). VET is predominantly dual, combining phases at a technology college with work at a company. Since the 1990s, the Government has provided wage subsidies to firms who offered training places (Helms Jørgensen, 2014). Also, school-based VET has been established for apprentices who had no contract with an employer yet. Apprentices were then encouraged to continue applying for company placements and to transfer to the dual system. At the same time, reforms modularised VET, i.e. split full apprenticeships into cumulative and individually certified modules (Thelen, 2014).

Standardisation of training and certification leads to low recruitment and screening costs and facilitates mobility of workers within the *flexicurity* employment regime (Helms Jørgensen, 2014, Thelen, 2014). *Flexibility* within the employment regime results from low job protection (Andersen and Svarer, 2007, Bredgaard and Larsen, 2007). *Security* results from generous welfare state provisions, for example a high replacement rate and up- and re-skilling funded as part of ALMP.

The labour market reform of 1994 increased activation elements within the Danish welfare state (Bredgaard and Larsen, 2007) by gradually abolishing the time receivers of unemployment benefits could search for jobs without participating in any kind of job relevant training (Andersen and Svarer, 2007). Some argue that, in the mid and late 1990s, flexicurity facilitated structural change and remedied its disruptive effects (Schmidt and Hersh, 2012). Under the new Liberal Conservative Government, since 2001, activation shifted from a ‘human capital’ (Becker, 1994) to a ‘work first’ approach (Larsen, 2009 in Daemmerich and Bredgaard, 2013), meaning a shift in emphasis away from VET for jobseekers to the enhancement of job search activities.

The financial and economic crisis of 2008 hit Denmark with a sharp decline in GDP and higher unemployment figures than other comparable economies (Madsen, 2011, p. 7, Andersen et al., 2011, p. 118, both in Schmidt and Hersh, 2012). In response to the crisis in 2008, skill formation and individual counselling for the unemployed decreased, and subsidised employment and internships further increased (Madsen, 2013).

3.1.2. VET and ALMP in Germany

In Germany, VET is offered in dual apprenticeships (IVET), full-time school-based training (IVET), continued vocational education and training (CVET), and transitional schemes for school-leavers, who failed to acquire an apprenticeship contract (Hippach-Schneider et al., 2007). However, dual apprenticeships are the most important form of vocational skill formation. As in Denmark, the social partners are involved in the governance and implementation of dual VET (ibid, Hanf, 2011). The *Länder*, employers, and apprentices share the cost of dual VET (Culpepper, 2001).

Companies offering dual VET need to ensure the supervision of the apprentices by a chamber-certified staff member (Hippach-Schneider et al., 2007). If a company cannot adequately supervise its apprentices, it can delegate the work-based training to a third party, for example vocational schools or another company within an *Ausbildungsverbund* – similar to the British “inter-firm training co-ordination” (Gospel and Foreman, 2006, p. 7).

CVET is less regulated than IVET. Hippach-Schneider et al. (2007, pp. 36ff) distinguish between regulated, company-based, and individual CVET. Requirements for regulated

CVET are the successful accomplishment of a first initial VET, adequate professional experience, or both. A large variety of providers offers CVET: the trade unions' vocational schools, professional associations, training charities, employers' associations, the chambers, and companies.

As VET is formally more accessible than university education, even complex pathways are perceived as suitable entries into the labour market for disadvantaged groups, long-term unemployed, and mature workers without any professional or vocational qualification (Hanf, 2011). VET as part of ALMP is offered by specialized providers, who can work around the lack of employer participation, even for apprenticeships that require a high amount of work-based training (Hippach-Schneider et al., 2007). Vocational re-training and transition programmes as part of ALMP are funded by the public employment services and the municipalities.

In Germany, modularisation has been discussed in the context of political concerns over lifelong learning, demographic change, and newly emerging sectors and skill profiles (Busemeyer and Trampusch, 2012). Larger firms favour modularisation and increased flexibility of content, duration, and costs (Busemeyer and Trampusch, 2013, Culpepper and Thelen, 2008 both in Trampusch, 2010), as well as the possibility to subcontract training (Thelen, 2007 in Trampusch, 2010) and target funds for additional certificates (*Zusatzqualifikationen*)³ at outstanding apprentices (Thelen and Busemeyer, 2008). In contrast, the trade unions support the status quo of full 3 to 3.5-year apprenticeships hoping to ensure the skilled workers' social status (Hanf, 2011). However, the social status of skilled workers has been increasingly undermined by other institutional factors.

The Hartz Reforms (2004), reforms of social welfare (namely *Arbeitslosengeld II*), the merger of social and unemployment assistance for the long-term unemployed, as well as the introduction of conditionality, and the shortening of entitlement for unemployment benefits, as well as the move away from the "idea of 'securing of living standards'" (translated from Hassel and Williamson, 2004, p. 12) reduced the economic stability for workers out of employment. As in Denmark, the reforms represented a turn towards a 'work first' approach (Eichhorst, 2015, Eichhorst and Marx, 2011).

³ Made possible by the reform of the Federal Vocational education and education and training Act (BBiG) in 2005 (Thelen and Busemeyer, 2008, p. 16). The condition is that they go "above and beyond the minimum requirements for apprentices within the general framework".

The reforms also introduced so-called ‘training vouchers’, which could be used by accredited providers for up-skilling long-term unemployed jobseekers. The use of vouchers has been criticised for disrupting long-established relationships between public employment services and non-profit training providers without improving training provision (Hipp and Warner, 2008). Although, past reforms have centralised the purchase by the public employment services of large training programmes and additional services in four regional agencies (Greer et al., 2017), the local jobcentres (for the long-term unemployed) and employment agencies (for the unemployed) maintained the right to design and buy specific up-skilling programmes from providers of their choice.

3.1.3. VET and ALMP in England

In England, the provision of VET is fragmented and varies in quality across sectors, qualifications, and regions (Clarke and Wall, 1998, p. 53: on the construction sector, Winch, 2011). Public agencies evaluate and accredit VET, provide guidelines, and oversee the system of professional certification. Over the past decades, each Government reformed the governance of VET (Cuddy and Leney, 2005, Grugulis, 2007, Keep, 2006, Winch, 2011). The proliferation of public bodies generally centralised decision-making and targets for VET providers (Keep and Ashton, 2004 in Grugulis, 2007, Lloyd and Payne, 2012), without however creating a coherent national framework for vocational skill formation (Hodgson and Spours, 2012).

Colleges, universities, non-profit and commercial providers, local authorities, Government departments, the military, and firms’ vocational schools provide IVET and CVET. Public colleges and private sector bodies offer vocational certificates (Gospel and Foreman, 2006, Winch, 2011), such as City and Guilds, BTEC (Business and Technology Education Council), and Sector Skills Council awards in 3.5 and 4-year technical and engineering apprenticeships. Colleges also train for National Vocational Qualification (NVQ) (level 1-3) (Winch, 2011, p. 85), Technical Certificates at NVQ level 2, Advanced Apprenticeships at NVQ level 3, and offer additional programmes, such as ESOL (English as foreign language), and employability skills. Work-based apprenticeships offered by inter-firm training providers are less common (Gospel and Foreman, 2006, Winch, 2011).

Reforms of the welfare state, in particular of the provision of services for the unemployed, under New Labour (1997-2010) and under the Coalition Governments (2010-2015) have marginalized non-profit and non-governmental organisations in the provision of support and training for the unemployed (Greer and Symon, 2014).

The Coalition Government cut welfare spending, and its Work Programme, services for the long-term unemployed, favoured a ‘work first’ approach over up-skilling and training of the unemployed (Daguerre and Etherington, 2014, Greer, 2016, Greer et al., 2017, Greer and Symon, 2014). The transfer of responsibility over determining training needs and provision of training for the long-term unemployed to mainly private contractors of the DWP (Department for Welfare and Pensions), in the so-called *black-box approach*, has been criticised to represent a ‘moral hazard’, a loss of control by the DWP over the actual delivery of training to the long-term unemployed, and a reduction of training opportunities (Daguerre and Etherington, 2014).

Other institutional reforms under the Coalition Government, such as the abolition of RDAs (Regional Development Agencies), which among others, used to administer funds for regional economic development and up-skilling programmes, the reduction of skills funding through the SFA (Skills Funding Agency), and the introduction of competitive bidding for regional development funds open for private sector companies, and newly introduced, publicly and privately funded Local Enterprise Partnerships (LEPs) diversified the stream of funding sources and purposes (Sissons and Jones, 2014). The next section places the Danish, German, and English skill formation regimes within the comparative debate.

3.2. Skill formation regimes compared

Comparative studies of VET in Denmark, Germany, and England have so far focussed on specific professions (Brockmann et al., 2008). Those who have compared the socio-economic performance of political economies have acknowledged the systemic relevance of VET as well as ALMP (Thelen, 2014). VET has been comparatively studied at the level of the national political economy (Busemeyer and Trampusch, 2012: focus on coordinated market economies). Many more comparative studies of VET have focussed on the regional, sector, and firm level (Brockmann et al., 2008, Culpepper, 2001: Eastern German and French regions, Géhin and Méhaut, 1993: German and

French industrial companies, Maurice et al., 1986, Sorge and Warner, 1980: French, German and UK engineering and chemical industries).

Typical dimensions of comparison are the nexus of employer and state engagement (Culpepper, 1996, Culpepper, 2001: on France and Germany; Kath, 1995, Krekel and Kath, 1999: on Germany), the participation of the social partners in the governance of VET (Marsden, 1999, Martin, 2011), the cost-sharing between state, employers, and individual apprentices, the relation to specific production models (Streeck, 1992), welfare state models (Crouch et al., 1999, Estevez-Abe et al., 2001), and dominant labour markets (Marsden, 1999), the place of learning, the relative status of the VET certificates compared to higher education degrees (Powel and Solga, 2008), and the degree of skills transparency (Andersen and van de Werfhorst, 2010). Sociologists of work distinguish between initial and continued or further VET (Greenhalgh, 1999), and secondary education and higher education (Powel and Solga, 2008).

The term *skill* itself is understood differently in different VET regimes (Brockmann et al., 2008, Grugulis and Lloyd, 2010, Jobert, 1996, Jobert et al., 1997). Vocational skill formation across the regimes varies in depths, extend, and purpose. The Danish and German skill formation regimes provide occupational and portable skills (Culpepper, 2001, Marsden, 1999, Martin, 2011, Thelen, 2004), while the English skill formation regime is fragmented, geographically and across sectors, and skills are less easily recognized across employers (Clarke and Wall, 1998, Winch, 2011). The German VET regime provides practical and formal knowledge, the English skills for completing narrow practical tasks (Brockmann et al., 2008). The literature emphasises the similarity of the Danish and German dual VET regime (Brockmann et al., 2008, Thelen, 2004, 2014). However, Martin (2011) distinguishes further between skills provided in the Danish VET regime, where the state takes a strong role, and social partners administer vocational skill formation, leading to a political economy where skills are “portable” and “industry-specific”, and skills provided in the German VET regime, where a national framework failed to rise, and the state leaves control over skill formation to firms, and skills across the political economy are more “firm-specific”.

In this thesis, skill formation will be first compared in terms of initial and continued vocational pathways and the relationship between VET and training as part of ALMP,

and second in terms of flexibility of training delivery, employer participation in training and funding, and the type of course participants. This second distinction loosely follows the analytical framework used by Busemeyer and Trampusch (2012) and Thelen (2014). Third, the relationship between industrial policy and skill formation and the possible impact of skill formation on the nature of the emerging turbine manufacturing industry will be explored.

Supply side industrial policy is argued to increase the supply of skilled labour, mitigate the effect of poaching and economic slumps, but also to have ambiguous knock-on effects on skill formation providers. Demand side policy can negatively affect work-based skill formation, but if it creates prospects of large-scale development of demand for offshore wind turbine deployment that appeals to important investments and long-term technology shifts, it also has a positive impact on skill formation at inter-firm training providers. The next section defines job quality and introduces the comparative debate on job quality.

4. Job quality

The job quality literature derives from various debates (Carré et al., 2012, Gallie, 2007, Holman and McClelland, 2011, Muñoz de Bustillo et al., 2009). The British debate on job quality can be traced back to Braverman's deskilling argument (1974) (Thompson and McHugh, 2009, Keep and James, 2012), research by the Tavistock Institute, the quality of working life movement, and job enrichment studies (Carré et al., 2012). Researchers across Europe and the US study the structural distribution of 'good' and 'bad' jobs (Kalleberg, 2011, Warhurst et al., 2012).

Definitions of job quality evolved by taking on changing labour market and social issues (Gallie, 2007, pp. 4-9) and tend to overlap (Grimshaw and Lehndorff, 2010, Holman, 2013, Holman and McClelland, 2011, Muñoz de Bustillo et al., 2011, Okay-Sommerville and Scholarios, 2013). They often combine *employment* and *work quality*; *objective* or *extrinsic* dimensions that exist independently of individual perception (Muñoz de Bustillo et al., 2011), and *subjective* or *intrinsic* dimensions, i.e. how work is perceived by the individual (Gallie, 2007, Handel, 2005, Kalleberg, 2011, Muñoz de Bustillo et al., 2011), and how it interacts with the individual's life context (Cooke et al., 2013).

Job quality can be divided into *employment quality* (pay, job security/insecurity, and flexibility), *work quality* (work organisation, job design, skill requirements and development, skill use, work intensity, autonomy, participation, social and physical environment), *subjective* (job satisfaction, stimulation, belief in usefulness of the job, work-life balance), and *procedural* aspects (workplace participation and representation) (Muñoz de Bustillo et al., 2009, 2011). This PhD thesis mainly focuses on objective aspects of job quality such as job security, in particular standard (direct) or non-standard (here: agency work) employment, pay, work organisation and social integration of agency workers, workplace representation, and skills. This section reviews different definitions of common aspects of job quality. Then it presents more in detail the comparative debates on how job quality is affected by changes in social dialogue institutions, skill formation, and welfare state provisions.

4.1. Different aspects of job quality

4.1.1. Job security

Employment security and *flexibility* derive from the contractual status, flexible working arrangements, and working time (Holman and McClelland, 2011, Muñoz de Bustillo et al., 2011). Here the focus is on the contractual status and job security, hence the likelihood of retaining a specific job. For more on the debate on flexible working hours and job quality see for example Leschke et al. (2008), Campbell and Chalmers (2008), Wood (2016), Kelliher and Anderson (2008), and Angrave and Charlwood (2015). According to these authors, workers perceive job quality as higher, when they are involved in scheduling their working time.

Those who examine workers' contractual status generally distinguish between two types of employment: *standard* and *non-standard employment*. Standard employment is full-time, permanent, and direct employment. Non-standard employment is part-time, temporary, or fixed-term employment (Gebel, 2010, Leschke et al., 2008, McGovern et al., 2004). Kalleberg et al. (2000, p. 256: on the US) define non-standard employment in more detail as “on-call work, day labour, temporary-help agency employment, employment with contract companies, independent contracting, other self-employment, [and] part-time employment in ‘conventional jobs’”. Instead of job security, job *insecurity* may be measured independently of the contractual status in terms of the fear

of losing one's job (Leschke et al., 2008). Standard and non-standard employment can be an active choice by the individual, as well as a compromise in the absence of alternatives (Loughlin and Murray, 2013).

Initially, non-standard employment, in particular agency work, was thought to be a mere tool for numerical flexibility and stabilizing the core workforce (Atkinson, 1984, Atkinson and Meager, 1986, Doeringer and Piore, 1985). However, some argue that non-standard employment is strategically used by management to discipline labour: Bidwell (2009) finds that contract workers, *here* managers, are hired for various highly skilled jobs, and often work in the same roles as directly employed workers. Accordingly, organisations avoid conflicts of interest between organisational and front-line workers' individual goals. Batt et al. (2002) observe that human resource practices have shifted from performance management via internal labour markets (citing Doeringer and Piore, 1971, Schacht, 1985, and Jacoby, 1985), over High Performance Work Systems (citing Appelbaum et al., 2000 and Osterman, 1994), to externalizing labour (citing Cappelli, 1999 and Osterman, 1999).

Production increasingly relies on *temporary* and *permanent* agency workers (Flecker, 2009, Littler and Innes, 2003, Nachtwey et al., 2015). The resulting triangular employment relationship – worker, agency (employer), client company (Galais and Moser, 2009, Mitlacher, 2008) – hinders monitoring working conditions, organizing workers (Lillie et al., 2014), and agency workers' participation in decisions and raising grievances (Kirov and Ramioul, 2014).

Non-standard employment increases the risk of low wage and reduces opportunities for career progression, employment security, and eligibility for social benefits (Gebel, 2010: on Germany, Kalleberg et al., 2000: on the United States, McGovern et al., 2004: on Britain). The contractual difference between directly employed and agency workers widens the gaps in terms and conditions for substantially similar jobs (Eichhorst, 2015, Hassel, 2014, Vidal, 2013a). However, agency work also puts pressure on core workers (Benassi and Dorigatti, 2015, Flecker, 2009). This is discussed further below. This PhD thesis focuses on the composition of workforce according to their contractual statuses (permanent, direct, fixed-term, part-time employment, and agency work), and job

security – hence fluctuation in labour demand, job gains and losses. The next section turns to the job quality aspect *pay*.

4.1.2. Pay

Pay was quasi absent from early discussions of quality of work (Gallie, 2007). In the context of growing low-wage sectors, pay became a widely-accepted indicator of job quality (Carré et al., 2012, Findlay et al., 2013, Kalleberg, 2011, Muñoz de Bustillo et al., 2011, Osterman, 2013). Holman and McClelland (2011, p. 8) define pay as “wage level, performance related pay, [and] benefits”. Leschke et al. (2008) take into account nominal wages and add in-work poverty status. In this PhD research, pay was captured by annual gross pay or hourly pay for unskilled and skilled workers, coverage by collective agreement, for example application of sector agreements, so called framework agreements on pay (a pre-stage of the sector agreement), and Equal Pay Agreements for agency workers. The next section turns to work organisation and social integration of agency workers.

4.1.3. Work organisation and social integration of agency workers

Muñoz de Bustillo et al. (2011, pp. 455-457) highlight that social and physical environment, and work organisation are important indicators of job quality, as they impact on an individual’s wellbeing. Holman and McClelland (2011) define work quality as *work organisation* and the *design of the jobs*, which are further determined by the levels of discretion, demands of the job, ergonomics and other physical conditions, as well as the organisation in teams, work groups, and autonomy of work.

Referring to Sen’s (1985; Sen and Nussbaum, 1993) capabilities approach, Holman and McClelland (2011, p. 7-23) state that “positive social relationships” and “social support” are crucial for workers achieving high job quality. Social relationships at work are important “job resources”, and can be seen as opposites of “emotional strain” and lack of “industrial culture”. In contrast, Leschke et al. (2008) define working *conditions* in terms of work intensity, work autonomy, and physical work factors. As agency workers work alongside directly employed workers, one salient issue of job quality at the offshore wind turbine manufacturers is the *social integration* of agency workers as a proxy for social environment. The next paragraphs discuss workplace participation and representation as aspects of job quality.

4.1.4. Workplace participation and representation

Muñoz de Bustillo et al. (2009) coin the term *procedural* job quality, i.e. trade union voice and participation mechanisms. Holman and McClelland (2011, p. 8) define empowerment quality as “employee engagement and communication practices”. Gallie (2013) defines three types of direct participation at work: discretion of individual workers, semi-autonomy of teams, and worker consultation. Workers participate in decision-making processes via trade union and workplace representatives, as well as management led employee engagement (Holman and McClelland, 2011). Leschke et al. (2008) propose measuring worker representation by collective bargaining coverage, trade union density, and consultation about changes in work organisation.

Participation impacts on other aspects of job quality: Batt (2001) shows that trade union representation matters for wage levels. Offline-problem solving groups and teamwork reduce quit-rates, whilst non-union dispute resolution procedures do not (Batt et al., 2002). Fairness at work increases when workers effectively voice their concerns (Carré et al., 2012). This thesis focusses on trade union coverage, organising and bargaining aims, as well as on workplace representation through works councillors or shop stewards. The next paragraphs discuss skills and development as aspects of job quality.

4.1.5. Skills and development

Skill levels are generally associated with work organisation and task discretion, and the “diversity in the substance of work” (Osterman, 2013, p. 743). Spenner (1990) defines skill in terms of workers’ autonomy and control, and substantive job complexity. Fraser (2010, p. 55) adds the dimension *skill intensity*, a combination of “skill demands of the job” and “the skill base of those workers who must perform it”. Skill intensity consists of three components: the skill *match* between worker and job, and the *stretch* and *learning* workers need to undertake to do the job: “It is the combination rather than the presence of an individual element that makes a job skill-intensive.”

Skills and *development*, when defined as job quality aspects, are composed of skill requirements, training, and opportunities for development (Holman and McClelland, 2011). Also, skills and development are functions of *empowerment quality* (also see Holman, 2013). Leschke et al. (2008) measure skills and career development by the amount of training employees receive, and their subjective perception of possibilities to advance. In contrast, Muñoz de Bustillo et al. (2011) define career development as (objective) aspect of employment quality. Okay-Sommerville and Scholarios (2013, p. 555) include “skill use” in their measure of job quality.

In the industrial relations literature, skills required of the job contribute to work autonomy, i.e. personal discretion, work organisation in teams, and responsibility over results (Batt and Appelbaum, 1995, Batt, 2004). Skills and development are tricky concepts; they are part of job quality, but are also assumed to impact on other aspects, such as job security and pay. This will be discussed more in detail further below. The next paragraphs define subjective job quality.

4.1.6. Subjective job quality

This thesis focuses on objective aspects of job quality. However, an important part of the job quality debate discusses subjective factors of job quality, often summarised under the term job satisfaction. Job satisfaction derives from the individual’s perception of job quality (Clark, 2005, Handel, 2005, Muñoz de Bustillo Llorente and Fernández Macías, 2005, Olsen et al., 2007). It is a contested measure (Muñoz de Bustillo Llorente and Fernández Macías, 2005, Muñoz de Bustillo et al., 2009, Muñoz de Bustillo et al., 2011, Osterman, 2013), although an important aspect of workers’ wellbeing.

Horowitz (2016) and Kelliher and Anderson (2008) show that objective dimensions of job quality are differently related to job satisfaction (Clark, 2005, Handel, 2005, Kalleberg and Vaisey, 2005). Factors assumed to affect job satisfaction the most, are whether the job fits with the personal life circumstances (Cooke et al., 2013), is perceived as useful to society (Muñoz de Bustillo et al., 2011), or as interesting (Horton et al., 2014), and whether work intensity and social relationships at work are appreciated (Muñoz de Bustillo et al., 2011, Olsen et al., 2007).

Job satisfaction is also related to participation (Muñoz de Bustillo et al., 2011), and the perception of job (Batt and Appelbaum, 1995) and status security (Gallie, 2013, Loughlin and Murray, 2013). This PhD thesis is not about job satisfaction. However, some anecdotal evidence was collected in interviews with works councillors. The table below summarises the aspects of job quality identified within the literature. The next section introduces the comparative debates on job quality.

Table 2 Dimensions of job quality

Objective	Employment quality	Remuneration/pay Security and insecurity Flexibility
Objective	Work quality	Work organisation Job design Skill requirements and development Skill use Work intensity Autonomy Participation Social environment/social integration of agency workers Physical environment
Subjective		Perceived job quality/ job satisfaction Whether job is interesting/stimulation Perceived as useful to society Whether it fits with personal life circumstances
Procedural		Workplace participation Workplace representation Trade union practice

The distinction between objective, subjective, and procedural aspects is based on Muñoz de Bustillo et al. 2009, 2011

4.2. The comparative debates on job quality

The comparative debates often explain differences in job quality across workplaces, sectors, and political economies by differing industrial relations institutions (labour market regulation, social dialogue, institutionalised skill formation and occupations) (Hall and Soskice, 2001) and welfare state institutions (Esping-Andersen, 1990). But there is disagreement on the interpretation of changes in job quality: Some analysts emphasise *dualisation*, the maintenance of employment conditions of the core workforce by destabilisation of employment conditions at the margins of the labour market (Hassel,

2014, Palier and Thelen, 2010). Others interpret the erosion of employment conditions at the margins as a trend that will increasingly concern the current strongholds of good employment conditions (Benassi, 2016, Benassi et al., 2016, Doellgast et al., 2016, Dörre et al., 2013, Greer, 2016, Vidal, 2013a).

The erosion of job quality is explained by the introduction of *workfare* through welfare state reforms (Dörre et al., 2013, Greer, 2016), which prioritise labour market participation over securing of living standards (Hassel, 2014), and the liberalisation of employment services, which resulted in an increase of agency work (Eichhorst, 2015, Eichhorst and Marx, 2011). It is argued that employers use agency work not as a tool for gaining flexibility, but to undermine the bargaining power of workers at the margin and at the core of the labour market (Doellgast et al., 2016, Eichhorst, 2015, Eichhorst and Marx, 2011, Nachtwey et al., 2015) – an argument that is inspired by Marx’ *reserve army theory* (2013 [1867]).

Based on these debates, this thesis takes into account the composition of the workforce the offshore wind turbine manufacturing sites, the role of agency work, trade union and workplace representation, ALMP and VET, as well as companies’ employment practices, and engagement with these different institutions. Industrial policy is examined as another possible contextual factor that impacts on job quality, as it has so far been mentioned *en passant* within the above debates, but has not been studied in detail.

For example, it has been argued that it is at the sector level where competition and interaction between firms and other organisations take place (Batt et al., 2009, Findlay et al., 2013, Hall and Soskice, 2001); that technologies, services, and product choices impact on labour demand, work organisation, and employment relations (Batt et al., 2009, p. 454); and that comparative, multi-level, and in-depth sector studies are useful to understand within occupation and sector variations of job quality (Carré and Tilly, 2012). The next paragraphs discuss how social partnership, skill formation, and welfare state provisions are assumed to impact on job quality. A common theme within these debates is impact of *dualisation* of labour markets (Palier and Thelen, 2010) on job quality.

4.2.1. Social partnership

Comparative industrial relations research focuses on the institutional relationships between national production models, workplace and management practices (Batt (Batt et al., 2009, Doellgast, 2012, Gautié and Schmitt, 2009: on low wage work, Katz, 1997: on the telecommunications sector, Maurice et al., 1986: on chemical, electrical, and mechanical engineering). The interest is to show how job quality can be maintained against competitive pressures through cooperative arrangements between capital and labour, supported by the state and a specific institutional context (Hall and Soskice, 2001).

The comparative literature has shown that workplaces in coordinated market economies with strong trade unions and institutionalised workplace representation generally fare better in terms of wage levels (Batt et al., 2009), job security, and discretion (Doellgast, 2012, Doellgast et al., 2009a). Workplace representation is assumed to positively impact on job quality (Batt et al., 2002, Carré et al., 2012, Doellgast, 2012, Holman and McClelland, 2011).

In Germany, the strength of employment protection, trade unions, and statutory workplace representation have provided the ‘beneficial constraints’ that were at the origin of ‘diversified quality production’ (Streeck, 1992, p. 4). Workplace representation is a central feature as works councils mediate change between employers and workforce (Rehder, 2003, Streeck, 1992). However, there is increasing recognition of the decline of trade union power and workplace representation (Dörre, 2002, Gumbrell-McCormick and Hyman, 2013); partly because of structural decline and growth of sectors with low trade union membership levels, partly because of reforms of the welfare state that weaken workers’ welfare rights (Greer, 2016, Greer et al., 2017), partly because of increasing standardisation of the labour process (Braverman, 1974, Massey, 1990 [1984]) that allows for the wider use of agency work (Benassi, 2016). The transition from a Fordist (until the late 1970s, early 1980s) to a Post-Fordist mode of production the liberalisation of markets, financialisation, anti-union regulations, and welfare state reforms have eroded the institutions that ensured a relative power balance and joint interest between capital and labour (Boyer, 1997, Vidal, 2013b).

In Germany, organized labour and management have formed competition partnerships, i.e. labour increasingly made concessions to management in terms of flexibility and wage levels (Dörre, 2002, Rehder, 2003). Studying the German automotive sector, Greer (2008, p. 192) explains the paradoxical decline in working conditions in “a context of unprecedented prosperity and (numerically) strong union organisation” with vertical disintegration, “the breakup of vertically integrated production organisation, enabled by the compression of time and space in the production process”, that undermines traditional collective bargaining mechanisms. Vertical and horizontal disintegration of firms, non-standard employment, part-time, fixed-term, and agency work have increased competition across the social organisation of production (Doellgast et al., 2016). The fragmentation of production is used to undermine workers’ collective and individual bargaining power (Benassi and Dorigatti, 2015, Flecker, 2009, Vidal, 2013a).

In the 1990s, facing the decline of manufacturing in Denmark, and the expansion of service sector work, the trade unions supported the offshoring of jobs and the Government’s open trade policy (Daemmerich and Bredgaard, 2013). Offshoring was perceived to help companies’ survival and free up labour for growing sectors. Hence, it is important to evaluate what are the patterns of social partnership in the offshore wind turbine manufacturing industry; and in how far trade unions and work place representation impact on job quality in the present cases. The next session discusses the link between skill formation and job quality.

4.2.2. Skill formation

LMEs and CMEs have distinct skill formation regimes (Hall and Soskice, 2001). Skill formation regimes are related to specific types of labour markets (Marsden, 1999). In CMEs, such as Germany and Denmark, high investment in vocational skill formation takes place (Estevez-Abe et al., 2001, Thelen, 2014, Thelen, 2004). In contrast, in England, a LME, investment in skill formation is low (Winch, 2011). Denmark and Germany comprehensive and centrally regulated vocational skill formation is argued to equalize access to labour markets (Brockmann et al., 2008,), while in England VET largely takes place in a privatised system and enhance socio-economic inequality (Gallie, 1991, Lindsay et al., 2013).

Skill formation regimes that provide occupational skills enhance skill transparency and lead to low levels of youth unemployment (Andersen and van de Werfhorst, 2010). Occupational skill formation allows firms to rely on external, occupational labour markets, whilst fragmented skill formation promotes the use of internal labour markets for skilled work, or secondary labour markets for lowly skilled work (Marsden, 1999). Hence, recruitment strategies are linked to specific production and product market strategies: where skill investments are firm and industry-specific, employers opt for high value, high quality products, where skills are general and low, employers opt for low-value and low-quality products (Estevez-Abe et al., 2001, Hall and Soskice, 2001).

The comparative advantage of the German manufacturing industry and its characteristic ‘flexible quality production’ is built on the *Fachkraft*, the skilled worker (Streeck, 1992). The term *Fachkraft* applies to “skilled workers at the intermediate level” (Hanf, 2011, p. 54-58), distinct from “unqualified workers” and “academically qualified workers”. Dual VET “provides a surplus beyond that which is necessary for certain job functions”, that “includes systematic, theoretical knowledge and (...) a strong educational dimension”. “Transparent clusters [of] general education and industry specific skills” define each occupation. VET results in strong occupational identities and enhances bargaining power through professional and occupational solidarity.

Although competition forces industrial firms to cut costs and rationalise their labour force by introducing leaner processes, strong employment protection incentivizes companies to find new occupations internally for redundant workforce (Streeck, 1992). Redundant workforce, as it is highly skilled, can be employed in new jobs that contribute to quality, diversified, and innovative production. The protected status of core workers means that they are less reluctant to invest in firm and industry specific skills (Culpepper, 2001, Estevez-Abe et al., 2001).

In contrast, LMEs are stylized as low-road production models (Hall and Soskice, 2001). Skill formation is described as more fragmented, as neither the public sector nor industry associations sufficiently coordinate with employers on skill formation. As skill provision is limited, employers seek production strategies that do not rely on specific skills but on generic and transferable skills (Estevez-Abe et al., 2001). Skill formation by employers only serves immediate production needs. As the acquisition of production specific skills

is perceived as risky in LMEs (Culpepper, 2001, Estevez-Abe et al., 2001), it is object of concession bargaining by workers (Kristensen, 2015). Poaching of scarce highly skilled workers is a significant problem, which is reinforced by employers' low investment in skill formation (Crouch et al., 1999). The low-skill and low-road account of LMEs has however been questioned. Recent contributors argue that high and low-skill, high and low-road production models co-exist within LMEs, strongly polarising the labour market between highly skilled workers with much individual bargaining power, and a large low-skill, low-wage sector (Brown et al., 2004, Gallie, 2007, Goos and Manning, 2007).

Assessing the impact of individuals' educational achievements on labour market outcome, Dieckhoff (2008) shows that the labour market effects of CVET differ across Germany, Denmark, and the United Kingdom in terms of pay, likelihood of being in a lower skilled job, and the likelihood of being in professional employment. Her findings confirm that vocational education has positive effects on wages and adequate skill levels in the occupational labour market regimes of Germany and Denmark, whereas it provides for weaker returns in the United Kingdom. De Grip and Wolbers (2006) compare job quality among low skilled young workers across European countries, manufacturing and service sectors, with different VET and labour market regimes (occupational labour markets versus internal labour markets). Job quality is assessed in terms of employment status (permanent or fixed-term), skill level (non-elementary), and participation in CVET. Their results show that good job quality is less accessible for lowly skilled young workers in countries with occupational labour markets such as Denmark and Germany.

More generally addressing the question of a growing reserve army of skilled labour, sociologists of work have debated, if technological change increases or decreases skill demands of work (Adler, 2007, Knights and Willmot, 2007, Thompson, 2007), and, if it does, in what way capitalism drives deskilling (Grugulis and Lloyd, 2010). The value of skills depends on the availability of matching jobs in the labour market on the one hand (Keep and Mayhew, 2010). On the other hand, deskilling is linked to increasing marginalisation of trade unions in wage setting; and trade unions' failure to enforce the match between real skill needs and required educational credentials. A key argument is that levels of formal education rise, but are increasingly detached from the skill

requirements of the labour process. Competitive pressures impose cost-savings on firms, and impact on skill demands and skill formation (Grugulis and Lloyd, 2010). Grugulis and Lloyd (2010) highlight the changing value of skills in earlier works: Brinkley (2008) on ‘qualification inflation’, Keep and Mayhew (2004) on the redefinition of relatively lowly skilled jobs as graduate jobs. Over-qualification (Pollmann-Schult and Büchel, 2004) or ‘credential inflation’ (Brown et al., 2004) are observed in the United Kingdom as well as in Germany.

Dörre (2002, p. 72: on Germany) argues that de-Taylorisation (first half of the 1990s), and re-Taylorisation (second half of the 1990s through to the 2000s) were deliberate moves of a *work political pendulum* towards a new paradigm that favours flexibility of production over efficiency. In the new economy, managers withdraw from supervision and training and embrace “adhocracy”. However, this is not necessarily a challenge to re-Taylorisation of tasks, but rather a manifestation of intensification and individualisation of risk and responsibility as shown by Sallaz (2015, p. 3). Sallaz describes new call-centre workers who are left to an “autonomous *learning game*” that forces them to figure out how to do their job without any training, which results in high levels of turnover. The decrease in provisions for training and career advancement might be a result of the externalisation of labour (Ward et al., 2001). Flexible labour processes, less job security, pressure on wages, and the lack of company training require workers to simply fit in (Vidal, 2013a). Later chapters will explore the role of skills for job quality in the offshore wind turbine manufacturing industry. The next section explores how welfare state provisions impact on job quality.

4.2.3. Labour market and welfare state provisions

The contributions to Gallie’s (2007) edited volume on job quality across European countries assess the effects of production models and welfare state regimes. They generally find more support for the assumption that power resources provided by the welfare state (generous employment benefits, support of female employment) (Esping-Andersen, 1990, Korpi, 1978, Korpi, 1983) lead to high levels of job quality, rather than institutional features of production models (vocational skill formation, workplace representation, and strong trade unions) (Hall and Soskice, 2001).

Over the past decades, social and economic changes put the European welfare states under pressure (Bosch and Weinkopf, 2008, Lloyd et al., 2008, Westergaard-Nielsen, 2008). Resulting labour market reforms decreased employment protection and facilitated market access for work agencies (Eichhorst and Marx, 2011, Ferreira, 2016, Forde and Slater, 2005, Forde and Slater, 2016, Stanworth and Druker, 2000). Reforms of unemployment benefits systems deliberately re-commodified labour (Daguerre and Etherington, 2014, Greer, 2016). From 2000, *flexicurity*, a combination of job flexibility (low levels of job protection), and employment security through continued skill formation and reintegration into new jobs, became a key policy under the EU Lisbon Agenda (Bosch and Lehndorff, 2005, Bosch and Weinkopf, 2008, Leschke et al., 2008). However, instead of *flexicurity*, most reforms have rather taken the shape of workfare aiming to enhance worker flexibility without providing for security (Greer, 2016).

Across residual welfare states such as the United Kingdom and the United States (Daguerre, 2004, Daguerre and Etherington, 2014, Greer and Symon, 2014), but also universal and corporatist welfare states, such as Denmark and Germany, ‘workfare’ provisions that aim at job reintegration of the unemployed regardless of physical abilities, family commitments, skill levels, and personal aspirations have become more prominent (Andersen and Svarer, 2007, Greer, 2016, Greer and Symon, 2014, Greer et al., 2017).

Active labour market policy impacts on job quality, in particular as workers accept low quality jobs, below their skill levels or extremely low pay, to reduce their contact with the welfare state administration (Dörre et al., 2013). Van der Wel and Halvorsen (2015: on eighteen European countries) show that a more generous welfare state (in contrast to the general public discourse) increases employment commitment. De Ruyter and Burgess (2003) explain the decline in job quality by the increase in non-standard employment, which results from excess labour supply. Greer (2016) argues that active labour market policy, in particular when taking the shape of workfare, re-commodifies labour and is detrimental on job quality. Van den Berg and Vikström (2009), surveying the Swedish population between 1999 and 2004, show that benefit sanctions force jobseekers to accept jobs at lower occupational levels; and that wages as well as working hours are lower after a sanction.

Similarly, Gaure et al. (2008) study the impact of unemployment insurance and active labour market programmes on job search behaviour and subsequent job quality. They compare data from before and after the reform of the Norwegian unemployment insurance system in January 1997 (data from 1993 to 2001). They show that the longer the registered unemployed could search for jobs, the higher their comparative earnings and the better the job matched their skills. These findings are confirmed in similar studies on Germany: Pollmann-Schult and Büchel (2005) compare unemployed jobseekers on benefits and without benefits and the quality of skill match when job searches are more extended; Gebel (2010) identify wage penalties for those who accept fix-term employment to quickly leave unemployment. The studies show that workers are more likely to take up jobs that match their skills, when they have longer time to search, and that they are more likely to find a permanent job, where wages are likely to be higher.

Dieckhoff (2011), comparing *unemployment scarring*, effects of previous spells of unemployment on job quality, shows that unemployment also affects non-pecuniary aspects such as job security and skill levels. She shows that effects differ across countries (Austria, Denmark, Spain, and UK): job security is lower for the previously unemployed in countries with high levels of institutional job protection such as Austria and Spain. Effects are particularly strong in Spain and explained by the generally high rate of unemployment that weakens the bargaining power of individual workers. Skill levels and career progression seem to be slower than for those without past unemployment spells, surprisingly in Denmark, a country with extensive provision for continued skill formation – this hints at the relevance of the dualisation debate, which is discussed next –, and in the United Kingdom, where, according to Dieckhoff, slower progression can be explained by the limited provision of high quality vocational education and stigmatisation derived from previous unemployment.

Johnson and Corcoran (2003: on USA) show that unemployment scarring together with the lack of job skills and experience stop former benefits recipients from moving from ‘bad’ to ‘good’ jobs, in particular during slumps. Hence there is no clear indication across the literature that continued skill formation universally leads to better job quality. As Benassi (2016) suggested, the abundance of vocational skills available in certain labour markets combined with increased standardisation of the labour process might

result in a growing share of skilled workers being in insecure agency jobs. Next, the above factors are placed within the dualisation debate.

4.2.4. Dualisation debate

The dualisation debate focuses on the question, whether job quality generally declines or whether it declines for parts of the labour market, whilst others continue to enjoy stable employment conditions or even improving employment conditions. Those who support the argument for dualisation highlight that changes to the welfare state, the decreasing number of manufacturing jobs, the relative growth of the service sector, rising unemployment, low-wage, and precarious work, widened the gap in labour standards between core and periphery labour force (Eichhorst, 2015, Hassel, 2014, Palier and Thelen, 2010). Workers in standard employment covered by collective agreement, on permanent and full-time contracts represent the *core*. The *periphery* consists of workers in non-standard employment: part-time, temporary, mini-jobs, and agency work, as well as jobs not covered by collective agreement. The crux of the disagreement within the literature is between those who see dualisation as a new stable equilibrium and those who perceive the erosion of job quality at the margins as part of a wider trend that with time will affect all jobs (e.g. Benassi, 2016, Benassi et al., 2016).

The erosion of job quality as a more general trend of is exemplified by the increase in agency work in sectors that used to represent the ‘core’ of the ‘core industries’ (Benassi and Dorigatti, 2015, Nachtwey et al., 2015: on the German automotive sector). Benassi (2016) shows that workers with low skills tend to be more likely to be employed through agencies. However, she also notes that agency work has increased among skilled workers who formerly represented the core of workers in standard employment. Her findings suggest an erosion of the link between skills and long-term employment in high performance work systems (HPWS) enabled by the standardisation of labour processes, legalisation of agency work, and deregulation of the labour market.

But do agency workers necessarily work in standardised routine jobs as Benassi (2016) suggests? Håkansson and Isidorsson (2012), investigating the use of agency workers in ten Swedish workplaces, identify three different outcomes of agency work for the skills of the core workforce depending on the labour process for which the agency workers

were employed. Their study shows that agency workers can be used for a variety of differently skilled jobs: 1) in line with the common periphery versus core worker thesis core workers might execute the more complex tasks, and agency workers might be assigned simpler tasks (numerical flexibility), 2) agency workers might be used for the same skilled tasks as core workers, thus serve as a capacity buffer (functional flexibility) (an “all core outcome”), which contradicts the ‘flexible firm’ thesis, and 3) the general deskilling of the labour process (“all periphery outcome”) to make the integration of agency workers in the labour process easier. In the first two scenarios, the intake of agency workers in addition to core workers has no effect on the skill levels of core jobs. In the third scenario, the deskilling of the labour process also affects the core workers, which corresponds to Benassi’s (2016) argument.

Adding to Håkansson and Isidorsson (2012) a fourth, fifth, and sixth scenario are suggested in this thesis. 4) Building on scenario 2 (capacity buffer), agency workers might acquire higher skill levels, because they are under the constant pressure to perform well to maintain their placement, and because they gain broader experience across a specific sector’s different firms through different placements, accumulating knowledge and expertise a lot faster than their peers who work permanently in the same workplace. Also, 5) agency workers might be hired to take on more complex tasks than the core workforce (cf. Bidwell, 2009), for example to support the transition from one type of labour process to another. They would engage in learning new skills on new machines, which they later pass on to the core workforce. Scenario 4 and 5 lead to the paradox of up-skilling agency workers, while the core workforce either stays in routine functions or even transfers to a deskilled and automated labour process, reversing the underlying idea of periphery and core in terms of skill.

Scenario 6 suggests that the increased intake of agency workers results in the complete abolition of core workers in the routine production process (another all periphery outcome). As a larger pool of agency workers proves to perform as well or even better than core workers, and a larger pool of agency workers becomes familiar with labour processes across the sector (increase in the reserve army of labour), companies become less dependent on a specific workforce, and one could argue also less reluctant to entirely staff their production with agency workers. An organisational compromise between having a core workforce and hiring only agency workers from third parties is

the operation of a company-owned work agency. Within the chapter on job quality, it will be discussed in how far workplace representation, trade union representation, skill formation, active labour market policy, and industrial policy impact on job quality. The last section of this chapter presents the analytical framework developed in this thesis.

5. Analytical framework

The study of industrial policy complements previous research on job quality that looked at phenomena such as technological change (Goos and Manning, 2007, Hyman and Streeck, 1988, Unger, 2000), the reorganisation and automation of production processes (Appelbaum et al., 2000, Fernández-Macías, 2012, Green, 2006, Katz, 1997), the decline of job numbers in manufacturing and their rise in service sectors (Bosch and Lehndorff, 2005, Doellgast, 2012, Doellgast et al., 2009b, Meisenheimer, 1998) and low-wage industries (Bosch and Weinkopf, 2008, Gautié and Schmitt, 2009, Lloyd et al., 2008, Tilly, 1997, Westergaard-Nielsen, 2008), the restructuring of firms (Doellgast and Greer, 2007, Doellgast et al., 2009b, Katz, 1997, Ruyter et al., 2011), the opening of markets for goods, services, and capital to European and international competition (Batt et al., 2009, Boyer, 2005, Brown, 1999, Busemeyer and Trampusch, 2013, Greer and Hauptmeier, 2016, Grimshaw and Lehndorff, 2010, Hassel, 2014), and welfare state reforms over the past decades (Estevez-Abe et al., 2001, Findlay et al., 2013, Greer et al., 2017, Van der Wel and Halvorsen, 2015). Job quality researchers engaged with both the Varieties of Capitalisms and welfare regimes approaches (Esser and Olsen, 2011, Gallie, 2007, Olsen et al., 2007, Warhurst et al., 2012). The contribution of this thesis is the integration of a framework to analyse industrial policy among the conventionally studied institutional factors.

The concept of *investor capitalism* is suggested to describe the characteristics of an industrial sector, where large investors have much influence on companies' and public policy, skill formation, and job quality. It is argued that in the context of a privatised energy supply industry, policy-makers find themselves in a bind regarding the realisation of public policy goals such as carbon emissions reduction, the deployment of renewable energy technology, and the creation of 'good jobs', as they depend on large-scale and long-term investments by the private sector.

Based on regulation theory (Aglietta, 2015 [1979]) and previous offshore wind sector industrial policy studies (Karnøe and Garud, 2012, Kern et al., 2014, Koch et al., 2012), this chapter has proposed that the shape of industrial policy is the result of distinct regulatory struggles. It is suggested that policy-makers in Denmark, Germany, and England, due to the changed context, a privatised landscape of European electricity utilities and globally operating components manufacturers, face the same investor capitalist pressures to guarantee long-term return on investment, but they formulate different responses to it.

These responses go beyond and differ from the particular institutional comparative advantages that have been suggested by the Varieties of Capitalism approach (Hall and Soskice, 2001, for a comprehensive critique see Streeck, 2010). Policy responses depend on the composition of political and economic interest coalitions, and how these respond to exogenous events. In line with the French regulation school, this analytical framework takes into account the governance and regulatory regimes within each country, and at international and European level. Regulatory institutions and governance bodies are here defined as the constitution of the government of each country, and powerful sub-national political entities such as the *Länder* in Germany, political parties, social movements, the trade unions, and industrial associations, as well as the incumbent and newly emerging actors of the electricity supply industry.

Based on previous studies of the offshore wind industry (Lewis and Wiser, 2007, Dawley, 2013, Pohl, 2013, Simmie, 2012, Simmie et al., 2014) and the Varieties of Capitalisms approach (Hall and Soskice, 2001), supply side policies are defined as policies that are aimed at facilitating the market participation of domestic producers, through public provision of infrastructure and tax credits for manufacturers, support of research and development, provision of skills, and support of supply chain and process optimisation. Demand side policies are defined as policies that are aimed at expanding the demand for energy technology, through infrastructure grants for building offshore wind turbines, price subsidies for electricity from renewable sources, favourable spatial planning and approval regulations for wind farms, allocation of seabed for wind farm construction, domestic and international targets for renewable deployment and reduction of carbon emissions, and support for marketing and establishment of production sites in other countries (*offshoring*).

It is suggested that in a privatised electricity supply industry, the deployment of offshore wind turbines and establishment of domestic industries are only realised, if supply and demand side policies are adequately matched over time to make up for the investment risks of technology suppliers and corporate and institutional investors. Demand side policy has to provide incentives for the private sector by guaranteeing long-term returns on investment and profit margins for investors in offshore wind turbine deployment, and supply side policy has to take the risks and chances of plant expansion, research and development, and skill formation.

It is suggested that industrial policy interacts with the production and welfare state regimes in place. Skill formation across the countries will be compared in terms of initial and continued vocational pathways available, the relationship between VET and training as part of ALMP (flexibility of training delivery, employer participation in training and funding, type of course participants (Busemeyer and Trampusch, 2012, Thelen, 2014)), as well as the relationship between industrial policy and skill formation. It is suggested that industrial policy can, although it might not be intended to, be detrimental to firms' economic stability, due to frequent changes in the regulatory framework. The resulting pressures are translated onto the workforce, and are often combined with ad hoc industrial policy measures, such as short-term skill formation programmes.

Job quality will be compared in terms of its objective aspects job security, pay, social integration of agency workers, and in terms of the impact of workplace representation, skill formation, and industrial policy (Muños de Bustillo et al., 2009, 2011). As discussed above, it has often been suggested that workers in Denmark and Germany, both coordinated market economies (Hall and Soskice, 2001) and generous welfare capitalisms (Esping-Andersen, 1990), would enjoy patterns of good job quality, while workers in England, a liberal market economy with residual welfare state, would not (Gallie, 2007, Holman and McClelland, 2011). More recent studies have shown that active labour market policy (Dörre et al., 2013, Greer, 2016), skill formation (Dieckhoff, 2008, Dieckhoff, 2011), collective and workplace representation and trade union bargaining (Doellgast, 2012, Doellgast et al., 2009a) can modify job quality, and might lead to dualisation (Palier and Thelen, 2010). However, also industrial policy within a

specific sector might impact on job quality as it affects labour supply and demand (cf. Benassi, 2016, Grugulis and Lloyd, 2010, Keep and Mayhew, 2010), and mediates the speed and dynamics of industrial change (cf. Aglietta, 2015 [1979]). The next chapters discuss industrial policy, skill formation, and job quality comparatively.

Table 3 Analytical framework

International context	Incidences in other countries
	EU and international regulations
Regulatory Institutions and governance bodies	Constitution of government
	Powerful sub-national entities
	Political parties
	Social movements
	Trade unions
	Industrial associations
	Incumbent and newly emerging actors of the electricity supply industry
	Actors of skill formation and labour market administration
Demand side industrial policy	Price subsidies for electricity from renewable sources
	Favourable spatial planning and approval regulations
	Allocation of seabed for wind farm construction, Domestic and international targets for renewable deployment and reduction of carbon emissions
	Support for marketing
	Support of offshoring
Supply side industrial policy	Public provision of infrastructure and tax credits for manufacturers
	Support of research and development
	Support of supply chain and process optimisation
	Provision of skills through education system and active labour market policy
	Available vocational pathways
Skill formation	Vocational education and training (VET)
	Active labour market policy (ALMP) funded skill formation
	Initial vocational training (IVET)
	Continued vocational training (CVET)
	Resources for skill formation provision
	Employer participation
	Types of participants
Job quality	Workplace representation
	Pay
	Job security and agency work
	Social integration of agency workers
	Skill use/discretion

CHAPTER III: RESEARCH METHODOLOGY

1. Introduction

This thesis compares data on job quality, skill formation, and industrial policy across Denmark, Germany and England. Data was collected on ten offshore wind turbine manufacturing sites, and ten skill formation providers: in Denmark, two manufacturing sites and two skill formation providers; in Germany, six manufacturing sites and four skill formation providers; and in England, two manufacturing sites and four skill formation providers. The aim was to answer the questions: *How are industrial policy, skill formation, and job quality shaped in the offshore wind turbine manufacturing industry? How does industrial policy affect skill formation? How does industrial policy affect job quality? How does skill formation affect job quality?*

In-depth case studies seemed the most appropriate method to explore this *multidimensional* set of questions (Eisenhardt, 1989, Eisenhardt and Graebner, 2007). Although this thesis does not employ ‘grounded theory’, it draws on the toolbox of classical grounded theory as in Glaser and Strauss (1967) for data collection and analysis as suggested by Yin (2014) and Eisenhardt (1989). This chapter first outlines the rationales of comparative in-depth case study research, then the research design; it explains the case selection and what type of data was collected, how access was gained to interviewees; it discusses ethical issues, as well as it reports on data organisation and analysis. The chapter concludes with limitations of the research design and obstacles encountered in its realisation.

2. Comparative in-depth case study methodology

Job quality, skill formation, and industrial policy have been studied with different methodologies and research designs by others. The choice for comparative in-depth case studies was motivated by the aim to explore the *multidimensional* relationships between industrial policy, skill formation, and job quality (Eisenhardt, 1989, Eisenhardt and Graebner, 2007). A comparative design was chosen to strengthen the quality of the findings (Yin, 2014). Case studies map out phenomena as a “combination of characteristics” (Ragin, 1987, p. 3); they “are rich empirical descriptions (...) that are typically based on a variety of data sources” (Yin, 1994 in Eisenhardt and Graebner,

2007, p. 25). They can be used to test theory (Pinfield, 1986, Anderson, 1983, both in Eisenhardt, 1989p. 535) and to “generate theory” (e.g. Gersick, 1988, Harris and Sutton, 1986, all in Eisenhardt, 1989, p. 535).

Case studies can consist of single cases or several sub-cases, which can be analysed at several levels (Yin, 1984 in Eisenhardt, 1989, p. 534). Comparative case studies are often undertaken when the circumstances of a certain phenomenon, and the causal relationship between circumstances and phenomenon, are not well known (King et al., 1994). They help the development of theories by stimulating the comparison of “ideas and evidence”, conditions, and contexts with particular “outcomes” (Ragin, 1987, p. 52). The comparison of cases helps to identify systematic patterns, and therefore rules and idiosyncrasies within cases (Eisenhardt, 1991 in Eisenhardt and Graebner, 2007, p. 27).

Comparative cases are defined and delimited as units, “sometimes by default”, or redefined in the course of research for analytical reasons (Ragin, 1987, p. 5). The aim is not the development of mere typologies, but to identify “specific trajectories” (Ragin, 1987, p. 6). A “trajectory” here seems to mean causality. To establish causality between different components of a phenomenon, some authors recommend the combination of cases as natural “experiments” – following a logic that is similar to laboratory experiments – to develop and “test” theoretical assumptions within similar but different contexts (e.g. Eisenhardt, 1989, Eisenhardt and Graebner, 2007, King et al., 1994, Yin, 2014), for example the comparison of different countries and firms by keeping the sector constant.^{4 5} This is what has been done in this thesis. The difference between laboratory experiments and natural experiments is the “rich, real-world context” of social phenomena (Eisenhardt and Graebner, 2007, p. 25).

The construction of a comparative research design that treats a combination of cases from the social world as a series of experiments has several implications for the use of

⁴ „Social scientists must be content to study naturally occurring (that is, ‘non-experimental’) data. Yet there is good reason to believe that the causes of these phenomena are both multiple and conjunctural and therefore require experiment-like analysis. Only when naturally occurring data approximate experimental designs is it possible to decipher the order-in-complexity that seems apparent in these phenomena” (Ragin, 1987, p. 29).

⁵ Eisenhardt and Graebner (2007, p. 27) describe this as a systematic process of „revelation of an unusual phenomenon, replication of findings from other cases, contrary replication, elimination of alternative explication”.

theory at the beginning of any research process (Yin, 2014). It suggests theoretical sampling, rather than random sampling as in quantitative methods. At the beginning of the research process a research question, which was formulated based on the identification of a gap or conflict in theory, or a puzzle, orientates the researcher regarding what data to collect and where to collect it (Eisenhardt, 1989, King et al., 1994). “A priori specification of constructs” based on literature can help to define the research design and to “measure” and identify constructs within the data (Eisenhardt, 1989, p. 538).

The aim is to find out “how different conditions or causes fit together in one setting and contrast that with how they fit together in another setting (or with how they might fit together in some ideal-typical setting)” (Ragin, 1987, p. 13). In theory building, the researcher always works within the nexus of construct definition based on literature (existing theory) and not having a theory, being ready to accept findings that lead to a new theory (Eisenhardt, 1989). The next section details the research design employed in the thesis.

3. Research design

In his introduction to case study methodology Yin states:

“Every type of empirical research study has an implicit, if not explicit, research design. In the most elementary sense, the design is the logical sequence that connects the empirical data to a study’s initial research questions and, ultimately, to its conclusions. Colloquially, a research design is *a logical plan for getting from here to there*, where *here* may be defined as the initial set of questions to be answered, and *there* is some set of conclusions (answers) about these questions. Between *here* and *there* may be found a number of major steps, including the collection and analysis of relevant data.”

(Yin, 2014, p. 28)

Yin (2014, p. 29) proposes five major components of a research design: A research question, its *propositions* “if any”, *unit(s) of analysis*, the *logic linking the data to the propositions*, and *criteria for interpreting the findings*. The criteria for interpreting the findings are derived from rival explanations that have been identified in the literature. The case study findings are the result of the deliberation between the case study data and these rival explanations. This thesis develops an alternative proposition, which is that

industrial policy affects skill formation and job quality. The research questions - *how are industrial policy, skill formation, and job quality shaped in the offshore wind turbine manufacturing industry? How does industrial policy affect skill formation? How does industrial policy affect job quality? How does skill formation affect job quality?* - are derived from observations on skill formation and job quality in the sector. Conventional propositions (employment regimes, production models), that rival the explanation defended in this thesis, are derived from the existing literature on skill formation and job quality.

The literature review discussed how differing skill formation and job quality across countries might be explained by differences in a country's production model (Hall and Soskice, 2001), and by differences in a country's employment regime (Gallie, 2007). However, these explanations seem to provide only partial explanations, and differing industrial policy across countries also might have additional explanative value. In-depth country case studies clarify the dynamic between employment regimes, production models and industrial policy for offshore wind turbine manufacturers, and how this impacts skill formation and job quality. Industrial policy can conflict with employment regimes and production models; instead of reinforcing them, industrial policy can supersede them.

Wider implications on answering the relatively substantial research questions might be a contribution to the debates on how institutions lead to different/similar outcomes in terms of skill formation and job quality across countries; in other words what are the mediating mechanisms between such institutions as employment regimes, production model, industrial policy, and skill formation and job quality? Within the research design, regulation of skill formation, labour market policy, and industrial policy is reconstituted based on secondary literature, interviews, newsletters, and industry reports. Interview data was specifically collected to understand skill formation and job quality in the offshore wind manufacturing sector itself, as it was not readily available.

The comparative cases are the three countries Denmark, England, and Germany. They are constituted by sub-cases: skill formation providers and manufacturers, and how they interacted. According to the literature, each country had a distinct employment regime and production model. Field research has shown that the countries were distinct by the

way industrial policy for the offshore wind industry was designed and implemented. The table below illustrates the research design.

Table 4 Research design

<i>Research questions</i>	<p>How are industrial policy, skill formation, and job quality shaped in the offshore wind turbine manufacturing industry?</p> <p>How does industrial policy affect skill formation?</p> <p>How does industrial policy affect job quality?</p> <p>How do skill formation and job quality interact?</p>	
<i>Propositions:</i> Conventional Propositions or rival explanations	<p>Skill formation and job quality are shaped by a country's production model, in particular vocational education and training, and organized labour (cf. Doellgast, 2012, Holmann and McClelland, 2011, Thelen 2004, 2014).</p> <p>Skill formation and job quality are shaped by active labour market policy (employment regime) (cf. Dieckhoff, 2011, Gallie, 2007, Holmann and McClelland, 2011).</p> <p>Skill formation and job quality are interdependent (cf. Becker, 1994, De Grip and Wolbers, 2006, Dieckhoff, 2008).</p>	
Alternative proposition	Skill formation and job quality are shaped by industrial policy.	
Key concepts:	How are they measured?	Data sources
Industrial policy	Supply and demand side industrial policy for the offshore wind sector and renewable energy sector	Interviews, newsletter and newspaper analysis, governmental documents, literature
Skill formation	<p>Skill formation initiatives that occur in the sector: company training, vocational education and training, training through active labour market policy</p> <ul style="list-style-type: none"> - Available skill formation programmes (ALMP or VET, IVET or CVET) - Resources for flexibility of training provision - Employer involvement - Participants - Impact of supply and demand side policy on training provision 	Interviews, public relations brochures of regions and skill formation providers, company and skill formation provider websites
Job quality	<p>Job quality at manufacturing sites:</p> <ul style="list-style-type: none"> - Job security - Agency work - Collective regulation of pay - Social integration - Impact of workplace representation, skill formation, and supply and demand side policy on job quality 	Interviews, company websites, press reports

4. Case selection

The country cases compared in this thesis were selected according to *theoretical sampling*. Glaser and Strauss (1967, p. 45) define this as a “process of data collection for generating theory whereby the analyst jointly collects, codes, and analyses his data and decides what data to collect next and where to find them”. As opposed to random sampling in statistical methods, the aim is to choose cases because of their specificity, to study a phenomenon in as many different circumstances as possible and necessary for *theoretical saturation* (Glaser and Strauss, 1967). For practical reasons, limited time and resources, and to enhance the dialogue with existing theory, several assumptions gained from pre-existing theory inform this sampling process.

Eisenhardt (1989, p. 537) identifies three aims for theoretical sampling in comparative case study research: “(a) controlling variation that is not important for answering the research question, (b) defining the limitation of the research findings regarding the ability to generalise, (c) replication, extension of emergent theory [by] fill[ing] theoretical categories and providing examples of polar types” (based on Glaser and Strauss, 1967, also see King et al, 1994; Ragin, 1987). Another reason for theoretical sampling is to “limit [the] investigation to small numbers of carefully selected cases and consider specific types of causal factors (instead of all possibly relevant causes) [as] the volume of logically possible comparisons can easily get out of control if the analysis is not restricted in this way” (Ragin, 1987, p. 51). Thus, within a well-known population, particular cases can be chosen. However, as the concepts and theory emerge, sampling can take place throughout the entire research process (Eisenhardt, 1989, Glaser and Strauss, 1967, King et al., 1994).⁶

The sampling of country cases is based on theoretical sampling and combined polar types defined by their independent variable: According to political economy theories, the three countries studied here represent distinct production regimes (Liberal and Coordinated Market Economies (Hall and Soskice, 2001); Neo-Liberal Market Capitalism and Social-Market Capitalism (Dicken, 2011); market oriented capitalism,

⁶ “The basic question in theoretical sampling (in either substantive or formal theory) is: *what* groups or subgroups does one turn to *next* in data collection? And for *what* theoretical purpose? In short, how does the sociologist select multiple comparison groups? The possibility of multiple comparisons, and so groups must be chosen according to theoretical criteria” (Glaser and Strauss 1967, p. 47).

meso-corporatist capitalism, social-democratic capitalism (Boyer, 2005); neo-liberalism, neo-corporatism, neo-communitarianism (Jessop, 2002)) and distinct welfare state regimes (Esping-Andersen, 1990). The table below summarises the dimensions in which the cases vary. The next paragraphs detail each country's offshore wind turbine manufacturing industry, the studied sites, and their local labour market context.

Table 5 Selection of polar cases

Cases	Assumed Employment regime (ALMP)	Assumed Production model (VET)	Assumed Job quality Skill formation regime	Manufacturing sites	Turbine deployment
Denmark	Universal	Coordinated	High road	***	**
Germany	Corporatist	Coordinated	High road	**	*
England	Residual	Liberal	Low Road	*	***

In Denmark, two manufacturing sites, one for blades, one for generators, and two skill formation providers, a technology college and an AMU centre were studied. All were located in the same town. In Germany, four manufacturers and four skill formation providers were studied in three different locations. Where available data on three unnamed steel components manufacturers, which were all based in Germany, were included. In England, two blade manufacturing sites, and four skill formation providers in two different towns were studied.

4.1. Offshore wind turbine manufacturing sectors across the countries

In Denmark, large global original equipment manufacturers of offshore wind turbines were present with production plants as well as about five hundred supply chain companies (staff, industry association, June 2014). Wind turbine assembly and the supply chain were mainly located in the town Brande, in central Denmark, and but also in Northern Denmark (Nordjylland) (Andersen et al., 2014, staff, municipality, June 2014). Companies for installation and maintenance of offshore wind farms were established in harbour towns like Esbjerg, Frederikshavn, and Grenaa from which departed vessels for installing and servicing the offshore wind farms (lobbyist, June 2014; researcher, October 2014; Port of Grenaa, 2015). Esbjerg was Denmark's most

important “offshore hub” for installation, service, and maintenance of offshore wind farms, oil and gas platforms (staff, municipality, June 2014; researcher, October 2014).

In the early 2010s, Northern Germany had one of the few construction ports for offshore wind farm equipment worldwide (BVGassociates, 2011). Several equipment producers operated sites in Northern Germany: Senvion (owned by Suzlon), Weserwind (owned by Georgsmarienhütte), Areva Wind, CSC (owned by Bard), Ambau, General Electric, Nordex, and Vestas. The enterprises Rotec, and Reetec provided the industry with installation and maintenance services. The company Siemens had the headquarters of its wind division, and a service and maintenance unit in Hamburg, but most of its production was located in Denmark. A Fraunhofer Institute for wind and energy systems technology (IWES) opened in 2009, and a wind-engineering department was established at a local polytechnic school (*Technische Fachhochschule*).

At the time of data collection (2012-2014), England had no operating manufacturing site for large offshore wind turbine components. Britain’s first large wind turbine components plant, which produced onshore blades for the Northern American market, had closed down in 2009, and reopened 2015 after winning the tender for supplying the extension of a close-by offshore wind farm. A North-Eastern town had been negotiating with another offshore wind turbine manufacturer about the location of a factory for several years.

4.2. Local contexts of the manufacturers and skill formation providers

The locations studied, although they were in different countries, with different institutional regimes, had similar characteristics in terms of their local labour market structure, industrial past, and role within the national economy. The locations had relatively high unemployment rates, in particular the areas studied in Germany and England, and in all three countries they suffered from industrial decline in the shipping and fishing industry. Within the national economies, the locations were seen as weaker, less attractive for workers, and in need of public support for economic development.

4.2.1. The Danish town

In Denmark, skill formation and job quality were studied at two manufacturing sites in a town with several component manufacturers and supply chain companies. The town had a population of one hundred thousand people with another one hundred thousand in the area (Town, 2014). In the past, the regional economy was strongly based on heavy industries, which experienced a decline of employment during the 1990s (staff, municipality, June 2014). The town's unemployment rate had risen over the past years: in 2008, it was 4 per cent (Town, 2008) and in 2014, 6.1 per cent (Town, 2014). The regional unemployment rate was slightly higher over the past years. Numbers were available online for the years 2007 to 2015 (Statistics Denmark, 2016). During these years, the unemployment rate had gradually risen from 6 per cent in the first quarter of 2007 to 7.4 per cent in the first quarter of 2015. Unemployment peaked at 9.6 per cent in the first quarter of 2011. The distance of these figures to the national average was very small in each period.

The local wind farm equipment industry developed from Danish agriculture machine manufacturers since the early 1970s (Andersen et al., 2014, company website, 2014). Interviewees stated that roughly three thousand workers worked in the local offshore wind industry in 2014; one thousand at suppliers which also supplied other sectors, and roughly two thousand workers at the local blade factory, of which about one thousand were agency workers (shop stewards, manufacturer, November 2014; manager, AMU centre, November 2014); the generator factory had shut down in 2011 and five hundred jobs had been lost (staff, municipality, June 2014).

4.2.2. The German towns

For several decades, the Northern German towns had suffered from several structural crises: the decline of the shipping and fishing industry, the reunification, the withdrawal of the US army during the 1990s (former manager, Seawing, February 2014; manager and member, municipal development agency, May 2013; officer, trade union, July 2012; Power et al., 2010). One town's local labour market statistics showed consistently high rates of long-term unemployment, and rates of unemployment above federal average: 15.3 per cent in March 2013 (Magistrat der Stadt, 2013), and 14.8 per cent in March

2015 (Magistrat der Stadt, 2015),⁷ compared to 11.3 per cent at federal level in March 2013, and 6.9 per cent in March 2015 (Bundesagentur für Arbeit, 2016). The difference to the national average had massively increased in the post-crisis years, despite the establishment of the new industry.

In the other two towns, the unemployment rates were relatively low in the post crisis years: around 4 per cent of the active population were long-term unemployed, and the total rate of unemployment was between 6.4 per cent and 6.6 per cent measured in March each year from 2012 to 2015 (Bundesagentur für Arbeit, 2016) in one town. In the other 6.1 to 6.5 per cent of the active population were long-term unemployed each March between 2013 and 2015, and the total rate of unemployment was between 8.7 and 9.3 per cent. The local offshore wind farm equipment producers started working on their first commissions around 2007 (officer, trade union, July 2012). At the time of data collection between one thousand five hundred and four thousand workers worked in the local offshore wind turbine industry (staff, municipal economic development agency, May 2013).

4.2.3. The English towns

One blade manufacturer established itself in a region with a strong industrial base with various employers in the engineering industry (Bondholders, nd, Regional Growth Fund, [about 2013c], Regional Growth Fund, [about 2013]). In previous years, a nearby harbour town had become base of maintenance and servicing for Round 1 and 2 offshore wind farms. The studied town however still suffered from the decline of the local ports, food processing, and manufacturing industries (officer, trade union, January 2014; trade council, July 2013). The Crown Estate's tender of Round 3 licensing for offshore wind farms at Dogger Bank, Hornsea, and East Anglia close to the North East English coast was an opportunity that local policy-makers wanted to use to attract inward investment by manufacturers of offshore wind turbines. The expectation towards the renewables sector's ability to create regional jobs was extremely high. One interviewee referred to forecasts of sixty-five thousand vacancies until the year 2020 in the regional renewables

⁷ The Federal Agency for Employment, Bundesagentur für Arbeit, published different figures for the same month in each year: unemployment quota of the active population (SGB II and SGB III Bereich) were 10.5 in March 2013, and 10.1 in March 2014, and March 2015, the long-term unemployment quota was 8.4, 7.9, and 8.0 in March each year (Bundesagentur für Arbeit, 2016).

sector (staff at LEP, July 2013; also forecasted by a commissioned study of ekosgen, 2012 in Humber LEP, 2013b, p. 8).

Economic decline since the 1970s had resulted in high levels of long-term, second and third generation unemployment (staff, LEP, July 2013, manager, CVET provider, November 2014 Humber LEP, 2013b). Educational levels of roughly 80 per cent of the population in working age (15-64 years) were National Vocational Qualification (NVQ) level 3 or below (City Council, 2009), wage levels were low, rates of active workforce were lower than in most other English regions, and unemployment was higher (about 13.6 per cent in 2011) (ONS, 2011). In this context, up-skilling initiatives were considered part of attracting the offshore wind industry.

The second blade manufacturer was located in a similarly sized town with a population of 139 400, with 80 200 in working age (16-64 years old) (Nomis, 2016). However, with only 4 500 workers were occupied in manufacturing industries. Whilst in the period July 2015/June 2016 only 5.4 per cent were registered as unemployed, 10.1 per cent of the population in working age claimed the ‘main out of work benefits’ such as jobseekers allowance, employment and support allowance (ESA – 7.4 per cent of working age receiving benefits because of long-term unemployment), incapacity benefits, lone parents and income related benefits, compared to 6.2 per cent in the region, and 8.7 per cent across Great Britain, showing that this town also was a low-income environment. From 2004, onwards unemployment rates rose to 9.2 per cent in the period July 2012/June 2013, and have fallen since then. The Nomis time series on unemployment from 2004 to 2016 show that rates in the town stayed far above the region’s, and above Great Britain’s, and fluctuated more strongly, which reflects the seasonal character of many of the local jobs (cf. BBC, 2012).

4.3. The skill formation providers

Across the countries, a variety of IVET and CVET modules or programmes existed for workers at the offshore wind turbine manufacturers. Some were delivered as part of ALMP. In each country, interviewees stated that the studied providers were among the most relevant ones for the sector. For a comparative overview also see appendix 1.

4.3.1. Technology College in Denmark

Since 2006/2007, the technology college worked with both manufacturers, West-Wind and Seagull (educator, November 2014; former HR manager, Seagull, June 2014), provided statutory health and safety courses for work with composite technologies, a basic course in composite technology, and contributed to developing a vocational course in composite technology for skilled blade workers and its institutionalisation as “Windmøllentechniker” apprenticeships within the Danish vocational curriculum.

4.3.2. AMU in Denmark

AMU centres across Denmark provide vocational skill formation to jobseekers and workers above 24, mainly continued VET, but also some initial VET, as part of ALMP. The AMU centre studied here worked with both wind turbine manufacturers and was one of only five ‘clear-cut’ AMUs that remained after a recent reform (manager, AMU centre, November 2014). The centre employed two hundred staff and fifty to sixty additional freelancers. Six staff, ‘business consultants’, advised companies on courses and funding. AMUs used various funding sources: government, job centres, European Union, and private businesses, which purchased customized courses. The centre offered eleven initial vocational apprenticeships, which were usually provided by the technology colleges, and could offer about twelve thousand state-funded modular vocational courses for all kinds of industries. The centre provided health and safety training for work with composite technology.

4.3.3. Public vocational school in Germany

The vocational school revived the apprenticeship for construction mechanics (*Konstruktionsmechaniker*). The public employment services and the municipality fully funded the school-based training expecting future work opportunities for school-leavers in the structurally weak region. In 2008, twenty-two apprentices started in the first year. One steel-welding plant had forty apprentices in two years. A second steel-welding company had over sixty to seventy apprentices in three to four years in dual VET. The school also participated in a research project funded by the BIBB, which was aimed at identifying the vocational training needs for skilled offshore wind turbine workers.

4.3.4. ALMP provider for IVET in Germany

The provider was the municipality's training provider for continued vocational education. Part of its activities was the provision of ALMP training. Following discussions with the BIBB and with VET experts from the local university, the provider adapted an existing dual VET programme, the 3.5-year apprenticeship for industry electrician (*Elektroniker für Betriebstechnik*) to the offshore wind industry's needs (manager, ALMP training provider A, July 2012). The training provider aimed to found a training consortium, which would be financed by the companies, and managed by staff from the municipality. The public employment services, the municipality (*Jobcentre*), the Federal Employment Agency (*Agentur für Arbeit*), and the European Union provided seed funding, while the companies were expected to gradually take over the funding (manager, ALMP training provider A, July 2012; manager, Jobcentre, May 2013). The public funding was conditional to targeting school-leavers who were disadvantaged on the labour market (manager, ALMP training provider A, July 2012).⁸ On 1st February 2004, the first cohort started with 18 publicly funded apprentices. New starts took place in 2007, 2008, 2010, 2012, and 2013. In 2008, one company funded two apprentices for the first time. In 2012, 16 apprentices started, three different companies funded half of them; the ESF and the municipality funded the other half. In 2013, economic difficulties in the sector prevented the start of another year.

4.3.5. Industry school in Germany

The industry school provided continued VET for technicians and engineers at power utilities. The school was owned by the industrial federation of the large power utilities in Germany such as E.ON, Vattenfall, RWE, EnBW; foreign manufacturing firms and utilities, and small regional power plant operators could become associate members. The training provider had been created in the early 1950s. It was formally open to the general public, but focussed on customised training for its members on the operation, service, and maintenance of large, mainly nuclear, gas, and water power plants (two managers,

⁸ This was a requirement for funds from different public sources: the public employment services, *Arbeitsamt* (now *Agentur für Arbeit*) and the *Sozialamt* (now *Jobcentre*, a part of the municipality), and the European Social Fund (ESF). For the two former the requirement was that the participants were recipients of social welfare benefits, and were disadvantaged on the labour market, thus had either low marks in final their degree, or, this was object of hard negotiations, a "migrational background", which made participants eligible in spite of a good school degree. All three financing bodies had their own definition of 'disadvantaged' participants (manager, training provider, July 2012).

August 2012). The school offered preparation for *Meister* certificates above the initial 3 to 3.5 years training for skilled engineering technicians. Since 2011, the school worked on a continued vocational curriculum that would certify maintenance technicians for wind power plants. The apprentices were to be mainly funded by their employer, but could also be self-funded. In contrast to the other training providers this school did not offer training to unemployed or ‘disadvantaged’ jobseekers.

4.3.6. ALMP provider for CVET in Germany

The ALMP training provider mainly delivered vocational courses for the public employment services (Federal Employment Agency), the municipal Jobcentre in charge of labour market services for the long-term unemployed, and the federal army. The up- and re-skilling of unemployed or redundant workers was offered as part of active labour market policy (ALMP) aiming at long-term integration in the labour market (manager and staff, July 2013). The provider also sold customised courses to companies. It offered courses in electro-mechanical wind and composite technology. Since 2000/2001, the provider and the municipality offered skill formation for the onshore wind turbine industry. The provider also developed a course for ‘examiners for steel engineering’ (*Materialprüfer*) collaborating with a large component manufacturer. Under the direction of the Fraunhofer Institute for Material Engineering (IFAM), a composite technology course, which started in 2006, was jointly developed with several public and semi-public research institutes, and local manufacturing and service companies (works council, Seawing, July 2013; manager and staff, ALMP training provider B, July 2013).

4.3.7. College A in England

The college offered about 540 different vocational diplomas for a broad range of sectors (College A, 2016): dozens of them related to engineering occupations and were certified by various awarding bodies: BTEC, CILT, City and Guilds, SEMTA, and EDEXEL. The college had recently invested in a renewable energy engineering centre. The college provided courses for the public employment services, e.g. teaching job search skills to long-term unemployed, making links to work experience within ‘Sector Based Work Academies’, teaching English as foreign language (ESOL) and numerical skills. Initial vocational training and further education were provided to self-funding individuals, companies, and the public employment services. In 2014, roughly 65 per cent were public funds for further and higher education and 35 per cent “commercial income”.

Funding sources were the LEP, SFA, EFA, HEFCE, students, companies, and Jobcentre Plus (JCP).

4.3.8. College B in England

The college offered engineering skills training for a variety of sectors (College B, 2017) and ran recruitment seminars for one of the two studied manufacturers (College B, 2016). In March 2017, it launched a composite technology training centre in collaboration with the local blade manufacturer and other employers in the local ship building industry.

4.3.9. Inter-firm training provider for IVET in England

The training provider, a charity, was founded by local engineering companies in the 1960s, addressing engineering skill needs in the region in response to the Industrial Training Act of 1964 (Broadhead and Hague, 2010). In 2013, the provider had three sites in the region. In 2013, it employed 65 training, management, and administrative staff. It trained electrical, mechanical, and machine maintenance engineers for manufacturing, offshore oil, gas, offshore wind and other industrial sectors. It offered apprenticeships at NVQ level 3 and 4. The apprenticeships led to SEMTA (Sector Skills Councils for Science Engineering Manufacturing Technologies) and City and Guilds awards, e.g. since July 2013, the City and Guilds' *Onshore Wind Turbine Technician* and *Offshore Wind Energy Technician* awards (staff, July 2013). The provider implemented two school-outreach programmes for the wind energy sector together with the largest offshore wind turbine manufacturer and several large European utility companies (Regional Growth Fund, [about 2013b]), and vocational re-skilling for redundancy plans. Very marginally the provider engaged with the Jobcentre Plus and agencies, providing welding courses for jobseekers or agency workers from time to time (staff, July 2013). Across the region, one hundred and ninety SMEs and several large engineering companies and utilities, but no wind turbine manufacturers, funded about two hundred apprentices per year. An important part of the funding per apprentice continued coming from public funds such as the SFA and RGF. The provider did not take on apprentices without an employment contract.

4.3.10. Inter-firm training provider for CVET in England

Local companies founded the inter-firm training provider in the 1980s. It offered 100 nationally approved courses for engineering in a maritime environment in the oil, gas, renewables and a few onshore industries (Regional Growth Fund, [about 2013b]). In 2014, the provider developed its curriculum to deliver the five *Global Wind Organisation* 'GWO' courses, which certified offshore wind service technicians (manager and staff, November 2014). The provider collaborated with other local training providers. It trained mainly for the private sector and highly-skilled individuals, who sought a professional and health and safety certificate for a specific type of engineering work, e.g. offshore. The provider helped companies to access funding for skill formation from the LEP.

4.4. The component manufacturers

Efforts were made to collect data on sites that covered the spectrum of all large components of offshore wind turbines (blades, generators, nacelles, foundations, and towers), and to take into account the diversity of manufacturers that could be found locally. The manufacturers studied here produced offshore wind blades, and assembled generators and nacelles. All sites were part of large multinational original equipment manufacturers (OEM), which were either specialised in wind technology, or provided a variety of sectors with technological equipment. Stating their country of origin would make the manufacturers immediately identifiable as the offshore wind turbine manufacturing sector is strongly concentrated. Throughout the thesis their names have been changed to East-Wind, Seagull, Seawing, and West-Wind.

In total, eight sites were studied. Where available data on three unnamed steel components manufacturers were included. Data on large steel component producers was only collected in Germany, but these cases stayed shadow cases as nobody from the companies could be interviewed and little data was available. Notably, the steel companies were hit first by the 2013/2014 crisis of the German offshore wind turbine industry. Interviews could not be conducted at these sites as they were about to shut down or already had shut down when access was attempted. In contrast, the companies West-Wind and Seagull could be studied across countries, while East-Wind and Seawing could only be studied in Germany. This section first presents each plant and

provides insights on the labour processes across blade manufacturing and nacelles assembly.

4.4.1. West-Wind blade factory in Denmark

The West-Wind blade factory employed about one thousand nine hundred workers, of which eight hundred fifty were from agencies (shop stewards, manufacturer, November 2014; manager, AMU centre, November 2014), at the time of data collection. Before West-Wind bought the blade factory in 2006, the site had been part of a Danish company that had pioneered modern wind turbine technology and produced blades in composite technology since the 1980s. The site had production, training, research and development, testing, and maintenance and service facilities (HR manager, June 2014).

4.4.2. Seagull generator factory in Denmark

Seagull's generator production and research facility had shut down in 2011 as part of a major structural overhaul of the entire company. Before the closure, the site employed roughly five hundred workers. Seagull also was one of the companies that had pioneered turbine technology since the 1970s.

4.4.3. Seawing nacelles in Germany

Seawing's wind turbine division had roughly two thousand staff in Germany in summer 2013. It operated a blade factory and a nacelles assembly plant for offshore wind turbines, two onshore wind turbine equipment plants, and a research and development site in Northern Germany. The sites were spread across the region, and with two exceptions, a three-hour car drive apart. The management and administrative services were located at the headquarters in a nearby city. Seawing's nacelle assembly plant employed eighty-nine people. Sixty-three of them were production and warehouse workers. Four *Meister* oversaw the workers. In peak times, up to two-thirds of the workforce onsite came from agencies.

4.4.4. Seawing blades in Germany

Seawing's blade factory was a self-contained subsidiary. It had resulted from a joint venture with a medium sized company that was specialised in blade manufacturing.⁹ Seawing operated another blade factory in Southern Europe and was building a third blade factory in North America (HR manager, April 2014). In 2010/2011, Seawing bought the second half of the joint venture, but continued working with the former joint venture partner occasionally subcontracting repair jobs (former manager, Seawing, February 2014). From the start, Seawing's blade factory had two hundred core workers, and in peak times hired up to five hundred agency workers. Onsite about forty staff worked in management, administrative, and research and development positions (works councillor, July 2013).

4.4.5. East-Wind nacelles in Germany

The multinational technology company East-Wind had bought a medium sized turbine workshop in the mid-2000s. East-Wind had several other sites in Germany, one blade production plant, and plants that built parts and provided maintenance services for conventional power plants. Except for the blade production, it had subcontracted the production of all large components. The suppliers provided large components according to the nacelle factory's plans. At its nacelle factory, hubs, platforms, machine houses, and tower blanks were assembled and equipped with electrical components. The site had a test station, an engineering department, research and development, procurement, human resource management, and IT services. The workforce on site fluctuated strongly, between eight and two hundred thirty directly employed production workers, and up to one hundred and twenty agency workers.

4.4.6. Seagull generator factory in Germany

The multinational company bought the medium sized generator workshop in 2004. In 2011, the workforce grew from one hundred and twenty to about four hundred and seventy of which one hundred and fifty were agency workers, two hundred and fifty permanent workers, fifty workers on fixed-term contracts, three *Meister*, and four

⁹ Interestingly this medium sized company was originally, since the late 19th century, owned by West-Wind. It later turned in a joint-venture with a large chemical multinational, during the 1980s, when the chemical multinational took entirely over from West-Wind. In the mid 1990s, the blade company turned independent ([West-Wind], 2015).

commercial and technical apprentices. About 30 per cent were skilled workers trained in electro-mechanical trades (works councillor, July 2013). In 2012, Seagull opened a sixty-million-Euros green field site close to the North Sea coast about 20 kilometres away from the town.

4.4.7. Seagull blades in England

In 2009, the Seagull plant was “Britain’s only major wind turbine manufacturing plant” (Macalister, 2009a). Seagull had a research and development site locally for more than three decades beginning with the incorporation of an information technology subsidiary (UK Companies House, 2016). Until 2009, the plant produced onshore blades for the US and potentially the UK market. In 2009, the blade factory had roughly six hundred workers and staff (Macalister, 2009b, Swarthmore College, nd). The plant was closed in August 2009 and reopened in 2015 for the production of blades for a new 7MW offshore turbine. Only the plant’s research and development facility continued operating throughout.

4.4.8. West-Wind blades in England

Since 2007, the manufacturer had planned building a turbine factory in England. In 2015, a blade factory was finally opened instead of a turbine factory ([West-Wind], 2015). About five hundred new production jobs were expected. The manufacturer operated factories and research and development sites in other technology segments in the country.

4.5. Labour processes at the manufacturers

4.5.1. Blade production

Blade production was physically demanding and repetitive (HR manager, West-Wind, June 2014; HR manager, Seawing, April, 2014; works councillor, Seawing, July 2013). Across the four manufacturing sites in Denmark, Germany, and England, the production consisted of five to eight consecutive processes, which contained storage, prefabrication, blade casting (upper and lower mould), finishing (pre-finish and finish), painting, and electrical work. One manufacturer had outsourced mould building, electrical work, and painting (HR manager, June 2014); another had outsourced blade repairing (HR manager, April 2014, works councillor, July 2013). The blades were constructed in composite technology, and “baked” in hermetically closed moulds to prevent the

escaping of toxic fumes. Before the baking process the carbon-mattes were layered and flattened. The layering by hand reached a relatively high degree of precision and could not yet be undertaken by a robot. However, ways to roll out the fibre mattes with robots were tested “to reduce the number of work injuries due to work with heavy tools” (shop steward, November 2014). The finish consisted of grinding the blades’ surfaces inside and outside, and polishing of the outside using heavy electrical tools. Finally, the upper and lower parts of the blade were fitted.

4.5.2. Nacelle assembly

At the Seawing and East-Wind assembly plants in Germany, the work processes resembled. Electricians equipped different parts of the turbine, nacelle, hubs, with electrical equipment, and tested the assembled machines (works councillors, July 2013). The difference between the two sites was the amount of information available for the skilled workers to assemble and equip the large components. At Seawing, the process seemed to be less organised, and required a lot of decision-making among the workforce, and ad hoc agreements about how to assemble the machines. In addition, at both sites, at several occasions, the workers had to repair components that had been supplied by third parties. The German assembly plants did ‘not yet’ produce serially, as the quality of supplied components was not constant (works councillor, Seawing, July 2013). The labour process at East-Wind and Seawing required some, but not all of a skilled worker’s expertise (works councillor, November 2014). The German Seawing and East-Wind nacelles assembly plants studied here, in theory, employed only skilled workers, which allowed for machine assembly in a “semi-lean fashion” (works councillor, July 2013). Compared with craftwork on construction sites, machine assembly at the factory was less skill intensive. However, the workers’ skills came in handy, as at one plant workers worked without proper construction documentation for five years (works councillor, July 2013). Although at East-Wind the construction plans were available from the start, as they were part of the machine certification (works councillor, July 2013), the workers used their skills to deal with faulty components. In the year 2014, the East-Wind site had to repair several turbines on site (works councillor, November 2014).

4.5.3. Generator assembly

At Seagull's Danish research and development production, where prototypes were developed, highly skilled workers worked closely with the engineers preparing the model 0 of new turbines for serial production (former engineer, June 2014). Workers had to be able to give technical feedback to the research and development engineers. They usually would be skilled mechanics and workers "with a high level of electrical experience". However, the research and development plant closed in 2011. The plant was also home to the serial assembly of generators, where workers assembled generators. Their skill requirements were low (former manager, HR department, June 2014).

The German Seagull site had started out as a small turbine workshop and was bought up by the manufacturer in the mid-2000s. Production processes were described as idiosyncratic, with very low attention to health and safety before the purchase by Seagull (works councillor, July 2013). Seagull introduced high health and safety requirements, and, when it restructured its worldwide operations in 2011, the generator plant was moved to a new greenfield site, where automated production was introduced. Since then, the labour process was divided in two consecutive segments. At the copper coil segment, machines bent coils, and copper bands were manually wound around the coils by a group of unskilled, female workers. In the second segment, machines operated the metal presses, electrostatic testing, impermeability, pre-assembly, and assembly. Skilled and semi-skilled workers, recently relabelled operators, fed and controlled the machines. At the end of each shift, all workers assembled in a specified area where they gave a report to the next shift. A digital sign counted the days since the last production related accident. Output was documented on a board that was filmed by a camera connected to a control centre abroad. The table below summarises the sites. The next section discusses the type of data sources used.

Table 6 Sites selected for case studies

<i>Denmark</i>					
West-Wind	Blades	600 – 1900	A	Age Since 1980s, bought in 2006	
Seagull	Generators	~ 500 lost in 2011	A	Since 1970s Shut in 2011	Shadow case
<i>Germany</i>					
Seawing A	Offshore blades Onshore blades (from 2014)	700–200	A	Built in 2006?	
Seawing B	Assembly nacelles	23-150	A	Since ~2007	
East-Wind	Assembly nacelles and towers	350–8	A	Bought ~2005	
Seagull	Assembly generators	470–120	B	Bought in 2004, new site in 2012	
Three steel companies	Large steel components	350 at one; others unknown	C and A	Since ~2006 2 companies closed in 2013	Shadow cases
<i>England</i>					
West-Wind	Offshore blades	~ 500	A	Since 2015	
Seagull	Onshore blades (until 2009) Offshore blades (from 2015)	In 2009: 525 were lost	B	Closed in 2009, reopened in 2015	

5. Data

Yin (2014) suggests six sources of evidence for in-depth case studies. Each has its individual strengths and weaknesses: documentation, archival records, interviews, direct observations, participant observation, and physical artefacts (Yin, 2014, p. 106). The empirical body of this thesis was based on a variety of sources: semi-structured interviews, secondary literature, the industry newsletter *New Power* (Wood, 2009-2014), a variety of local newspapers, including a systematic reconstruction of the Green Port Hull project based on the analysis of the local newspaper *Hull Daily Mail*, and annual industry reports by the European Wind Energy Association (2011–2015), as well as annual reports of the offshore wind turbine manufacturing companies and their websites.

Across the countries, skill formation, work arrangements, and local industrial policy were explored in qualitative in-depth interviews with 80 informants from offshore wind turbine manufacturers, municipalities, trade unions, industry associations, skill formation providers, and agencies in the three countries. Most of the data was collected between early 2012 and early 2015. The research strategy was *iterative*, which means that reflection based on collected data led to additional data collection to extend and refine the emerging theory (Glaser and Strauss, 1967). Additional countries and

interviewees were added, because there was the opportunity to do so, but also to enhance theory until *theoretical saturation*, i.e. the “incremental learning” was minimal by the addition of supplementary data (Eisenhardt, 1989). Germany was studied first, then England, and then Denmark. The following sections discuss the use of qualitative interviews, divided in subsections on *semi-structured expert interviews*, *developing interview guides*, *selecting interviewees*, *gaining access*, *face-to-face or phone interviews or both*, and *research ethics*, followed by sections on the use of documentary research and secondary literature for the construction of in-depth case studies.

5.1. Interviews

Interviews represented the principal source of data. Yin (2014, p. 110) affirms, “one of the most important sources of case study evidence is the interview. (...) [The interviews] will resemble guided conversations rather than structured queries.” This type of interview is termed “unstructured”, “in-depth”, or “intensive” (Weiss, 1994, pp. 207-208 in Yin 2014, p. 110) or “open-ended” interview (Silverman, 2014). Flick (2014) uses the term “semi-structured interview” for interviews guided by a list of questions that is loosely followed. Silverman (2014, p. 169) states that a clear strength of interviews is the direct access to interviewees’ interpretations of the world and accounts of their actions.

For this thesis data was collected through interviews, as it was assumed that human perception matters. In addition, in particular regarding skill formation and job quality, and actors’ rationales, data was not publicly available. Interviewees were often ready to give information verbally in a face-to-face or phone interview, which they might never give in writing.

To enhance reliability and validity of the findings, data was triangulated across interviews and documents (Eisenhardt and Graebner, 2007, Yin, 2014). Triangulation is a central principle of case study research (Yin, 2014). Data triangulation means that the same research question is explored based on different sources of evidence. The different sources of evidence are used to corroborate the case study findings. Other ways of triangulating exist: investigator, theory, and methodological triangulation (Patton, 2002). Here the focus was on data triangulation.

5.1.1. The semi-structured interview

Silverman sees interview data as limited by the way it is recorded in transcripts and field notes, and audio and video recordings (Silverman, 2014, p. 170). This implies, interviews do not represent the world as it is. However, the role of the researcher is to construct knowledge about a small part of reality based on theoretical assumptions and on a variety of interviews, and possibly other sources, and to find an abstract meaning in the compilation of data. In contrast, perfect representation of the world would just be that, and would still have to be interpreted. Interviews are a filter that is applied to the world by the interviewer and the interviewee; it filters what is relevant to the research question and what is not. According to Silverman, different research approaches, the positivist, naturalist, and constructionist approach, require different forms of interviews. The approach taken here comes closest to Silverman's naturalist approach which fits with "unstructured, open-ended interviews":

"Interviewees are viewed as experiencing subjects who actively construct their social worlds; the primary issue is to generate data which give an authentic insight into people's experiences..."

(Silverman, 2014, p. 173)

Flick (2014) discusses the semi-structured interview as a viable alternative for unstructured interviews. The semi-structured interviews loosely follow an interview guide, but are actively and spontaneously adapted by the interviewer to the situation and emerging topics that are perceived relevant to the research question. In other words, more and not anticipated data can be accessed in an openly designed interview:

"The interest [in semi-structured interviews] stems from the view that the interviewed subject's viewpoints are more likely to be expressed in an openly designed interview situation..."

(Flick, 2014, p. 207)

5.1.2. Expert interviewees

Interviewees were seen as *experts* in the substance on which they were interviewed. Flick (2014, p. 227) defines expert interviewees as members of “institutions, who have specific insights and knowledge because of their professional position and expertise”, interviewees “who are particularly competent as authorities on a certain matter of facts” (based on Deeke, 1995, pp. 7-8). Informants interviewed here fit into this category: trade union officials, works councillors, staff and managers at municipalities, managers at companies, staff and managers at public and private training providers and employment services were interviewed because of their professional access to information on skill formation and job quality in the offshore wind turbine manufacturing industry, as well as on how industrial policy might affect these.

Bogner and Menz (2009, pp. 46-49) suggest three purposes of expert interviews: a) the exploration of a new field of study that has the aim to generate hypotheses and identify possible themes; b) complementation of other data and findings, that are derived from other sources of data collection and analysis; c) ‘ethnography’ of experts, e.g. “to learn about contents and gaps in the knowledge of people working in certain institutions concerning the needs of a specific target group” (from Flick 2014, p. 228). The latter refers to the interpretive knowledge of experts: their interpretations of the world, rules, and opinions (Bogner and Menz, 2009, p. 52). In addition, Meuser and Nagel (2002) state that knowledge about specific processes and contexts can be reconstructed based on expert interviews. Here the author used the latter approach to reconstruct the impact of industrial policy on skill formation and job quality.

5.1.3. Interview skills

Flick (2014, p. 209) states that both a good training in conducting interviews and a good “overview of what has already been said and its relevance for the research question in the study” are essential to gaining the necessary spontaneity. Prior to this PhD research, the researcher received qualitative interview training at the University of Geneva, as well as she had conducted interviews for her *Mémoire de Licence* (Schulte, 2008) and for undergraduate research projects. She also conducted interviews for collaborative research projects prior and in parallel to her PhD field research. Because of this experience she felt confident in preparing and conducting interviews for this research project. As part of the iterative research process, field notes and interview transcripts

were regularly reviewed and at different stages of the field research, narratives on specific topics were compiled based on interview data and document analysis. This helped reiterating and improving interview questions in between interview waves.

5.1.4. Developing interview guides

When preparing and conducting the interview it is useful to imagine the interview as “an evolving drama” (Hermanns, 2004 from Flick, 2014, p. 210) in which the interviewer helps the “evolution of this drama” by explaining to the interviewee what is expected from her during the interview, by creating an atmosphere in which the interviewee opens up to the questions, and in which the interviewee is guided from one interview topic to another. The interviews were initially based on guidelines that were informed by publications on skill formation in the sector (Bonnett, 2008, BVGassociates, 2011, Salot et al., 2010). The original research question was “How do firms in the offshore wind turbine manufacturing industry meet their skills needs?” The question was built on the assumption that the jobs available in the offshore wind sector would determine the content of skill formation and that there was a *skill gap* between manufacturers’ workforce needs and available labour. At the start of the field research, the analytical framework was not entirely clear. Hence, the aim was first of all to see ‘what is out there’ and to gain access.

Based on a pilot case study conducted in Germany during summer 2012, and along the entire research process the questions became clearer and more focused on the working conditions at the sites, and the collaboration with the local skill formation and labour market institutions, agencies, as well as trade unions and the effects of industrial policy. Based on the pilot study, the comparative skill formation and production models literature, two tables that grouped questions for different types of interviewees were developed (see appendices 2 and 3).

All interviews started with the same set of questions that were aimed to provide an easy start and to collect contextual information. The second part of the interview covered the questions that were relevant for the particular interview. Also, specific questions based on interviews with other informants and particular to the case would be asked. The question: “Is there anything I haven’t asked but that you feel is relevant?” towards the end of the interview, was not a trivial question, but could generate more valuable data.

The last part was again common to all interviews. The interviews ended with the opportunity for informants to ask questions to the interviewer. Contacts were exchanged. It was offered to stay in touch for a debriefing or questions that might occur after the interview. If the interviewee so wished, a summary report of the field research would be provided after the end of the research project.

One important observation from the interviews was that the question: “How do you perceive the future of [the skill formation provider/manufacturers] in the current political and economic situation?”, was often raised by the interviewees themselves in the middle of the interview, or was a trigger to a longer narrative about the difficulties that resulted from changing and churning industrial policy for the manufacturers.

5.1.5. Gaining access to interviewees

For this thesis, sixty-three interviews were conducted with eighty interviewees in Denmark, England, and Germany. In total, fifteen interviews were conducted by phone with one participant per interview; forty-eight interviews were conducted face-to-face with one to three participants. One interviewee was interviewed twice. The interviews were conducted in waves over the years 2012 to 2014, which permitted data analysis in between each wave. Data collection across the countries started subsequently, with Germany in 2012, England in 2013, and Denmark in 2014.

Interviewees were recruited from a mix of personal contacts, snowball sampling, and cold calling based on contact lists compiled by systematic internet research for trade unions, training providers, municipalities, work agencies, public employment agencies, and industry associations. The aim of sampling was to gain insights from different types of interviewees, such as managers versus trade union officers and works councillors, and different types of organisations: manufacturers of different large components in each country, and providers of initial and continued vocational skill formation in the domain of VET and ALMP regimes. This diversity also reflected the structure of the sector in each country. Often organisations had been recommended by key informants. And this recommendation was triangulated with data on the industry.

Companies in the sector were not contacted directly at the start of the research project,¹⁰ however contact to works councillors in Denmark and Germany was soon established via the trade unions Dansk Metal and IG Metall. Contact to the several Danish and German manufacturing sites' management was established via municipalities or personal contacts, when the research project was well advanced. Initially, the interest in exploring the interaction of the manufacturing sites with their local context in terms of access to workers and skill formation was predominant. However, this interest shifted, when more insights were gained on job quality at the sites and how it seemed to interact with skill formation and industrial policy.

Interviews took place in several waves to reduce travel time and cost, and accommodate other commitments, such as teaching and work on other research projects. In addition, the sequencing of different waves, allowed analysis of data in between waves of interviews, recruitment of additional interviewees, and familiarising with and reflecting on the cases. The next subsections present the interview field research process for each country in temporal order, first in Germany, then in England, and last in Denmark. At the end of this section, a table gives an overview of the interviews conducted per country, type of organisation, type of interviewee, setting (face-to-face or telephone), and wave.

5.1.5.1. Interviews in Germany

In Germany, in total twenty-nine interviews were conducted with thirty-seven interviewees. One interviewee was interviewed twice. Twenty-three interviews were face-to-face. Six interviews were conducted by telephone. Thirteen face-to-face interviews had only one participant. One interview had three participants and seven interviews had two participants. In two interviews participants had a hierarchical relationship, being managers and senior staff members.

In March 2012, the field research started in Germany as a pilot study with a first contact at the metal sector's trade union IG Metall. This contact was arranged on the recommendation of a researcher at the German trade union research institute WSI. The

¹⁰ This way of gaining 'official access' would probably have required approaching the public relations departments and might have ended there.

contact at IG Metall resulted in invitations to two sector events by the trade union in 2012 and 2013, where contacts with works councillors in the industry could be made. A visit to an offshore wind industry trade fair in summer 2012, served to identify local employers and training providers in the sector. The trade fair catalogue provided a list of training providers, which were contacted for interviews. This was complemented by contacts to work agencies in the region found in the online directory.

An interview with a manager at a training provider in summer 2012 resulted in a large quantity of possible interviewees at other training providers, the local trade union office, the municipality, and the government of the *Land*. All were contacted by email and a follow-up phone call, and most were available for interviews, except the political representatives of the *Land*. The researcher also reached out to a personal contact at the BMU (the Federal Ministry for Environmental Affairs), but never received a reply regarding the interview request. Policy-makers seemed less inclined to talk to researchers on the, in 2012 and 2013, highly debated issue offshore wind.

From an interview with a manager at a municipal development agency contacts to companies' site management resulted. Again, all suggested contacts were approached but management from only two out of twelve companies were available for interviews, and another interview with a manager resulted from these two contacts. Access to management interviewees was never arranged through works councillors. This is surprising given Germany's reputation for trusting working relationships between works councillors and management and earlier field research experiences, where interviews with management – in the automotive industry – were arranged on recommendation of works councillors (Schulte, 2008).

Internet research led to interviews with researchers at two higher education establishments. One of these resulted in additional contacts and interviews with a training consultant and a manager at a vocational school. The interviews in Germany were conducted during field research trips between April 2012 and November 2014. Most of them were face-to-face interviews of forty minutes to an hour and a half at the individuals' workplaces. These interviews were recorded digitally and summarised in a written narrative. The last set of interviews, conducted in 2014, were phone interviews

of roughly a half hour each. Some were recorded with consent of the interviewees, and all were documented by hand-written notes.

5.1.5.2. Interviews in England

In total, eighteen interviews were conducted in England with twenty-two interviewees. Four interviews were conducted by phone. Fourteen interviews were face-to-face. Four face-to-face interviews had two participants, with all interviewees having a hierarchical relationship, being a senior and junior staff, or manager and senior staff.

The first interview in England was conducted in April 2012 at Unite the Union (*hereafter*: Unite), and led to a contact at the industry association RenewableUK. From RenewableUK no-one was available for an interview, but the interview questions were answered by email. A visit at the trade fair Global Offshore in London in summer 2012, made clear that many harbour towns were advertising their harbour infrastructure for offshore wind turbine projects, but none seemed to have any manufacturing sites.

While interviews could be conducted with local stakeholders on the establishment of a new blade factory, the legacy of the closed blade factory was recorded based on documentary evidence. Contacts to interviewees resulted from internet research and were used for cold calls and emails to potential informants, or more generally, their organisation. The first set of six face-to-face interviews was conducted in summer 2013 with seven interviewees, two at a Local Enterprise Partnership, two at the City Council, one at a university, one at a provider of initial vocational education and training, and one at the local Trades Council.

In early 2014, a set of telephone interviews was conducted with trade union officials. In November 2014, another day of face-to-face interviews followed, this time with a manager at the LEP, staff at a provider of continued vocational training, and the manager of another initial and continued vocational training provider. Also, interviews were conducted with two managers at a financial institution that brokered capital between investors and offshore wind developers, and with managers at a company that had produced offshore wind turbines in the past. Getting access to interviewees in England involved more cold calling than in Germany. Sometimes obstacles were encountered as gate keepers, such as switchboard operators did not know to who direct

requests from a researcher, and even when contacts had been successfully established interviewees were probing the interviewer's knowledge of policy a lot more than in interviews with German and Danish interviewees. It seemed that trust could only be built by displaying a high level of expertise of the sector (cf. Charmaz, 2013), this was possibly because contacts had not been mediated through other informants.

5.1.5.3. Interviews in Denmark

In 2014, the field research was extended to Denmark. In total, sixteen interviews with twenty-one informants were conducted in Denmark. Eleven were face-to-face and five interviews were by phone. Two interviews included three participants, and one interview two participants. The interviews with three participants were with the educators at a technical college, and with the shop stewards of a manufacturer and a trade union official. In the group interviews, none of the participants had a hierarchical relationship. This is notable, as, in Germany and England, group interviews mostly included informants linked through hierarchical relationships, which might suggest a different level of trust within these organisations.

Many contacts in Denmark were arranged on recommendation of researchers from a Danish university, which the researcher had known through a collaborative research project in a different area. These contacts were complemented by internet research, a resulting list of contacts, and cold calling as in England. Two weeks were spent with interviews in Denmark, one week in June and one week in November 2014. Two sets of face-to-face interviews were conducted in summer and winter 2014, with four informants in three interviews in June (former HR manager, Seagull; manager, HR department, West-Wind; two staff at the municipality, and a researcher), and nine interviewees in seven interviews (manager at a technical college, three educators, one trade union officer and two shop stewards, a manager at an AMU centre, a manager at a temporary work agency). During 2014, also four phone interviews were conducted, with a lobbyist from an industry association (June 2014), a researcher (October 2014), a HR manager at a manufacturer (October 2014), and a senior staff at another temporary work agency (November 2014).

Interviews with industry experts from universities, at the municipality, the industry association, and the interviews with management and former management at the manufacturers resulted from *snowballing*, contacts mediated through other informants or researcher colleagues. Access to the trade union, the AMU centre, the technology college, and the private work agencies was the result of cold calling and follow-up emails. The access to the shop stewards at one manufacturer was facilitated by the trade union Dansk Metal. Access to shop stewards and a consultant who had accompanied the documentation of skill profiles at the closed down generator factory could not be gained, although a former HR manager, in a relatively high position, tried to facilitate the contact. The following table gives an overview of all interviews.

Table 7 All interviewees per country, type of organisation, interview setting, and wave

	Organisation	Interviewee(s)	Setting	Wave
	<i>Manufacturers</i>	<i>Management</i>		
D	Seawing blades	Former manager	phone	Feb-14
D	Seawing blades	HR manager	phone	Apr-14
DK	West-Wind	HR manager	face-to-face	Jun-14
DK	Seagull	Former HR manager	face-to-face	Jun-14
DK	West-Wind	HR manager	phone	Oct-14
E	South-Wind (onshore)	Three managers	face-to-face, 2 jointly	Nov-14
		<i>Workers</i>		
		Works councillor		
D	West-Wind		face-to-face	Jun-13
		Three works councillors		
D	Seawing blades		face-to-face, jointly	Jul-13
D	Seawing nacelles	Works councillor	face-to-face	Jul-13
D	Seagull	Works councillor	face-to-face	Jul-13
D	East-Wind	Works councillor	face-to-face	Jul-13
D	East-Wind	Works councillor	phone	Nov-14
DK	Seagull	Former engineer	face-to-face	Jun-14
		2 shop stewards + trade union official		
DK	West-Wind		joint interview	Nov-14
		<i>Trade union</i>		
D	IG Metall	Officer	face-to-face	Mar-12
D	IG Metall	Officer	face-to-face	Jul-12
D	IG Metall	Officer	face-to-face	
		Officer		Jul 2012, Jul 2013
D	IG Metall		face-to-face	
DK	Dansk Metal	Officer	face-to-face	Nov-14
E	Unite	Officer	Face-to-face	Apr-12
E	Unite	Officer	phone	Feb-14
E	Unite	Officer	phone	Jan-14
E	Unite	Officer	phone	Feb-14
E	Trades council	Officer	face-to-face	Jul-13
		<i>Municipalities</i>		
	Municipal development agency	Manager and a staff member	face-to-face, jointly	May-13
DK	Municipality industry hub	Two staff	face-to-face, jointly	Jun-14
	Municipal planning department			
E		Manager and staff	face-to-face, jointly	Jul-13
				Jul-13, Nov-14
E	LEP	Two staff, one manager	face-to-face	
		<i>Employment services</i>		
D	Jobcenter (public)	Manager	face-to-face	May-13
D	Jobcenter (public)	Two staff	face-to-face, jointly	Jul-13
D	Private work agency	Manager and staff member	face-to-face, jointly	Jul-12
DK	Private work agency A	Staff	face-to-face	Nov-14
DK	Private work agency B	Manager	phone	Nov-14
		<i>Training provider</i>		
D	ALMP training provider A	Manager	face-to-face	Jul-12
D	ALMP training provider B	Staff	phone	Jul-12
D	HSE training provider	Owner	face-to-face	Jul-12
D	University	Two researchers	face-to-face, jointly	May-13
D	Vocational school	Manager	face-to-face	May-13

D	ALMP training provider C	Manager and staff member	face-to-face	Jul-13
D	Technical college (HE)	Researcher	face-to-face	Jul-13
D	Industry training provider	Two managers	face-to-face	Aug-13
DK	University A	Researcher	face-to-face	Jun-14
DK	University B	Researcher	phone	Oct-14
DK	Technology college	Manager	face-to-face	Nov-14
DK	Technology college	Three vocational educators	face-to-face, jointly	Nov-14
E	Vocational school	Staff	face-to-face	Jul-13
E	Local college location A	Manager	face-to-face	Nov-14
E	Local college location B	Staff	phone	Feb-14
E	University location A	Researcher	face-to-face	Jul-13
E	University location C	Researcher	face-to-face	2014
E	Provider of continued vocational training	Manager and staff	face-to-face, jointly	Nov-14
<i>Industry organisations</i>				
D	Regional industry network	Manager	phone	Feb-14
D	Federal level industry network	Lobbyist	phone	Feb-14
DK	Industry association	Lobbyist	phone	Jun-14
<i>Other</i>				
E	Investment bank	Two financial advisors	face-to-face, jointly	Dec-14
D	Workers' chamber	Three labour lawyers	face-to-face, 2 jointly	Jul-13

5.1.6. Face-to-face versus telephone interview

Both, face-to-face and telephone interviews, were conducted. This was not a methodological concern but a practical one, and the result of limited time and financial resources as well as availability of interviewees. Some have suggested that phone interviews might yield different results compared to face-to-face interviews (Novick, 2008; Irvine, 2011), while others have confirmed that data from face-to-face and telephone interviews has similar levels of validity (Sturges and Hanrahan, 2004). Here, phone interviews tended to be shorter than face-to-face interviews (cf. Irvine, Drew, and Sainsbury, 2012), roughly 20 minutes for phone interviews compared to a minimum of 40 minutes and a maximum of two hours for face-to-face interviews. In phone interviews, informants tended to provide shorter and more precise answers, only briefly answered follow-up questions, and often declined being recorded (cf. Irvine, 2011).

At the beginning of the field research, face-to-face interviews were arranged with the intention to gain the trust of the interviewees, as it was expected that this would result in additional interviewees. Also, phone interviews could not provide observational data; for example, when interviewing on manufacturing sites, the researcher was often shown around, and time between interviews was an occasion to gain an impression of the towns where the manufacturing took place, which helped reflecting on the cases. However, in research where observational data is not important, phone interviews might be considered superior (Holt, 2010) or at least equally valuable (Sturges and Hanrahan, 2004) ways of data collection, because they are less resource intensive. Towards the end of the field research, phone interviews became more frequent and a way to corroborate data at less cost.

5.1.7. Research ethics

Research ethics cover important moral and legal issues regarding the conduct of field research and the exploitation of research data. Central to ethical research are the informed consent of research participants, the anonymity and confidentiality of interviewees, and the safety of both researcher and interviewees. According to Silverman (2014, p. 140) research ethics deal with two sets of questions, those related to the personal motivation for researching a certain topic, and those linked to the role informants are given. The motivation to do this research on industrial policy, skill formation, and job quality in the offshore wind industry came from the researcher's

background in comparative industrial relations research, and the realisation that the dominant theory in comparative industrial relations, Varieties of Capitalisms (Hall and Soskice, 2001) does not take into account industrial policies, while these seemed to play an important role in other areas of social science, for example in industry studies by human geography researchers (cf. Christopherson and Clark, 2007, Simmie, 2012, Simmie et al., 2014, and many more). The offshore wind industry seemed a small enough sector to be studied comparatively, and logistic synergies could be gained, because at that time the researcher was also involved in another research project on a different industry that covered the same three countries. In addition, skill formation, job quality, and industrial policy seemed to be issues that strongly concerned the informants themselves.

Furthermore, in sociological research, ethics particularly concern the researcher's responsibility regarding the relationship between interviewer and informant, and the use of the data collected from and about individuals (Ryan, 2004, p. 133 in Silverman 2014, p. 140). Approval was gained from the Research Ethics Committee prior to the field research based on submission of sample interview guides (similar to those in appendices 2 and 3), an outline of the field research strategy, the Consent Form and Participant Information Sheet. The paragraphs below discuss how *informed consent*, *anonymity*, and *confidentiality* were considered in the conduct of this project, as well as the ethical dilemmas encountered and how they were dealt with.

5.1.7.1. Informed consent

In the context of interview-based data collection informed consent is the agreement to provide data by the interviewee based on the information received from the interviewer (Wiles, 2013). An important condition for informed consent is that interviewers provide interviewees

“with clear information about what participating in a research project will involve and giving them the opportunity to decide whether or not they want to participate. Specifically, research participants need to be made aware of: what the research is about; why it is being conducted; who is funding it; what will happen to the results and how they will be disseminated; what their participation in the project will involve; what the potential risks and benefits of their involvement might be; and, how issues of anonymity and confidentiality will be managed. Potential research participants should also be made aware that they are not obliged to take part and that they can withdraw from the study if they later change their mind about participating.”

(Wiles, 2013, p. 25)

Informants received a Consent Form and Participant Information Sheet by email prior to the interview or at the interview. In the case of interviews that were arranged and took place via a phone call this information was exchanged verbally. Restating some information on the research project and gaining informed consent also verbally served as an introduction to each interview. The consent form detailed the possibility to withdraw from the study, how confidentiality and anonymity would be dealt with, and stated institutional affiliation and contact details of the researcher. Interviewees were given the opportunity to ask questions on the research. About a third of the interviewees were interested in receiving a report on the findings after the completion of the research project.

5.1.7.2. Anonymity of interviewees and duty of confidentiality

Wiles, in her handbook on research ethics (2013), states that anonymisation of interview data is the primary way for researchers to protect confidentiality. Anonymisation is attained through the use of pseudonyms “applied to research participants, organisations, and locations or other ways of not revealing participants’ real identities” (Wiles, 2013, p. 9). Here pseudonyms have been given to the organisations studied and to the informants. Informants are attributed pseudonyms that describe roughly what their role is within the organisation, without providing much detail on the hierarchical level, other than manager or staff and area of expertise.

In addition, Wiles (2013) states that data, which the informants wished to remain confidential, should not be disclosed. Throughout the field research, it occurred only once that an informant asked the researcher to turn off her recorder, and to not use the information given; she complied to this request. Wiles also refers to cases in which

confidentiality and anonymity cannot be fully preserved. This might be the case of the offshore wind blade factories in England of which there are only two at the time of writing. Hence, the use of pseudonyms for interviewees was particularly important.

5.1.7.3. Ethical dilemmas

Wiles (2013) presents three cases of ethical dilemmas related to consent, disclosure, and confidentiality. This section discusses situations from the field research that fit either of these. Generally, the researcher arranged interviews to take place with individual informants. However, it happened that an interview arranged with one individual turned out to be a group interview. This resulted in a dilemma over confidentiality, as it was impossible to protect the anonymity of each informant vis-à-vis the other. The dilemma consisted of either accepting the informants' choice to be interviewed together, or imposing on them a, from a confidentiality point of view more desirable, one-on-one interview. The researcher chose the former option. In the situation where manager and staff member were interviewed at the same time, the interviewer was aware of the hierarchical relationship between them. However, the researcher had the impression that the interviewees felt safe and that there was mutual trust between both interviewees.

In contrast, two situations occurred, which the researcher felt were problematic: One interview with the head of a local works council took place in a shared office, which other works council members, who were not part of the interview, could freely access. Two of them spontaneously joined the interview without asking. This happened when the interview was already well advanced. The researcher decided to brief these new participants, and checked with the initial informant, if it was fine to carry on with the interview.

In another interview with staff at a jobcentre, interviewees did not seem comfortable. Their manager, who had been interviewed several weeks before, had arranged the meeting. Both informants seemed reluctant to answer any questions, although they had given their consent to be interviewed. Their unease might be explained by the joint interview situation, or pressure to participate, and fear to say something harmful. Baffled by the atmosphere and in that moment not thinking of the underlying ethical problem, the researcher did not suggest that she could interview each of them separately, which might have resolved the issue. As a consequence, very little insights could be gained.

Another explanation of the front-line staff's unease might be found in the wider context: Just three weeks before the interview, the widely read German magazine, *Der Spiegel*, had run a feature on malpractices and fraud at the front-line of the German public employment services (Dahlkamp et al., 2013).

5.2. Documents

Yin (2014) states that, if available, documentary information should be part of every case study. Although one needs to be aware that documents might not always be accurate, and may be biased by their (unknown) purpose and author. Documents can be used "to corroborate and augment evidence from other sources" (Yin, 2014, p. 107), to look up the names or titles and spellings of organisations and people that have been referred to in interviews, to support evidence from others sources, and to gain clues for further investigation. Documents consulted included academic journals on the broad field of renewable energy, publications of the Ministries involved in energy, labour market, and education policy, government funded research in the area of renewables, work and skill formation, industry publications and trade union publications, labour market statistics, and newspaper articles. Regarding the Green Port Hull project in England, the only local newspaper (2010-2013) was analysed, in particular articles mentioning the project "Green Port Hull" (Lexislibrary, 2013-2014). At interviews a bulk of flyers, information brochures, printed research reports in particular regarding local economic development policies were collected, and at one occasion a monograph on an organisation's history. These documents were revisited when writing up the case studies.

Yin (2014) suggests arranging to examine files at local libraries, references centres, and in archives of the studied organisations. For this project, one local library was visited, and the researcher searched for historical accounts about the case study towns. Although, a reconstruction of local industrial history was not the primary object of the case studies, it was however useful to know about the towns' industrial past to contextualise information that was received in interviews and from other sources. The most up-to-date information on the cases was either from interviews, news clippings, or regularly up-dated websites.

Yin (2014, p. 9) states that internet research can pose a problem because of the amount of material available. Reviewing every source might “actually waste a lot of time”. He suggests to “sort...materials....by their apparent centrality to [the] inquiry”, and to prioritise material for deeper reading. For this study, each country was allocated a digital file which contained other topical files, such as skill formation, labour market, trade union data, where documents were collected. Occasionally the researcher returned to her archive to retrieve data and investigate the cases further, in particular in preparation of interviews, and during the writing up process.

5.3. Literature

Flick (2014, p. 66) suggests to read and use “the theoretical literature about the topic of (...) study, the empirical literature about earlier research in the field of (...) study or similar fields; the methodological literature about how to do [the] research and how to use the [chosen] methods; the theoretical and empirical literature to contextualise, compare and generalise [the] findings”. Theoretical literature informs about the state of knowledge in the subject area, the theories employed, the concepts, debates and controversies, open questions, and research gaps. Engaging with the *substantive theories*, that is the literature on the state of knowledge on a specific topic and its ‘real world’ context helps to develop the vocabulary that is needed to engage with expert informants (Charmaz, 2013, Flick, 2014). It also serves as a secondary source of data (Yin, 2014). Context theories or background theories help to build the theoretical framework for conceptualising the study (Flick, 2014) and to communicate a contribution in line with the conventional and established semantics of the field (Glaser and Strauss, 1967). Strauss and Corbin (1998), in their handbook on techniques and procedures for developing grounded theory, suggest the use of empirical literature or technical literature. Although addressing users of grounded theory, their reflection on collecting and analysing data has in parts become a mainstream tool in qualitative research (cf. Flick, 2014). According to Strauss and Corbin (1998, pp. 49-52, from Flick, 2014, p. 69) data can be compared to the concepts used in the literature. Knowing the literature helps to see the data in a more nuanced way; published empirical accounts can add to collected data and help to understand data better; philosophical and theoretical literature can be inspirational and give direction in field research and data analysis. Furthermore, literature can inform interview questions; it may inspire questions for data

analysis, support theoretical sampling, and it might support findings in the data or might be overcome by the findings.

The use of the literature to access existing substantial and theoretical knowledge in the area of one's research is different from the *tabula rasa* approach – researchers should collect data without preconceived ideas from the existing literature, reading the relevant literature would come in later in the writing up and analysis process – originally advocated by Glaser and Strauss (1967; Charmaz, 2013, also see Flick, 2014). The need to know the field before data collection partly results from the research conventions that have developed over the years such as the need of writing a formal research proposal and requests for ethical approval that address the existing literature and justify the importance of a particular research question and approach (Charmaz, 2013). The need to know the field also derives from the need to negotiate access, for example when expert interviews are a source of data (Flick, 2014).

6. Organising data

Using multiple sources for data collection is common practice in case study research (Eisenhardt, 1989, Yin, 2009). Data from interviews and documents was fed into excel sheets and thematic summaries. The original documents were kept for later reference during the writing up process. Interviews were partly transcribed for the extraction of particularly illustrative quotes, but the majority was summarised in several pages long narratives, which provided a basis for the country case studies. An interview summary contained a) summary of the interview context and b) a summary of the information given by the informant(s).

7. Coding and analysis

Similar to the analytical process of grounded theory, in case study research data collection, coding, and analysis happen in parallel (Eisenhardt, 1989, Glaser and Strauss, 1967, Yin, 2009). Glaser and Strauss (1967) call the analytical process that takes place “constant comparison”. They structure it in four phases: “(1) comparing incidents applicable to each category, (2) integrating categories and their properties, (3) delimiting the theory, and (4) writing the theory” (105). Whereas phase one and two focus on structuring the data, phases three and four confront data to existing theory to reach a higher level of theoretical abstraction. Eisenhardt (1989) distinguishes between analysis

within a case, across cases, and across sources. Ragin (1987, p. 16) suggests “to examine each case directly and compare each case with all other relevant cases”. Glaser and Strauss (1967, pp. 49ff) recommend group-wise comparison according to a logic that maximizes and minimizes differences among the “comparison groups”. All these approaches of comparison will help to get a rich idea of the inner logic of cases and the similarities and differences between cases. Big differences and small differences between cases can only be established when the cases are entirely known. This shows that case analysis and comparison are intertwined steps to develop theory and to develop a presentation and illustration of the theory that makes sense for other readers.

As the amount of data to compare was considerable, initially Atlas.ti, and later MAXQDA, both information technology tools, were tried out for coding the data.¹¹ MAXQDA is easier to manipulate and more versatile than Atlas.ti, and a full thematic analysis with MAXQDA was applied to the summaries of the interviews conducted in Denmark to test the use of the programme. However, the analysis with MAXQDA did not seem practical, as many passages were double or triple coded, and the retrieved data set resulted in a multiplication of text pieces that would have been more easily to understand in their original context. As Yin (2014) states, information technology can support keeping track of pieces of information, but the overall analysis of the case and the understanding of the inner logic of cases, and the meaning of cross-case comparison needs to develop in the researcher’s mind. Thus, the author returned to ‘playing with the data’, i.e. rereading interview summaries, redefining the core themes and arguments, sorting different sections of interview summaries by the concepts and relations that were identified, and sorting data into tables. Feedback from other researchers also played an important role in motivating this researcher to think further about the data.

Several rounds of sorting were necessary for extracting the most relevant concepts, processes, and relations. This was part of the writing-up process. This phase of the research, contrary to the first phase, when questions were formulated and the research design was based on pre-existing theory, was inductive.¹² The aim of this multi-step

¹¹ The coded data could have been extracted for example, by quotation per coded concept, and as such be later on used as a support for presenting the research result.

¹² “...because the investigator determines which of the theoretically relevant similarities and differences are operative by examining empirical cases. (...) the researcher formulates a general explanation on the basis of identified similarities.” (Ragin, 1987, p. 45)

comparative analysis was to “go beyond initial impression” and to generate “accurate and reliable theory (...) with a close fit to data” (Eisenhardt, 1989, p. 541). The table below illustrates the gradual refinement of the analysis:

Table 8 Transformation from country case studies to analytical accounts

<i>First drafts</i>	<i>Second draft</i>	<i>Third draft</i>	<i>Fourth draft</i>
Denmark	Industrial policy	Industrial policy	Industrial policy
Germany	Denmark SF and JQ	Denmark SF	Skill formation
England	Germany SF and JQ	Denmark JQ	Job quality
	England SF	Germany SF	
		Germany JQ	
		England SF	
		England JQ	

SF = Skill formation, JQ = Job quality

8. Developing a new theory

In the last phase, results of the data analysis were confronted with pre-existing theory and pre-existing research. The aim was to enhance confidence in the research findings, to demarcate the research contribution, and to delimit its general validity: What was the overall meaning of the case studies? What was their significance within other theories? Theories and the findings from the case studies were compared and contrasted. Developing and defending a theory in dialogue with pre-existing theory and developing formal theory consisted in discussing “what comparisons the author has forgotten or ‘thrown away’ because of [her] initial focus, second, what comparisons [she] has suggested in passing but has not followed up, third, what comparisons are suggested by one’s own reflection on the theory. As these analyses feed into the development of another theory, further comparisons - directed by that theory - will occur to the analysis, just as if [she] were thinking about [her] own data” (Glaser and Strauss, 1967, p. 90).

9. Limitations and obstacles

Case study design might lead to findings with limited validity (Yin, 2014). A way to deal with this was the design of comparative case studies from countries that were seen as particularly different, and by controlling for the sector across countries. The sector focus might limit the findings' validity, however, as manufacturing occurs across a variety of industries, it might be possible that the findings on skill formation and job quality apply to all manufacturing sectors that show similar patterns in terms of dependence on state support.

The findings are also limited by the amount of data and the type of data on which they are based, here mainly interviews, and documents available in the public domain. Richer insights might have been gained by participant observation of production work at manufacturing sites and of strategic decision-making processes by managers at the offshore wind turbine manufacturers, as well as by a close analysis of the legal regulatory framework for offshore wind turbine deployment, the study of transactions between manufacturers and developers, and a more detailed analysis of markets for renewable energy. The interviews conducted here served as a shortcut to the data that could be expected from these types of analysis. Access to interview data was less resource intensive, but data might be less precise.

Obstacles in terms of operationalising the research design were in particular financial and time resources as well as access. For example, the number of cases had to be limited, and the only production workers who could be interviewed on job quality were works councillors. Interviews with works councillors, managers, staff from training providers, and the public and private employment agencies had to suffice as proxies in most cases, but were also valuable sources for triangulation. Also, no policy-makers at regional, national, and European level could be interviewed. In addition, the fact that the researcher did not speak Danish limited her access to publications in Danish language, although online translation technologies, like google translator might have helped to resolve this issue.

10. Conclusion

This chapter has introduced comparative case study methodology and theoretically informed sampling. It has detailed how access was gained, data has been collected, and difficulties with data collection were resolved. For example, a large number of interviews was combined with document analysis to fill gaps in the data. Interviewees gave insights into processes and rationales that drove their actions, which were otherwise hidden. The interviews directed the researchers' attention towards what was relevant to the informants: industrial policy.

The interviews with various informants corroborated the impression that industrial policy strongly impacted on skill formation and job quality. Documentary analysis and secondary literature also served as a back-up, a source for triangulation, for new ways to think about data, and a starting point for issues that might have been relevant for the interviewees.

It is important to note, that in Germany contact with management was never arranged through works councillors, despite Germany's reputation for social partnership (Gumbrell-McCormick and Hyman, 2013). In Germany and England, group interviews mostly included informants linked by hierarchical relationship, whereas in Denmark, fewer group interviews were conducted, and these always involved informants who had no hierarchical relationship, although in one case, the interview had been arranged through the manager. This might suggest a different level of trust between management and staff.

This chapter also described how data has been documented, and how a theory was built from constant comparison throughout the research process, how data was interpreted and how the development of a presentation of the data was part of the final analysis and theory creation. The comparative research design represented a complex analytical and practical challenge in terms of working in different languages and in terms of logistics. However, it proved worthwhile, as the offshore wind turbine sector is operating in a transnational space. Institutional and industrial policy differences and similarities between locations are exploited by manufacturers. Industrial policy in one country impacts on skill formation and job quality in the other countries, as the next chapters on industrial policy, skill formation, and job quality will show.

CHAPTER IV: ENERGY AND INDUSTRIAL POLICY

1. Introduction

Environmental movements, first anti-nuclear and later anti-carbon dioxide emissions, gained in popularity during the 1980s and 1990s (Radkau, 2011). By the end of the 1990s, climate change discussions had become important topics at national and EU level (Lauber and Mez, 2007). The creation of ministries with Energy and Climate Change in their name in the first decade of the millennium shows that the theme had established itself in the mainstream political discourse (Helm, 2010 [2004]).

However, some countries pursued the development of low carbon and no nuclear technologies much earlier. The Organisation of the Petroleum Exporting Countries' (OPEC) embargoes of 1973 and 1979 showcased the political but foremost economic vulnerability of European countries that relied strongly on imported fossil fuels. The 1986 nuclear accident at the Chernobyl power plant in Ukraine raised awareness of the uncontrollable risks of nuclear power. It strengthened the anti-nuclear movements in several countries. These two series of events, oil crises and emergence of social movements against civil use of nuclear power, are widely perceived as triggers of policies that first supported research and development programmes for renewable energy technologies¹³ and later their commercialisation through a variety of subsidy schemes that helped the transformation of the European energy supply industry.

The electricity supply industry in European countries was still largely state-owned, when renewable energy technology was first developed and tested. From the end of the 1980s onwards, the United Kingdom was the first country to privatise its electricity supply industry. In the late 1990s and early 2000s, many other countries followed suit under the European Commission's (EC) Directives (1996/92/EC, 2003/54/EC) that imposed liberalisation of their electricity supply industry. This increased private ownership across Europe.

¹³ Such as wind turbines, photovoltaic panels, bio-fuel power systems, and wave and tidal energy systems

Industrial policies for the private and commercial use of renewable energy sources, and liberalisation and privatisation of the electricity supply industry were unconnected political projects. However, they were in reality strongly interdependent. The outcomes of renewable energy expansion, type of renewable energy source favoured by incumbent and new market actors was dependent on structure and type of subsidy scheme, but also on how electricity supply industries had been shaped by liberalisation and privatisation policies in each country. The liberalisation of the European Union internal markets for goods and electricity and European competition law added another layer of complexity to international interdependence of the energy supply industries. No longer were large electricity utilities national actors; the most powerful ones had turned into European and international supply utilities and investors. Nonetheless, national industrial policies stayed relevant for these companies. The opening of the European market made export of energy technology a lot easier and came in the right time for certain countries' industries (Karnøe and Garud, 2012).

Design of industrial policy and resulting regulatory framework were highly dependent on interests and power institutionalised in governances and regulatory bodies in each country. Industrial policy can be divided into two types of policies: supply side and demand side policy. Here supply side industrial policy is defined as public provision of infrastructure and tax credits for manufacturers, support of research and development, education and training, and supply chain and process optimisation. Demand side industrial policy is defined as electricity price subsidies, favourable spatial planning and construction regulations, target setting for carbon emissions and use of renewable energy, and support for marketing, offshoring, and inward investment. Demand for offshore wind turbines is dependent on duration and size of public subsidies provided per MW energy generated from offshore wind turbines.

This chapter shows that only Denmark has achieved a match between supply and demand side policies favourable to durable expansion of its offshore wind turbine industry. Germany has by nature of its supply side structure a strong basis for supply side industrial policy, but struggled to maintain a consistent demand side policy for conflicts of interests within its electricity supply industry. The United Kingdom, here in particular England, by nature of its weak supply side structure, had difficulties to develop a domestic industry. In contrast, due to its centralised governance system, it was

able to impose a strong demand side drive for offshore wind turbines, which resulted in large scale deployment, and later engaged in ‘post-hoc’ supply side policy closely collaborating with the large developers and their equipment suppliers.

This chapter sheds light on this political complexity. It gives an overview of the amount of offshore wind turbines deployed, the equipment supply industry in Europe and the European Union regulatory framework that shapes the prospects of equipment suppliers. It then details the industrial policy that provided the context for production, deployment, and operation of offshore wind turbines in Denmark, Germany, and the United Kingdom. Examples from roughly a dozen production sites serve to illustrate the local effects of industrial policies: The Seagull generator and the West-Wind blade factory in Denmark, seven German sites – Seagull generators, Seawing blades and Seawing nacelles, East-Wind nacelles, and three steel welding sites, and, in England, the Vestas blade factory on the Isle of Wight and the Siemens blade factory in Hull. The country-by-country analysis is followed by a comparative discussion.

2. The industry in Europe

Offshore wind turbines are more complicated to install and operate than onshore wind turbines. They are more maintenance intensive. They are still the most expensive renewable energy source on the market. Why do they have so much support? Petersen and Thorndahl (2014 in Andersen Andersen et al., 2014, p. 13) trace back the nowadays still common reasoning for building offshore wind farms to a report by the Danish Ministry of Energy (1983). This report established that offshore wind farms were more effective than onshore wind farms, as they were able to capture higher wind speeds and more consistent wind on sea, and would attract less public opposition. These arguments, despite all logistical and technical challenges, became the mantra of the industry and of supportive politicians, also in England and Germany. Offshore wind farms are large-scale projects and fit well into business models of large utilities, whose market position has come under threat by decentralisation and introduction of small scale renewable energy generation systems that were owned by individuals, cooperatives, and municipalities.

The first offshore wind farm was built in 1991 in Vindeby in Denmark (Danish Energy Agency, 2012). It consisted of ten wind turbines and had a total capacity of 5MW.

During the 1990s, offshore wind turbines were mostly installed as test fields. But by 2014, 2 488 offshore wind turbines had been connected to the grid in seventy-four wind farms in eleven European countries. They reached a total capacity of 8 045.3MW (EWEA, 2015, p. 3). Roughly half the capacity was installed in the United Kingdom.

The size of single projects increased drastically in the 2000s with projects varying between 20 and 170MW. Between 2010 and 2013, projects again increased in size, and varied between 150 and 500MW. After 2013, projects were medium-size, between roughly 290 and 370MW (EWEA, 2015, p. 17). The smaller size of the latest projects resulted from UK seabed planning by the Crown Estate and changes in electricity subsidy schemes.

The MW capacity of turbines increased drastically, jumping from 1 to 2MW between 1998 and 2000, then gradually increasing to 3MW between 2000 and 2005, and to 4MW between 2005 and 2012. Launches of more powerful turbine models in 2005 and 2012 were followed by slight declines in average capacity of turbines installed (EWEA, 2015, p. 16). Investors preferred riper technologies to the newest and most powerful technologies, as the latter had no or only little commercial track record (two financial advisers, December 2014). The most advanced turbines had between 8 and 11MW capacity (two staff, Danish municipality, June 2014; works council, East-Wind, November 2014; works council, Seagull, July 2013), but the most commonly deployed models had 3 to 5MW (4coffshore, 2015), at the time of writing. Larger wind farms were built further away from the shore (up to 120 kilometres) and in deeper water (up to 50 metres). But construction continued in areas close to the shore and in water as little as ten metres deep (EWEA, 2015, p. 18).

In 2000, offshore and onshore wind energy were 2.4 per cent of the European Union's power mix. In 2014, its share increased to 14.1 per cent (EWEA, 2015). Installed capacity of offshore and onshore wind amounted to 128,751.4MW. Denmark, Germany, and the United Kingdom had the largest amount of offshore wind turbine capacity. But offshore wind turbines contributed varying shares to the total wind turbine capacity in each country: 36.1 per cent in the UK, 26 per cent in Denmark, and 1.6 per cent in

Germany (EWEA, 2015a; 2015b). Appendices 4, 5, and 6 contain overviews of the grid connected offshore wind farms per country.¹⁴

3. The supply chain

The offshore wind industry has two supply chains (engineer, Seagull, June 2014): production of turbine equipment (generators, nacelles, towers, blades, foundations and cables) and installation and maintenance services. The industry also generates planning, financing, and lobbying activities. Offshore wind turbine equipment producers and installation and maintenance services are mainly located close to harbours to minimise logistics costs. The industry's headquarters are mainly in capitals or regional capitals.

Equipment manufacturers Alstom, Areva, Bard, Gaia, Gamesa, General Electric, Samsung, Senvion, Siemens, Vestas, and WinWind often produced their own blades and generators, and operated assembly factories that equipped tower and nacelle blanks with electrical installations. Steel companies Aker Verdal AS, Ambau GmbH, Bladt, Cuxhaven Steel Construction (CSC), Erndtebrücker Eisenwerk, HGN, Ingeniería y Diseño Europeo (IDESIA), Jan De Nul Group, Peer Aarsleff/Bilfinger, Siag, Sif, Smulders, Steel Engineering, and Weserwind provided the large steel components, towers and foundations, as blanks to the turbine manufacturers. ABB, JDR, LS Cable & Systems, Nexans, NKT, NSW, Parker Scanrope, and Prysmian supplied electrical transmission cables. These major supply companies were identified based on EWEA annual industry reports (2012-2015).

The market for offshore wind turbines was highly concentrated, with Siemens Wind Power having provided 64.2 per cent of all grid connected offshore wind turbines in Europe by 2014. Vestas followed with 25 per cent, Bard with 3.2 per cent, Senvion with 3.8 per cent, and Areva Wind, General Electrics, Alstom, Samsung, WinWind, and Gaia with less than one per cent (EWEA, 2015b). Manufacturers with important market shares originate from corporatist European economies. Some manufacturers had had severe financial difficulties over the past years, and some decided to discontinue production of offshore wind turbine equipment or had restructured their supply chains:

¹⁴ On Denmark, Germany, and the United Kingdom, including windfarms around England, Scotland, Northern Ireland and Wales.

“The previous CEO wanted to control the supply chain. However, under his direction the company was making losses. Lately the company has reduced its production capacities from thirty-one to nineteen production plants. It also has reduced the number of suppliers it directly works with. It now works with ‘preferred and strategic’ suppliers, who themselves sub-supply from other companies. With this structure [the company] could reduce the number of suppliers from one thousand five hundred to three hundred preferred and strategic suppliers.”

Former engineer, June 2014

Between 2010 and 2011, market leadership shifted from Vestas to Siemens Wind Power. Siemens Wind Power turned into the most successful manufacturer of offshore wind turbines on the European market. In 2010, Vestas had supplied 60 per cent or 185 offshore wind turbines and Siemens 36 per cent or 110 offshore wind turbines. From 2011 onwards, Vestas’ annual share of offshore wind turbines dropped to around 5 per cent on average (calculation based on EWEA, 2012–2015). Siemens supplied an annual average of 80 per cent of all offshore wind turbines between 2011 and 2015. Siemens Wind Power was commissioned to provide the only two large Danish projects in more recent years – Horns Rev II (91 turbines grid connected in 2009) and Rødsand II (90 turbines grid connected in 2010). While Siemens Wind Power expanded its offshore wind turbine business, Vestas underwent important organisational restructuring.

In April 2012, a joint venture of Alstom and EDF secured the French market by winning rights to construct offshore wind farms on the French Atlantic coast (Bezard, 2012). Since 2014, Vestas and Mitsubishi (Vestas, 2014a), and since 2015, Areva and Gamesa teamed up in joint ventures (Areva, 2015). Vertically integrated turbine manufacturer Bard shut down its steel component operations in April 2013 (DPA, 2013). General Electric concentrated on providing a medium scale offshore wind turbine of around 4 MW to the Northern American market. In 2014, General Electric and Siemens were bidding for the turbine division of the French company Alstom, although General Electric had already decided to exit the offshore wind turbine business (manager, South-Wind, November 2014).

4. European Union policies

The European Union increased in importance for the energy policy of its member states. Energy policy had been a common topic since the 1951 Paris Treaty, which established the European Coal and Steel Community.¹⁵ However, until establishment of the European Union through the Treaty of Maastricht in 1993, the institutional frameworks governing energy policy within member states had been unaffected. Creation of the common market combined with liberalisation of the electricity supply industry from 1998 onwards (1996/92/EC), definition of carbon emission reduction and renewable energy consumption targets (2001/77/EC), and plans to build European interconnector grids to provide the infrastructure for a common electricity market have shaken up energy policies and the European electricity supply and equipment industry.

Renewables Directive 2001/77/EC did not only establish goals for renewable energy use per country until 2010, but also linked these to more “social cohesion, local employment, and environmental protection” (Söderholm and Pettersson, 2011, p. 518). The directive did not prescribe any type of incentive mechanisms or technology. 2008 Climate and Energy Package set the target of 20 per cent greenhouse gas reduction to the base year 1990 by the year 2020 to be reached by 20 per cent more energy efficiency and a 20 per cent share of renewable energy in total energy consumption. Although liberalisation of the electricity supply industry (1996/92/EC, 2003/54/EC) obliged political authorities to create economic incentives for investors and consumers and to make the market deliver, renewable energy technologies were excluded from the imperative of the free market that is institutionalised in EU state aid rules. Renewable energy technologies were infant industries (researcher, summer 2014; Thomas and Fouquet, 2012). Governments were allowed to subsidise these. The following sections present key regulatory and governance bodies and supply and demand side policies in Denmark, Germany, and England. Appendices 7, 8, and 9 contain comparative tables on these.

¹⁵ Initial member states were Germany, France, Italy, Belgium, Luxemburg and the Netherlands.

5. Denmark: match of supply and demand side policy

Between 1991 and 2010, twelve offshore wind farms, or roughly 400 turbines, were installed and connected to the electricity grid in Denmark (4coffshore, 2015). In 2011, Denmark had a degree of energy self-sufficiency of 111 per cent and covered 21 per cent of gross energy consumption with energy from renewable sources (Eurostat and IEA in Danish Energy Agency, 2012, p. 22). With this Denmark led on all other EU countries. The two most important suppliers of offshore wind turbines in Europe (EWEA, 2012–2015), Vestas and Siemens Wind Power but also important service companies for the industry had their origins in Denmark: logistics, transport, and training company Maersk and health and safety training company Falck Nutec. Roughly 500 supply chain companies were established in Denmark (staff, industry association, June 2014). In Denmark, the West-Wind blade factory and Seagull generator factory (closed in 2011) were studied in terms of their local context, skill formation, and job quality. This section describes the policy context of wind turbine equipment manufacturing in Denmark.

5.1. Regulatory institutions and governance bodies

Denmark has a centralised governance structure with a strong national government and specific devolved rights and duties. Municipalities and regions, industry associations and trade unions are important industrial policy actors, although central government gives the policy direction. The recent reduction of fourteen to five administrative regions had shifted more power to central and over-regional level (former manager, manufacturer, June 2014).¹⁶ Although Denmark has oil and gas resources in the North Sea, it was a fossil fuel importing country in the 1970s and highly affected by the OPEC embargoes. Government decided to phase out the use of fossil fuels in the long-term. Since then industrial policy had three objectives: independence from imported fuels, phase-out of the use of oil and gas, and reduction of carbon dioxide emissions (Sovacool, 2013). For many years, government policy provided a stable framework, but this stable framework was the result of political struggles between differently interested parties (Karnøe and Garud, 2012). The Danish electricity supply industry had assimilated the liberalisation imposed by the EC Directives, and avoided radical changes in its policy orientation.¹⁷

¹⁶ The country is divided in the regions Nordjylland (Northern Denmark), Midtjylland (Central Denmark), Syddanmark (Southern Denmark), Sjælland (Zeeland), and Hovedstaden (Capital Region).

¹⁷ E.g. Olsen and Skytte (2002) on electricity market liberalisation in relation to the traditional consumer ownership model, Pedersen and Rieper (2008) on institutional changes and their effects on stated policy goals within the Danish context, Lund et al. (2013), and Munksgaard and Morthorst

5.1.1. Electricity supply industry

Three organisations operate under the Danish Ministry of Energy and Building's responsibility: Danish Energy Agency, public enterprise Energinet.dk, and Danish Energy Regulatory Authority. The Danish Ministry of Energy and Buildings reports to Danish Parliament and Parliament's Standing Committee on Energy (Danish Energy Regulatory Authority, 2013). The Danish Energy Agency implements energy legislation, and develops regulatory tools for the electricity supply industry (Danish Ministry for Climate, Energy and Building, 2012). Energinet.dk owns and manages transmission infrastructure (high voltage and natural gas pipelines), except for district heating. Local not-for-profit monopoly companies own both, energy generation facilities and delivery systems for district heating.

Institutions involved in electricity supply show the strength of different governance levels. Municipalities are owners of municipal electricity grid and also suppliers of electricity. They are decision-makers but there is dialogue and co-decision making with higher policy levels. The state keeps important stakes within the country's largest electricity suppliers. Because of close interaction between different levels of government, state ownership of supply system and grid, and cooperative involvement of industry and trade unions, Denmark's governments could give reliable indicators for private investors and development of a strong equipment supply chain. Also, the opening of the EU internal market in the 1990s and expansion of wind turbine deployment in other countries during the 1980s and 1990s provided important business opportunities for the domestic industry at the moment where the technology was mature (Karnøe and Garud, 2012). Pension funds in cooperation with the government became important investors in renewable energy plant and technology projects (Investment Fund for Developing Countries, 2014, Danish Ministry of Climate, Energy and Building, 2014).

(2008), both on the effects of the newly created markets on the expansion wind power, Moreno et al. (2012): on electricity prices, Jacobsen and Jensen (2012) on security of supply, and Olsen et al. (2006) on consumers.

5.1.2. Industry interest organisations

The two Danish industry associations organising the wind energy sector, the Danish Wind Energy Association, and Offshore.dk are located in the South of Denmark in Copenhagen to maintain access to Christiansborg, the Danish parliament (staff, industry association, June 2014). Most of the 500 supply chain companies located in Denmark have established relationships with the companies that dominate the European market for offshore wind turbines. Many feel dependent on the large wind turbine equipment manufacturers.

5.1.3. Trade unions

Trade union Dansk Metal organises skilled workers in the offshore wind turbine industry, 3F (Fagligt Fælles Forbund) unskilled workers, and HK (Handels og Kontorfunktionærernes Forbund) employees in white-collar positions (manager, HR department, June 2014; Jørgensen, 2009). Companies in the Danish wind equipment industry did not distinguish themselves from other manufacturing industries in terms of trade union organisation (officer, trade union, November 2014; HR department, June 2014; former manager, HR department, June 2014). At the West-Wind blade factory, the majority of production workers were unskilled and 3F members. The shop stewards came from Dansk Metal. Seagull had been organized by Dansk Metal “100 per cent” (former manager, HR department, June 2014).

5.1.4. Local industry and local government

The Seagull generator plant (until 2011) and the West-Wind blade factory located in a region that was considered structurally weak. The region had been able to acquire “150 million to 200 million kroner of subsidies per year” during the second half of the 1990s. “A lot” of this came from ESF and ERDF. Between 2002 and 2010, the region was able to “create around one thousand jobs per year” (former manager, HR department, June 2014). During the previous two decades, the town invested heavily in its development from “coal to culture” (two staff, municipality, June 2014). Local government focused strongly on knowledge creation and cooperation between vocational schools, university, and local businesses. A new event centre and a new concert hall were built in a former power plant at the Eastern fringe of the inner city. New student accommodation was built close-by at the harbour front. For the last “five to eight years”, the municipality had focussed on attracting young people, and on helping the founding of new companies.

Interviewees at the municipality spoke of a “re-birth” of the city’s economy. However, one observed a constant drain of young and skilled people to the metropolitan area. From 2014, the campaign “STAY” aimed at this population. Future plans of public investment included construction of a regional ‘super-hospital’ (manager, AMU centre, November 2014). Interviewees stated that in the region “everybody knows everybody... it is easy to create good cooperation” (former manager, HR department, June 2014).

Seagull had pioneered turbine technology since the 1970s and 1980s. Seagull’s generator factory used to have 500 staff; thirty to fifty engineers and blue-collar workers worked in the plant’s research and development workshop (former engineer, June 2014). In 2011, research and development and production facilities were shut down as part of a major restructuring. Their functions were transferred to sites in a different part of Denmark and to Germany.

With the purchase of the blade factory in 2006, West-Wind re-entered the wind technology market (shop stewards, West-Wind, November 2014), which it had prematurely abandoned about a decade earlier. It had not recognized the commercial potential of this new technology (Simmie et al., 2014). Before West-Wind bought the blade factory, the site had been part of a Danish composite technology company that had pioneered modern wind turbine technology and had produced blades since the 1980s. Between 2011 and 2014, the workforce increased rapidly from 600 to 1,900. The blade factory received tax breaks for keeping its production locally. However, one interviewee suggested that Danish wage levels were too high (HR department, October 2014). And “political signals” were needed to prevent the company from transferring work to different sites abroad. The following sections detail supply and demand side policy for the offshore wind turbine industry.

5.2. Supply side policy

In Denmark, it is a consensus among industry actors that reducing costs of offshore wind energy works through policies that reduce its factor costs (staff, municipality, June 2014; staff, industry association, June 2014; manager, HR department, June 2014; former manager, HR department, June 2014). The cost of energy is the sum of price of a turbine, price of installation, and price of maintenance over 20 years, divided by the (expected) amount of MW produced over 20 years (staff, municipality, June 2014).

5.2.1. Research and development

During the 1970s and 1980s, the Danish wind turbine industry developed from an economically suffering agricultural machinery industry (Andersen et al., 2014, Vestas, 2014a). Public support for research and development on electricity generation from wind energy goes back forty years. Revenue from taxes on gasoline, diesel, and oil (all three introduced in 1974), coal (1982), carbon dioxide (1992), natural gas, and sulphur (1996) funded research on energy efficiency and renewable energy technologies, in particular wind energy technology (Sovacool, 2013). Government supported collaboration between public research institutes and manufacturing industry. The national Risø research institute was commissioned to provide testing and design facilities and to support certification of new products (Andersen et al., 2014).

The first offshore wind farm in the world, a test field, was built in 1991 in Vindeby by the utility Elkraft (Andersen et al., 2014). The wind farm consisted of ten 450KW Bonus (now Siemens Wind) turbines. In 1995, followed the second test field at Tunø Knob with ten Vestas turbines. The Danish government helped the emergence of a duopoly of offshore wind turbine producers.

Research and development support continues to the present. The Ministry of Climate, Energy and Building increased funds for research and development for energy technology from 350 million kroner in 2005 to 750 million in 2009 and 1.1 billion in 2010 (Danish Ministry for Climate, Energy and Building, 2012). Funding for energy research could be accessed through several bodies and programmes.¹⁸ In 2009, universities and private companies conducted “climate research” with a value of about 750 million kroner. Danish universities like the Danish Technical University (DTU) and public research institutes like Risø are actively involved in ongoing research on wind energy technology.

¹⁸ For example, the Danish Council for Strategic Research’s committee on sustainable Energy and environment, EUDP Energy Technology Development and Demonstration programme, Green Labs DK, 2 SPO schemes for environmentally friendly electricity production, and efficient electricity usage, the Danish National Advanced Technology Foundation, the Green Development and Demonstration Programme (GUDP). ForkVE, exclusively for energy technologies, and Business Innovation Fund provided support for market entry of new products. The state owned Vaekstfonden provided investment support (Danish Ministry for Climate, Energy and Building, 2012).

5.2.2. Education and training

Knowledge and skills in wind turbine technology are national export and labour market assets: “Denmark is a pioneer country in this sector and a lot of expertise is held by the Danish”, stated one interviewee (industry association, June 2014). The dual VET system flexibly integrates the needs of equipment manufacturers. Public technology colleges and AMU centres provide VET and health and safety certificates. Training curricula are developed in dialogue between vocational schools, employers, and trade unions, and are accredited and promoted by tripartite bodies at national level. VET, university education, and primary and secondary schools are largely state-funded (Helms Jørgensen, 2014). Large wind turbine manufacturers had certified the company Maersk to provide training for offshore wind turbine service and maintenance technicians (Maersk, 2016).

5.2.3. Supply chain and process optimisation

Siemens and Vestas hardly cooperated to improve their logistics (researcher, October 2014). Danish Government collaborated with the Danish Wind Energy Association to fund research on supply chains and logistics (Andersen et al., 2014, Lutz, 2013). DWEA, Offshore.DK, regions, and municipalities worked together to set up programmes according to industry needs (staff, industry association, June 2014). Across Denmark, several municipalities promoted cooperation between potential supply chain companies and equipment manufacturers. The Wind Network¹⁹ of the municipality that was studied here offered a relatively modest programme, which was funded by the ESF and run by two full-time staff. It attempted to open up opportunities in the wind turbine industry to local SMEs. Over a three-year period (2011-2014), the network offered a two-year continued training and informal network activities to twenty-eight owners or executives from local companies. The rationale was that the non-commercial and non-competitive setting of the training would help business collaboration between the companies (two staff, municipality, June 2014). The Wind Network also facilitated contacts to the regional Vaeksthus, which was a public agency that matched companies with business consultancies and provided free advice to the local industry.

¹⁹ Changed name.

5.3. Demand side policy

5.3.1. Public subsidies for building wind turbines

Since 1979, Danish Government made available subsidies for individual, local cooperative and municipal investments in certified wind, solar and biogas electricity systems (Andersen et al., 2014, Sovacool, 2013). Electric utilities were excluded from this subsidy scheme. They could only receive permission to build wind farms when local residents and farmers did not oppose to it (Maegaard, 2010a in Sovacool, 2013, p. 830). Subsidy schemes were decreased over time as wind technology became cheaper. In 1985, Danish Government and electricity utilities agreed on the first large-scale wind power plan – installation of 100 MW over the following five years (Sovacool, 2013). That year, two important policies were passed (Daugbjerg and Tinggaard Svendsen, 2011). The “Wind Turbine Guarantee” provided long-term subsidies for wind turbine installation. It gave priority access to the grid to electricity generated from wind. And it established sharing of costs of grid connection between utilities and owners of wind turbines.²⁰ Decentralisation of electricity transmission and distribution network made the Danish electricity grid highly efficient (Sovacool, 2013) and robust (Danish Ministry for Climate, Energy and Building, 2012). Alternative energy technology could be more easily integrated than in other countries.

5.3.2. Electricity price subsidies

In 1981, feed-in-tariffs were introduced. They obliged utilities to buy all electricity generated from renewable sources at a price higher than the market rate (Morthorst in Sovacool, 2013). Current subsidies would be phased out in 2020 (former engineer, Seagull, June 2014; Chairmen of the Danish Council of Environmental Economics, 2014). Further subsidy schemes were planned, but depended on a significant reduction of costs. 40 per cent cost reduction of offshore wind energy were needed (former engineer, Seagull, June 2014).

²⁰ Higher electricity costs for renewable energy due to feed-in-tariffs were socialized through a public service charge (PSO) applied to the electricity bills of all consumers (Daugbjerg and Tinggaard Svendsen, 2011, p. 289).

5.3.3. Spatial planning and construction regulations

The Danish electricity grid was historically divided in two separate grids for Eastern and Western Denmark. They were operated by the utilities Elkraft and Eltra. In 2005, the merger of grid operators Eltra, Elkraft System, Elkraft Transmission, and Gastra created Energinet.dk (Energinet.dk, 2014). Owner of the transmission infrastructure Energinet.dk was in charge of connecting Danish offshore wind farms to the onshore electricity grid (Energinet.dk, 2013).

Danish Government tendered rights of use within Danish territorial waters and economic zone (Söderholm and Pettersson, 2011). Around 2011, Government tendered the 600MW-offshore-wind-farm at Kriegers Flak and several smaller offshore wind turbine installations totalling 400MW (Danish Government, 2011, p. 29). These were closer to the coast than the existing wind farms. The administrative process was relatively lean. The Danish Energy Authority provided a “one-stop-shop” for the necessary permit and special environmental impact assessment to potential bidders (Markard and Petersen, 2009 in Söderholm and Pettersson, 2011, p. 524). The Danish Energy Authority “coordinate[d] the inter-departmental planning and permitting process” behind the scenes.

5.3.4. Targets for carbon emissions and renewable energy

Because Denmark is a “small and open economy”, Danish Government strongly defended domestic industry interests (Danish Government, 2013, p. 32), advocated higher emission reduction targets at EU level, 30 per cent by the year 2020, promoted a long-term phase out of fossil fuels, and fought against “green protectionism”, trade barriers for energy technology (Danish Government, 2011, p. 4). Its 2011 climate policy plan was for increasing EU greenhouse gas reduction targets for 2050 to 80 per cent-95 per cent compared with 1990 levels for the EU average. National aim was 100 per cent energy provision from renewable sources by 2050.

5.3.5. Marketing and offshoring

In 2013, Denmark’s exports of energy technology increased by 11 percent to 67.6 billion kroner. Exports of renewable energy technology reached 17.6 percent, while total goods exports rose only by 2 percent (Danish Ministry for Climate, Energy and Building, 2014b). The energy technology industry had become highly relevant for “employment,

(...) and added value” (Danish Ministry for Climate, Energy and Building, 2012). The government wanted to “bring manufacturing back” (lobbyist, June 2014).

“An important development at the moment is the internationalisation of the sector. There is a strong interest in helping exports to take off. Danish Government has its own specialised bodies, which are targeting different export markets. The idea is to increase the customer base of Danish companies. ...The Danish supply chain is mature.”

Lobbyist, based on hand notes, June 2014

An HR manager (October 2014) at a manufacturer stated that unskilled production work would be transferred to other countries if there would be no political signals, for example an extension of the waiver on local business rates (researcher, October 2014). However, offshoring was also supported by Dansk Metal and shop-stewards at West-Wind, who stated that the company had “not enough workers to do the work in Denmark” (November, 2014).

The Danish Wind Energy Association and Offshoreenergy.dk, municipalities and regional Vaeksthus facilitated marketing and offshoring. The Danish Wind Energy Association closely monitored investments by Siemens and Vestas in other countries. Their international expansion was perceived as a positive signal for Danish supply chain companies. The industry association offered supply chain companies access to public funding to cover overhead costs for expanding abroad (staff, industry association, June 2014). Municipalities helped local companies to apply for public funding. For example, EU contact offices helped to acquire funding from “about 20 to 30” different EU funding streams for different kinds of companies and purposes. The office was said to have a success rate of roughly “70 per cent” for its bids (staff, municipality, June 2014). The municipality also supported accessing regional, national and international funding.

6. Germany: Institutionalised conflicts of interest

When German Federal Government decided the *Energiewende* ('Energy turn around') after the nuclear accident at Tepco's Fukushima power plant in Japan in March 2011, the offshore wind farm equipment industry briefly went through something 'like the gold rush' (trade union officer, May 2012). Between 2010 and 2014, four offshore wind farms or 143 turbines were connected to the grid and operating (4coffshore, 2015). The first offshore wind farm was the test field Alpha Ventus, which consisted of six Areva M5000 and six Repower 5M (now Senvion) turbines and had a total capacity of 60MW. The project was realised by public-private-partnership. Ideas to build turbines offshore were discussed as early as 1997, but conflicts of interest between stakeholders delayed installation (former manager, Seawing, February 2014). In the 2000s, when the political context became more favourable, several equipment suppliers opened production sites across Northern Germany. About 10 000 people worked for the offshore wind energy sector in 2012 (EWEA, 2013). But, as conflicts about regulation of liabilities for late grid connection and expansion of the North-South electricity transmission grid remained unresolved, further investments stalled (Fornahl et al., 2012, Pohl, 2013, Smith Stegen and Seel, 2013). The manufacturers had to shut down or partly shut down their operations in late 2013 and 2014 (manager, vocational school, May 2013; former manager, Seawing, February 2014; works councillor, November 2014).

6.1. Regulatory institutions and governance bodies

6.1.1. Government

Governmental support for renewable energy technology started as in Denmark in the late 1970s as a reaction to the economic crises that had resulted from OPEC embargoes. In 1979, renewable energy support schemes were included into national competition law (Lauber and Mez, 2007). The 1986 Chernobyl nuclear accident enhanced ideological dispute between those for and against the civil use of nuclear power (Koch et al., 2012, Richter, 2013).

The citizens' initiative that later became the Green party and civil society organisations like BUND and Greenpeace lobbied for nuclear phase out (Koch et al., 2012). They were initially opposed by all established political parties. Christian democratic and liberal democratic parties were traditional strongholds of conservative energy policy (Laird and Stefes, 2009, Lauber and Mez, 2007, Winter, 2013). During the 1990s, the

social democratic party SPD became more supportive of green issues. However, once governing, despite being in coalition with the Green party (1998-2005), the SPD tended to support traditional industries' interests (Laird and Stefes, 2009). It pursued anti-nuclear and renewable energy policies, while it looked for a consensus with the nuclear power utilities.

The following SPD/CDU coalition stayed committed to phase out nuclear power. But CDU/FDP (2009-2013) Coalition Government, which had announced the *Energiewende* ('energy turn around'), decided to *exit from the exit* and revoked the nuclear phase out in late 2010. Nuclear power was declared essential to maintain electricity supply while the country was transitioning towards a low carbon electricity supply industry. The Fukushima nuclear accident in March 2011 changed politics again. Under pressure, as society and media took great interest in the issue, Federal Government first decided a moratorium for six German nuclear power plants (Berkel, 2013, Winter, 2013). In June 2011, it decided to completely phase out nuclear power plants until the year 2022 (EFI, 2012, p. 28). In the following years, (ironically) coal power expanded as 'bridging-technology' to transition to the agreed levels of renewable energy and low carbon energy provision.

In the run-up of the federal elections in 2013, the political parties set energy policy centrepiece. The government parties promoted the energy turn around. Offshore wind seemed complementary to other onshore renewable energy technologies. German planning law, accommodating the lobby of coastal regions, ensured a low visual impact of offshore wind farms (Douvere and Ehler, 2009). Offshore wind also provided a large-scale, centralised electricity generation opportunity for large utilities. However, offshore wind farms were significantly more complicated and expensive to build than onshore windfarms. They also required new electricity transmission networks from the North to the South for which no *Land* wanted to pay. In addition, new legislation was needed to regulate electricity transmission and grid connection (Fornahl et al., 2012, Pohl, 2013, Smith Stegen and Seel, 2013).

However, the political debate increasingly focussed on rising consumer prices in relation to renewable energy. The expansion of coal and gas-based electricity generation was proposed, to keep the costs down. As a result, both big parties, CDU and SPD,

announced amendments to the renewable energies law (EEG) for after the election. This increased insecurity for investors. Various conflicts of interest further postponed a solution (Schultz, 2013). The federal elections of 2013 resulted in a grand coalition of CDU and SPD. But ratification of a reformed EEG in August 2014 seemed to come too late for the industry.

6.1.2. Divided interests across the *Länder*

The German federal regions or *Länder* had diverging interests. The constitutional subsidiarity principle gives them important legislative power at federal level. Ministers of the *Länder* promoted industries in their constituencies, as these provided local jobs and often seats in advisory boards for high-ranking local politicians (Liedke, 2006). The *Land* North Rhine Westphalia, with a local economy traditionally based on coal mining, was stronghold of the electricity utility RWE. The *Land* Baden Württemberg had stakes in former state-owned Energie Baden Württemberg (EnBW). The *Länder* supported *their* utilities. Southern *Länder*, in particular Bavaria, were opposed to ‘electricity highways’ from offshore wind farms in the North to industries in the South (trade union official, July 2013). Only the Northern and Eastern *Länder* Bremen, Hamburg, Lower Saxony, Schleswig-Holstein, Saxony, and Saxon Anhalt supported wind and photovoltaic industrial policy. During the 1990s and 2000s, equipment suppliers located in these regions, often aided by generous public subsidies (Fornahl et al., 2012, Ergen and Kohl, 2015, Pohl, 2013).

6.1.3. Industry interest organisations

Traditional energy utilities and renewable energy technology manufacturers were organised in separate industry association. Incumbent utilities faced new entrants that built pre-dominantly on electricity generation from renewable sources. The big four utilities, EnBW, RWE, E.ON, and Vattenfall owned and operated nuclear, coal, and gas power plants. Their interest was to maintain their way of electricity generation. Although, large electricity utilities, E.ON (since 2005), RWE (since 2009) and Vattenfall (since 2002) had gained experience with offshore wind turbines in the UK (4coffshore, 2015), they had failed to invest in renewable energy infrastructure in Germany, when subsidy schemes were generous (Berkel, 2013). Operating conventional energy generation continued to be more profitable and better fitted their business model.

Meanwhile, electricity generation had decentralised. Political power of the Big Four was waning. But their influence showed in the new rise of coal power.

The electrical equipment industry organised in the politically powerful industry association VDMA (*Verband Deutscher Maschinen- und Anlagenbauer, Umbrella body of the German Machine Manufacturers*).²¹ Seeing market opportunities for its members, it supported the development of new energy technology. The offshore wind industry itself was politically less strong. Since October 2012, OWIA (Offshore Wind Industrie Allianz) represented four regional offshore wind industry associations with only one full-time staff in Berlin. The four associations were WAB (with 350 members in North-West Germany, since 2003), Renewable Energy Hamburg (with 170 members in Hamburg and the Hamburg region, since 2011), the Wind Energy Network (109 members in North-East Germany, its predecessor existed since 2002), and Wind Comm (with 70 members in the Land Schleswig-Holstein, since 2004, but reconstituted in 2010) (lobbyist, February 2014). The majority of their members were medium-sized technology companies. One interviewee stated that growing membership made it difficult to represent all interests. Most vocal within the network were large companies, in particular through advisory committee connections with the industry (HR manager, Seawing, April 2014; manager, industry network, February 2014).

6.1.4. Trade unions

While workers at big utilities and in the chemical sector organised within the trade union IGBCE, IG Metall organised the workers at manufacturers of wind turbines. In 2010, the IG Metall board decided to coordinate trade union activities in the wind and photovoltaic sectors. It had realised that because of the EEG (*Erneuerbare Energien Gesetz, Law on Renewable Energies*) large companies which were its traditional constituency had entered the sector. However, these companies continued, as the SMEs which they integrated, to be hostile towards trade union members and works councils (officer, trade union, March 2012). Also, offshore wind turbine plants offered employment conditions below standards of the metal workers' collective agreement (trade union officer, July

²¹ E.g. VDMA hosts the annual electrical and heavy industry trade fair Hannover Messe, which is the major event for international and national presentation of the industry's technological state of the art, and represents more than 3100 medium sized technology companies (VDMA, 2016), the German *Mittelstand*, often referred to in industrial relations literature (e.g. Herrigle, 1996).

2012; officer, trade union, March 2012, works councillor, Seawing, July 2013).

Organising workers meant preventing erosion of social partnership, as in particular young workers, who were not (yet) union members, had found work in the new sector.

To get the manufacturers to negotiate collective agreements, IG Metall started a new type of organising campaign (cf. Dribbusch, 2013). It initially relied on an expert from the US (trade union officer, July 2012) and achieved to establish works councils in the large offshore wind turbine companies, and introduction of a framework agreement on pay (trade union officer, July 2012; works councillor, July 2013; manager, Seawing, April 2014; works councillor, Seagull, July 2013). Organising was slow and painful, because many workers initially did not trust the trade union.²²

“[Company A] was a success story in terms of co-determination, and company apprenticeships. But we also have [company B] here in [town], where we are negotiating a collective agreement., where we will also talk about apprenticeships. Then we have [company C], where we will have the first talks in July. This will be for all sites in Germany. That means it will all be more difficult and it needed some pressure from the workforce, which we are currently organising. And we have [company D] in [a neighbouring town], which made a massive effort to prevent the workforce from electing a works council. This shows, we have a broad range of cases in the sector.”

Trade union official, July 2012

IG Metall explicitly supported *energy turn around* and expansion of the wind and photovoltaic sectors (officer, trade union, July 2012). However, it was powerless in changing energy policy. The chemical workers’ trade union IGBCE organising workers at large electricity utilities had strong stakes in the survival of nuclear, coal and gas power.

In Germany, trade unions are traditionally involved in designing industrial policy through various committees at municipalities, ministries of *Länder*, and federal ministries. This is a common trait of corporatist governance. Stakeholders are informally consulted, typically in round table events, permanent sector workshops

²² For a very detailed presentation of IG Metall’s organizing campaign in the German wind turbine industry see Dribbusch, 2013.

(*Arbeitsgemeinschaften*), or more formally in tripartite committees, for example in governance VET, parliamentary consultation processes, and within projects that such as the *Stiftung Offshore*.²³

IG Metall's regional and municipal offices decided their own agenda. However, the headquarter bundle these initiatives and promoted their coordination (officer, trade union, March 2012; officer, trade union, July 2012; officer for the region, trade union, July 2012). Trade union officers at local branches were often approached by companies that sought financial support or planning approval from local authorities; but the trade union was not able to gain any bargaining power out of this:

“Of course, we notice again and again, if it is about getting millions of subsidies, loans, and permissions for new buildings or the up-grade of harbour infrastructure (...), the companies are really keen on talking to us [although the trade union doesn't have any decision-making power], but afterwards [when everything has been provided] they are not interested anymore (...). Social partnership can really be a one-way street.”

Trade union officer, March 2012

Also, no statutory provision required high social standards in exchange for public investments. In fact, the industry strongly opposed inclusion of social standards in public contracts. One former site manager (February 2014) stated that linking EU funding to employment creation would hinder productivity in the industry – jobs would automatically be rationalised and lost, because the overall framework was not conducive to increase demand for offshore wind turbines.

6.1.5. Industry and local government

Establishment of the offshore wind turbine industry started as political project by the *Länder* and Northern German municipalities. It should create jobs for local workers. A commissioned report estimated that, if offshore wind projects expanded as set by Federal Government, about six thousand local manufacturing jobs would be created (manager, municipality, May 2013). In reality, the manufacturers' workforce needs strongly

²³ Stiftung Offshore was a stakeholder network of organisations, companies, municipalities, civil society organisations, trade unions, and the *Land* Hamburg that was funded by the Ministry for Economic Affairs (BMWi) to consult on regulatory matters with the offshore wind industry.

fluctuated, depending on developers' investments, which were dependent on demand side industrial policy.

In Germany, East-Wind nacelles, Seagull generators, Seawing nacelles and Seawing blades, and three steel component producers, as well as four training providers were studied. Between 2007 and 2014, the Seawing blades factory's workforce fluctuated between roughly two hundred and sixty and seven hundred. The municipality supported short-time work agreements and up-skilling, when the site had economic difficulties in 2014. Seawing's nacelle assembly plant employed sixty-three production and warehouse workers. In peak times, up to 60 per cent of its production workers came from agencies. In summer 2013, the East-Wind assembly plant employed eight hundred to eight hundred and fifty employees and workers (works councillor, July 2013). It had between two hundred to two hundred and fifty permanent production workers. In November 2014, the site employed only five hundred and fifty staff and eight or nine production workers (works councillor, November 2014). In 2014, when the East-Wind wind assembly site was short of contracts, it negotiated with the *Land* about financial support, but outcomes of these negotiations were not yet known at the time of the interview (works councillor, November 2014). Seagull bought a medium-sized generator workshop in 2004. In 2011, the workforce grew from one hundred and twenty to about four hundred and seventy of which one hundred and fifty were agency workers. As part of its global restructuring, in 2012, the manufacturer opened a new 60 million Euros green field site about 20 kilometres away (works councillor, July 2013). The steel welding companies that provided foundations and tower blanks were hit the hardest and earliest by the sector's downturn in 2013. By 2014, two out of three had shut down.

Establishment of the manufactures was supported by municipal economic development agencies, which had funds to develop infrastructure (manager and staff, municipality, May 2013). However, direct subsidies, especially from the ERDF had significantly decreased since the 1990s. In 1993, direct subsidies could be up to 35 per cent. In 2013, they amounted to a maximum 10 per cent of the total investment, and stopped at two million Euros.

As means for direct subsidies were limited, economic development agencies tried to enhance the Northern towns' appeal for business by customising infrastructure, establishing complementary organisations, for example research and development and training providers and industry associations. The latter bundled interests of equipment producers, service providers, training providers, municipalities, and social partners. When the manufacturers ran out of contracts, short-time work, and training packages for the companies' unskilled workers were developed in cooperation with CVET providers and funded by the municipalities and *Länder*.

6.2. Supply side policy

6.2.1. Provision of infrastructure

Municipalities as well as individuals had the right to invest in their own electricity generation schemes (Mitchel, 1996, p. 180). During the 1990s and early 2000s, industries for wind farm equipment and photovoltaic panels were supported with subsidies from the ERDF and federal development funds, when they located in structurally weak Northern and Eastern German regions (Ergen and Kohl, 2015, Smith Stegen and Seel, 2013).

6.2.2. Research and development

Initially, support of research and development of renewable energy technology was a political 'concession' to critiques of nuclear energy and coal (Jacobsson and Lauber, 2006 in Lauber and Mez, 2007, p. 177). Between 1974 and 1990, most of the funding went into training, development of prototypes and tests. Funding amounted to about 10 million Euros in 1974, peaked at 150 million in 1983, and declined to 82 million per year in 1986. The Chernobyl nuclear accident in 1986 halted the decline of research funding. Federal and *Länder* research programmes continued until the late 1990s.

The Fraunhofer Institutes for Wind and Energy Technology and for Material Engineering closely collaborated with the offshore wind turbine equipment manufacturers. Both were part of the Fraunhofer group, which was founded as a largely state-funded not-for-profit organisation. It operated sixty research institutes in Germany,

which covered a large spectrum of engineering research (Fraunhofer Institute, 2014).²⁴ Research and testing collaboration with equipment manufacturers was discontinued by 2014, as the manufacturers were not generating sufficient revenue to pay (former manager, Seawing, February 2014). Also, technical universities played an important role in applied research, for example the Bremerhaven *Fachhochschule* (here translated as *polytechnic*).

In 2005, as part of the municipality's and *Land*'s project to support the establishment of offshore wind equipment manufacturers, the polytechnic was asked by the municipal department for economic development and *Land* to establish an institute for teaching and research on wind energy systems technology (researcher, July 2013). The institute received funding for four years from the Land to establish and coordinate network activities between research institutes and companies, which worked on themes related to wind energy. Local industry and municipality funded research infrastructure and two professorships for five years. The institute also engaged in research funded by federal ministries, European Union and the industry.

The institute had strong links to wind turbine manufacturers, service providers, utilities, and research institutes. Contacts did not result from support by a wind industry association, but from the researchers' work biographies that mixed many years of industry expertise with work at public research institutes, universities and polytechnics (researcher, July 2013). Municipality and public employment services arranged regular meetings between researchers from the polytechnic and educators from local VET and ALMP training providers. Also contacts to Fraunhofer research institutes and the Alfred Wegner Institute were close. All bodies were part of the public sector or not-for-profit, and many had strong links via advisory boards and funding. The polytechnic also collaborated with other German and European universities. It occasionally provided commercial courses. A lot of the activities started as "a hobby", thus outside of the day-to-day business.

²⁴ In 2014, the entire group employed roughly 24 000 staff, and had a contract volume of 618 million Euros from the private sector, 654 million Euros from the public sector. It received a basic financing of 444 million Euros from the public budget, which was a decrease of 17 per cent towards the previous year. It owned 6 618 patents in 2014, and submitted 564 new patent applications to the respective authorities in 2014 (Fraunhofer, 2014).

These unstructured activities served the establishment of formalised arrangements – enquiries by teaching staff about industry needs informed curriculum design, short theory seminars for workers at a manufacturer’s premises took place in exchange for short training placements for Bachelor and Master students, combination of employment at a manufacturer with engineering studies at the polytechnic informally piloted establishment of a dual academic and vocational programme. Exchange of students between universities, polytechnics, research institutes, and industry went well until 2013. Then the sector plunged into economic difficulties. This reduced demand for engineers. It also made hiring student assistants politically difficult at manufacturing sites, where workers were made redundant (HR department, April 2014).

6.2.3. Education and training

Germany is known for its dual VET regime that trains skilled workers for most occupations. Germany also has high quality and free of charge higher education. The equipment manufacturers mainly relied on skilled workers who were trained in electrical and mechanical occupations for assembly and installation and maintenance, but also hired unskilled workers for machine operation and blade production. Quick recovery of the German industry after the financial and economic crisis of 2008 and sudden surge in contracts after the Fukushima nuclear accident, made it difficult for the offshore wind equipment industry to find skilled workers (manager, vocational school, May 2013). The companies had the reputation of not sufficiently engaging with VET (Salot et al., 2010).

The municipalities were determined to get local training providers to match the new companies’ needs and facilitated their contact (manager and staff, municipal development agency, May 2013; manager, vocational college, May 2013). VET and CVET providers customised training programmes, often co-financed by ESF, municipalities, and *Länder*, and run as pilot projects and ALMP programmes. These were temporary and targeted workers, who were disadvantaged on the labour market because of lacking occupational skills or other personal barriers.

6.2.4. Supply chain and process optimisation

The offshore wind turbine manufacturers hardly collaborated with local supply chain companies. Blade factories acquired supplies from “two or three” large multinational suppliers (works councillor, Seawing, July 2013), while generator and nacelle assembly

plants had suppliers several hundred kilometres away, in Western and Southern Germany, and Central and Eastern Europe (works councillors of both Seawing sites, July 2013; works councillor, East-Wind, July 2013). East-Wind nacelles and towers had over a thousand suppliers. Except for blades, it subcontracted production of all large components. The suppliers provided large components according to East-Wind's plans (works councillor, July 2013). However, faulty components delayed delivery. Liability disputes were major problems for the manufacturers (works council, East-Wind, November 2014; works council, Seawing, July 2013; works council, Seagull, July 2013; former manager, Seawing, February 2014). One manufacturer introduced a zero-tolerance policy. Workers sent back any faulty item and were prohibited make repairs on-site, even if they technically could (works council, Seagull, July 2013). Another issue was transition to lean production. Low number and small size of projects and short delivery deadlines were blamed for the absence of process optimisation, personnel planning, and workforce training (former manager, Seawing, February 2014; works council, Seawing, July 2013). There was no public support for component supply chain optimisation. In contrast, a local labour supply chain established itself rapidly with about one hundred seventy small and large work agencies (manager and staff, temporary work agency, July 2012). This will be further discussed in chapter VI on job quality.

6.3. Demand side policy

The manufacturers produced high quality technology but the domestic market was tiny (project South-Wind, November 2014). The regulatory framework was not helping. Also, the manufacturers were too small or did not have financial condition to compete for large contracts against already well-established companies (former manager, Seawing, February 2014; manager, South-Wind, November 2014). These large contracts were for projects in the UK.

“Although the big MW turbines with the best track record are [names two manufacturers]. The problem is that they have a too low balance sheet at the moment. These are the guarantees looked at by the utility: The bigger a company, the smaller the guarantee it needs to give. The cheaper it gets capital, the cheaper it can sell its turbines. In cases like [company], utilities would look at the financial condition of the mother company.... As [company] is in financial difficulties and only held afloat by its subsidiary, [the subsidiary]’s chances on the offshore wind turbine market are low. This is why projects are scaled back. Although confidence in the supply chain is now bigger, there are no economies of scale.”

Former manager at a turbine manufacturer, November 2014²⁵

6.3.1. Electricity price subsidies

In 1988, German Federal Government initiated price-subsidy and priority-of-grid-access programmes (feed-in-tariff) for wind and photovoltaic technologies. In 1991, feed-in-tariffs (FiT) for power from wind, solar, biomass, hydro, landfill, sewage, and methane resources were introduced based on the Feed-in Law of 1990. The European Commission accepted the law but announced a review after two years (Lauber and Mez, 2007). Feed-in-tariffs provided important financial incentives to investors. Large amounts of solar, photovoltaic, and onshore wind technology were installed by small regional electricity utilities, community investment funds, and individuals since the 1980s (Lauber and Mez, 2007, Mitchel, 1996), and large utilities consequently lost important market share (Berkel, 2013, Richter, 2013).²⁶ Decentralised electricity generation did not fit their business model.

Expansion of renewable energy technology provided opportunities for technological and political learning (Lauber and Mez, 2007). But visible expansion of onshore wind turbines – the “asparagusation” of the German countryside (in German *Verspargelung*, a neologism invented to describe the visual impact of onshore wind turbines (Dohmen and Hornig, 2004)), resulted in growing public opposition. Large utilities realised that the decentralisation of electricity generation nibbled at their profits. Their lobby influenced the translation of European Commission’s Directive 96/92/EC into German law, the

²⁵ Also quoted in chapter VI on job quality.

²⁶ To provide an example of the size of the change taking place: under the feed-in programmes of the early 1990s the capacity of electricity generation from wind energy expanded from 20MW in 1989 to 1,100MW in 1995 (Lauber and Mez, 2007), and 39,165 MW for onshore and offshore wind in 2014 (EWEA, 2015a and b).

1998 Electricity Supply Industry Reform Act (*Gesetz zur Neuregelung des Energiewirtschaftsrechts*). From 1999 onwards, the electricity supply industry was privatised. Privatisation and liberalisation favoured the expansion of large electrical utilities (Lauber and Mez, 2007, p. 183).

However, the 2000 Renewable Energy Source Act (EEG, *Erneuerbare Energien Gesetz*) (Bund, 2004) granted continued priority grid access to electricity from renewable sources. The Renewable Energy Source Act 2004 renewed the political commitment to renewable energy.²⁷ The European Commission's Directive 2003/54/EC was introduced in German law by two legal amendments of the Electricity Supply Industry Act in 2005 and 2006. A review of the Renewable Energy Supply Act was planned for 2007. The Renewable Energy Source Act was reformed in 2009 and 2012.

The year 2012 was characterised by a “climate of uncertainty [for] suppliers, ports, shipyards and the whole maritime economy” due to political struggles over regulation of the sector: “further investment in offshore wind farms has been put on hold until legal and financial issues surrounding offshore grid connection (...) and liabilities (...) have been clarified” (EWEA, 2013, p. 29). The 2012 amendments were particularly important for offshore wind developments, as they regulated liabilities in case of late grid connection.

Further changes to the EEG came by the reform of 1st August 2014. For offshore wind, two new and different funding models were ratified.²⁸ Although provisions continued to support offshore wind technology, interviewees within the equipment industry unanimously preferred regulatory stability:

²⁷ Renewable energy sources according to this act are “wave power, tidal power, salt gradient and flow energy, wind energy, solar radiation, geothermal energy, energy from biomass inclusively biogas, landfill gas and sewage treatment plant gas as well as the biodegradable fraction of municipal and industrial waste” (Renewable Energy Source Act 2004) (Bund, 2004).

²⁸ The aim was to expand offshore wind to 6 500 MW by 2020, and 15 000 MW by 2030. The model of the ‘compressed tariff’, extended until the end of 2019, set the subsidy for electricity generated by offshore wind farms at 19.4 cents/kWh for the first eight years of operation. From January 2018, the subsidy would be reduced to 1.0 cent/kWh. The second ‘base model’ provided for a lower subsidy of 15.4 cents/kWh for a longer period of twelve years, but would decrease the subsidy annually by 0.5 cents/kWh from 2018, 1.0 cents/kWh in 2020, and 0.5 cents/kWh by 2021 (BMW, 2014).

“The current situation of the sector is tense, as there is no clarity about the future design of the EEG [Renewable Energy Law]. The promises made in the Coalition Agreement of last autumn [2013] have already been revised, and new ideas are being discussed, but decisions are not expected before August 2014. Every modification of the law leads to a change in the cost calculation of new [plant] projects. (...) Currently investors are very reluctant to invest and prefer to wait. Old projects, for which grid connection has been confirmed, and where construction has already begun, continue to be worked on, but no new projects will start as long as there is no guarantee about the legal framework.”

Manager, industry network, February 2014

“At federal level, the debate focuses too much on the cost of renewables. Everyone knows the price, but nobody knows the value such as avoided CO² emissions, availability of renewables, saving of fossil resources, and creation of a sustainable energy system. The aim of [lobby group] is to ensure the [policy and regulatory] framework stays the same in the long-term, in particular the EEG [Renewable Energy Law]. Thus, the opposite of [what happens] today. Now the planning cycle of an offshore wind farm is five to seven years, but the EEG changes every or every other year. The ideal would be to know for sure at the moment of paying the contract, what subsidy level will apply to the electricity. Over the past three months the [political] position of Gabriel [the then Minister of Economy and Energy] has again changed from the Coalition Agreement to Gabriel’s ten policy points.”

Lobbyist, based on hand notes, February 2014

6.3.2. Spatial planning and construction regulations

Seabed was allocated to builders of offshore wind farms for free (Portman et al., 2009). The coastal *Länder* had marine spatial planning authority over the territorial sea. Federal Government has planning authority over the exclusive economic zone (Douvere and Ehler, 2009). This meant each *Land* had its own policy on seabed close to its coast. The Federal Maritime and Hydrographic Agency drew up use-plans for the exclusive economic zone. Its experts took into consideration different conflicting interests. In December 2005, one area in the North Sea, and two areas in the Baltic Sea were designated to become ‘priority areas’ for offshore wind.²⁹ Regarding seabed close to the shore, planning authorities gave priority to preservation of the natural *Resort Wattenmeer* and to interests of local people (former manager, Seawing, February 2014; Douvere and Ehler, 2009). Priority areas for offshore wind farms are between thirty to

²⁹ “Priority areas ...are reserved for a defined use in which other conflicting uses are excluded” (Douvere and Ehler, 2009, p. 85).

one hundred sea miles from the shore, which means in water up to fifty metres deep (MPIP, 2006). Distance from harbours and water depth present technical challenges, which developers did not have in earlier projects on the Belgian, Danish, Dutch, or English coast (senior staff, trade union, March 2012):

“[UK and DK] have different planning regulations. In Germany, statutory protection of the mudflats makes everything three times more difficult. The English [sic!] just say, “we don’t care if the machine stands five kilometres from the shore. We just put it there because that’s cheapest”. But NIMBY [not in my back yard] is too strong in Germany.”

Former manager, Seawing, February 2014

Portman et al. (2009) describe transparent and straightforward approval processes in Germany. It is a "non-discretionary administrative act" with possibility of rectifying amendments within the approval process. "Wind farm project applicants have legally valid expectations that their projects will be approved" (Douvere and Ehler, 2009, p. 3600). Spatial planning during the 1990s, facilitated expansion of onshore wind farms, whereas marine spatial planning for offshore wind farms resulted in a planning regime that posed significant problems for installation. Grid connection was technically difficult and one to two-year delays in the schedule were common (ore/dpa, 2012). This explains the importance of regulating liabilities.

6.3.3. Targets for carbon emissions and renewable energy

In the 1990s, climate protection became central policy. This was when Germany committed to carbon emission reduction targets at international level.³⁰ Emission reduction targets became salient after ratification of EC Directive 28/2009 on Climate Protection. For Germany, the directive set the target to increase the share of renewables in energy consumption from 5.8 per cent in 2005 to 18 per cent in 2020. The 2013 Coalition Agreement re-affirmed ambitious aims to reduce CO² emissions.³¹

³⁰ Kyoto protocol of 1997, entered into force in 2005.

³¹ The 2013 Coalition Agreement stipulated a reduction of CO₂ emissions by 40 per cent in 2020 compared to the base year 1990, 55 per cent by 2040, 80 to 95 per cent by 2050 (Smith Stegen and Seel, 2013, p. 1483. This aim should be achieved by a reduction of energy consumption by 20 per cent by 2020, 50 per cent by 2050 with the base year 2008, and in the transportation sector, 10 per cent by 2020, and 40 per cent by 2050 (Nitsch et al., 2012 in *ibid*, p. 1483). Also, the expansion of renewable energy use by 35 per cent of the gross electricity production in 2020, 50 per cent by 2030, 65 per cent by 2040, 80 per cent by 2050 should contribute to meeting this target (Arbeitsgemeinschaft Energiebilanz e.V., 2013 in *ibid*, p. 1483).

6.3.4. Marketing, offshoring and inward investment

Industry associations and municipal departments of planning and economic development represented harbours and industries at international trade fairs (for example at the annual *Global Offshore* trade fair in London), and supported international trade fairs in their own area, the *Husum Wind* and *Windforce*. Offshore wind turbine manufacturers based in Germany had planned to be involved in projects around the English coast and had looked into developing production sites abroad (manager, South-Wind, November 2014). Germany Trade and Invest, the German foreign investment agency, which was similar to the former British UKTI,³² could provide support for foreign trade and inward investment projects. In general, German policy-makers and trade unions were more inclined to support employment in the country than offshoring.

7. England: ‘post hoc’ supply side policy in a demand-led regime

The first wind farm, a test field, went online in 2000. By 2014, about 4.5 GW of electricity generation capacity or roughly 1 100 wind turbines, were connected to the electricity grid in the UK (EWEA, 2015b). Large electricity utilities like E.ON, RWE, Vattenfall, DONG, Centrica, SSE, Statoil, Statkraft, Scottish Power, and EDF had developed these wind farms. The most important developers in terms of MW were Danish utility DONG (about 735 MW), Vattenfall (about 540MW) and E.ON (about 430MW). The largest offshore wind farms were realised from 2009 onwards. Although the UK had the largest amount of offshore wind turbines in Europe, the supply chain mainly consisted of manufacturers based in continental Europe (HM Government, 2013). For example, for the Thanet offshore wind farm the manufacturing supply chain was estimated to consist of approximately 80 per cent of imported goods (Jeremy Nicholson, Director of Energy Intensive Users Group in Wood, 1/2011).

Foreign manufacturers had already gathered experience with producing offshore wind turbine technology in other countries and were more trusted by investors (two financial advisers, November 2014; manager, South-Wind, 2014; former manager, Seawing, February 2014; EWEA, 2011-2015). Siemens and Vestas dominated the market. Although they had announced plans to build factories in England, neither Vestas, nor

³² In 2016 UKTI was transformed into the Department for International Trade.

General Electric, Senvion or Areva did (manager, South-Wind, November 2014; Wood, 2009-2014). Vestas temporarily closed down its blade factory on the Isle of Wight in 2009 and abandoned plans to build a turbine factory in Kent in 2012 (Wood, 6/2012). Siemens and General Electric had been negotiating the construction of turbine factories with several locations (Wood, 10/2009; 3/2010). In 2016, after almost ten years of negotiation, Siemens began to staff a new blade factory in the UK (Green Port Hull, 2016).

UK Government counted about fifty supply chain companies for offshore wind farms (HM Government, 2013). They provided project development, installation, operation and maintenance services, turbine foundations, and small components. The majority provided geotechnical and environmental surveys. Operation and maintenance services to offshore wind farms operated out of six (HM Government, 2013, p. 28) to fourteen UK harbours (4coffshore, 2015).

7.1. Regulatory institutions and governance bodies

Before privatisation, the electricity supply industry was the biggest domestic industry. It had a powerful administration at its centre, the Central Electricity Generation Board (CEGB) (Cheshire, 1996). Privatisation of the UK electricity supply industry was realised between the mid-1980s and mid-1990s (Thomas, 1996a). The Regional Electricity Companies (RECs) were sold to a few private companies. The market for electricity opened only gradually to new suppliers. *Contracts for difference* (CfD) were guaranteeing threshold revenue to electricity generators by balancing the difference between generation costs and electricity market price (Thomas, 2006).

During the 1990s, electricity generation shifted from coal-based (Cheshire, 1996) to the at that time cheaper natural gas-based electricity technology (Thomas, 2006). The UK electricity supply industry was bought out by mainly US American investors. Obligated by the EC directives of 1996 and 2003, other EU members had privatised their electricity supply industries. This resulted in large and still partly state-owned, electricity generation companies. As the US investors withdrew, the continental utilities rapidly amalgamated the UK electricity supply industry (Thomas, 2006). To the present, the UK electricity supply industry is controlled by the Big Six: British Gas (owned by Centrica),

EDF, Npower (RWE), E.ON, Scottish Power, and SSE. Their investment decisions determine the demand for energy technologies.

Increasing influence of European Union climate policy reinforced Government discourse and diversified environmental policies. A whole new set of bodies were to design, implement, and control policy. This led to intersecting responsibilities within and across ministries (Helm, 2010 [2004]). The Department of Energy and Climate Change (DECC) was created in 2008. Its work involved co-ordination with the Department for Business, Innovation and Skills (BIS), and the Department for Environment, Food and Rural Affairs (Defra). The DECC's achievement in terms of carbon emission reduction and the 2050 reduction of emissions goals were monitored and often publicly commented on by the Climate Change Select Committee (Wood, 2009-2014), which had no executive powers (Committee on Climate Change, 2010).

State agency Ofgem (Office of the Gas and Electricity Markets), a “non-ministerial government department, and an independent National Regulatory Authority” according to EU law (Ofgem, 2015), was in charge of regulating and ensuring competition in wholesale and retail electricity markets. It administered the price subsidy schemes for low carbon electricity, and organised tenders for the electricity supply infrastructure, for example offshore grid links (Wood, 11/2010). Ofgem's role had expanded over the years from “protect[ing] consumers and promot[ing] competition”, to delivering government goals of reducing carbon emission, expanding renewable energy, and tackling fuel poverty (“Ofgem review: call for evidence a government response” in Wood, 11/2010, p. 63). The Coalition Government's *Green Deal* extended Ofgem's powers but reduced its political autonomy by imposing duty to report on future energy capacity to the Secretary of State (Wood, 12/2010).

The Coalition Government reformed energy policy-making. Several bodies, formerly involved in implementing and monitoring energy policy, were shut down. Subsidy schemes for low carbon technologies underwent redesign under the Electricity Market Reform (EMR) and marine and spatial planning authorities were restructured.³³ To

³³ In the area of energy policy, relevant changes are abolition of advice service Consumer Focus and transfer of parts of its responsibilities to the Citizens Advice Bureau, and merger of Office of Fair Trading and Competition Commission. The Environment Agency had to “become more customer-

provide more security for investment in large-scale developments, Government created the Green Investment Bank (RenewableUK, 2012b), which received a budget of 3 billion pounds from 2012/13 to 2014/15. As developers put new projects on hold while waiting for the EMR, the Green Investment Bank had difficulties funding new projects (GIB operations manager in Wood, 5/2013). Between 2012 and 2015, the Green Investment Bank acquired stakes in already existing wind farms (see table in appendix 6, 4coffshore, 2015). Industry-led advisory bodies promoting the offshore wind industry proliferated during the Coalition Government. In June 2015, the new Conservative Government (elected in May 2015) announced plans to privatise the Green Investment Bank (Pratley, 2015).

7.1.1. Industry interests

Large businesses were well represented at newly created advisory bodies. The Offshore Wind Industry Strategy 2013 (HM Government, 2013) was based on a report by the Offshore Wind Industry Council (OWIC). This council was chaired by the Chief Corporate Officer of the utility Scottish Power. It included developers, representatives of the UK based supply chain, Government, Crown Estate, and devolved administrations, and the Offshore Wind Programme Board (OWPB). The latter had representatives from utilities and supply chain companies, Crown Estate, UK and Scottish Government, and Statutory Nature Conservation Bodies.

Large equipment manufacturers and electrical utilities dominated RenewableUK (formerly British Wind Energy Association), the sector's industry association. It lobbied government, participated in advisory committees, organised trade fairs, and had a relatively strong media presence. In November 2009, the REA (Renewable Energy Association) and BWEA (British Wind Energy Association) merger had been called off (Wood, 12/2009, p. 41). Since introduction of LEPs, private sector influence on local development policy and funding allocation had also increased.

oriented and more cost efficient" (Wood, 10/2010, p. 28). Renewables Advisory Board and, causing controversy across the electricity supply industry, Infrastructure Planning Commission were abolished. Other organisations were "under consideration" to be abolished, merged, or change in responsibility: Sustainable Development Commission, UK Atomic Energy Authority, Carbon Trust, Coal Authority, Ofgem and Energy Saving Trust. Committee on Climate Change, Fuel Poverty Advisory Group, Committee on Radioactive Waste Management, Nuclear Decommissioning Authority and Nuclear Liabilities Fund would be kept.

7.1.2. The trade union

Unite organised workers in the offshore wind turbine and electrical equipment industry. Unite did not support onshore wind, because of political and public opposition (cf. Hagget, 2011, officers, trade union, April 2012 and February, 2014), and despite surveys that attested public support of onshore wind turbines (e.g. by the BBC *in* Wood, 9/2013, pp. 8f). The English Vestas site was not organised by any trade union when it closed in 2009. However, when protesting workers, later joint by environmental campaigners, began occupying buildings at the Vestas blade factory on the Isle of Wight on 20th July 2009, following the announcement of the plant closure (Swarthmore College, *nd*) and the occupation turned into a month-long industrial dispute ending on 12th August 2009 (Swarthmore College, *nd*; Press Association, 2009), Unite officials and member of parliament Andrew Turner got involved in mediating between workers and plant management (Stevens, 2009).

Only, around 2013, Unite became more active regarding the wind turbine industry. As it also had members in the oil and gas sector, it announced (a compromise) supporting renewable *and* fossil fuel industrial policies (national officer, trade union, February 2014). In 2012, it signed a Memorandum of Understanding with RenewableUK in favour of developing the domestic renewables industry (RenewableUK, 2012a; officer, trade union, April 2012). Supporting nuclear, offshore wind, and fossil fuel Unite hoped to increase the number of manufacturing jobs in the UK. In 2013, Unite entered negotiations with Siemens attempting to get recognition for the new offshore wind turbine plant in Hull. However, Unite did not get involved in local economic policy. Despite enhancing collaboration of local businesses, public authorities, and other organisations, the newly created LEPs – replacing Regional Development Agencies (RDAs) from 2010 onwards – did not include the trade unions. Unite was not on any LEP boards and interviewed Unite officers were unaware of the LEPs' existence.

7.1.3. Manufacturing sites

The Vestas blade factory in Newport on the Isle of Wight in the South-East and the Siemens blade factory in Hull in the North-East of England exemplify the effects of changing industrial policy since the 2000s. Industrial policy under the Coalition Government (2010-2015) provided increasingly favourable conditions for inward

investment. Inward investment by large equipment manufacturers was not only dependent on available infrastructure, but more importantly on price mechanisms that supported electricity from offshore wind in the long-term. Producing large components in the UK would be considered by manufacturers when orders reached a “reasonable amount [of] roughly one hundred turbines per year over a five-year period” (manager, South-Wind, November 2014). The cases Vestas and Siemens illustrate the need for stable favourable demand and supply side industrial policies aiming at large scale:

“Sophistication increases in this order: foundations, towers, nacelles, and blades. The more megawatts to be installed the more likely it is a company will locate a factory close to the construction site. Another reason for a company to decide early if it moves production close to a future offshore wind farm is the likelihood that it will receive orders by the wind farm operators.

For [company] it is straight forward, as it will deploy a wind farm in a joint venture with the utility [...]. [Company] would be the first mover for [town].

[Town] finds itself in direct competition with [a town in Germany]: [The town in Germany] has all the infrastructure ready in place but is far from the UK [sic!] wind farms; [the English town] is close-by, has a lot of space, but virtually nothing has yet been developed.

Another option is the [...] site, where there is still one free spot in the delta. [This] also is the station of one hundred and ten maintenance workers from [names two large turbine manufacturers], as well as of other small and medium companies. The turbines in the existing fields are 6 MW and have 25-years servicing warranties with the manufacturer.”

Staff LEP, July 2013

Until 2009, the Vestas Newport plant produced onshore blades for the US market. As no favourable policy for onshore wind turbines emerged in England, and in the United States calls for domestic production rose, the production of onshore wind turbines was relocated to a plant in the State of Colorado, US in 2009 (Swarthmore College, *nd*). However, the production facilities on the Isle of Wight were reopened in 2015 (Vestas, 2014b). The Vestas’ plant closure can also be seen within the wider context of the company’s economic difficulties, which forced it to restructure and reduce surplus capacities across Europe between 2009 and 2011, as in Northern Europe demand for its turbines had not increased as expected (Bradbury, 2009, 29th July, Hawkes, 2010):

“The announcement [of the plant closure] was made in response to conditions in the Northern European markets not having met the company’s expectations. The current market conditions are caused by the credit crunch, weak currencies and a lack of local political action in certain markets.”

Vestas Wind Systems in Denmark, quoted in Bradbury, 2009

In particular UK planning law regarding onshore wind was considered a barrier to investors and growth of a domestic market:

“As a result of the current market conditions in Northern Europe and the planning process in the UK, Vestas has decided not to move forward with its plans to convert the factory into the production of 44-metre blades. The company initiated consultation with employee representatives at the blade factory on the Isle of Wight on 30 April 2009 about the future of the factory.”

Bradbury, 2009

Although Vestas’ blades could be adapted for offshore wind turbines, the market for offshore wind turbines was still too small:

“The Danish company manufactures small wind turbines that are not suitable for the UK onshore market. The blades might be usable offshore but the British North Sea market is at a very early stage of development and large orders could take up to five years to materialise – too long, argues Vestas, for it to keep its Isle of Wight manufacturing plant open.”

Macalister, 2009b

A Vestas spokesperson explained the 2009 plant closure by lower production costs (Macalister, 2009a) and “greater demand” for Vestas turbines in the US (Macalister, 2009b). The manufacturer however considered continuing operation of its prototype development facility at the site in Newport, if government support would be granted. Eventually, Vestas kept open its research and development facility on the Isle of Wight. In 2010, the facility employed two hundred and fifty research and development specialists, and two hundred and fifty staff at its sales centre in Warrington and at a repair and spare parts plant in Bristol (Hawkes, 2010).

In 2011, Vestas considered building a factory at the Port of Sheerness in Kent (The Guardian Environment Network, 2011; Wood 06/2012). The company searched for a

manufacturing site for its 7MW wind turbine. It acquired the ‘right of land’ to build a plant that would employ up to two thousand people (The Guardian Environment Network, 2011). But Vestas required political signals from Government that it would provide a stable and attractive investment environment:

“We need to make sure it makes sense businesswise (...). Before our customers can provide us with the needed order pipeline, they need to see stability in the market and a long-term political and regulatory certainty that ensures their business case. (...) Making that happen lies in the hands of the policy-makers, so we are looking forward to seeing the UK government providing the best possible terms for the offshore wind industry to truly take off and the potential jobs becoming a reality.”

Anders Sørensen, Vestas’ offshore president in The Guardian Environment Network, 2011

The plans to build a plant in Kent were not realised (Wood, 06/2012), as the regulatory environment stayed unstable. Eventually, in November 2014, Vestas announced returning to produce on the Isle of Wight (Shankleman, 2014). It planned producing blades for the Vestas 8MW turbine from the second half of the year 2015 onwards.

Vestas’ return to the England took place in a political environment that had much changed from when it had decided to close its plant:

“The announcement comes as a new government and industry-backed report on Wednesday reiterated that the UK is the number one market for offshore wind energy in the world, with potential investment opportunities reaching 21 billion pounds by 2020.”

Shankleman, 2014

The 8MW turbine would be produced for developer Dong Energy and its extension of the offshore wind farm Burbo Bank on Liverpool Bay. Vestas’ return to England can also be seen as a strategic move in its competition with Siemens, which opened a blade factory in Hull at a similar time; and both together show how the investment environment for offshore wind had vastly improved compared to previous years. Vestas chief executive Jens Tommerup was quoted in the Guardian:

“MHI Vestas Offshore Wind will become the first manufacturer with the capacity to serial produce blades for future offshore wind projects in the UK, and we look forward to sharing further aspects of our industrial strategy in due course.”

Shankleman, 2014

The negotiation, from 2007 through to 2016, over establishment of a blade factory in Hull by Siemens also illustrates the relevance of supply and demand side industrial policy. In 2007/2008, Regional Development Agency (RDA) *Yorkshire Forward* started negotiating with Siemens Wind Power (Hull Daily Mail, 2010-2013; researcher, university, July 2013; manager and staff, municipality, July 2013). Under the impression of the Labour Governments’ Grants for Business Investment scheme, which supported development of electricity generation from offshore wind, and Round 3 tendering in 2009, Associate British Ports (ABP), Hull City Council, East Riding Council, and University of Hull developed the project “Green Port Hull” (GPH) from 2010 onwards. The project to develop Hull’s Alexandra Dock as a site for renewable energy industries. The general elections of 2011 replaced the Labour Government by a Liberal Democrat-Conservative coalition. The new government replaced the Grants for Business Investment with the Regional Growth Fund (RGF) (60 million pounds, tendered in 2011/2012 and allocated for six years from 2013 onwards), and reformed governance of regional economic development.

When RDAs across England were abolished and quasi replaced by LEPs, with a transition phase from 2010 to 2012, Hull City Council continued negotiating with Siemens (manager and staff, municipality, July 2013), although in England local authorities, the City Councils, had relatively limited resources. For most of the funding they depended on central government, and regional development was not their statutory duty. However, the location of a Siemens factory was seen as an opportunity for Hull to contribute to the North East’s ‘Green Revolution’ and economic revival (Humber LEP, 2013a, p. 16). Hence, the Green Port Hull project was not compromised by the change of government.

As elsewhere, the Green Port Hull project was said to match the availability of docks, which had not been used since decline in the fishing industry. The docks were close to seabed allocated in Round 3 tenders for offshore wind farms. In January 2011, Siemens signed a Memorandum of Understanding (valid until June 2011) over the construction of a manufacturing plant for 6MW offshore wind turbines with the Association of British Ports (ABP). ABP agreed to make investments of approximately 100 million pounds to prepare the dock for construction. ABP received a 125-million-pound loan from the European Investment Bank for this (Hull Daily Mail, 2012). And Siemens agreed to start building its plant by mid-2012. Siemens received 130 acres at Hull's Alexandra Dock, and was expected to create eight hundred permanent jobs from 2013 onwards. The plant was assumed to produce two hundred turbines per year and to provide the Dogger Bank, Hornsea, and Norfolk offshore windfarms (Lea, 2011).

Although the Memorandum of Understanding ran out in mid-2011 without being further renewed, Hull City Council continued negotiating with Siemens. In September 2011, Hull City Council pledged five million pounds for Siemens out of its ten million pounds "New Look Spending Programme" central government grant (Hull Daily Mail, September, 20). At about the same time, it was reported that Siemens also negotiated with German and Danish locations to establish its plant. In 2011, the Siemens plant was estimated to be "up and running" by the end of 2014.

In May 2012, the Environment Agency (EA) recommended the development for conditional approval for fear of increased flooding of the towns Hull, Grimsby, and Immingham (Lea, 2012b). One day later the EA lifted its objection to the GPH planning application as ABP had provided for "sufficient habitat compensation". Opposition voiced by residents did not stop the plan. Both projects, port transformation and plant construction, achieved planning consent by Hull City Council in May 2012 (Lea, 2012a). However, Siemens postponed its final investment decision to early 2013.

The LEP supported the Green Port Hull project by applying for central government funding. A seconded staff from the consultancy Parsons Brinckerhoff, Balfour Beatty and the North-East Region, supported the Regional Growth Fund (RGF) bidding process (LEP, July 2013). Her role was to promote 'green technologies and renewables' within the LEP's strategy. The LEP acquired 25.7 million pounds from the RGF to support the

Hull Green Port project (Regional Growth Fund, [about 2013d]). In January 2013, Danish utility Dong and Siemens signed an agreement on the supply of thirty-five wind turbines of a total of three hundred turbines for the offshore windfarm at Westernmost Rough (Newton-Syms, 2013).

However, the EMR further postponed Siemens' plans to build the factory. In May 2013, Vince Cable, at that time Business Secretary, suggested that Green Port Hull would be postponed until after the next general elections in 2015 (Lea, 2013) and referred to the need of an appropriate "strike price", a "guaranteed price for renewable energy". In early 2014, despite planning consents, public subsidies, and attempts to focus the local businesses on renewables and offshore industry, no construction at the Alexandra Dock had yet started. Siemens' factory eventually opened end of 2015 and began hiring workers in early 2016 (Green Port Hull, 2016).

Important industrial policy changes under the Coalition Government (2010-2015) were shift of authority over planning applications to the Secretary of State, implementation of the EMR (Wood, 3/2013; 10/2013), favourable 'banding' of renewable obligations (ROC) for electricity from offshore wind, higher degree of involvement of utilities and their supply chain in policy design within Offshore Wind Industry Council, Offshore Wind Investment Organisation, and Centres for Offshore Renewables Engineering (HM Government, 2013). These might have largely increased investors' trust in the stability of the emerging framework (Kern et al., 2014). Also changes in local governance have contributed to create more favourable conditions for offshore wind turbine manufacturing. The blade factories on the Isle of Wight and in Hull illustrate this. The following sections detail supply and demand side policy changes that over the past decade or so fundamentally changed the conditions for offshore wind turbine manufacturing in England.

7.2. Supply side policy

Before privatisation of the electricity supply industry, the supply chain for heavy electrical equipment and energy technology was largely state-controlled. Liberalisation of international trade through the GATT and creation of the EU common market exposed the UK electrical industry to competition for which it was not prepared (Chesshire, 1996, Thomas, 1996a, Thomas, 1996b). The worldwide electrical equipment industry consolidated rapidly (Thomas, 1996b).

From 2002 onwards, once the Crown Estate had identified offshore wind farm developers, supply side policy for the offshore wind turbine industry expanded significantly. Funding for offshore wind farm developers, their supply chain, research and development and infrastructure was available under New Labour (1997-2010) and Coalition Government (2010-2015). Public subsidies for offshore wind turbines were argued to respond to increasing political pressure by UK industry for ‘domestic content’ (manager, South-Wind, November 2014). The industry requested components of wind turbines to be produced in the UK. But scarcity and high cost of skilled labour and high profit margins, which were expected by investors, made producing complex engineering products in the UK difficult.

7.2.1. Infrastructure and development grants

While electricity price subsidies incentivised wind farm developments, initially there was no incentive for ports to develop the necessary infrastructure for manufacturing and installation bases. UK ports were operated privately. Municipalities did not have sufficient funds and no planning authority for large infrastructure projects. The New Labour Government launched the Grants for Business Investment scheme, a 60-million-pound funding pot for Assisted Areas in England to which port owners with or without involvement of local authorities could apply. Developments related to green industries were eligible.

Offshore wind turbine manufacturers could access funding from the Regional Development Fund and get tax breaks, if they settled within Enterprise Zones. The Coalition’s spending review in September 2010 confirmed the 60 million pounds for new port infrastructure and 140 million pounds for low carbon technologies. Sudden availability of public funding for port infrastructure motivated many applications that

from a technical and commercial point of view were unreasonable and were never completed (manager, South-Wind, November 2014). These ports were either located too far from offshore wind farm zones or their tidal conditions were inadequate for installation and maintenance vessels.

7.2.2. Research and development

Before privatisation of the electricity supply industry, research and development (R&D) was mainly conducted by the state agency CEGB (Central Electricity and Gas Board). During the 1980s, the CEGB tentatively invested in small wind power projects “to become familiar with the technology”, but it preferred “large [power] plants in general and (...) nuclear power (...) in particular” (Cheshire, 1996, p. 31). Its achievements were hardly translated into the domestic supply chain and privatisation led to a “substantial reduction” in R&D funding. Public research funding for renewable energy technology declined strongly since the 1980s (UKREC, 2013). In 2002, direct research funding was at its low-point – 2.2 million pounds.

From 2002 onwards, when the first tender for offshore wind farms was prepared by the Crown Estate, R&D funding increased. In 2001, nine large electricity utilities and developers of offshore wind farms, Scottish Government and the predecessor of the Ministry DECC funded the Low Carbon Trust. The nine utilities were DONG Energy, E.ON, Mainstream Renewable Power, RWE, Scottish Power Renewables, SSE Renewables, Statkraft, Statoil, and Vattenfall. The Trust allocated R&D funding through competitive tenders (Low Carbon Trust, 2015). The Coalition Government (2010-2015) further increased influence of private sector companies on energy research policy by creating the Low Carbon Innovation Co-ordination Group (LCICG), which was to develop Technology Innovation Needs Assessments (TINAs) and Government’s Low Carbon Innovation Strategy plan until 2020 (HM Government, 2013).

Change of government in 2010 led to insecurity over funding. Although the Liberal Democrats had promised to support offshore wind farms, the Coalition Government announced cutting low carbon technology funding of the DECC by 85 million pounds (Wood, 7/2010, p. 31). The offshore wind grant was reduced to 10 million pounds, of which of which 5 million pounds went to seven unnamed companies, and 5 million pounds went to Siemens for developing a 6MW offshore wind turbine in the UK.

Lacking long-term commitment to funding R&D and infrastructure by Government was blamed for the absence of skilled jobs and labour in Hull, where Siemens planned a blade factory (staff, LEP, July 2013). However, NAMTEC, the National Metals Technology Centre, which provided technical and R&D support for oil and gas, aerospace and defence and power generation from fossil and renewable sources, was located in Rotherham, close to Sheffield, about seventy miles from Hull. Hull university's R&D activities in electronics, modelling and testing, and environmental research could be applied in the areas of "offshore wind, tidal devices, hydro-power, biofuels, renewable energy supply chains, CCU, mCHP and 3D visualisation (Regional Growth Fund, [about 2013b]). The university offered an engineering foundation course, which a local inter-firm VET provider had helped to design (staff, training provider, July 2013; researcher, July 2013). It also offered the "UK's first Master's degree programme with a focus on teaching advanced skills and knowledge critical to the renewables sector" and developed the MSc Environmental Technology (Renewable Energy) for students who aimed to work in the "onshore and offshore wind, wave and tidal power sectors" (Humber LEP, *nd c*, p. 14). The university had a "cube", a training pool for offshore maintenance and construction workers, which it rented out to third parties.

7.2.3. Education and training

Industry association RenewableUK reported a skill gap in engineering professions and offshore wind farm construction management. The skill gap was explained by low training investments over the past decades (HM Government, 2013; RenewableUK, 2011). On the other hand, engineering profession suffered from low reputation and decreasing student numbers (McInnes *in* Wood, 1/2013, p. 9-11, Woodward *in* Wood, 6/2012). Several programmes targeted raising young people's interest for work in the offshore wind industry: for example, "Champions for Wind" by the consortium Forewind (staff, LEP, July 2013).

But VET provision for the energy technology and utilities industry was fragmented, "crowded and complicated" and in a "permanent state of change" (Bonnett, 2008, p. 2). The sector had its own VET administration, the Sector Skills Council for Energy and Utility Skills (EU Skills). Electrical utilities could use the employer-led National Skills Academy for Power (NSAP). Large manufacturing and energy technology companies

either operated their own training centre, for example Siemens in Newcastle or funded inter-firm training providers. In 2010, City and Guilds launched the Wind Turbine Engineering Apprenticeship, which was taught at colleges and inter-firm training providers (HM Government, 2013, p. 51). The existing apprenticeship programmes seemed highly selective.

To increase skilled labour supply, LEPs and local authorities could submit bids for funding up-skilling programmes to City Deal programme, Regional Growth Fund and European Social Fund (staff, LEP, July 2013; manager and staff, municipality, July 2013). The Humber LEP in Hull worked together with a number of local engineering associations and engineering skills providers (staff, LEP, July 2013): Humber Marine Engineering Academy, Team Humber Marine Alliance, Renewables Network, Grimsby Renewables Partnership, and Humber Chemical Focus. The members of these networks were local large, small and medium sized businesses and charities.

The LEP was an incubator for ideas, for example creation of a ‘skills escalator’ for the renewables industry that would show workers how to develop from NVQ level 1 to 4 (staff, LEP, July 2013). Moreover, the LEP aimed to create awareness among local businesses through ‘skill pledges’. Also, the local population should learn about the opportunities, which would arise in the renewables industry. The LEP advertised this in the local newspaper, was present at public events and did school outreach work. The LEP was involved in promoting skill formation together with the Jobcentre. It contributed to ‘sector skill days’, similar to job fairs, for unemployed jobseekers.

The LEP had successfully applied for the City Deal programme, which allowed the LEP to tender funding from SFA and EFA among local VET providers (manager, LEP, November 2014; manager, college, November 2014). The Regional Growth Fund subsidised the Green Port Hull project. It had an Employment and Skills strand which provided: 1) wage subsidies for apprentices who were enrolled in an Advanced Engineering Apprenticeship (Level 3) and lived in Hull or the Yorkshire and Humber sub-region, 2) subsidies to engineering employers who up-skilled their workforce by one NVQ level (to level 3, 4 or 5) and engaged in enhancing employability skills (50 per cent of the direct costs), 3) subsidies for up to 25 per cent of the total costs for manufacture and maintenance of wind turbines and production equipment at original

equipment manufacturers (OEMs) and first tier suppliers, and 4) a 20 per cent wage subsidy for the first year of employment for workers from disadvantaged groups at OEMs and their suppliers (Regional Growth Fund, *nd f*).

The Humber LEP also helped a consortium of five regional colleges applying for funding from the ESF (staff, LEP, July 2013). The colleges won 3.2 million pounds. Skill formation in the region was funded by successful bids to Regional Growth Fund, “Employer Ownership of Skills” programme, ERDF, ESF, Local Growth Fund, Learning Fund and Growing Places Fund (manager, LEP, November 2014).

7.2.4. Supply chain and process optimisation

University of Hull’s CASS unit was in charge of implementing the Green Port Growth R&D Support and Funding component. This meant CASS supported local businesses with “renewable energy R&D expertise”, assisted with identifying “R&D needs”, developed “R&D implementation programmes”, engaged with the renewable energy technology supply chain “from a R&D perspective”, and provided support with accessing R&D funding and expertise from third parties (Regional Growth Fund, [about 2013c]). The university was interested in providing services to the offshore industry: environmental impact assessment, renting out the training pool, advising companies on research and development, helping companies to find network partners. However, interviewees stated that they did not expect any of the local businesses to become part of offshore wind turbine manufacturers’ technology supply chain (July 2013).

Across England, the Regional Growth Fund was to fund the Offshore Wind Supply Chain Growth Programme with 20 million pounds (HM Government, 2013).

Manufacturing Advisory Service (MAS) and Grant Thornton, RenewableUK and Advanced Manufacturing Research Centre (AMRC) implemented the programme. Small and medium enterprises were to receive “market insight in customer needs and (...) a comprehensive package of support, (...) to improve positioning for new contract opportunities, [and] an innovative design project or access to investment finance” (HM Government, 2013, p. 21). Offshore wind farm equipment manufacturers could apply to the Advanced Manufacturing Supply Chain Initiative (AMSCI), which allocated 120 million pounds in a competitive tender. Two rounds were conducted in 2013.

The Coalition Government on the one hand increased incumbent equipment manufacturers' and utilities' influence on industrial policy and indirectly promoted their control over their market. On the other hand, Government wanted a UK supply chain that was "cost competitive, innovative, provided quality and reliable products and had the capacity to bid for and win contracts, [where] new entrants increased capacity, introduced innovations, drove down costs and helped prevent bottlenecks occurring" (HM Government, 2013, p. 20).

It is however hard to see how new companies could enter a market that was politically co-regulated by their larger competitors. For example, private sector companies in the joint Offshore Wind Project Board would "assess the gaps revealed by the supply chain analysis to consider if they can be filled by UK companies active in other sectors or through inward investment in the UK. Together they will develop a suitable course of action to target appropriate companies" (HM Government, 2013, p. 26).

7.3. Demand side policy

UK Government's demand side policy mainly secured large investors' profits. Despite talk about 'localising' economic development, centralisation of tenders for development funding favoured large actors, for example Crown Estate, large banks, utilities and their supply chain. This is evident from the list of successful RGF bids (BIS, [around 2013]).

7.3.1. Provision of infrastructure

Demand for offshore wind turbines was initiated by the Crown Estate's designation of specific zones of the English, Scottish and Northern Irish seabed for construction of offshore wind farms.³⁴

³⁴ The Crown Estate manages the UK's seabed and other properties of the Crown. It is 'an independent commercial business, created by Act of Parliament' (The Crown Estate 2015a), and owned 'by the Sovereign in the right of the Crown' (The Crown Estate, 2015b). The Crown Estate is managed by its executive staff, and according to the principles of profit maximisation.³⁴ The Crown Estate's profits return to the UK Treasury. Its strategic focus is 'investment in core sectors of the West End, dominant regional retail and leisure, agricultural and strategic land, and offshore wind'. The dimension of the Crown Estate's business is exemplified in 2014/2015 numbers: it managed "an 11.5 billion pounds property portfolio" and delivered "a net revenue profit of 285.1 million pounds (2014/15) to the Treasury" (The Crown Estate, 2015a).

Offshore wind farm developers could apply for public funding from the Offshore Wind Capital Grant Scheme, which was jointly funded by Department for Trade and Investment (DTI) and New Opportunities Fund of the Lottery Fund (New Opportunities Fund, 2009). The scheme targeted offshore wind farm developments in areas that had been tendered under the Crown Estate's Round 1 and 2, and demonstration projects of Round 3 developments. The total amounted to 102 million pounds. A maximum of 10 million per project or 40 per cent of total costs could be funded.

In 2012, Treasury announced funding for the "pipeline of projects": 53 billion pounds for eleven European Pressurized Nuclear Reactors, 54 billion pounds for offshore wind, and 20 billion pounds for power transmission and distribution. Small scale electricity infrastructure would receive significantly less by Defra: onshore wind projects 5 billion pounds, biomass electricity generation less than 1 billion pounds, and an anaerobic digester scheme 10 million pounds (Wood, 1/2012). DECC earmarked 10 million pounds for Local Environment Assessment.

The European Investment Bank provided loans: 300 million Euros for the European Interconnector project, 200 million Euros for renewable energy businesses with wind turbines by 2012 (Wood, 10/2009, p. 34), and 900 million pounds to support 50 per cent of DECC funding for Offshore Transmission Owners (OFTOs). These would be commissioned to operate electricity transmission from offshore wind farms for a 20-year period (Wood, 9/2013).³⁵

7.3.2. Electricity price subsidies

Early price support mechanisms (NFFO 1-4, NETA and BETTA) were based on bids. Competitive bidding was counter-productive to developing low carbon technologies (Gross and Heptonstall, 2010, Mitchel, 1996). The need to bid represented "an entry

³⁵ In 2009, thirteen bidders have qualified to participate in the tender process for six wind farms (Staoil/Statkraft 315 MW Sheringham Shoal, Vattenfall 150MW Ormonde and 300MW Thanet, SSE/RWE 504MW Greater Garbard, Dong 2x 178 MW at Walney): ABN Amro Infrastructure Capital Management, Balfour Beatty Capital, Dong Energy Sales and Distribution A/S, Equitix (consortium of Equitix and AMP), ESB International, Frontier Power Consortium (Frontier Power and Infracapital Partners), Imera, Macquarie Capital Group, National Grid Offshore, RWE Npower, SSE Offshore Transmission, a Statkraft UK and StatoilHydro UK consortium, Transmission Capital Partners (consortium of International Public Partnerships, Transmission Capital and Amber Infrastructure) (Wood, 11/2009, p.67)

barrier for smaller new entrants” (Gross and Heptonstall, 2010, p. 335). The mechanisms’ periodicity provoked supply bottlenecks and increased imports of wind turbines. The only UK producer Wind Energy Group (WEG) could just not meet demand within the set deadlines (Mitchel and Woodmann, 2010). Bids inflated the number of planned projects relative to the amount that would be realised. Exaggeration of the scale of expansion created by the bids, reinforced public opinion against onshore wind. Recurrent changes to support schemes and periodical reviews dissuaded long-term investments (Gross and Heptonstall, 2010, p. 341).

The price subsidies’ initially non-discriminatory approach towards technology favoured the cheapest, standard, and large-scale solutions and hindered innovative energy systems, small producers and realisation of social and environmental benefits (Mitchel and Woodmann, 2010). More recent support mechanisms were still based on competitive tenders and created “conditions that were relatively unfavourable to the rapid adoption of renewable energy” (Gross and Heptonstall, 2010, p. 352). This however seems to have changed under the Coalition Government (2010-2015), as the following sections will discuss.

After privatisation of the electricity supply industry in the 1990s, Government continued regulating and steering the electricity market through various price mechanisms (Mitchel and Woodmann, 2010, Rutledge and Wright, 2010). Subsidies for low carbon technologies were introduced in 1990: The Non-Fossil-Fuel Obligation (NFFO) 1, contract for difference (CfD), and the Fossil Fuel Levy (FFL). The NFFO subsidy was intended to support electricity generated by nuclear power plants, as attempts to privatise nuclear power plants had previously failed (Thomas, 1996a), and a formula was needed that would hide the subsidy to nuclear power from European Commission and the public (Gross and Heptonstall, 2010, Mitchel and Woodmann, 2010, Thomas, 2006). During the 1990s, four NFFOs were tendered (1991, 1994, 1995, 1997). From April 2001, a New Electricity Trading Arrangements (NETA) and later the British Electricity Trading and Transmission Arrangements (BETTA) followed. Both were “technology neutral”, but contained support mechanisms for electricity generated from renewable sources (Mitchel and Connor, 2004 *in* Gross and Heptonstall, 2010, p. 339). NETA and BETTA

were based on the mechanism of Renewable Obligation Certificates (ROCs)³⁶ and the Climate Change Levy (CCL) (Helm, 2010 [2004]). A ‘banding’ review aimed at establishing differentiated ROC price levels. It started in 2006. In 2009, important changes were introduced for electricity generated by offshore wind farms. The Renewables Obligation Order 2009 “introduced banding (...) by technology so that higher-cost technologies earned more ROCs per unit of electricity than lower-cost technologies” (Gross and Heptonstall, 2010, p. 343).

In 2010, right after its election the Coalition Government announced a new Energy Bill (Wood, 5/2010, p. 66). Its aim was to promote energy efficiency, carbon emission reduction at coal fired plants and new nuclear. The Coalition Government also initiated the EMR, which would change support for electricity generation technologies. The reform would enter into force in 2017. The ROC banding review started in October 2010 (Wood, 2009-2014).

In 2010, Vestas, General Electric, Siemens, and Gamesa had announced plans to open factories in England, possibly under the impression of Round 3 tenders in 2009. But their plans were not realised for a number of years, because the regulatory environment

³⁶ With the introduction of Renewable Obligation Certificates, legislation set annual targets for the percentage of electricity from a renewable source that electricity suppliers (retailers) would have to purchase from electricity generators in wholesale markets. These targets were gradually increased.

“The RO is a ‘certificate trading scheme’. Renewable energy generators [electricity producers] are awarded Renewable Obligation Certificates (ROCs) for their output, which they can all (?) to suppliers. (...) Suppliers require ROCs to prove compliance with the [legal] target.” They have to present their ROCs annually to the regulatory agency Ofgem. The price of ROCs fluctuates according to supply and demand. It increases with the demand by suppliers, which depends on their total sales, and decreases with the increase of ROCs available on the market, thus the increase of electricity generated from renewable sources. “If suppliers end each year without sufficient ROCs to cover their obligation, they must make a payment into a buy-out fund. The buy-out fund price is fixed per MWh of shortfall, and is adjusted in line with inflation each year, it ensures that ROC prices are capped, hence protecting consumers. The proceeds of the buy-out fund are paid back to suppliers in proportion to how many ROCs they have presented. (...) suppliers pass the cost of compliance on [to consumers] as an increase in the tariff for the electricity they sell. (...) The market for ROCs is flexible. ROCs can be traded independently from the electricity produced by renewable generators, or sold together with it. Generators can enter into bilateral contracts with suppliers for ROC purchase or sell them through an open auction process, equivalent to a spot market. Auctions are run online by the Non-Fossil Fuel Purchasing Agency several times a year, and allow a transparent wholesale price to emerge for ROCs. As well as buying ROCs from independent renewable generators either directly or at auction, suppliers can become renewable generators themselves, build their own renewable energy schemes and generate their own ROCs” (Heptonstall, 2008a in Gross and Heptonstall, 2010, p. 340). From 2002 to 2009 RO legislations undergoes several modifications detailed in Gross and Heptonstall, 2010, p. 343.

was undergoing “unpredictable” changes (manager, South-Wind, November 2014). The Coalition Government’s announcement of funding cuts, EMR and ‘banding’ review (between October 2010 and July 2012) irritated investors (Wood 12/2012). This had repercussions on utilities, technology manufacturers and equipment suppliers. General Electric decided to abandon the European offshore wind turbine market (manager, South-Wind, November 2014). Vestas reopened its blade factory on the Isle of Wight in 2015. Siemens opened its blade factory in Hull only in 2016, after several years of negotiations.

When the final ROC banding review in July 2012 fixed a stepwise reduction of ROC/MWh between April 2013 and March 2017, original equipment manufacturers rushed to meet the deadline for being eligible for higher ROC payments. Developers who felt that their equipment manufacturers would not be able to supply components on time, dropped or significantly reduced their contracts (manager, South-Wind, November 2014). Asked why so many projects were dropped in 2013 one manager explained:

“One idea is that the utilities were making enough money with onshore wind. Offshore wind on the contrary is a high-risk business. Plus, the development of infrastructure projects is not [the utilities’] field of expertise.

Second, the Electricity Market Reform has brought a lot of insecurity over the calculation of returns on investment. Centrica had invested about 50 million pounds into development of the project Race Band. They were as far as selecting the turbines, when they abandoned the entire project. Similarly, RWE and its project Galloper. For them the nuclear accident in Fukushima and the phase out of nuclear energy production in Germany, meant that they lost the money, which they would have used to develop their offshore wind projects.

The only utilities left in the business for offshore wind are the ones with state involvement. They never run out of cash: Dong, Statkraft, EDF and Vattenfall. They don’t have big capital problems, but they will only buy Siemens and Vestas turbines – continental companies buy from continental companies – no matter what the EU competition law rules. They will not buy RePower or GE turbines. These competitors are used as a ‘pricing strategy’.

When ROC banding dropped at the end of 2013, the OEMs rushed to meet the deadline for being eligible for higher ROC payments. Developers who felt their OEMs would not be able to supply the components on time, and would not be able to finish the project on time, dropped the project, no matter how far it was advanced.”

Manager, South-Wind, November 2014

Utility E.ON reduced plans for the Rampion offshore windfarm by about 25 per cent of its surface, EDF and Eneco reduced the amount of turbines for their Navitus Bay offshore windfarm by thirty-five. Scottish power put development of offshore wind farm Argyll Array on hold (Wood, 12/2012). However, the regulatory regime gradually developed in favour of wind turbine manufacturers:

“If nothing had changed, things would have been better for offshore wind. The CfD [Contracts for Difference] timing and the time EIAs [Environmental Impact Assessments] took have slowed down the process.

ROCs [Renewable Obligations Certificates], which are replaced by the CfDs, were disliked by the companies as their price was instable because determined in a market [according to a complicated auction process]. However, the companies got used to them.

The CfDs are full of dilemmas. To know the return of investments, the costing needs to be known a long time in advance. The supplier contract needs to be signed much earlier, which means more stability for the supplier, but more financial risk for the utility, because it will suffer the consequences from shifting margins, if this is not buffered by the CfD.... The OEMs need to be known when the bid for the project is put in at the Crown Estate.”

Manager, South-Wind, November 2014

Electricity generators could apply for CfDs from spring 2013 (HM Government, 2013). Successful applicants would be supported from 2014 onwards. Generators could choose between CfDs and ROCs until the latter's phase out in 2017. To manage the transition from one scheme to another, Government announced a “Final Investment Decision Enabling Programme” for developers (Wood, 3/2013, p. 75). The European Commission launched a review of the EMR in the context of EU state aid rules. It finally approved the use of CfDs in September 2013 (Wood, 10/2013).

7.3.3. Spatial planning and construction regulations

The Crown Estate allocated seabed around the UK in six different tendering rounds. The first three rounds were aimed at attracting “commercial development of offshore wind farms” (The Crown Estate, 2015c), and are known as Round 1 (started in the year 2000), Round 2 (mid-2003) and Round 3 (2009) (The Crown Estate, 2015d). In these rounds

“prospective developers bid for site option agreements” (Söderholm and Pettersson, 2011, p. 524). Rounds 4 and 5 allocated seabeds in Scotland and Northern Irish sea (The Crown Estate, 2013a). The sixth round allocated seabed for “testing of emerging offshore wind technologies, including floating announced in mid-2013”.

For rounds 1 and 2, developers themselves proposed seabed areas (The Crown Estate, 2015d). The selection process consisted of three stages: “(a) pre-qualification (e.g. according to financial standing, and offshore development expertise), (b) site allocation and (c) granting of agreements for lease” (Pettersson, 2008 in Söderholm and Pettersson, 2011, p. 524). In round 3, the Crown Estate relied on an “Offshore Energy Strategic Environmental Assessment (SEA)” conducted by DECC and SEA Steering Group.³⁷ It approached a selected number of developers and asked for their bids (The Crown Estate, 2015d). Again, developers were involved in the identification of adequate sites for new developments (Pettersson, 2008 in Söderholm and Pettersson, 2011, p. 524).

Offshore wind farms counted as Nationally Significant Infrastructure Projects (NSIPs). This put them under the Department for Communities and Local Government’s authority. To streamline application processes for various required permits, an Independent Planning Commission was set up in 2009. It was put in charge of deciding applications for projects above certain capacity limits (in MW), which was established by the Planning Act of 2008. This practically concerned all offshore wind farms. Government regularly issued energy policy statements which provided guidance.

In 2010, Government also announced abolition of the Independent Planning Commission by its Localism Bill 2011 (Wood, 2009-2014). In April 2012, the Independent Planning Commission was replaced by the Major Infrastructure Unit, which became part of the Department for Communities and Local Government. The Major Infrastructure Unit would work alongside the Planning Inspectorate. Large infrastructure

³⁷ The SEA (Marine Energy Strategic Environmental Assessment) informs Ministerial decisions regarding the development of infrastructural development projects having implications on the coastal and water environment. It prescribes a process of consultation involving stakeholders from “the public environmental authorities and other bodies” and if likely to be affected “neighbouring states”. The SEA process is conducted by the DECC and the SEA Steering Group, which includes “departmental representatives, conservation and other agencies, NGOs, industry representatives and independent experts.” The aim is to ponder “environmental protection and sustainable development” with infrastructural developments “promoting economic development of the UK’s offshore energy resources”. (DECC, 2012).

projects, such as new power stations and new power line projects, would be subject to approval by the Secretaries of State based on the Major Infrastructure Unit's recommendations (Wood, 5/2010, p. 66). The House of Commons would approve National Policy Statements (NPS), which until then were "merely discussed in parliament" (Wood, 12/2010, p. 62). Developers, industry and other supporters of offshore wind largely criticised this change. They expected a rising number of delayed decisions. The table below sums up the six rounds of offshore wind farm tenders.

Table 9 Rounds of tenders for offshore wind farms by the Crown Estate

	Publication of tender	Number of turbines	Total capacity of all operational projects	Distance from shore	Number originally allocated	Operational wind farms
Round 1	2000	30 maximum	1.2 GW (includes extension)	'Close'	17	13
Round 2	2003		2.4 GW (include extension)	The Greater Wash, the Thames Estuary and Liverpool Bay, within and outside the 12 nautical mile territorial waters from the shore	16	8
Extension round 1 & 2	2010					
Round 3	2009		up to 33 GW		9	
Scotland	nn		2.28 GW	The Beatrice, Neart na Gaoithe and Inch Cape	4	
Northern Ireland	2012		600 MW		1	
Test fields	2013	Up to 15	100 MW per test field			

Based on The Crown Estate, 2015c; 2015d; 2013; and author's own calculations

7.3.4. Targets for carbon emissions and renewable energy

Climate Change Act 2008 set national targets for carbon emissions – “at least 34 per cent by 2020, and at least 80 per cent by 2050, taking 1990 as the base year” (HM Government, 2013, p. 61). EC Renewable Energy Directive 2009 set a target of 15 per cent of energy consumption from renewable sources by 2020. UK Government planned to periodically set and increase reduction targets until 80 per cent carbon reduction would be achieved by 2050. Rationale was to “provide a level of predictability for UK firms and households to plan and invest for a low-carbon economy”, in other words to make forecasts of market developments easier (Committee on Climate Change, 2015).

Government established carbon emission reduction targets through the Carbon Budget. This was based on recommendations by the Committee on Climate Change. Since 2008, Government had decided on four Carbon Budgets.³⁸ Another was announced in 2016 for the period 2028–2032 (Committee on Climate Change, 2015). Coordinated increase of targets aimed at avoiding a “too rapid (...) shift [that] would require costly scrappage of higher carbon investments before the end of their lives”. One can assume that the periodical setting of targets also provided opportunities for utilities and large equipment suppliers to lobby for convenient carbon reduction targets and renegotiate their market conditions.

7.3.5. Marketing and inward investment

While in Denmark, government, industry associations and trade unions supported offshoring of jobs because this was part of domestic manufacturers’ expansion strategy, UK Government favoured ‘inward investment’. The Offshore Wind Industry Council (OWIC), which oversaw delivery of the Coalition’s Offshore Wind Industry Strategy 2013, was co-located with UK Trade and Invest (UKTI). UKTI also hosted the Offshore Wind Investment Organisation (OWIO). The latter aimed at attracting inward investment and represented domestic companies abroad (HM Government, 2013). UKTI was a “private sector-led body” (Wood, 8/2013, p. 4; HM Government, 2013). Also, the Centres for Offshore Renewables Engineering (COREs), joint projects of Government and the regions Great Yarmouth and Lowestoft, Humber, Kent, Liverpool City, North

³⁸ 2008–2012: 23 per cent below the level of 1990, 2013–2017: 29 per cent, 2018–2020: 35 per cent, –2027: 50 per cent (Committee on Climate Change, 2015).

Eastern and Tees Valley were to attract inward investment (HM Government, 2013). Local Enterprise Partnerships had signed a Memorandum of Understanding on attracting inward investment.

8. Comparative discussion and conclusion

This section compares energy and industrial policy across the three countries. It highlights how industrial policy impacted investors and emergence of the offshore wind turbine industry.

The most successful offshore wind turbine manufacturers are from Denmark. Denmark also has a significant equipment supply chain. Structurally weak parts of Northern Germany have attracted turbine manufacturers. The manufacturers relied on suppliers located in Western and Southern Germany (Pohl, 2013), and Central and Eastern Europe (works council, Seawing, July 2013; works council, East-Wind, July 2013). England had no production site of large offshore wind turbine components before 2015. Roughly 80 per cent the components and services used for offshore wind farms in England were imported (HM Government, 2013; cf. Wood, 1/2011). In contrast, the UK led all other European countries in terms of offshore wind turbine deployment. Denmark came second and Germany third. However, offshore wind turbines in Germany contributed only a small part to the country's wind turbine capacity. Investments in offshore wind were not taking off as expected.

Industrial development in each country was related to transformation of the electricity supply industry and energy policy. Over the past four decades, Denmark's industrial policy managed to align interests of large utilities, municipalities, industrial organisations, and the public to support offshore wind turbines (cf. Karnøe and Garud, 2012). In Germany, industrial policy supported new actors in use and production of renewable energy technology, but failed early on to interest large and politically powerful utilities in renewable energy expansion (cf. Berkel, 2013, Richter, 2013). In England, industrial policy for renewables was half-hearted for many years, and actually aimed to support 'low carbon' nuclear power (Mitchel, 1996, Helm, 2010 [2004], Rutledge and Wright, 2010). Only the Crown Estate's and large utilities' joint effort made large-scale offshore wind investments, and only these, commercially viable for incumbent utilities (Kern et al., 2014).

In Denmark, R&D subsidies go back to the 1970s. Taxes on fossil fuels were used to promote research into renewable energy technology (Sovacool, 2013). R&D support in Denmark encouraged collaboration between public research institutes and private sector, the former as service providers to the latter. In Germany, research and development seems to have been dominated by public research institutes but collaboration with the private sector was not uncommon. In the early phases of offshore wind, public-private-partnerships also involved social stakeholders, which might have slowed down initial deployment and hindered large-scale deployment of offshore wind. But it also allowed more democratic and socially equitable decision-making (Douve and Ehler, 2009, Hagget, 2011). Later, R&D for the private sector through public institutes were based on commercial contracts, and halted when the offshore wind turbine manufacturers plunged into economic difficulties. In England, large utilities and developers controlled the Low Carbon Trust, and through this an important part of R&D in the area of renewable energy technology.

In Denmark and Germany, VET was largely state-funded, but not exclusively and in the same way. Large manufacturers required service and installation technicians to acquire their own specific training certificates. These were provided by private companies that had been accredited by the manufacturers. Pre-requirements for specialised training were skilled workers' qualifications, which in Denmark and Germany could be gained at public vocational schools. In Germany, municipalities and labour market authorities had designed short-courses and vocational apprenticeships for the long-term unemployed and disadvantaged school-leavers. In contrast, in England, access to 'good' VET was highly selective. Subsidised by SFA, companies sponsored apprentices at inter-firm training providers. These also conducted pre-selection for the companies. College apprenticeships were perceived second class.

In Denmark, in recent years, training and consultancy services have helped supply chain access for small and medium companies. In Germany, research and development and commercialisation of onshore wind were supported from early onwards (Simmie et al., 2014). In recent years however, large equipment manufacturers were largely left to themselves to improve their supply chain. The generally small size of contracts did not give much opportunity and incentives to innovate. In England, the Offshore Wind

Industrial Strategy (HM Government, 2013) introduced funding for supply chain analysis and improvement, and allocated control over funding to large utilities and their suppliers.

While in Denmark and England, seabed was tendered in commercial bids, in Germany seabed allocation was an administrative, but also political process. Denmark had an “one-stop-approval” process (Söderholm and Pettersson, 2011). In England, tenders had led to collaboration between the Crown Estate and private developers. In both countries, seabed had been allocated in well-accessible areas. In Germany, planning favoured environmental interests and assigned seabed far off the shore, making offshore development technically difficult and expensive (Douvere and Ehler, 2009).

In contrast, coastal municipalities and *Länder* in Germany accommodated infrastructure requirements of offshore wind turbine manufacturers, up-skilled the workforce, and supported investment in new production sites (Pohl, 2013). Danish support for infrastructure was hard to retrace but was highly likely. In England, support of infrastructure came from Government funding pots under New Labour and Coalition Government. Funding was allocated through competitive bids from (BIS, [around 2013], Dawley, 2013, HM Government, 2013, Wood, 2009-2014). Ports were privately operated and could submit their own bids for infrastructure development. Spatial planning and construction regulation for large infrastructure became more centralised under the Coalition Government (Wood, 2009-2014).

Electricity price subsidies in Denmark were from early on targeted at transferring funding from fossil fuel to wind energy support schemes (Sovacool, 2013). Also, Germany provided support schemes early on. This resulted in a fast and wide expansion of onshore renewable energy technology (wind and photovoltaic) (Lauber and Mez, 2007). From the late 2000s onwards, energy policy turned more erratic. Favourable policies resulted from exogenous events, such as the Fukushima nuclear accident in 2011. But large incumbent utilities were quick to reaffirm their political power and interest in fossil fuel technology (Berkel, 2013, Pahle, 2010, Richter, 2013, Winter, 2013). In England, electricity price subsidies did for a long time not favour expansion of renewables (Jacobsson et al., 2009, Mitchel, 1996, Mitchel and Woodmann, 2010, Rutledge and Wright, 2010). A more predictable policy framework emerged under the

Coalition Government, which enhanced collaboration between Crown Estate, large utilities, large manufacturers and governmental bodies (Kern et al., 2014).

Targets for carbon emissions and renewable energy resulted from Directive 2009/28/EC. However, each member-state could decide more ambitious goals and how to reach the target. The UK committed to the lower 80 per cent of carbon emission reduction suggested by the EC (Committee on Climate Change, 2015), while Germany and Denmark left it open if they aimed for 80 or 95 per cent of carbon emission reduction (Smith Stegen and Seel, 2013). Denmark set the most ambitious target to cover 100 per cent energy consumption with renewable energy by 2050 (Danish Government, 2011). The UK committed to 15 per cent by the year 2020 (Committee on Climate Change, 2015), Germany to 40 per cent by 2020, and 80 per cent by 2050 (Arbeitsgemeinschaft Energiebilanz e.V., 2013 in Smith Stegen and Seel, 2013). In the UK, the Committee for Climate Change set intermediary targets explicitly in order not to disturb investors and to allow incumbent utilities to make a smooth transition to low carbon electricity generation (Committee on Climate Change, 2015). Danish Government lobbied European level for higher carbon reduction and renewables deployment targets and for lowering export barriers (Danish Government, 2013).

In Denmark, government and industrial associations actively supported offshoring of jobs with relocation subsidies (interview, lobbyist, June 2014, Kebmin, 2014b, Kebmin, 2014a). In Germany, offshoring was opposed out of fear of job losses (trade union officer, July 2012, manager, municipality, May 2013). Local policy-makers were ready to spend money to keep jobs locally. In England, focus was on inward investment (2010-2013, interviews, LEP, July 2013, November 2014, Wood, 2009-2014). High amounts of subsidies were available, through infrastructure grants, subsidised investment capital and tax credits.

This chapter presented the European offshore wind turbine sector and its regulatory framework. It discussed Denmark's, Germany's, and the UK's, in particular England's, energy and industrial policy, and their varying support of the offshore wind turbine industry. The chapter discussed the role of regulatory bodies and governance institutions, and supply side and demand side policies.

Based on previous studies of the offshore wind industry (Lewis and Wiser, 2007, Dawley, 2013, Pohl, 2013, Simmie, 2012, Simmie et al., 2014) and the Varieties of Capitalisms approach (Hall and Soskice, 2001), supply side policies have been defined as policies that were aimed at facilitating market participation of domestic producers, through public provision of infrastructure and tax credits for manufacturers, support of research and development, provision of skills, and support of supply chain and process optimisation. Based on previous studies of deployment of offshore wind turbines, *demand side policies* were defined as policies that supported demand for offshore wind turbine technology, through infrastructure grants for building offshore wind farms, price subsidies for electricity from offshore wind turbines, favourable spatial planning and approval regulations for offshore wind farms, allocation of seabed for wind farm construction, domestic and international targets for renewable energy technology deployment and reduction of carbon emissions, and support for marketing and establishment of production sites in other countries (*offshoring*).

The chapter attempted to illustrate how Denmark was able to make supply side and demand side favourably match. Danish manufacturers also benefitted from the opening of international markets. The chapter discussed Germany failed to make supply and demand side match because of unresolved conflicts of interest among parties and within the industry. Finally, the chapter has showed how in England a coalition of interest for offshore wind turbine deployment, and ‘post-hoc’ supply side industrial policy emerged.

Supply and demand side policy contributed to offshore wind turbine manufacturers’ economic success. While in Denmark over the past three or four decades, European market leaders for offshore wind turbines emerged, offshore wind turbine manufacturers in Germany had to deal with a lack of contracts. In the England, almost after a decade of negotiations with various government bodies, the company Siemens began staffing its new offshore wind turbine equipment factory. And Vestas had re-opened its blades factory due to more favourable industrial policy. Industrial policy has important implications for skill formation and job quality. This will be discussed in the next two chapters.

CHAPTER V: SKILL FORMATION

1. Introduction

Within the comparative industrial relations and sociology of work literature Denmark and Germany are described as similarly coordinated skill formation regimes, as both rely social partnership, which provides broad occupational skill-sets (Hanf, 2011) for high-road production models (Culpepper, 1996, Hall and Soskice, 2001, Streeck, 1992, Thelen, 2004, Thelen, 2014) and sector-wide portable skills (Marsden, 1999, Martin, 2011). England is characterised by a fragmented skill formation regime (Clarke and Wall, 1998, Grugulis and Lloyd, 2010, Sissons and Jones, 2014) that provides narrow task related skills (Winch, 2011), and therefore only allows for a production model that requires few occupational skills. This view has been challenged by others who find a polarisation between highly skilled jobs and very low-skill jobs (Brown and Hesketh, 2004, Goos and Manning, 2003, Lawton, 2009, Nolan and Wood, 2003 all in Grugulis and Lloyd, 2010) and a polarisation of investment into skill formation by employers (Gallie, 1991 for the 1980s, Lindsay et al., 2013 for the 1990s).

This chapter presents findings on three related questions: First, how far was the new industry shaped by locally available skills, second, how was publicly available skill formation designed and provided to the emerging offshore wind turbine industry, and, third, how was skill formation within and for the manufacturers impacted by supply and demand side policy?

The next paragraphs introduce findings on the skill provision in the local labour market, and on how manufacturers themselves responded to the available skill set. This is followed by a comparison of how far in each country initial and continued vocational education and training (VET) and training as part of active labour market policy (ALMP) were provided, how skill formation providers engaged with the new industry, and how far employers got involved in skill formation and its funding. It will also consider whether skill formation was inclusive of a variety of participants. This distinction loosely follows Thelen's (2014) and Bussemeyer and Trampusch's (2012) framework for the comparison of vocational skill formation regimes. Lastly, findings are presented on how far skill formation was related to supply side policy, and was impacted

by demand side policy. It is suggested that skill formation in Denmark is a ‘permanent’, in Germany an ‘ad hoc’, and in England a ‘post hoc’ industrial policy feature. This last section highlights conflicts between supply-side policy aimed at increasing skill provision, the institutional framework of skill formation, and demand-side policies.

2. Locally available skills and the new industry

This section explores how far the new industry was shaped by locally available skills. Blade production was less investment intensive than assembly of nacelles and generators, as it required no large machines, metal presses, or robots; it also did not rely on a complex supply chain (manager, South-Wind, November 2014). Blade manufacturing was more labour intensive than machine assembly (consultant, July 2013; site manager, Seawing, February 2014; HR department West-Wind, June 2014), and hence had stronger labour market effects (HR department, June 2014; staff, LEP, July 2013). Compared to nacelle assembly the worker ratio in blade production was roughly “seven or six to one” (HR department). Blade production was said to be “manufacturing”, requiring more manual skills and physical labour than nacelle “assembly”. “Sophistication” –meaning workforce needs – increased from foundations, to towers, nacelles, and blades (consultant, July 2013).

One manager stated: “There is a rule of thumb: for one man who works in the assembly of the nacelle, there are two who equip the tower, and three [who] work on the blade” (November 2014). As blade production was less skill intensive, blade workers could be trained faster than electro mechanics (Jaax, 2016). Therefore, blade production was thought to fit well into ‘low-skill’ labour markets (manager, South-Wind, November 2014).

2.1. The local labour markets

The regions where manufacturers and skill formation were studied had suffered from industrial decline over the past decades. The Danish region’s heavy industry lost many jobs during the 1990s. Public investments and EU funds were used to counteract job losses (HR department, manufacturer, June 2014). When West-Wind took over a smaller wind turbine manufacturer in 2004 and expanded its blade production, it was difficult to find enough workers (staff, municipality, June 2014).

In Germany, local policy-makers saw offshore wind turbine manufacturers as a chance to revive the region. A chamber publication discussed the “skill-mismatch” (Salot et al., 2010) between the manufacturers’ skill requirements and the skill profiles among the local unemployed. As the manufacturers could not fill their vacancies by tapping into the local labour market, they relied on agencies and migrant work. Skill formation was seen as a panacea against unemployment, yet curtailed in its potential by migrant labour and agency work, as one trade union officer described:

“[The end of local shipbuilding some years ago] led to the problem, that these skilled workers are not so easy to find any more in the labour market, at least not in this region. And we experience, that with this entire rise in employment, many workers come from Eastern European countries. But the problem still is the high number of unemployed here in [town]. We have a 15 per cent rate of long-term unemployment, and we see that the Federal Government is reducing the funding for vocational qualification in its current labour market policy, because they say, in sum, unemployment is decreasing in Germany, and ‘we will make cuts everywhere’.

So, they don’t look at the regions that in particular in these times have a need to qualify the unemployed, but they make cuts across all public employment agencies. Of course, this makes it more difficult to train the [local] unemployed for the sector.

We have eight thousand five hundred long-term unemployed in [town], and of these two thousand are younger than 25 years. We have to try to develop programmes, so that they have a chance. And in addition, we have the problem, that these young people often are already the second generation in long-term unemployment. And there are families here in [town] who have long-term unemployment in the second and third generation. This is the problem, and we are currently looking for a way out of this cycle, and this needs programmes.”

Trade union officer, July 2010

Local skill formation providers and ALMP initiated courses specifically to help the local youth and (long-term) unemployed access jobs in the new industry (manager, training provider, July 2012; manager, training provider, July 2013). However, instead of providing direct employment these led mainly to insecure agency jobs, as the next chapter will discuss more in detail.

The UK energy industry forecasted a lack of adequately skilled engineers (Boettcher et al., 2008, Bonnett, 2008, Groom, 2012, RenewableUK and Energy&UtilitySkills, 2011). Government programmes, local enterprise partnerships (LEPs), city councils, and skill formation providers developed strategies to increase vocational skill formation in engineering and the chances of inward investment by large offshore wind turbine manufacturers. As staff at one local LEP put it, the region needed to provide higher levels of VET to help local workers access jobs in the renewables industry (July 2013):

“We are seen as a low-skill job environment. People in the area find it hard to progress because of a lack of opportunities to progress into higher skilled employment. People who stay in the region have illiteracy and numeracy problems, or lack further education. We used to have a lack of people with NVQ 2 and 3 levels, but this has been targeted by policy and the situation could be improved. It is still hard to recruit level 4 and above, and so a lot of people are recruited from outside the area. How does this relate to renewables? A lot of routes into the renewables sector are through vocational pathways. We need people with degrees, and we need people with vocational training.”

Another interviewee described the general lack in England of the skill-set needed for the offshore wind turbine industry:

“In the UK, the idea would be to build as cheaply as possible with the lowest qualified labour as possible. Up-skilling used to be financed by central government and administered by the Regions. For the unemployed there were re-skilling programmes, but there were hardly any up-skilling programmes for already employed people. Since the 1970s reforms created comprehensive schools for all, making access to universities possible for all, but discredited former college degrees in technical professions. This promoted the change of the UK from a manufacturing economy to a servicing economy. The skill-sets required for the offshore wind industry do not exist in the UK in a large amount.”

Manager, November 2014, based on hand notes

The table below summarizes the studied skill formation initiatives and manufacturers within their local economic context. The next section presents findings on how the manufacturers engaged with the local labour market in relation to the locally available skill profiles.

Table 10 Skill formation providers, manufacturers, and regional economies

<i>Studied organisations per country</i>	<i>Regional economy</i>
<i>Denmark</i>	
Vocational school	National average unemployment
AMU (ALMP) training provider	<i>Dual</i> labour market
2 sites: Seagull, West-Wind	Important role of <i>agency work</i>
	Industrial decline over past 30 years
<i>Germany</i>	
1 vocational school	Above national average unemployment, youth and long-term unemployment
1 ALMP provider for IVET	<i>Dual</i> labour market
2 ALMP providers for CVET	Important role of <i>agency work</i>
1 inter-firm training p. CVET	Low-skill population
6 sites: Seagull, East-Wind, Seawing blades, Seawing nacelles, 2 large steel component plants	Industrial decline over past 30 years
<i>England</i>	
2 colleges	Two regions with above national average unemployment, youth unemployment, long-term unemployment
1 IVET inter-firm training P.	Low-wage and seasonal labour market
1 CVET inter-firm training P.	Low-skill population
2 sites: Seagull, West-Wind	Industrial decline over past 30 years

2.2. The local turbine manufacturing industry

The introductory chapter provided an overview of the work processes at the blades, nacelles, and generator plants. This section presents findings on the skill-sets of workers and the manufacturers' engagement with the local labour market.

West-Wind in Denmark hired its blade workers from agencies and had more skilled workers than it needed (HR department, October 2014). Some jobs required carpenters and mechanics as team leaders, but skilled workers were said to take on unskilled production work during times when craft jobs were short. They would leave when more relevant craft work became available outside the company.

The site's HR management was aware of this seasonal fluctuation and used vocational training to enhance the *psychological contract*: “to provide ownership over the process”, and encourage workers to stay at the company (HR department, June 2014). In this way, “good workers” were encouraged to participate in training for Windmøllentechniker at the local technology college, and to apply for team leader positions (HR manager, October 2014).

In contrast, when negotiating the construction of a new offshore wind turbine plant in England, the manufacturer West-Wind initially told the city council and the local jobcentre that its hiring requirements would be engineering apprenticeships of NVQ level 3 or 4 (staff, municipality, July 2013). Eventually the manufacturer West-Wind changed its skill requirements to City and Guilds awards and BTECs at level 2, but also below this level (Green Port Hull, 2016). Job adverts for operators at the blade factory mainly stated behavioural requirements, such as discipline and thoroughness, physical strength and endurance, and some previous experience in manual work, e.g. surf board manufacturing, for which there was a small industry in the area. West-Wind in England had strict behavioural requirements at the point of recruitment and announced it would run regular health checks on its workforce. Job adverts stated that regular alcohol and drugs tests would take place. West-Wind recruited via a website set up by the city council to promote green jobs in the area, through online application forms, and at recruitment events.

The Seagull blade factory in England was listed as one of the supporters of the local community college and had participated in local job and skill fairs (College B, 2016). At these events the company displayed up-coming vacancies, offered interview skills training, and information on the recruitment process and requirements.

The Seawing blade factory in Germany initially had very low skill requirements at the moment of hiring, and then used local ALMP training to up-skill its workforce. The workers at the blade factory came from all walks of life, “from the carpenter to the stonemason” (works councillor, July 2013). Many workers and team leaders had been unemployed for a year or more prior to working at the site.

Initially, the most important criterion for recruitment was experience in manual work with different materials, but not necessarily a skilled apprenticeship.³⁹ With time, the recruitment criteria became stricter, but the site had difficulties finding the right workforce:

“At the beginning anyone could be hired, now they require at least a skilled trade background (...) for new workers.... The region has a weak socio-economic structure, a high rate of unemployment, and many long-term unemployed. Young people who haven’t completed school. This is the type of people we have access to.”

Works councillor, Seawing, July 2013

Staff at training providers and the jobcentre hinted at the difficult personal situation of many blade workers: previous long-term unemployment, debts, divorce, also drug abuse and addiction (manager and staff, ALMP training provider B, July 2013; manager, jobcentre, May 2013). Although a local ALMP training provider offered six-week inductions, and continued training that was financed by the municipality. Several interviewees mentioned the continuing low level qualifications and skills of the production workers, and the company’s failure to provide adequate training (works councillor, Seawing, July 2013; trade union officer, July 2012; manager and staff, ALMP training provider, July 2013).

East-Wind and Seawing nacelles as well as the steel component manufacturers in Germany were stated to exclusively hire skilled workers (works councillors, July 2013; manager vocational school, May 2013). However, one works councillor at East-Wind suggested that when the companies hired workers from agencies, they could not be 100 per cent sure that all were skilled workers (works councillors, East-Wind, July 2013). Many skilled workers of the Seawing plant came from small workshops in the region, or had worked in construction or at nearby shipyards (Jaax, 2016). All studied manufacturers in Germany and Denmark subcontracted agencies, which recruited from beyond the local labour market, from other regions in Germany and Eastern Europe (officer, trade union, May 2012).

³⁹ This refers to skilled apprenticeships in any kind of manual trade; in Germany, an initial apprenticeship for work with composite technology, which is used in blade production, did not exist.

The Danish Seagull generator research, development, and production plant hired skilled engineering workers, who had been trained at a technology college (former HR manager, June 2014; former engineer, June 2014). The German Seagull generator plant employed skilled, semi-skilled workers, and three *Meisters* (skilled workers with an advanced vocational qualification (Hanf, 2011)) (works councillor, July 2013). After the introduction of automated production at the German Seagull generator factory, the company considered compliance to the corporate “mindset” more important for career advancement than “craft” skills (works councillor, July 2013).

The newly established steel-component sites in Germany produced foundations and tower blanks for offshore wind turbines. They hired skilled workers from a variety of vocational backgrounds: electricians, construction, and automotive mechanics, and trained them on the job. However, they realised that as the sector expanded and Germany’s industries generally recovered from the financial and economic crisis of 2008, vacancies became harder to fill (manager, vocational school, May 2013). The launch of the apprenticeship at the vocational school responded to the two local steel components manufacturers’ workforce needs. The table below summarises skill provision in the local labour market and manufacturers’ engagement with skill formation, recruitment strategies, and skills or behaviour requirements.

Table 11 Blade factories

	West-Wind <i>Denmark</i>	Seawing <i>Germany</i>	West-Wind <i>England</i>	Seagull <i>England</i>
Skill provision in local labour market	H	L	L	L
Engagement with skill formation	Training at AMU and tech college	Modules/short courses by ALMP Training provider	Internal training, and/or training in DK	Collaboration with local college Starting in 2017
Recruitment strategy	Agencies	Agencies	Through LEP website	Through college
Skills or behaviour requirements	Health and safety training	Some experience with manual work	NVQ 2 Or experience in work with composite technology Strict behaviour requirements	nn

Table 12 Assembly factories

	West-Wind <i>Denmark</i>	East-Wind <i>Germany</i>	Seawing <i>Germany</i>	Seagull <i>Denmark</i>	Seagull <i>Germany</i>
Skill provision in local labour market	H?	L, but skill formation and migrant labour	L but skill formation and migrant labour	H?	L?
Engagement with skill formation	Provided by AMU or Technology College	Sponsor few apprentices at ALMP IVET provider	Sponsor few apprentices at ALMP IVET provider	Provided by AMU or Technology College	Behavioural, motivational, 'cross training'
Recruitment strategy	nn	Agencies	Agencies	From vocational college	Agencies
Skills or behaviour requirements	Health and safety training Skilled VET for Some jobs	Skilled VET	Skilled VET	Skilled VET many years of experience	Behavioural, 'company mind-set'

Table 13 Steel component factories

	Company 1 <i>Germany</i>	Company 2 <i>Germany</i>
Skill provision in local labour market	L	L
Engagement with skill formation	Dual and school-based VET	Dual VET
Recruitment strategy	Direct hire?	Direct hire?
Skills or behaviour requirements	Skilled VET and DIN or ISO welding certificate	Skilled VET and DIN or ISO welding certificate

Although they experienced skill shortages when expanding, Danish and German assembly sites seemed to have benefited from access to semi-skilled and skilled electricians and mechanics (works-councillor, East-Wind, July 2013; manager, South-Wind, November 2014). Blade factories could access training in composite technology, which was made available by ALMP and VET training providers.

Over the past decades, Germany and Denmark developed domestic turbine industries through inventors' initiative, the availability of R&D and marketing support (Simmie, 2012, Simmie et al., 2014), and broad provision of engineering skills (works councillors, East-Wind, July 2013; lobbyist, Denmark, June 2014). Skilled workers could work in a

non-routine process, and contributed to process and product development (former engineer, Seagull, Denmark, June 2014).

England had no offshore wind turbine assembly plant for nacelles or generators, presumably because no component supply chain existed and labour costs for adequately skilled workers were too high (manager, South-Wind, November 2014). The cost of skilled labour, and its scarcity, limited the chances of developing a genuine domestic (offshore) wind turbine industry (manager, South-Wind, November 2014). In the North-East of England, a blade factory was chosen to be built, after years of negotiations over a turbine factory. This eventually reinforced the local low-skill environment, frustrating the hopes of increasing demand for engineering skills. The next section compares how far in each country initial and continued VET and ALMP were provided, how skill formation providers engaged with the new industry, and how far employers got involved in skill formation and its funding. Finally, it looks at how skill formation included a variety of participants.

3. Initial and continued VET and ALMP

World-wide Global Wind Organisation certificates – industry-wide standards – were only about to emerge in the year 2014 (manager and staff, ALMP training provider, July 2013). This section presents findings on skill formation initiatives that developed mainly before 2014. In the following paragraphs, different types of vocational training in the sector will be presented by the examples of a Danish technology college and one of the five Danish AMU centres; two ALMP training providers, a vocational school and an inter-firm training provider in Germany; and two colleges and two inter-firm training providers in England.

Within these countries, VET and AMLP were interconnected to varying degrees. In Denmark apprenticeships for technicians for composite technologies (blades) and engineering (turbines) were quickly integrated into the national skill formation regime. VET for offshore wind turbine manufacturers developed organically alongside manufacturers' needs and was quickly institutionalised.

The technology college in Denmark provided dual apprenticeships in composite technology for “Windmøllentechniker” in collaboration with the local blade manufacturer (educator and manager, November 2014). The technology college had provided statutory health and safety courses for work with composite technologies to the local West-Wind blade factory’s workers since 2006/2007 (educator, November 2014). Based on this collaboration, the manufacturer requested a basic course in composite technology.

Subsequently, the manufacturer and these two technology colleges developed two vocational courses – one for skilled turbine engineers and one in composite technology for blade workers. They achieved recognition as “Windmøllentechniker” apprenticeships within the Danish VET regime. In general, accreditation of new courses was fast, “about six weeks” (manager, AMU centre, November 2014). Educators at the vocational college justified the institutionalisation of the skilled apprenticeship in composite technology by the level of complexity of blade building and the applicability of respective skills across different industries such as, shipbuilding, airplanes, and wind turbines.

The offshore wind turbine manufacturers West-Wind and Seagull used the vocational college for initial and continued VET as well as the AMU centre for continued VET. Blade workers were mainly hired through agencies, therefore agencies sent their new recruits on health and safety courses to work with composite technology - “Epoxy courses” at the AMU centre - before their placement at the blade factory (HR manager, manufacturer, June 2014; manager, AMU centre, November 2014). The vocational college’s management felt strongly loyal to the blade manufacturer.⁴⁰

School-based training for “Windmøllentechniker” at the vocational college took place during twenty weeks spread over two years. Throughout this time five weeks of training alternated with twelve weeks of practical work at the factory. In teaching theory and practical skills in composite technologies, the educators called their approach “problem based learning” (educator, November, 2014): Apprentices were assigned projects that

⁴⁰ Before agreeing to an interview for this PhD research, the manager in charge needed a period of consideration to decide, if staff talking about the training would interfere with the college’s good relationship to the manufacturer (manager, November 2014).

involved a combination of different tasks and conceptual work. The educators stated that these courses were also an opportunity to learn from apprentices and to get an up-date on technological developments at the blade factory. The Danish Seagull generator factory hired graduates from the same college's two-year vocational programme for mechanics (former engineer, June 2014). The college also provided one or two-week courses for blue-collar workers at the Seagull generator factory (former manager, Seagull, June 2014).

The local AMU centre, an ALMP training provider, was involved in skill formation for the local wind turbine industry too. It aimed "to develop the workers from unskilled to skilled, and to give [them] the desire to learn more" (manager, AMU centre, November 2014). Recently the centre had offered sixty-five two-day 'epoxy courses', health and safety training for work with composite technology, for one thousand three hundred agency workers (manager, AMU centre, November 2014). The participants came from one large agency, and were trained for their placement at the local blade factory (shop steward, November 2014; manager, AMU centre, November 2014). As a statutory requirement, the health and safety course were state-funded (manager, AMU centre, November 2014). The centre also provided leadership training to the blade manufacturer. This training was co-financed by the public and the company. The generator factory continued training its workers and white-collar staff at the AMU centre (former HR manager, June 2014).

Across Germany a variety of CVET programmes for onshore wind turbine technicians existed, and provided either school-specific or chamber (IHK) certificates. For example, vocational schools in the *Land* Schleswig-Holstein offered vocational training for technicians in wind energy technology (*Techniker/in in der Fachrichtung Windenergie-technik*, BERUFENET, 2011). In 2003/2004, the regional chamber for commerce and industry (*Industrie und Handelskammer*, IHK) created a continued VET exam and certificate, but no specific vocational occupation was designed due to the observation that "skills from different skilled vocational occupations come together – electronics, mechanics, and different health and safety modules, as well as composite technologies" (manager and staff, ALMP training provider B, July 2013).

The ALMP provider collaborated with the local shipyard and steel industry in developing a course for ‘examiners for steel engineering’ (*Materialprüfer*). This was facilitated by the municipal economic development agency. Under the direction of the Fraunhofer Institute for Material Engineering (IFAM), a composite technology course was jointly developed by several public and semi-public research institutes, and local manufacturing and service companies (works council, Seawing, July 2013; manager and staff, ALMP training provider B, July 2013) and started in 2006.

Interviewees stated that courses in composite technologies seemed a good fit to the structure of the local labour market, in terms of knowledge and task complexity. The entry requirements for jobseekers, were lower, and several local blade manufacturers, wind turbine servicing, and the airplane industry used composite technologies (educator and manager at ALMP training provider, July 2013).

In contrast to Denmark, in Germany the institutionalisation of dual apprenticeships for blade workers or offshore wind turbine engineers within the VET regime was slower and the emerging skill gap for blade workers was filled by ALMP short-term training programmes. The VET regime was described as too rigid and slow moving. Interviewees from training providers and researchers in the field of vocational education stated that it took about ten years to establish a new curriculum and vocational occupation (interviews in July 2012, May 2013, July 2013).

In addition, it was argued that the establishment of a new VET depended on the economic situation of the respective sector, its size, and a large manufacturer taking the lead in establishing vocational and occupational standards (manager, ALMP training provider, July 2012; manager, vocational school, May 2013). The turbine manufacturers prioritised protection of their intellectual property (manager and staff, ALMP training provider B, July 2013; manager, industry training provider, August 2012). In addition, the manufacturers saw their commercial environment as too instable (works councillors and manager, 2013, 2014).

In consequence, across Northern Germany skill formation in the offshore wind turbine industry differed from the dual VET regime, as during the early 2000s vocational skills for workers in the sector were mainly provided through ALMP.

Prior to data collection, and until roughly 2013, different ALMP training providers and vocational schools piloted IVET for the offshore wind industry funded by temporary ALMP programmes: for construction mechanics, industry electricians, and mechatronic specialists (mechanical and electrical) (manager, ALMP training provider A, July 2012; manager, vocational school, May 2013). The initial VET pilot programmes for wind turbine technicians were mainly school-based and available to disadvantaged youths.

For example, the 3.5-year school-based apprenticeship mimicked initial dual VET. For industry electricians, work-based training took place at the ALMP provider's workshop three days a week, and the theoretical training was two days a week at the local vocational school. The vocational training was complemented by support classes on numerical and literacy skills, German and English. These support classes were 90 minutes per week throughout the school year. Students who had been diagnosed with dyslexia, or had very poor knowledge of German or English received individual support. The provider also offered additional preparation for exams.

Other ALMP training providers in Germany initiated continued VET modules for wind service technicians and composite technology in the early 2000s. These ALMP training providers delivered vocational courses for the public employment services (Federal Employment Agency), the municipal Jobcentre, which in Germany is in charge of labour market services for the long-term unemployed, and the federal army. One of the ALMP providers was owned by the umbrella organisation of the German trade union federation DGB. The provider offered up-skilling and re-skilling of unemployed or redundant workers as part of ALMP training modules, lasting seven months and aimed at long-term integration in the labour market. The ALMP provider also designed customised courses against payment for manufacturers and service companies (manager and staff, July 2013).

The energy utilities' inter-firm training provider only initiated CVET for wind turbine service technicians roughly ten years later than the discussed ALMP training providers (manager, August 2012). This was after the Fukushima nuclear accident in Japan in 2011 and the Federal Government's announcement of a permanent exit from nuclear energy provision. This training was targeted only at skilled workers of large energy utilities.

In England, vocational certificates for turbine engineers were rapidly established by employer-led bodies, and the local skill formation providers, colleges and inter-firm training initiatives received accreditation to provide training for these certificates. Training was provided by vocational colleges and inter-firm training providers, although over the past decades regularly changing government policy and short-term provision of funding appeared to preclude a long-term strategy for forming a broad engineering skill-base (Boettcher et al., 2008, Bonnett, 2008, Groom, 2012, RenewableUK and Energy&UtilitySkills, 2011).

However, the Coalition Government's (2010-2015) discourse strengthened the argument for more investment in vocational education and training, and skills supply at the level of apprenticeships. Reforms of local government and the abolition of RDAs on the one hand reduced general funding for skill formation, but on the other, localised funding provision through the introduction of LEPs (Sissons and Jones, 2014). LEPs could access funding for 'green' and engineering skills and tender it locally for vocational skill formation (manager, LEP, November 2014). Therefore, the effects on institutions of skill formation were possibly more fragmented across the constituencies of LEPs.

Manufacturers and skill formation initiatives in two towns were studied in England. In line with the large deployment of offshore wind turbines around the English coast, skill formation providers mainly targeted turbine installation and maintenance. However, public funding for skill formation by manufacturers was available within local economic development policy. In the first town, vocational engineering skills were mainly provided to local companies by three providers. An association based on "inter-firm coordination" (Gospel and Foreman, 2006) provided initial VET, an industry association offered CVET, and the local college provided a large variety of engineering apprenticeships. Regional Growth Fund brochures also promoted other providers of engineering training in the region (Regional Growth Fund, [about 2013b]), but these were rarely mentioned by interviewees in the context of engineering training and the regions' project to become a renewable technology industry hub.

The training providers studied here mainly focussed on provision of vocational skills in line with SEMTA, BTEC and other Sector Skills Councils programmes operated within the English VET regime. They also offered – marginally and limited in time –

programmes funded by ALMP. These programmes were not targeted at the offshore wind turbine industry.

One community college offered dozens of training modules related to engineering occupations and certified by various awarding bodies: BTEC, CILT, City and Guilds, SEMTA, and EDEXCEL (College A, 2016). The college provided courses for the public employment services: teaching job search skills to long-term unemployed, making links to work experience within ‘Sector Based Work Academies’, teaching English as a foreign language (ESOL) and numerical skills.

One IVET training provider trained electrical, mechanical and machine maintenance engineers for manufacturing, offshore oil, gas, offshore wind and other industrial sectors offering apprenticeships at NVQ level 3 and 4. The apprenticeships led to SEMTA (Sector Skills Councils for Science Engineering Manufacturing Technologies) and the City and Guilds awards, like the City and Guilds’ *Onshore Wind Turbine Technician* and *Offshore Wind Energy Technician* since July 2013 (PR staff, July 2013). The provider implemented two school-outreach programmes for the wind energy sector together with various large utilities and manufacturers (Regional Growth Fund, [about 2013b]) and vocational re-skilling within redundancy plans. Very marginally, the provider engaged with the Jobcentre Plus (JCP) and agencies, providing welding courses for jobseekers.

The IVET provider’s main programme was, similar to Germany VET - a ‘dual’ apprenticeship over three to four years, which began with one year of work-based training at the provider’s workshop for three or three and a half days a week, with theory training on the other days. In year two, three, and four apprentices continued their work-based training at their employer (PR staff, July 2013). A social worker helped apprentices overcome individual issues to limit dropout.

In England, further education certificates confirming participation in GWO (Global Wind Organisation) courses, BOSIET and OPITO were provided to self-funded or employer-funded individuals by private, and public-private training providers across the UK: e.g. AIS Group, Energy Skills Scotland, Falck Nutec, Garrad Hassan, Maersk training, Offshore Marine Academy, West-Wind, and Smart Wind, and HOTA.

The CVET training provider studied here was founded by local companies in 1987. It offered one hundred nationally approved courses for engineering in a maritime environment in oil, gas, renewables and a few onshore industries (Regional Growth Fund, [about 2013b]). In 2014, the provider developed its curriculum to deliver the five *Global Wind Organisation* ‘GWO’ courses, which certified offshore wind service technicians (manager and staff, November 2014). The CVET training provider collaborated with other local training providers, a company that specialised in work at heights and an IVET provider. The training of jobseekers commissioned by the JCP was relatively marginal (manager and staff, November 2014).

VET providers in England seemed ambiguous towards offering apprenticeships to unemployed and disadvantaged jobseekers. They all had participated in programmes by the DWP or JCP, but none of them saw these as ‘core activity’ or an activity at all. Some interviewees saw this as an area the providers were not particularly good at. In contrast to Denmark and Germany, ALMP and VET seemed not at all connected in England.

3.1. Resources for flexibility of training delivery

This section shows how far manufacturers could access courses and how training providers adapted to participants’ needs and employers’ requests for specific content and scheduling of training. In Denmark, the Seagull and West-Wind sites could access and influence VET and ALMP training content in relatively straightforward ways. Training modules could be booked flexibly at the vocational college and AMU centre. Although the accreditation of the *Windmøllentechniker* apprenticeships required that training content was relevant within the sector, the local arrangement between vocational schools and employers could consider specific needs.

The college’s educators regularly visited the West-Wind blade factory and were in close contact with the manufacturer to update courses. Educators could be contacted directly to discuss new courses quite informally, as one of the educators explained, “when they have difficulties with packing, and repairing blades, they call us and ask us, can you make a course on that? And then we do that” (educator, November 2014). Customised courses could be scheduled “within an hour”.

The close relationship between the vocational college and the West-Wind blade factory was also exemplified in a long-term contract on training provision, which allowed the college to make investments in infrastructure (educator, November 2014). The college also hired out its facilities for the factory's internal courses. In contrast to the West-Wind blade factory, the Danish Seagull generator plant relied on existing mechanical and electric engineering apprenticeships without strongly interfering with the curriculum design (HR department, June 2014), showing the trust in the VET system.

The manager at the AMU centre also emphasised flexibility and service to companies' requests: The AMU centre employed two hundred staff and, to maintain flexibility and offer high quality to the local companies, fifty to sixty additional freelancers. The AMU centre had six 'business consultants', who advised companies on courses and access to public funding from the government and jobcentres. The centre also accessed funding from the European Union.

In Germany, vocational schools had less flexibility than the ALMP training providers, and also less than the Danish colleges and AMU centres. Although, the public vocational school worked closely with the *Meisters* in charge of VET at the steel component manufacturers, it was limited by its status. Only during the regional government's pilot programme "Proreko Schule" (2005 to 2012), which was discontinued in 2012, was the school allowed to engage in commercial contracts with the private sector (manager, May 2013; Niedersächsischer Landtag, 2010). The school's funding paid for staff, but there were only limited funds for equipment and infrastructure.

Also, the vocational school could only provide training that was recognised as initial vocational apprenticeship. It could not offer courses for DIN or ISO welding certificates for construction mechanics who worked at the local steel component manufacturers, as, as vocational school, it was not allowed to acquire the necessary accreditation: "This is a very hot topic in Germany" (manager, vocational school, May 2013). Instead, the school's educators freelanced for DIN and ISO certified providers in the region. Statutorily vocational schools had to provide full vocational apprenticeships, while ALMP training was more flexible in terms of content, duration, and funding. For

example, ALMP training providers could access funding from the ESF to improve their CVET offer (manager and educator, July 2013).

The German ALMP training providers, which piloted IVET programmes for industry technicians, had more flexibility. The providers aimed to identify the needs of the offshore wind industry, and then to adapt the content of existing apprenticeships (two researchers, University of Bremen, May 2013). The VET regime did not include initial apprenticeships for offshore wind service technicians. Therefore, following discussions with the BIBB and with VET experts from the local university, this provider decided to adapt an existing VET programme - the 3.5-year apprenticeship for industry electrician (*Elektroniker für Betriebstechnik*) - to the industry's needs (manager, ALMP provider, July 2012). The training provider adapted the curriculum to the funding companies' ⁴¹ requests and would subcontract certificate training, for example for driving forklifts.

The ALMP provider for continued VET emphasised close collaboration with local manufacturers for up-dating training. To keep up to date on industrial developments, the provider's staff would go on short industry internships, and closely worked with the service companies' *Meister* and management. When designing the CVET programmes the ALMP provider CVET worked closely with a servicing company. At the utilities' industry school, member companies usually addressed their requests for specific training directly to the school's teaching staff. Educators enjoyed a high degree of professional discretion.

In England, accredited course frameworks were highly prescriptive on training content. However, training modules could be booked separately, like in the Danish vocational skill formation regime. In addition, the inter-firm VET providers seemed keen on closely collaborating with its apprentices' employers. However, West-Wind did not work with any of the local training providers. Seagull worked more closely with the local college, jointly setting up a new engineering centre from March 2017 onwards (College B, 2017).

⁴¹ Three manufacturers sponsored apprentices at the ALMP training provider as detailed the section on employer participation.

3.2. Employer participation in training and funding

This section discusses the varied levels of engagement of companies with vocational skill formation and the diversity of funding mechanisms available to them. Funding for vocational skill formation came from public VET funds, ALMP funds, employers and participants themselves. In Denmark, skill formation for the sector was part of permanent provision and public funding, but in Germany and England, public subsidies for skill formation in the sector were short term. In Germany subsidies for skill formation for the offshore wind industry were embedded in locally designed short-term ALMP programmes that were added onto local industrial policy for the sector. In England, skills funding was directly targeted at employers. Skills funding for the sector could be applied for at the national level Regional Growth Fund, and was retendered by the LEPs (staff and manager, municipality, July 2013; staff at LEP, July 2013 and November 2014).

In Denmark, all VET contained in the national curriculum was funded by the public and employers could access training and wage subsidies (Helms Jørgensen, 2014). Subsidies for training were not limited to one specific group of the labour force, but covered all employees of Danish firms and workers in Denmark (manager, vocational college, November 2014). The manufacturers Seagull and West-Wind in Denmark received wage subsidies and reimbursement of the training costs for about twenty nationally recognised courses provided by the technical college as part of the regular VET regime. Firms could book subsidised courses from the national curriculum or purchased customised courses at the AMU centre. Agencies that provided the sector also used the AMU centres to up-skill workers for future placements.

In Germany, employers were expected to financially contribute to the cost of *dual* apprenticeships by paying a wage to their apprentices and providing work-based training of their apprentices from the start (Culpepper, 2001, Hippach-Schneider et al., 2007). Thus, a major challenge for public bodies and funders such as municipalities and Jobcentres, was to get the industry to contribute their share financially and in terms of work-based training. This was also a challenge for training providers, which had acquired third party funding and aimed to establish dual apprenticeships for the offshore wind turbine industry. Public funding of ‘pilot programmes’ was thought of as seed funding (manager, ALMP training provider A, July 2012). Initially, flexible

arrangements that were offered to companies deviated from a typical dual apprenticeship. Providers offered a variety of funding schemes that exempted companies from paying apprentices, and providing the work-based phases of the apprenticeship on their premises (manager, Jobcentre, May 2013; manager, ALMP training provider A, July 2012).

One ALMP provider was supposed to set up an inter-firm training ‘consortium’, which would later be financed by the companies, and managed by staff from the municipal training provider, *Volkshochschule*. The municipality-run Jobcentre, the Federal Employment Agency (*Agentur für Arbeit*), and the European Union provided seed funding while companies were expected to gradually take over the funding (manager, ALMP training provider A, July 2012; manager, Jobcentre, May 2013). This ALMP training provider and a vocational school offered different funding schemes to the local offshore wind turbine manufacturers: fully school-based training in the first year and dual training from the second year or an entirely school-based apprenticeship.

This impacted on the costs for companies and apprentices’ pay. As long as the apprentices were fully school-based, they were paid according to the *BAE* tariff (*Tarif für außerbetriebliche Berufsausbildung*, ‘tariff for non-company-based vocational apprenticeships’), which was set by the federal authorities, and no costs incurred to the companies. The BAE tariff was lower than the apprenticeship pay established by the metal workers collective agreement. As soon as the apprentices were ‘transferred’ to dual VET, their training company was supposed to pay the apprentices according to the collective agreement for apprentices in the metal sector. As the industry failed to increase its financial engagement over the years, the public funders withdrew their support one by one (manager, Jobcentre, May 2013; manager, ALMP training provider A, July 2012).

The lack of participation by offshore wind turbine manufacturers was publicly criticised (cf. Salot et al., 2010, various interviews during 2012, 2013, and 2014), but interviewees refused concrete information on which local manufacturers engaged with vocational training offered by ALMP training providers. However, based on various interviews (works councillors, July 2013; an educator and two managers at ALMP training providers, May 2012 and July 2013) it can be assumed that the manufacturer Seawing –

having sites in different towns across Northern Germany – engaged in traditional dual VET for mechanics and electricians at sites where it produced onshore wind turbines (works councillor, July 2013) but did not at its ‘offshore wind’ sites where it could benefit from a fully school-based VET at the ALMP training provider. The nacelle assembly plant Seawing sponsored several apprentices in full-time school-based training (works councillor, July 2013). The apprentices were interns at the plant during school holidays and on their school-free days. The East-Wind site also sponsored apprentices at the same provider (works council, East-Wind, July 2013; officer, trade union, July 2012).

The vocational school began providing construction mechanics apprenticeships with twenty-two apprentices in 2008. Two local steel component plants, which produced foundations and tower blanks, had several dozens of apprentices in construction mechanics (manager, vocational school, May 2013). The apprentices of one plant started with one year of school-based and fully publicly funded training as part of the municipality’s commitment to support local offshore wind turbine manufacturers. From the second year onwards, its apprentices were transferred to a dual apprenticeship. The steel-welding plant had forty apprentices in two years. The second steel-welding plant had over sixty to seventy apprentices in three to four years in dual VET.

The German Seawing and East-Wind had previously paid for the *Meister* training of several workers (works councillor, Seawing, July 2013; works councillor, Seawing, July 2013; works councillor, East-Wind, July 2013). German manufacturing sites provided a variety of internal courses themselves. Statutory health and safety training was usually provided internally by a worker who was certified as a health and safety specialist (works councillor, Seawing, July 2013). Seawing trained crane drivers internally, as they had a worker with the required certificate (works councillor, July 2013). Other manufacturers bought crane and forklift driving and welding modules from external providers (works councillor, Seawing, July 2013).

In England, evidence of initial and continued vocational training by providers suggests that vocational skill provision depended as much on funding from businesses, as governmental industrial policy. In one town, short-term funding for engineering skill formation was provided through the local authority and later the LEP, based on two

rationales: it was expected that the company West-Wind would build an offshore wind turbine factory locally, and poach skilled workers from the local engineering SMEs. Up-skilling of local workers would lower unemployment and create new perspectives at the newly established and growing supply chain. Across the region, around one hundred ninety SMEs and several large engineering companies and utilities funded about two hundred apprentices per year at the IVET inter-firm training provider. However, no wind turbine manufacturers contributed. The apprentices had an employment contract from the start, and were paid by their employer.

Initially, the inter-firm training provider was mainly government funded. Public cuts at the end of the 1990s brought the provider to the brink of bankruptcy, but it was saved by funds from local SMEs and large enterprises (Broadhead and Hague, 2010). Since then, it aimed to be company-funded and limit its dependence on public funding. However, an important part of the funding per apprentice continued coming from public funds. In the 2000s, the provider's apprenticeship was funded partly by companies and partly by the SFA. The companies paid a fee of six thousand pounds per apprentice for the full four-year programme and a wage to their apprentices. Wages varied between one hundred and two hundred and forty pounds per week depending on the funding company and the year. The full cost incurred by the provider was twenty-two thousand pounds per apprentice.

A delegation from the manufacturer West-Wind visited this training provider in 2012, although it had its own engineering training centre only a few miles away. However, the West-Wind plant did not end up working with any of the local skill formation providers for IVET and CVET. It announced it would train workers either in Denmark (access to state funding), or on its new site (also access to state funding via ALMP). The English municipality was announced to fund wage and training subsidies to the new blade factory for hiring long-term unemployed workers from within 30 kilometres from the factory (Regional Growth Fund, [about 2013b]).

3.3. Course participants

The Danish college provided initial and continued vocational training to 16 to 24-year old apprentices in and out of employment. Half of the participants in the dual *Windmøllentechniker* composite technology apprenticeship had a skilled craftsman background; half were unskilled (educator, November 2014). At West-Wind, they either worked in the production or installation and maintenance of blades. By 2014, the college had trained fifty West-Wind workers over three years. All had participated in *health and safety, basic, and specialised training*. By 2014, the college had trained four hundred participants in a basic course in composite technology. In contrast, AMU centres across Denmark focused on training of above 24-year old jobseekers and workers. Participants of the AMU centre's Health and Safety courses were trained for unskilled production work at the blade factory.

In Germany, initial VET for industrial 'electricians with specification wind' at the ALMP training provider was aimed at disadvantaged youths. The initial apprenticeship offered by the ALMP training provider started with eighteen state-funded apprentices on 1st February 2004.⁴² New starts took place in 2007, 2008, 2010, 2012 and 2013. Supported by the local wind industry association, the provider organised internships at local offshore wind turbine manufacturers and service companies. Staff at the provider stated that experience from internships motivated some manufacturers to sponsor or hire regular apprentices. In 2008, one company funded two apprentices for the first time. In 2012, sixteen apprentices started. Half of them were funded by three different companies and the ESF and the municipality funded the other half. After 2012, there was no new start.

The minimum admission criterion was an extended lower secondary school degree (*erweiterter Hauptschulabschluss, Berufsbildungsreife*). Public funding was conditional to recruiting school-leavers who were *disadvantaged on the labour market* (manager, ALMP training provider A, July 2012).⁴³ As the apprenticeship was demanding, the

⁴² The training start differed from the usual date, which is 1 August of every year, because the apprenticeship should be open to school leavers who had difficulties finding training by 1 August ('disadvantaged on the training market').

⁴³ This was a requirement for funds from different public sources: the public employment services, *Arbeitsamt* (now *Agentur für Arbeit*) and the *Sozialamt* (now job centre, a part of the municipality), and the European Social Fund (ESF). For the former two, the requirement was that participants

training provider had difficulties finding apprentices who fulfilled the funding criterion and showed the potential to complete. Applicants went through an eight-week selection process from 1st December to 31st January of each year. Although the process seemed to favour high performers, a manager at the provider explained that one rather chose applicants, for whom difficulties in the search of an apprenticeship could be expected. As long as it received public funding, the provider was determined to offer at least 50 per cent of the apprenticeship places to disadvantaged applicants (manager, ALMP training provider A, July 2012).

At the ALMP provider for CVET, interviewees (manager and educator, July 2013) stressed the high investment of the Jobcentre in unemployed jobseekers, who wanted to work for offshore wind turbine manufacturers. ALMP supported continued VET modules for the long-term unemployed and composite technology modules for unskilled workers, who were at risk of losing their jobs because of economic fluctuation in the offshore wind turbine industry.

The CVET programmes for wind service technicians, although targeting (long-term) unemployed jobseekers, had high entry requirements. These included an electro-mechanical apprenticeship, physical fitness, a driver's license, and a number of 'soft skills'. It required working in teams of two technicians, who worked independently and with clients and took technical decisions while considering the financial consequences. Work in production or installation only required parts of this skill-set.

Interviewees stated that the personal situation of participants often interfered with successful completion of the challenging VET programme (manager and staff, ALMP training provider B, July 2013; manager, Jobcentre, May 2013). The provider tried identifying candidates who were likely to complete. The provider also developed long-term support for those with more complex needs, but the public employment services and the municipality were reluctant to finance additional social support (manager and staff, ALMP training provider B, July 2013).

were recipients of welfare benefits, and were disadvantaged on the labour market, thus had low marks in final their degree. Another condition which was the subject of hard negotiations, was a "migrational background", which made participants eligible despite a good school degree. All three financing bodies had their own definition of 'disadvantaged' participants (manager at training provider, July 2012).

In 2012, the Jobcentre withdrew financial support for the initial VET scheme for disadvantaged groups, as it refused to subsidise the dual VET scheme that should have been paid for by wind turbine manufacturers (manager, Jobcentre, May 2013). The local Jobcentre insisted on the continued participation of employers in IVET, supporting the traditional dual apprenticeship regime in Germany. In contrast, CVET for jobseekers, who wanted to become turbine technicians or blade workers, continued to be funded by ALMP.

The German energy industry's inter-firm training provider developed a training programme for wind service technicians from 2011 onwards (manager, August 2012). This training was targeted at employer-funded workers. The provider would offer wind turbine training priced at about 14 000 Euros. This was almost double of the cost of about 8 000 to 9 000 Euros of previous ALMP training (prices of 2013). Therefore, the industry school's price setting excluded many potential participants and did not set out to compete with the training already offered by ALMP training providers.

In England, highly reputed vocational apprenticeships relied on employer participation and had high entry barriers such as extremely selective recruitment and strong competition between applicants. One inter-firm training provider claimed to be the only way apprentices could enter regional engineering companies, and that they selected only the best candidates (staff, July 2013). This provider ran the recruitment of apprentices for its client companies. For two hundred places a year, it received one thousand two hundred applications. The recruitment consisted of an online assessment, an interview based on a portfolio prepared by the applicant, and a two-day event in which companies presented themselves. During the two-day event, preselected candidates could leave their CVs with the companies. Another assessment conducted by the companies themselves followed to select those who were finally hired.

Generally, the provider did not take on apprentices without an employment contract. Apprentices without a contract often started vocational training at the local college and reapplied for an apprenticeship at the provider the following year, but there were exemptions. However, under the Government's "Access to Apprenticeship

Programmes” (AtA) three hundred unfunded apprentices could be trained for four consecutive years.

The inter-firm training provider for CVET mainly provided training for the private sector and highly-skilled individuals, who sought a professional or health and safety certificate for a specific type of engineering work, e.g. offshore (staff, November 2014). A pre-requisite for participating in continued training at the provider was a mechanical or electrical vocational qualification, such as a BTEC, SEMTA or a City and Guilds award. In England, the disadvantaged in the labour and education market seemed to be easily marginalised when it came to gaining engineering skills and finding skilled work (manager, College, November 2014).

However, municipal funding was available for up-skilling and in work-subsidies in case employers recruited long-term unemployed jobseekers from within the region (Regional Growth Fund, [about 2013d]). The Regional Growth Fund, subsidising the regional development programme around the West-Wind plant with 25.7 million pounds, had an Employment and Skills strand that targeted four different areas. These were: 1) wage subsidies for apprentices who were enrolled in an Advanced Engineering Manufacture craft or technician apprenticeship (Level 3), who resided within the area, 2) subsidies to engineering employers who up-skilled their workforce by one NVQ Level (2 to 3, 3 to 4, or 4 to 5), and who engaged in enhancing their employees employability skills (50 per cent of the direct costs), 3) subsidies for up to 25 per cent of total costs for manufacture and maintenance of wind turbines and production equipment at OEMs and first tier suppliers, and 4) a 20 per cent wage subsidy for the first year of employment for workers from disadvantaged groups, living in the area, at OEMs and their supply chain companies. These funding criteria closely fitted the negotiations with the turbine manufacturer (staff, municipality, July 2013). Appendix 1 contains a comparative table on the skill formation providers across the three countries. The next section discusses how far industrial policy and skill formation were intertwined and how far skill formation was impacted by industrial policy.

4. Skill formation and industrial policy

Chapter IV compared industrial policy for the offshore wind industry in Denmark, Germany and England. It argued that Denmark – by matching supply and demand side policy dynamically over time – had succeeded in the establishment of an industry, which provides for the deployment of turbines domestically and internationally. In Denmark, the expansion of domestic offshore wind turbine manufacturing seemed to be a continuation of industrial policy for wind technology since 1970s. Although public subsidies declined during the 2000s, the Denmark-based industry dominated the growing Northern European and global market. Through the involvement of a broad spectrum of stakeholders, Danish policy-makers achieved a successful match between supply and demand side policies.

In contrast, Germany successfully created domestic manufacturing jobs in the short-term due to its supply side structure, but experienced a significant crisis in 2013/2014, a few years after the industry's establishment. In Germany, industrial policy was supportive of onshore wind and photovoltaic technology until the 2010s. After the nuclear accident at a Tepco power station in Fukushima, Japan, and the announcement of a permanent phase out of nuclear energy provision by the German Federal Government in 2011, offshore wind experienced 'the gold rush'. However, very quickly regulatory issues resulted in the Germany-based manufacturers' decline.

The Government and the Crown Estate in England promoted a massive expansion of offshore wind turbine deployment, without any significant creation of domestic manufacturing jobs until very recently, due to its traditionally weak supply side structure. England engaged in 'post hoc' supply side policy, once large utilities and their component suppliers had been identified and encountered a sufficiently large demand for offshore wind turbines. This section first discusses how skill formation was linked to supply-side industrial policy and was affected by demand-side industrial policy. The section then turns to a characterisation of the sector skill formation regimes which were, to different degrees, embedded in industrial supply side policy measures: in Denmark 'permanent', in Germany 'ad hoc', and in England 'post hoc'.

Skill formation had various roles within industrial policy across the countries. In Germany and England sector targeted skill formation subsidies were part of attracting

the manufacturers. In Germany, skill formation was used for buffering the effects of economic decline on an unskilled work force. In Denmark and England, it was not. At German and Danish manufacturing sites, work-based skill formation was curtailed by demand side pressures. In England, public subsidies for skill formation were not only used to attract manufacturers but to reduce the risks of poaching for incumbent small and medium sized companies, in the context of location of a large component producer. In particular, in England and Germany the short-term increases in public funding for skill formation as part of industrial policy had knock-on effects on the skill formation providers.

The following paragraphs provide detailed evidence for these statements. They start out by showing how skill formation was used as *supply-side policy* to increase access to skilled labour for manufacturers, and to buffer decrease in workforce needs during slumps. They also show how the increase of funding impacted on skill formation providers. Then, the effects of demand-side policies on skill formation are presented: how demand side policy interfered with work-based skill formation, and how expectations of increased turbine demand promoted more private sector engagement in skill formation through inter-firm training providers. The table below summarises the commonalities and differences between countries in terms of temporary skills funding provision for the offshore wind turbine sector, and its effects.

Table 14 Commonalities and differences in terms of skills funding

	Denmark	Germany	England
Temporary increase in public funding for skill formation	n	y	y
To attract manufacturers by increase in skilled labour supply	n	y	y
To reduce risk from poaching for SMEs	n	n	y
To buffer effects of economic decline on workers	n	y	n
Has knock-on effects on local skill formation	n	y	y
Skill formation is curtailed by demand side pressures	y	y	<i>No evidence</i>
Inter-firm skill formation, exists and is dependent on demand side prospects	y by Maersk – private contractor	y by utilities’ vocational school	n

Y = yes, N = no

4.1. Supply side policy

4.1.1. Increasing supply of skilled labour

In Denmark, manufacturers negotiated skill provision with the existing public providers and funding regime, but in Germany and England, skill provision was part of a wider industrial policy project to encourage manufacturers to establish or expand their local production sites. In Germany, regions and municipalities initiated the additional industry specific skills funding. In England, additional skills funding for engineering skills was initiated by central government. In Denmark, the large international technology manufacturer West-Wind entered the offshore wind sector with its purchase of a Danish blade manufacturer. As West-Wind pursued its expansion in a global market for offshore wind turbine technology, its blade factory found itself in the need for more workers. The West-Wind blade and turbine factories pushed forward the institutionalisation of VET for “Windmøllentechniker” for composite technology and turbine engineering with two public technology colleges. Training as part of industrial policy by the municipality and funded by the ESF was aimed at white-collar jobs. This was organised through a subsidised industry network that provided continued training to company executives

with the aim of facilitating future business collaborations among (potential) suppliers of the wind turbine industry (staff, municipality, June 2014).

In contrast, in Germany, municipalities played an active role in enhancing vocational skill provision in the offshore wind turbine sector. Since 2000/2001, the ALMP provider for CVET and the municipality planned skill formation for the *onshore* wind turbine industry, as wind service technicians seemed high in demand. They expected that local companies would be interested in hiring unemployed jobseekers if up-skilling was provided and funded by a third party (manager and staff, ALMP training provider B, July 2013). In 2002, one municipality and the *Land* decided to establish the *offshore* wind industry locally (manager and staff, municipal development agency, May 2013; manager, ALMP training provider A, July 2012). In 2003, one local ALMP provider started training wind turbine technicians at two sites, but one was soon closed, as competitors began offering similar courses to tap into the same public funding regime (*training vouchers*), and finding enough participants became difficult (staff, ALMP training provider C, July 2012; manager and staff ALMP training provider B, July 2013). Here, the contradictory effects of marketisation in combination with increases in public funding became tangible (Greer et al., 2017, Hipp and Warner, 2008).

In the context of the municipality and region fostering the local offshore wind turbine industry, one of the two Seawing sites tried combining a dual white-collar apprenticeship with higher education studies for an engineering degree (professor, July 2013). Through contacts at the local polytechnic school, seminars were provided to the workers at the Seawing blade factory by one professor in exchange for some practical work experience at the factory for students. The companies also employed student assistants from the local polytechnic school and universities, and co-directed Bachelor and Master's theses (professor, July 2013). The manufacturers received interns from the local ALMP training providers for short stays (manager, ALMP training provider, July 2013).

Between 2004 and 2013, different ALMP training providers and vocational schools across Northern Germany also piloted initial VET for the offshore wind industry. These were funded by temporary ALMP programmes and embedded into local economic development policies of establishing the offshore wind turbine industry: for construction

mechanics, industry electricians, and electrical-mechanics specialists (manager, ALMP training provider A, July 2012; manager, vocational school, May 2013).

The provision of funding for piloting initial VET was justified with industry-targeted industrial policy and the aim to provide opportunities to access jobs at newly establishing manufacturers for ‘disadvantaged’ school-leavers. One example of this was the initial VET programme and the attempt to initiate a training consortium (*Ausbildungsverbund*) by the ALMP initial VET provider (manager, ALMP training provider A, July 2012; officer, trade union, July 2012), which was introduced in the first half of the chapter. The initial VET programme was launched in 2004. But no new cohorts started between 2005 and 2006. The gap was caused by a lack of funding, as in the early years, local companies were reluctant to fund the apprenticeship due to the unstable political and economic environment. In 2012, the programme was discontinued because of economic difficulties in the offshore wind turbine sector.

In another Northern German town, that was also expecting future work opportunities for school-leavers in the offshore wind turbine industry, the local vocational school was involved in political talks on the establishment of production sites between the municipality, the public employment services, and two steel components companies in 2004/2005. These resulted in the provision of a vocational apprenticeship for steel construction mechanics (*Konstruktionsmechaniker*) in 2006/2007 (manager, vocational school, May 2013). The vocational school revived the apprenticeship, and the public employment services and municipality agreed to fully fund the – in its first years entirely – school-based training. Nevertheless, hit by the slump in demand for offshore wind turbines, both manufacturers closed their production sites 2013 and 2014.

In England, funding for skill formation for the offshore industry was part of the central government’s aim to expand offshore wind farm developments around the English coast, but also specifically targeted at already identified turbine manufacturers following specific employers’ demand (manager, municipality, July 2013). Therefore, it is proposed to call this approach to skill formation ‘post-hoc’. Skills funding could be directly accessed by employers, i.e. not necessarily through the intermediary of skill formation providers.

4.1.2. Mitigating effects of poaching

In England, the increase in public funding for engineering skill formation was aimed at reducing the risks of poaching to local small and medium-sized engineering companies, in the context of expanding large component producers (staff, LEP, July 2013; manager and staff, municipality, July 2013; PR staff, IVET training provider, July 2013; manager, college, November 2014). Local engineering companies worried that the newly established blade manufacturer, which could offer higher wages, would poach their best workers. So, the city council targeted governmental funding from the Regional Growth Fund at local SME and large enterprises (staff and manager, municipality, July 2013). The scheme funded eight hundred and fifty apprentices in the region. One hundred eleven apprentices had started the programme by mid-2013.

Local stakeholders from the LEP hoped that the wind turbine manufacturer would act as an “anchor organisation”, which attracted other supply chain companies (professor, university, July 2013). Local engineering companies were not expected to become suppliers of the offshore wind component producers, but the hope was that new plants would bring business for the local services industry. West-Wind finally built a blade factory, which did not rely on a complex component supply chain. This is why the short-term increase in skills funding might have increased the number of available engineering workers, but did not necessarily increase the number of skilled engineering jobs in the region. Skilled engineering jobs however, might have been created in the installation and servicing of offshore wind turbines in the region, which is an area that should be addressed by future research.

4.1.3. Buffering the effects of slumps

In Germany, skill formation was used to buffer the effects on the redundant workforce of the sector’s slump in 2013/2014. In contrast, the Danish Seagull site reacted to economic difficulties by shrinking its workforce and rationalising its skill profiles – a common approach among Danish companies (Andersen, 2015). Once the German offshore wind turbine industry experienced economic difficulties, the IVET pilot programmes were discontinued. Only support for modular vocational training remained as ALMP intervention combined with short-time work (HR department, April 2014; works council, Seawing, July 2013; manager and staff, ALMP training provider B, July 2013). When no new contracts were won in 2013 and 2014 by East-Wind, Seagull, and

Seawing, and the two steel companies, the manufacturers in Northern Germany released hundreds of agency workers. They attempted to keep their core workers through short-time work arrangements and ALMP subsidised qualification programmes.

ALMP training providers offered modular vocational training to unskilled workers of some of the manufacturers (HR manager, Seawing, April 2014; works councillor, Seawing, July 2013). For example the Seawing blade factory benefitted from the public programme *Wegebau* financed by the Land ('building pathways', manager and staff, ALMP training provider, July 2013), as the *Land* and the municipality provided training funds for the company, and a short-time work agreement, a *Betriebliches Bündnis für Arbeit* (company agreement for work), had been signed between plant management and the works council (HR manager, Seawing, April 2014; manager and staff, ALMP training provider, July 2013). Also, the Seagull and East-Wind sites negotiated with their municipalities and *Länder* about subsidised skill formation packages in anticipation of the economic slump (works councillor, East-Wind, November 2014; works councillor, Seagull, July 2013).

In contrast, when the manufacturer Seagull went through a major restructuring process, as the Northern European market for wind turbines did not grow as expected (former HR manager, July 2014), an external consultant assessed skill needs and provision at its Danish generator factory more closely. Instead of using skill formation, or short-time work to overcome the phase of low labour demand, the Danish Seagull site opted for 'shrinking' its operations 'healthy'. The remaining jobs were transferred to other sites in Denmark and Germany. The generator plant in Denmark closed in 2011 and it stayed unclear from the interviews how the manufacturer Seagull engaged with the Danish skill formation regime after restructuring. Seagull continued producing generators at a fully automated greenfield site in Germany. German ALMP provided up-skilling of unskilled workers to occupy redundant workers and keep them available for the industry in case of a re-surging demand for offshore wind turbines. However Danish interviewees did not report any ALMP measures aimed at keeping workers in the sector, or at keeping the Danish generator factory open.

4.1.4. Knock-on effects on skill formation providers

In England and Germany, the temporary increase in public funding for vocational skill formation had knock-on effects for skill formation providers. The increase of public funding in a *marketised regime*, where providers compete for participants and/or contracts (Doellgast and Greer, 2013, Greer and Symon, 2014, Hipp and Warner, 2008) was potentially disruptive. In 2003, the ALMP providers in Germany started training wind turbine technicians in two locations, but one was soon closed, as competitors began offering similar courses to tap into the same public funding regime (*training vouchers*), and finding enough participants became difficult (staff, ALMP training provider C, July 2012; manager and staff ALMP training provider B, July 2013).

Similarly, in England the abolition of RDAs, their replacement by LEPs, and the local LEP's successful bid to the SFA within the City Deals programme, significantly changed the framework for local training providers' funding and for curriculum design. In the past, the local College had been directly funded by the SFA, and could ignore funding from the RDA (manager, college, November 2014). After the funding cuts under the Coalition Government, the college diversified its sources and acquired funding from the LEP among others. The diversity of funding gave a 'relative freedom to respond to local needs'. The reforms of industrial policy governance changed the situation for local skill formation providers. The latter felt more actively involved in funding allocation, although the reforms had reduced their funding from the SFA. The local college invested in a new building for energy engineering skills, hoping for more training demand in the context of the Round 3 offshore wind farms and the region becoming a renewable energy hub.

In the context of funding cuts under the Coalition Government (2010-2015) and the introduction of competitive bidding, the college and other training providers from the region worked together in the LEP's committees aimed at jointly creating a 'National College for Offshore Wind'. At the IVET inter-firm training provider, in 2013, companies could acquire apprenticeship funding of seven thousand pounds per apprentice from the Regional Growth Funds, which led to a 'record year' for the provider (PR staff, July 2013). Twenty-six companies used the scheme for the first time.

During 2014, the CVET provider expanded its activities as influx of public funding for skill formation in the engineering sector was expected to increase competition among similar providers across the country. This expansion created a lot of supplementary work, and insecurity over the future of the organisation. The inter-firm training provider created a role for a new marketing manager to attract new clients within and beyond the region. As the provider had won funding from the LEP, it built a hall for training, but later decided to deliver the training at a partner's premises. The partner organisation was specialised in training for work at heights. And the former CVET provider did not want bite into the latter provider's market. Both providers tried to share the commercial risk of expansion by increasing their collaboration.

4.2. Demand side policy

4.2.1. Negative impact on work-based skill formation

Interviewees at the manufacturers in Germany and Denmark reported that demand-side pressures interfered with work-based skill formation (works councillors, various manufacturers, July 2013; shop stewards, November 2014). The German ALMP continued training providers realised that the wind turbine manufacturers were often not interested in developing their workforces' deep technical know-how (manager and staff, ALMP training provider B, July 2013). The companies had sufficiently skilled workers (some of the manufacturers subcontracted more complex work to specialist companies), and prioritised on availability of *hands*.

The works councillors at the German Seawing blade factory reported that often there was no time for training as blades had to be delivered quickly to meet deadlines for the feed-in-tariffs. The lack of training was also explained by the lack of vocational training pathways for 'blade workers', and by the frequent change of HR management staff (manager and staff, ALMP training provider, July 2013; trade union officer, July 2012; HR manager, April 2014). Time pressures on production led to a lack of health and safety training on the shop floor (works councillor, Seawing, July 2013). Also, at the Seawing and East-Wind sites, pressure to meet the subsidy deadlines reduced the time for training. Shop stewards at the Danish West-Wind blade factory stated that production pressures impacted on-the-job training. There were four on-the-job induction courses of two weeks each for blade workers, for example in polishing and fibreglass technologies, "but only when there is time" (shop steward, November 2014).

4.2.2. Positive impact on skill formation at inter-firm training providers

In Denmark, the provision of specialised wind turbine technicians continued to be controlled by the turbine manufacturers. West-Wind, Seagull, and all large wind turbine manufacturers in Denmark had subcontracted the company Maersk (Maersk, 2016), which acted as inter-firm provider for continued training of installation and maintenance workers. The manufacturers tried to protect their knowledge from competitors (manager, HR department, June 2014), but were willing to share confidential knowledge within a commercial contract over training provision.

In contrast, German energy utilities aimed for shaping skills, and service and maintenance standardisation, as soon as the policy framework appeared to shift towards more long-term and expanding support of large scale wind-energy provision. This was in the context of the Federal Government's announcement of a permanent phase out of nuclear energy in 2011 (manager, inter-firm training provider in Germany, June 2012). In 2012, two staff worked on developing a continued vocational curriculum that would certify maintenance technicians for wind turbines (manager and manager, August 2012). The federation's members and managers decided to launch the new course, as they expected increasing demand for wind turbine service technicians.

The start of inter-firm training provision by the utilities was motivated by an expected shift in the business model of wind energy generation to more large-scale wind farms. This change in the business model would result from the German federal government's declining support of nuclear power and increasing support of renewable energy after the Fukushima nuclear accident (manager, industry training provider, August 2012). Since the late 2000s, wind turbine operations had transformed from small contracts between manufacturers and individuals to larger fields with turbines from different manufacturers and run by the utilities. The establishment of a wind turbine technician CVET was an attempt of the utilities to gain independence from manufacturer specific skills and knowledge about wind turbine maintenance (manager, inter-firm training provider, August 2012). By establishing CVET at their industry school the utilities also hoped to drive the harmonisation of the reference designation system for plant components (RDS-PP), which would enhance their ability to standardise service and maintenance by

utilities or generic subcontractors.⁴⁴ This shows the relevance of supply and demand side industrial policy.

4.2.3. ‘Permanent’, ‘ad hoc’, and ‘post hoc’ skill formation

In Denmark, changes and expected changes in workforce and skill demands seemed to be entirely buffered by existing VET and ALMP institutions, technology colleges and AMU. Skill formation for highly skilled maintenance and service work seemed to be either supplied by the manufacturers themselves or the subcontractor Maersk. In contrast, in Germany and England, industrial policy dramatically impacted on the skill providers. In Germany, the impact was mainly on ALMP training providers, as they were operating in an institutionally more flexible regime (see first section of this chapter); in England, it was the incumbent VET providers.

In Denmark, dynamically adapting skill formation seemed a ‘permanent’ feature. In Germany and England additional public funding and provision of skill formation seemed an important pillar of ‘ad hoc’ and ‘post hoc’ industrial policy for offshore wind turbine technology. In Germany ‘ad hoc’ design of training programmes preceded or paralleled the establishment of the turbine manufacturers, but was also used to buffer slumps in workforce demand. In England ‘post hoc’ design of public skills funding resulted from negotiations with the manufacturers, West-Wind and Seagull, and was based on feedback from local SMEs. Up-skilling followed a defensive rationale, mitigating the possible poaching of skilled workers from local companies. Policy-makers argued that skills funding and up-skilling would allow local jobseekers to access ‘good’ jobs. However, the next chapter will show that the hope for access to ‘good’ jobs was frustrated by the predominance of agency work and the rationalisation of production processes in the maturing sector. The next section concludes this chapter.

⁴⁴ Among wind energy components manufacturers there were two different systems regarding the marking of small components parts. The aim of designing a training was to influence the establishment of one dominant designation system to develop one software that helped operators to make IT analyses.

5. Discussion and conclusion

The introduction formulated three questions: How far did the local skill-set impact the emerging offshore wind turbine manufacturing industry? How is vocational skill formation shaped in the offshore wind turbine manufacturing sectors across Denmark, Germany and England and how is it embedded in national vocational education and training (VET) and active labour market policy regimes (ALMP)? And, how is skill formation affected by industrial policy

This chapter discussed the impact of the locally available skill set on the shape of the new offshore wind turbine manufacturing industry. In Denmark and Germany, large manufacturers acquired small brown field sites that were specialised in onshore turbine production. They expanded these brown field sites, as did West-Wind in Denmark, and Seagull and East-Wind in Germany, or created joint ventures with specialised SMEs as did Seawing blades. In the early years, before lean production was introduced, the availability of an electro-mechanical skill-base was crucial for turbine production.

The manufacturers Seagull and West-Wind had several rationales for operating blade (and not nacelles or generator) factories in England: there was a lack of skilled engineering workers and the companies already had established engineering and steel casting supply chains in other locations. But offshore wind farm developers were confronted with political demands of *domestic content* in UK offshore wind farms as shown in the previous chapter on industrial policy. Thus, they had to increase the number of components supplied by UK-based factories. The re-location and reopening of blade factories in England by Seagull and West-Wind are a strategic response to these demands (manager, Southwind, November 2014). The advantage of blade factories compared to nacelles assembly and steel casting was that blade workers could be trained relatively quickly and the supply chain relied on a handful of global suppliers (works councillor, Seawing, July 2013; manager, South-Wind, November 2014; HR department, April 2014).

Skill formation in the offshore wind turbine industry across the countries was, to varying degrees, integrated in the existing VET regimes. Skill formation initiatives in Denmark seemed to be closely embedded in existing VET and ALMP regimes. Skill formation in the sector seemed a ‘permanent’ feature as manufacturers and agencies generally used

the already available training subsidies and the public providers AMU and the technology colleges (Jørgensen, 2009, Helms Jørgensen, 2014). Collaborating with the manufacturer West-Wind, the technology colleges relatively quickly set-up a dual vocational programme for blade workers and wind turbine technicians. The AMU centre provided health and safety training.

In general, training providers in Germany and Denmark worked closely with the manufacturers regarding the design of skill formation. The Danish West-Wind pushed for the institutionalisation of dual blade and turbine worker apprenticeships and benefitted from the option to train its workers from foreign sites at the Danish technology colleges. Both manufacturers, Seagull and West-Wind, also provided courses themselves through their own training units (HR department, June 2014, shop stewards, November 2014) and the company Maersk (Maersk, 2016). In contrast, the manufacturers in Germany were less actively involved in vocational skill formation but relied on school-based skill formation at vocational schools and ALMP training providers. This confirms a trend of increasing disengagement from skill-formation by manufacturers already identified by others (cf. Busemeyer and Trampusch, 2012, Thelen, 2014).

Skill formation initiatives in Germany showed the importance of ALMP, and the slowness of the regular VET regime in recognising newly emerging occupational profiles (cf. Busemeyer and Trampusch, 2012: German VET regime's resistance to modularisation), such as those of blade workers. New skill profiles emerged for work with composite technologies, but in Germany the manufacturers did not engage in the institutionalisation of new skilled occupations and vocational apprenticeships (cf. Nicklich, 2014).

The German skill formation initiatives showed that differences in institutional regulation of dual VET and ALMP had consequences for providers. The support that was given to manufacturers by ALMP in Germany seemed to undermine the dual VET system, which in contrast required more funding and supervision of apprentices by employers. ALMP training providers, having more flexibility (Hippach-Schneider et al., 2007), filled the gaps in the German VET regime by offering 'ad-hoc' school-based vocational apprenticeships, internships, and designing training modules as part of local industrial

policy, funded through ALMP. In Denmark, AMU centres and colleges, and in England, all training providers, had access to public funds as well as they could provide commercial training. In Germany, only ALMP providers were allowed to also provide commercial training; vocational schools were not.

The skill formation initiatives in England confirm the idea of regional fragmentation (Clarke and Wall, 1998) – each locality had its own approach. Three English training providers in proximity to one turbine manufacturing plant were, despite their engineering expertise, not used by the manufacturer. The manufacturer Seagull's work with a local college shows that different outcomes in terms of local arrangements are possible. Comparing both cases shows that local training cooperation and flow of public funding depend on specific arrangements and negotiations between a public funder, local stakeholders, and multinational turbine manufacturers. They are not necessarily determined by an overall national institutional regime, but rather by local economic development policy. The local idiosyncrasies in England in terms of skill formation might have even increased since 2012 with the introduction of competitive tendering of economic development funds (e.g. Regional Growth Fund) and skills funding (e.g. City Deal) and the creation of LEPs leading to self-reliant communities (cf. Sissons and Jones, 2014).

Vocational skill formation provision varied across the countries in its inclusivity towards disadvantaged participants. Vocational colleges and AMU centres did not distinguish between client groups, but divided their participants according to age groups and offered both IVET and CVET. In Germany, public vocational schools and providers of ALMP (the majority of providers) both worked with disadvantaged groups. In England, inter-firm training providers primarily focussed on 'good applicants', whereas vocational training for disadvantaged and unemployed groups were marginal, even at the more broadly oriented vocational college. Funding for training of long-term unemployed and in-work subsidies was directly accessible for employers. In this respect, findings across the countries fit established views that, on a spectrum, vocational skill formation in Denmark is most inclusive, followed by Germany, while England it is least inclusive (cf. Thelen, 2014).

The second half of the chapter discussed the effects of industrial policy on skill formation. Skill formation is itself part of supply side industrial policy as discussed in the previous chapter. Here, the effects on training providers of funding increases for sector specific skill formation were discussed in the context of each country's skill formation regime. In Germany, additional skill formation in engineering skills for offshore wind turbine mechanics and training modules in composite technology for blade workers through ALMP short-term programmes were described as important part of local economic development policies by interviewees. Funding for these programmes was temporary, and negotiated between local stakeholders: training providers, municipality and Jobcentre, and manufacturers, and other funding providers.

In England, one municipality allocated additional funding for skill formation in engineering skills, on the job training and in-work subsidies directly to employers in the renewables industry. As in Germany, it was part of local economic development policy targeted at the offshore wind and other engineering industries and limited in time. The temporary character of the additional funding led to instabilities for providers. In contrast, in Denmark, funding for vocational skill formation could be accessed within the regular ALMP and VET regime and was not limited to a specific local economic development policy agenda.

In all three countries, the aim of skill formation for the sector was to increase labour supply for the manufacturers. However, other rationales also played a role. In England, additional skills funding was available to all local employers who engaged in enhancing their workers' engineering skills. The aim was to lower the risks of poaching for local small and medium enterprises in the context of the establishment of a large turbine manufacturer in the region. In the German municipalities, skill formation was directly targeted at the wind turbine manufacturers. Skill formation was also available to the Germany-based sites in times of economic slumps, to provide sector specific up-skilling to redundant workers in times of low labour demand and to keep workers within the sector. In Denmark, vocational skill formation was rather used to re-skill workers for new jobs (Andersen, 2015).

Skill formation was affected by demand side policy for the offshore wind turbine sector. The pace of production dictated by subsidy schemes impacted negatively on workplace training. Manufacturers relied on large amounts of agency workers, as discussed more in detail in the next chapter. This is why, manufacturers hired workers only for the time they needed labour for production, not for the time they would need to train them.

At German and Danish sites, on-the-job training was deemed necessary by works councillors and shop-steward, as well as vocational educators, in particular in blade production, where many unskilled workers were employed. But in reality, training would take place only “when there is time” (works councillor, November 2014; also, several works councillors at different sites, July 2013), which was rare. The responsibility to train was often shifted to agencies, which in turn used ALMP training funds. As production of offshore wind turbine blades in England only started after data collection, it is unclear how manufacturers effectively engaged with skill formation in the context of the recently reformed energy market and a subsidy scheme for offshore wind electricity.

The German utilities’ initiative to develop a wind turbine service technician training programme after the Federal Government had announced the definite exit from nuclear energy in 2011, shows how dependent the private sector’s engagement is on the prospects of long-term and stable policy support for a new technology. However, as discussed above, the utilities’ rationale was not only to increase skills provision, but also the chance to take influence on technical standardisation for wind turbines and to gain more control over service and maintenance of the turbines in their wind farms relative to the turbine manufacturers.

This chapter has shown that although skill formation for the sector in each country was shaped by the institutional VET and ALMP regimes in place, it was also shaped by how supply and demand side industrial policy were designed in each setting.

The next chapter will explore the impact of industrial policy on job quality. It will also discuss more in detail how skill formation impacted on job quality, namely by increasing labour supply on the one hand, and, on the other hand, by buffering to varying degrees the negative impact of volatile demand side industrial policy on labour in the sector.

CHAPTER VI: JOB QUALITY

1. Introduction

The previous chapter discussed skill formation in the offshore wind turbine industry. This chapter compares job quality at the Danish West-Wind and Seagull factories, the German East-Wind, Seagull, Seawing blades and nacelles factories, as well as, where data was available, three unnamed steel component factories, and the English Seagull and West-Wind blade factories. The chapter evaluates the proposition that workers in Denmark and Germany, both characterised as coordinated market economies (Hall and Soskice, 2001, Thelen, 2004, Thelen, 2014), enjoy patterns of good job quality (worker representation, job security, relatively high pay, social integration, and discretion (cf. Muños de Bustillo et al., 2009) while workers in England do not encounter these patterns.

This chapter links job quality with industrial policy. It explores how demand side industrial policy impacts on companies and job quality, not only in terms of skill formation as the previous chapter has shown, but also in terms of non-standard employment, job insecurity and social integration. The chapter shows that differences between job quality in Denmark, Germany and England persist. It also confirms that institutions produce dualised labour markets. The chapter shows that effects of dualised labour markets on job quality are partly superseded by industrial policy. In general, job quality is low. Common features that are assumed to drive dualisation such as differentiated workplace representation (Eichhorst, 2015), different skill levels (Hassel, 2014), and workfare (Dörre et al., 2013, Greer, 2016) impact job quality as previously shown by others, however the effects are nuanced. For example, skill formation is not a panacea against bad jobs (cf. Benassi, 2016). Financialisation seems to be interlinked with industrial policy, and provides additional rationales for the use of agency work (cf. Nachtwey et al., 2015).

First, this chapter reviews the regulatory context of agency work. It then presents findings on companies' rationales for using agency work, which are also commonly discussed in the literature (cost saving, avoidance of scandals, numerical and functional flexibility, and financialisation). Then the chapter relates the use of agency work to active labour market policy (supply side policy) as well as volatile subsidy schemes (demand side policies). Third, findings on job quality of core and agency workers are presented in terms of job security, pay, and social relationships. It is discussed how these were impacted by industrial policy and differentiation between core and agency workers. Last the chapter discusses the mitigating and reinforcing effects on job quality of workplace representation and skill formation.

2. Regulatory context of agency work

In Denmark, the regulation of private agencies was abolished during the 1990s (Jahn and Rosholm, 2010). The Danish government was reluctant to regulate agencies (shop steward, November 2014; manager, AMU centre, November 2014). Changes in the regulation of public employment services led to relatively high growth rates in this sector over the past years (Bredgaard et al., 2009). Agencies operated either as subcontractors of the public employment services or on the free market. They benefitted from the crisis of 2008/2009, and the reforms of the public employment services over the past decades (manager, AMU centre, November 2014). Agencies hired workers for the same duration as they had a placement at a client company: “agency workers are not slaves”, explained one job advisor at an agency (November 2014).

In Germany, the liberalisation of the labour market and increased *activation* within welfare state provisions have helped the agency work sector and its growth in the former strongholds of standard full-time and skilled employment, the manufacturing industry (Benassi and Dorigatti, 2015, Eichhorst and Marx, 2011, Ferreira, 2016). Many large agencies have works councils, apply collective agreements of the temporary work sector, and have themselves company agreements, which however often just restate statutory minimum standards (Ferreira, 2016). However, the agency sector consists mainly of small agencies.

The same employment law applies to work agencies as to any other employer (manager, work agency, July 2012). After the first six months of employment employers have to give a reason and one-month notice for dismissals; after two or four years of employment, depending on the agency's company agreement, the agency has to give a permanent contract. In reality, however, agencies rarely contract workers for more than two years (labour lawyer, July 2013). There was anecdotal evidence of malpractice: The agencies had developed a system of circumventing Germany's strict employment law; to do so, they shifted workers among themselves, leaving a contract, making all workers redundant, and opening as a new provider (labour lawyer, July 2013). In 2012, after the so-called 'Schlecker Scandal', involving the in-house work agency of a large drug-store chain, a statutory minimum wage for agency workers was introduced in Germany (Ferreira, 2016).

Also in England, agency work was a growing sector (Forde and Slater, 2005, Forde and Slater, 2016, Stanworth and Druker, 2000). Initially, agency work was hardly regulated in England, until the late 1990s. Then law stipulated that agency work established an employment relationship between agency and worker, and that certain minimum standards applied to this kind of employment. Research has shown that agency work in Britain is widely spread among low-paying jobs, but not necessarily low-skill, and is relatively common in clerical routine jobs; it is involuntary, and hardly just a transitional status in individuals' work biography (Forde and Slater, 2005). Governmental regulation in England has been assumed to facilitate the agency sectors' consolidation through the way it implemented the European Temporary Agency Work Directive into employment law (Agency Working Regulations of 2011). It allowed deviations from equal pay (Swedish derogation), when a permanent employment relationship exists between agency and worker (Forde and Slater, 2016). The next section will present findings on companies' rationales for using agency work.

3. Industrial policy – a rationale for agency work?

Agency work for production jobs is generally associated with employers aiming to gain numerical and functional flexibility for peak times (Atkinson, 1984, Atkinson and Meager, 1986, Doeringer and Piore, 1985). However, others identify agency work as a newly permanent and political feature of employment relations (Flecker, 2009, Littler and Innes, 2003, Nachtwey et al., 2015). Agency work is a means for employers to put pressure on labour costs by negotiating terms and conditions with agencies (Christopherson and Clark, 2007, Vidal, 2013a), creating competition with the internal workforce (Benassi and Dorigatti, 2015, Flecker, 2009), and tapping into a pool of workers that is difficult to organise for trade unions, as many are migrant workers (Lillie et al., 2014).

This section begins by reviewing findings that support conventional explanations of agency work as recruitment tool: cost savings, avoidance of scandals over mass redundancies, numerical and functional flexibility, and the gain of competitive advantages in a financialised economy. It then presents findings on how supply side policy (skill formation and active labour market policy) facilitates agency work, and how volatile demand side policy provides another important rationale for its use.

3.1. Agencies as recruitment tools

When the industry grew more rapidly in Denmark in 2006/2007 in the context of a growing global market for offshore wind turbines, skilled workers, who had lost their jobs during the previous decades, had already moved on to other regions, and it was difficult to recruit workers at the pace needed (staff, municipality Denmark, June 2014; HR department, West-Wind, Demark, June 2014; also see Fornahl et al., 2012: on North-West Germany). In the past West-Wind had exclusively hired production workers from agencies:

“Especially for hiring blue-collar workers, agencies are being used.... Blade manufacturing is very labour intensive and there are over two thousand workers at the factory at the moment. Hiring of new production workers takes place through agencies only.... As long as [interviewee] has been working for [the company, since 2007], the HR department has not been involved with recruitment of blue-collar workers. This always took place through agencies.”

HR manager, June 2014, based on notes

3.2. To save labour costs

Agency work saved costs to the company on the days the workers would not work. And there was no need to pay for holidays or sick leave. In addition, the manufacturers could dictate the prices to agencies. West-Wind’s procurement department negotiated with up to seven agencies, and could arrive at “very good terms” (HR department, October 2014):

“Using agency workers does not reduce the [hourly] pay, although it helps to keep labour costs down. [The company] negotiates with several agencies, and could arrive at very good agreements that leave a very small margin for the agency.”

Another manager at the same manufacturer confirmed this (June 2014):

“West-Wind prefers working with only a few agencies and hires a large number of workers to reach ‘economies of scale’, and lower the price via negotiations, like for material supply.”

3.3. To avoid scandals about mass redundancies

In Denmark, a manager at a work agency (November 2014) stated that employers using agency workers avoided the scandal of mass-redundancies in sectors with seasonally fluctuating workforce demands. This resonates with observations from the offshore wind turbine manufacturing sector. West-Wind mainly relied on agency workers, which provided the company with extreme numerical flexibility. West-Wind’s HR managers refused to talk about the number of agency workers at the site, as one was aware that “this information [was] highly political, and the use of temp workers [was] highly contested” (HR department, June 2014). While Seagull’s downsizing across the world

was largely mediated, West-Wind could rationalise workforce simply by letting go agency workers.

3.4. To gain numerical flexibility

In Denmark, despite *flexicurity*, which allowed for short notice of redundancy (between zero and fourteen days) for workers on permanent contracts, and an absolute maximum of 120 days for workers with very long tenure, work with agencies was used to increase numerical flexibility. The fast pace of production innovation made exact workforce planning difficult, as the following two quotes regarding the same factory illustrate:

“The retraining of people for the new blade is problematic as the production has to be stopped for this. Some people are sent home, some people are being trained, but it’s complicated.”

Shop steward, November 2014

“There is a fast pace of product and production innovation. This is why needs for workforce cannot be exactly planned, and agencies are the favoured channel of employing workers.”

HR manager, based on notes, June 2014

3.5. To gain functional flexibility

Private sector agencies were also said to be better at making workers fit for any kind of job (manager, agency, November 2014). For a while the Danish trade union 3F operated an agency to reintegrate unemployed trade union members into work quickly. 3F however had little success (officer, trade union, November 2014) and its agency was bought up by a private sector competitor a couple of years before the interview (manager, agency, November 2014). The reason for better performance of private agencies was seen in the way agencies matched jobseekers and jobs: “Trade unions and public employment services see jobseekers as boxes, we see them as balloons,” said one agency’s manager, suggesting that private agencies promoted higher flexibility in terms of what kind of jobs workers would take on.

This was also related to agencies taking responsibility for up-skilling workers before their placement, as illustrated by West-Wind and its workforce supplier (HR department, June 2014):

“Usually, when the company wins a contract it can plan personnel and inform the agency about its workforce needs and skill requirements. Then the agency will undertake the up-skilling [through the AMU centre] before the placement starts.”

At the German Seagull generator plant, agency workers were used for transitional periods between manual assembly and automated production. Before the introduction of lean production at the generator factory, and when the site’s orders peaked, three hundred and twenty workers and staff, and one hundred and fifty agency workers worked at the old and the new sites (works councillor, July 2013). When the Seagull generator factory moved to a new green field site, the plant’s agency workers were the first to learn how to operate the new machines. They were set to train the core workers, who would step-by-step transfer from the former plant to the new plant, while the number of agency workers was continuously reduced:

“It was a difficult situation (...), but it was clearly communicated, and the agency workers had the chance to quit before entering this set-up. The company also wanted to avoid manipulation. Many agency workers had been in and out of the company for many years, and did identify with the company.”

Works councillor, Seagull, July 2013

The Seawing blade factory used agency workers and subcontractors during peak times, also to buy external expertise in composite technology. In peak times, the company relied on two to three different companies, who came on-site with up to sixty workers (works councillor, Seawing, July 2013) to help out and repair faulty blades.

3.6. To gain advantages in a financialised economy

At the Danish West-Wind blade factory, shop stewards stated that the foreign headquarters perceived the workers on-site only in terms of financial numbers (trade union officer, November 2014), which might in part explain the high number of agency workers, instead of direct employment:

“The cooperation between the [company management] and the shop floor workers is okay, but in the company, it is felt that the bosses sit in Germany, and they perceive the site only in terms of headcounts.... For the current costs on the balance sheet only the directly employed count. The agency workers are extras and are accounted for differently. But some of the agency workers have been there for more than two years. And the whole situation creates a lot of frustration for the permanent workers.”

Trade union officer, November 2014

The shop stewards assumed that the agency workers were mainly used to make the company more competitive. Other interviewees hinted at the relationship between financial balance sheets and capital markets. These were extremely important for companies to access cheap credit to pre-finance large contracts, as they occurred in particular in the UK (see chapter on industrial policy):

“It would be great to work with the developers and clients from [the UK], but it is difficult to get these companies, the ‘big utilities’, as customers, because they prefer to work with large companies like [company]. To us they say: ‘We know that you can do this, but for these projects your financial structure is “too short”. We are not sure, if you can lift such a big investment volume.’ The link to our parent company is problematic. Its financial balance sheet is in such a bad shape that our refinancing rates would be 8 per cent, and [the competitor] can have a rate of 2 per cent. At that moment, we are out of business.”

Former manager, February 2014

A former manager at another manufacturer confirmed this view (November 2014):

“Although the big-megawatts-turbines with the best track record are [names two companies]. The problem is that these have a too low financial balance sheet at the moment. These are the guarantees looked at by the utility: The bigger a company, the smaller the guarantee it needs to give. The cheaper it gets capital, the cheaper it can sell its turbines. In cases like [another company], utilities would look at the finances of the parent company. As [the parent company] is in financial difficulties and only being held afloat by [its subsidiary], [the subsidiaries]’s chances on the offshore wind turbine market are low. This is why the projects are being scaled back, although the confidence in the supply chain is now bigger, but there are no economies of scale.”

The above illustrates how cost sensitive the companies were; and how this translated into high shares of agency work. The next two points add to how supply and demand side policies impacted the companies' cost structures. The first illustrates how manufacturers used agencies. Agencies benefitted from access to skill formation through ALMP, and could recruit unemployed jobseekers directly from the public employment services. The second illustrates how changing subsidy schemes were perceived to make it impossible for manufacturers to commit to workers long-term.

3.7. Agency work facilitated by active labour market policy

In Denmark, ALMP activation measures were said to make jobseekers more open to work for agencies (senior staff, agency A, November 2014; manager, agency B, November 2014). Also, the introduction of severance pay in Denmark, an achievement of collective bargaining in 2009 to mitigate the effects of the 2008/2009 crisis (Schmidt and Hersh, 2012), had unintended consequences for the workers, as companies increasingly sought workers from agencies to avoid the risk of paying for severance (HR department, West-Wind, October 2014).

In Germany, many companies exclusively hired workers through agencies. As, the ALMP training providers needed to find a minimum number of participants to run their courses, and were only paid by the public employment services for participants who completed, the agencies became important allies in recruiting participants (manager and staff, ALMP training provider, July 2013; manager, Jobcentre, May 2013; manager and staff, agency, July 2012). Funding arrangements of ALMP training gave agencies and manufacturers the opportunity to shift training costs to the public employment services.

The following quotes illustrate the interdependence between manufacturers, agencies, training providers, and public employment services. The ALMP training providers trained jobseekers, who agencies directed to them before hiring. The ALMP training providers received payment from the jobcentre for the training.

“Who are the customers? This is a difficult situation. The participants are called customers, but they are not the ones who pay. When the amount of training providers increased, it was an existential battle. To find participants, we worked with many temporary personnel service providers. As they are potential employers they have better access to participants. These agencies then use the public funding to let the participants be trained through us. They hire the participants after completion. To hire the [workers] first and then pay for the training themselves is not profitable enough for the agencies.”

ALMP training provider B, July 2013

The agencies financially counted on the public employment services to fund the training of their future workers:

“The [informal] relationship [between work agencies and training providers] are ‘give and take’. On the one hand, we are interested in the training of good workers, who will go on a placement, on the other hand, the training providers also acquire participants from us to fill up their groups, otherwise they cannot proceed with the programme. In fact, we try to transfer most of the costs for training to the public employment agency, for example by using their training vouchers.”

Manager agency, July 2012

The jobcentre recognised that it subsidised the training for future agency workers, who would be employed by the turbine manufacturers:

“You have to think them together: agencies, jobcentres, and training providers. Often the companies have already made a choice about the local training provider, and then they come to us to get the funding [for the training]. Our collaboration is good. Over the past years many agencies have entered the sector, the companies have become more careful, and use the agencies to maintain their flexibility in terms of workforce.”

Manager, jobcentre, May 2013

But this close collaboration between public employment services, agencies, and training providers had, possibly unintended, side-effects on job quality. For example, one works councillor described that some workers had accepted work at the blade factory through agencies, because they feared that, if they did not accept to work for an agency, they would be sanctioned by the jobcentre, and consequently lose their social benefits (labour lawyer, July 2013; works councillor, Seawing A, July 2013). Also at the jobcentre one

was aware that some long-term unemployed jobseekers did not have much of a choice other than working for an agency, as a manager at the local jobcentre described (May 2013):

“The jobcentre treats agencies like all other local employers. They are regularly asked about their job offers. If they want to hire, then we work with them: There are the unemployed. We want to integrate them in the market diligently. And at that moment, whoever wants to hire, we work with. Everywhere, where we see a perfect fit [‘Passgenauigkeit’] we book the unemployed on.

We treat everyone [every company] the same. It is a principle of equality and neutrality. In doubt, this is based on the Basic Law [*Grundgesetz*, the German Constitution]. We are a public agency, even if we want to be a service provider.

Finally, this is also the right to freedom of choice of the jobseeker: we cannot withhold any job offer. Because the unemployed are drawing on benefits, they are in a plight [or dilemma]. But mostly the problem is not that they have too many job offers but none.”

Possibly because of this absence of choice, some agency workers came with the “wrong kind of motivation”, stated one works councillor (Seawing, July 2013), meaning that some workers came to work, because they felt threatened to lose their benefits, and not because they wanted a job at the blade factory:

“Everything arrived here, long-term unemployed, who didn’t want, but were pressured by the public employment services, under threat to lose their benefits, ‘fished away’ by agencies.”

Front-line staff interviewed at the jobcentre (July 2013), however, did not provide any examples on whether their interactions with jobseekers had led to work in the sector. Similar to agencies in Germany, agencies in Denmark used the public ALMP training provider AMU for up-skilling workers for the blade factory. The next section discusses the role of the volatile policy environment for the use of agency work by the manufacturers.

3.8. Volatile policy environment

As the chapter on industrial policy has shown, Denmark, Germany and England provided different policy frameworks to investors and manufacturers, which impacted on the economic situation of both. Interviewees hinting at the dependence on political regulation stated “it is a political market...it is controlled by politicians” (former engineer, Seagull, Denmark, June 2014). Industrial policy resulted in highly fluctuating workforce demands. In Germany, the regulatory framework was blamed to not provide stable enough conditions for directly hiring workers (former manager, February 2014). Manufacturers were said to have become more careful (manager, jobcentre, May 2013; manager, ALMP IVET training provider, July 2012; job advisor at agency, July 2012; former manager, February 2014):

“There are companies, which always hire through temporary work agencies. And now we have the first situation, where apprentices from the 2007/2008 cohort were hired [by an agency]. They could not be hired directly, because of the contract situation [referring to orders from offshore wind farm developers].”

ALMP training provider, Germany, July 2012

Managers at the manufacturers confirmed the need for numerical flexibility in the unstable policy environment, as the following quote illustrates:

“[The company maintains] strong collaboration with personnel service providers [work agencies], mainly in the field of temporary and hired work, because this enables us to stay flexible. Because business is very volatile, one cannot plan for personnel long-term. This is detrimental to [directly] hiring workers and on skill formation. In peak times [the company] worked with fifteen different personnel service providers.”

Former manager, Seagull, February 2014

This must be an estimate, as other interviewees’ accounts slightly differed, but estimates were always above ten different providers. Also, the way subsidy schemes were shaped, for example tight deadlines, impacted on the pace of production and hence short-term labour demand that was fulfilled by use of agencies (works councillor, July 2013):

“Originally the company hired agency workers, because everything always needed to go quickly, and subsidies [feed-in-tariffs] were allocated based on an annual deadline. Also, it was unclear if the rate for the next year would still be the same or not.”

In contrast, lack of skills of individual jobseekers was not seen as a reason for them being hired as agency workers. Agency work was just the only way to get employed at the manufacturers, as these strongly relied on temporary subsidy schemes. One job advisor put it this way:

“But you cannot always assume that agency workers have a barrier. There are really workers who are qualified, absolutely reliable. But they don’t find work in the wind energy sector directly, because (...) the sector is strongly subsidised. One does not know how it will be in a couple of years. Many companies do not hire workers permanently, they first hire through external service providers. This is then the only way into the sector.”

Job advisor, agency, Germany, July 2012

The next sections present findings on how industrial policy, agency work, workplace representation, and skill formation impacted on job quality of directly employed and agency workers at the component production sites.

4. Job quality

4.1. Job security

Job security was strongly influenced by industrial policy. Initially, jobs of directly employed workers seemed secure, but to buffer production peaks manufacturers in Denmark and Germany employed up to 60 per cent of their workforce through agencies. Some agency workers were on the sites for several years. However, when firms across Denmark, Germany, and England had economic difficulties, and restructured their operations, core workers were made redundant. In 2009, one blade manufacturer in England shut down its operations; in 2011, it shut down sites in Denmark and restructured its worldwide operations; in 2013 and 2014 several manufacturers closed down sites in Germany.

Job insecurity was caused by unfavourable industrial policy context, not necessarily in the country where the sites operated, but in the markets to which manufacturers exported. Since 2009/2010, until then, the world's largest offshore turbine manufacturer had to react to the decline of global demand of its products (former HR manager, June 2014). Between 2010 and 2013, three rounds of lay-offs reduced its workforce from around twenty-five thousand worldwide to eighteen thousand. In 2011, the plant's Danish research and development, and generator production facilities were shut down. Roughly five hundred jobs were lost locally.

Also, in Germany, manufacturing jobs were insecure. In times of the slump that hit the offshore wind turbine sector in Germany during 2013/2014, not only agency workers but also directly employed workers had to leave the companies. In summer 2012, roughly three thousand workers worked at the offshore wind turbine manufacturing sites in Northern Germany. While in May 2013, four thousand workers worked in the local offshore wind farm equipment industry (municipal development agency, May 2013), by July 2013, one thousand five hundred of them had lost their jobs (works councillors, various sites, July 2013). After moving to the new green field site and introducing automated production in 2012, the Seagull generator factory reduced its workforce from roughly four hundred seventy to two hundred twenty; including redundancies of twenty-three directly employed workers. During 2014, all agency workers and forty core workers were made redundant at the *East-Wind* nacelles site (works councillor, November 2014). Between 2007 and 2014, the *Seawing* blade factory's workforce fluctuated between roughly two hundred and sixty and seven hundred including about five hundred agency workers (works councillor, Seawing blades, July 2013). Hence fluctuation of workforce needs was mainly buffered by reducing the number of agency workers. Regarding the Seawing nacelles factory, it remained unclear whether only agency workers lost their placements during the 2013/2014 slump, or whether also directly employed workers were made redundant. It is likely though, as an HR manager at Seawing blades stated that, when blade production slowed down, the plant's machine maintenance workers were transferred to Seawing's nacelle assembly plant. Roughly five hundred jobs were lost, when the English Seagull blade factory closed in 2009. The following table shows the number of directly employed and agency workers at the sites between 2007 and 2015. The next section details the use of agency work at the studied manufacturing sites.

Table 15 Workforce fluctuation at the turbine and blade factories (2007-2016)

	2007	2009	2010	2011	2012	2013	2014	2015/2016
<i>Denmark</i>								
West-Wind				600		About 1000 direct, 400 agency workers	1000; summer 400 additional agency workers; autumn 460 additional agency workers	
Seagull				Shuts down, 500 jobs lost				
<i>Germany</i>								
Seagull			120	450	Initially 470, including 150 agency workers, reduction of workforce from mid 2012	220 workers onsite; 23 redundancies, 37 can be deferred		
Seawing blades	200					Reduction from 700, to 400, to 260	234, of these 36 white collar workers	
Seawing nacelles		23, plus agency workers	23, and 50 agency workers were transferred to direct employment		73, plus about 70 agency workers	April 2013: 89 directly employed with 63 production workers, 8 agency workers; July 2013: 58 agency workers		
East Wind	40					800-850 jobs, 25% fixed-term, 200-250 production workers, 80-120 agency workers	All fixed-term contracts end, 40 redundancies, 550 jobs remain, 200 workers transferred to service company; second half of 2014: 8-9 production workers remain	
Steel						closed		
Steel			350 workers in best times but unclear which year				closed	
<i>England</i>								
Seagull (blades)		Closed ~500 jobs lost						Re-opened, up to 800 jobs
West-Wind (blades)								Opened ~ 500 jobs from 2016 onwards

Numbers are based on interviews and Lea (2011), Shankleman (2014), and Stevens (2009).

4.2. Use of agency workers

Agency work is a form of non-standard employment (Gebel, 2010, Holman and McClelland, 2011, Kalleberg et al., 2000, Leschke et al., 2008, McGovern et al., 2004, Muñoz de Bustillo et al., 2011) and commonly associated with lower pay and job security. Some have argued that agency work is used for lower skilled work (Benassi, 2016, Hassel, 2014); however, there is evidence that this is not necessarily the case (Bidwell, 2009, Forde and Slater, 2005, Hakansson and Isidorsson, 2012).

4.3. Agency work at the sites

Agency work was a common phenomenon at the Danish West-Wind blade factory and the German manufacturing sites. Over the past three years the West-Wind site's workforce had increased rapidly from six hundred to one thousand nine hundred in late 2014. During summer 2014, the site took on four hundred and sixty additional workers through one large agency. In November 2014, eight hundred and fifty agency workers worked at the blade factory (shop stewards, November 2014). From interviews with a former HR manager and former engineer it stayed unclear if the Danish Seagull generator plant had had any agency workers.

Confirming Meyer and Fuchs' (2008 in Ferreira, 2016) observation of agencies clustering around industrial hubs, when offshore wind turbine manufacturers established themselves in Northern Germany from the mid-2000s, temporary work agencies quickly followed (manager, jobcentre, May 2013; trade union officer, July 2012). About one hundred and seventy agencies were registered in the town where the Seawing blades and nacelles and East-Wind sites operated (manager, agency, July 2012). When the local offshore wind industry experienced a slump in 2013/2014, the local agencies struggled to stay in business (works councillor, November 2014; labour lawyer, July 2013).

However, at peak times the manufacturers in Northern Germany hired up to 60 per cent of the workforce from agencies (*see table above*). Since the introduction of lean production at the Seagull generator factory by the end of 2012, no agency worker had been onsite. However, when production peaked and during the transition to the new factory in 2012, one hundred and fifty agency workers, one third of the workforce, worked on the old and new sites (works councillor, Seagull, July 2013). At East-Wind's nacelles assembly site, up to 50 per cent of the production workers came from agencies.

In the past, the site had worked with five to six agencies (works councillor, East-Wind, July 2013). In peak times, *Seawing's blade* had more than twice as many agency workers than core workers. The workers had been hired from up to thirteen different agencies (works councillor, Seawing blades, July 2013; former manager, February, 2014). At Seawing nacelles, in peak times up to 60 per cent of all production workers were from agencies. 50 per cent of the production workers came from agencies in 2012, but only eight agency workers worked there in April 2013, before increasing to fifty in July 2013. Some worked for up to twenty-four months, and at least one worked for five consecutive years, through various agencies (works councillor, Seawing B, July 2013).

An HR manager at Seawing blades stated in 2014, that the times of high numbers of agency workers were over (April 2014), because of the slump in the demand for blades and *Equal Pay* (*see below*). In contrast, at the East-Wing nacelles factory, it was expected that after the 2013/2014 slump agency work would be continually used (works councillor, November 2014). Expectations to increase direct employment were low. The use of agency work allowed the wind turbine manufacturers to relatively quickly adapt their workforce to changes in labour demand (c.f. interviewees in Stanworth and Druker, 2000).

For their dependence on subsidy cycles, the new blade factories in England would seem as prone to use agency work as the Danish and German ones. However, in the context of the English offshore wind blade factories no use of agencies was reported (manager, technical college, November 2014). Agency work was said to only concern seasonal low-skill work, and interestingly the interviewee only referred to migrant workers:

“[The town] and the region do not have a lot of placement providers There is a high number of migrant workers for seasonal work, but they use their existing networks. And the business landscape is dominated by small and medium enterprises, which are not interesting to this kind of companies. [The town] does not have many large employers.”

Manager, large regional VET provider, November 2014, based on notes

Hence, the new blade factories in England will be interesting test cases in the future. The next section discusses pay among core and agency workers.

4.4. Pay

This section discusses in how far the offshore wind turbine manufacturers were covered by collective agreements at the sector and workplace level, and in how far terms and conditions for agency workers were similar to those of core workers due to Equal Pay Agreements.

4.4.1. Collective agreements for core workers

The Danish trade unions and management at the sites took collective regulation of pay for granted (former HR manager, Seagull, June 2014; HR manager, West-Wind, June 2014; trade union officer, November 2014; shop stewards, November 2014). West-Wind's company agreement was renegotiated nationally every third year. Based on this, each site negotiated local agreements that could not undergo the company agreement. Different local agreements applied to different jobs. The blade factory's agreement for production workers differentiated only little between skilled and unskilled workers. Workers with a skilled *Windmøllentechniker* certificate earned five kroner or fifty pence sterling (roughly the exchange rate of 2014) more per hour (shop steward, November 2014). 172 kroner or 17.2 pounds per hour was the starting pay for unskilled workers. This pay was "comparatively high" in the manufacturing industry and an incentive to stay in the company (HR department, October 2014).

In Germany, at least one large steel component plant had traditionally been covered by the metal workers' sector agreement (trade union officer, July 2012). From 2013 onwards, the German trade union IG Metall achieved to implement collective framework agreements on pay, ERA (Entgelt Rahmenabkommen) (cf. Dribbusch, 2013), starting with the Seagull generator factory, and later at the East-Wind, Seawing nacelles and blade factories. Before the collective agreement, pay at Seawing's blade factory was the lowest compared to other sites. At the Seawing plants, the collective agreement would increase pay by about 20 to 30 per cent (works councillor, July 2013). Pay would be according to job profile and qualification (HR department, April 2014). At the nacelle assembly factory, the entry pay of a skilled worker was 32 000 Euros gross per annum (works councillor, Seawing nacelles, July 2013). At the generator factory, the lowest pay grade for unskilled manual workers was about 27 000 Euros; higher-grade machine operators started at roughly 38 000 Euros (works councillor, Seagull, July 2013).

The new equipment manufacturers, offering higher wages, poached many workers from local small businesses (works councillor, Seawing nacelles, July 2013). Many workers perceived pay at the turbine manufacturers as very generous compared with their previous employment in the crafts and service sector (works councillor, Seawing A, July 2013; works councillor, Seawing B, July 2013). Interviewees said things like:

“We earn well, we want a collective agreement, so that pay is ensured.”

Works councillor, Seagull, July 2013

“Our pay is good; for some colleagues, it was hard to see why they should become trade union members.”

Works councillor, Seawing nacelles, July 2013

After Seagull’s reorganisation, jobs and pay settlements were re-evaluated (works councillor, 2013). Some workers were paid less, as their job was deemed less skilled; others received a pay rise, as their pay did not reflect the new pay scale. In total, the plant’s wage bill had slightly increased:

„After reorganising, many workers’ job profiles were degraded, because some jobs were not needed any more. This August, we will continue negotiating, but generally, everything will be fitted to the new system. The pay setting will be fitted to the actual task.”

Works councillor, July 2013

4.4.2. Equal Pay for agency workers

The trade unions in Denmark and Germany highlighted the importance of *Equal Pay Agreements* to avoid wage dumping for core workers. The trade union Dansk Metal was not opposed to employment of agency workers in general, but it was against employing those hired from agencies, which refused to sign agreements with the trade unions, and those which undermined labour standards:

“Agencies should not prevent the possibility of a better tomorrow, tomorrow should always be a bit better than today.”

Trade union officer, November 2014

Equal Pay Agreements were referenced to collective agreements that applied to directly employed workers. Because of West-Wind’s collective agreement with the Danish trade unions, agency workers had to be paid the same hourly wage as directly employed workers after six to nine months into their placement, but some workers never achieved this length of placement (trade union officer, November 2014). However, the agreement did not include payment for holidays or sick leave.

The German IG Metall was dissatisfied with the companies’ practice to rely on a high number of agency workers. However, interviewees acknowledged that the phenomenon of agency work was there to stay (trade union officer, July 2012), since the *Arbeitnehmerüberlassungsgesetz* (AüG) (law that allows subcontracting workers to third parties) had been enacted in 1972 (Ferreira, 2016) and employment services had been liberalised during the 1990s (ibid; Eichhorst and Marx, 2011). However, trade union officers deplored the different conditions that applied to core and agency workers:

“Also pay levels are different. So, it can be that in one place there are two people who are doing the same job, but one of them earns two or three Euros more [per hour]. The amendment of the AüG was a recipe for this. What these companies are doing is legal, unfortunately. And the companies, which use agency workers, they exploit this, because agency workers generally earn less than core workers.

That is easy, 'I keep a nice and small core workforce, and then I take in an amount x of agency workers for each single order, and I am really saving payroll costs. And I use this to put pressure on my own core workers, because I can say [to them] "watch, they [the agency workers] can do the same as you do, and they are happy with 12 Euros. And you are now asking for 16 Euros. If you continue like that, you all can leave, and I will only take on agency workers in the future.” The pressure on the core workers is enormous, and the work agencies are here to make money quickly. [When the wind turbine manufacturers relocated to the town] the agencies sprang up like mushrooms.”

Trade union officer, July 2012

The trade union officers at IG Metall were concerned about the effects of agency work on the union's members among the directly employed workforce. As it was difficult to organise agency workers, the IG Metall had supported the *Equal Pay Agreement*. The Equal Pay Agreement would ensure that hourly pay for agency workers, who were six months into their placement, was equal to the hourly pay of directly employed workers. However, when collective agreements on pay for directly employed workers and the Equal Pay Agreement entered into force, the manufacturers had stopped employing agency workers, because of the offshore wind sectors' crisis (HR department, Seawing, April 2014). The next section discusses social relationships at work; in particular, the integration of agency workers.

4.5. Social relationships

Agency workers and core workers worked alongside on the shop floor, often doing the same jobs. As the number of agency workers fluctuated strongly, social tensions were not unusual. Some companies provided agency workers with company uniforms in different colours, or by provided company uniforms when the workers had worked on-site for a specific amount of time (HR manager, West-Wind, June 2014; agency, Germany, July 2012). One interviewee reported that agency workers were working harder than core workers (works councillor, July 2013); others stated that fellow workers picked on agency workers (works councillor, July 2013). Others reported that agency workers strongly identified with their work at the manufacturers, and did not perceive any difference between themselves and core workers (labour lawyer, July 2013). No agency workers could be interviewed. Core workers at the Danish West-Wind site were said to have great difficulties integrating agency workers (trade union officer, November 2014). Permanent workers were said to be reluctant to bond and to share their knowledge, as they couldn't be sure about the perspectives of agency workers in the company (trade union officer, based on notes, November 2014):

“One problem is that the whole construct of agency work leads to a situation on the shop floor, where [the company's] workers have difficulties building the same social relations to agency workers. People won't attach emotionally; they don't share knowledge as much; and there is no solidarity in that sense, because it stays always unclear if the agency worker will stay.”

At the German Seawing nacelles factory one works councillor (July 2013) stated that agency workers worked harder than core workers, but that management made no effort in retaining these workers:

“We don't have any problems. They are recognised as fully valued colleagues. We don't let them feel that they are only agency workers. They are completely integrated in the production process. We have also experienced, once [the agency workers] had gone, that they have had more expertise than our own people, and that our people had made less effort, that the agency workers had been the ones doing the work, and were increasing their value through this. And this expertise, we are losing it again and again. But the management doesn't get it, that we are losing out. For example, when our agency workers are hired by a competitor.”

At the Seawing blades factory, one works councillor (July 2013) described the integration of agency workers as “medium successful”:

“Team leaders have been observed to threaten agency workers: ‘if you don't do what I want, I will cancel your placement! The tone is not the easiest here.... A lot of the [permanent] workers used to work on the docks. The tone is quite rough, and (...) new people, who are not used to this, they take this for a moment, but then they leave.”

Interviewees explained the “rough” communication style at the site by a “Northern German culture”, but also blamed it on tensions resulting from the high number of agency workers, worker fluctuation, frustration over lack of skills and motivation, and inability to plan the work in advance due to dependence on yet unknown subsidy levels:

“For a long time, there is no work at all, and then from one moment to the other we have to work full speed [to deliver blades in time for the respective feed-in-tariff period].”

Works councillor, Seawing, July 2013

Works councillors at the blade factory reported incidents of overstraining workers through stress resulting from constantly changing agency workers, and lack of skill formation:

“[Agency work] is a very high stress factor for our colleagues, who have to train one today, tomorrow another, and, the day after, the third. Of course, this is difficult, and there is no structure. Over years there is no planning whatsoever and then there comes an order and off it goes.”

When the sector declined in 2013/2014, redundancy hit agency workers particularly hard, as short-time work, internal transfers, or social plans that were negotiated at the sites did not apply to them:

“[The local labour market offers] mainly precarious work, and employment in traditional manual labour. [There is] an enormously high rate of agency workers, who actually do not perceive themselves as agency workers. They really say: ‘I work in the wind energy sector. I have learnt this. I worked there as agency worker. I was trained on the job. Since then, I have worked in the wind energy sector. And, I cannot do any other work than this.’ They have been trained specifically, as all other workers. They really feel they are part of the workforce. And then they are really surprised and disappointed, when they realise that in times of crisis, it is very different for them [compared to the directly employed workers].”

Labour lawyer, July 2013

The next sections discuss the impact of workplace representation and skill formation on job quality.

5. Impact of workplace representation

5.1. Role of the shop stewards/works councillors

At the two Danish manufacturing sites, shop stewards seemed to be relatively well-established counterparts of management. As common for Danish workplace representation (Jørgensen, 2009), workers’ councils were bi-partite: half management and half shop stewards. The shop stewards were “informed and involved” (HR department, West-Wind, June 2014), but did not have co-determination rights regarding hiring or firing as German works councillors do.

At the Danish West-Wind blade factory, cooperation between plant management and the shop floor workers was described as “okay” (shop steward, November 2014). The workers’ council met four times a year at company level and was involved in the bi-

annual re-negotiations of collective agreements. One full-time, and nine to ten part-time shop stewards represented one thousand nine hundred workers, including agency workers. The chief shop stewards were Dansk Metal members. 3F and Dansk Metal had set-up a work club where the trade union members could join social activities for a small fee. As West-Wind was expanding blade production across Europe and worldwide, important issues were the negotiation of the terms and conditions for local workers, who would help to train colleagues at foreign sites. The *Seagull* generator plant used to be almost 100 per cent organised by Dansk Metal (former HR manager, June 2014). Relations between management and shop stewards were described as good.

In contrast, the works councillors at the German sites clearly struggled to find their role as worker representatives and to be recognised by the site management. The trade union IG Metall aimed to establish works councils, “who were more than just helpers of the HR department” (trade union officer, March 2012). As many new works councillors had little experience, the trade union offered various courses and organized networking events for them. But as stated in chapter IV on industrial policy, the trade union’s support was relatively recent. When Seagull had bought the small generator factory in 2004, it had been the factory’s works council, which negotiated a company agreement on pay. The trade union had not engaged for lack of sufficient levels of trade union membership among the site’s workers. In 2013, the relationship between works council and management was described as “constructive, everything else would be a waste of resources” (works councillor, July 2013).

At Seawing nacelles, the workers elected their first works council in 2009. The works council was dissolved, as the members of the works council could not agree on a joint strategy (works councillor, July 2013). In 2011, a new works council with five members was elected.⁴⁵ To better represent the site’s eighty full-time directly employed and up to eighty agency workers, the head of the works council decided to work full-time, but was criticised for this by other works council members who continued labouring on the shop floor. The head of the works council explained:

⁴⁵ According to law (*Betriebsverfassungsgesetz*) sites with up to 100 FTE (full-time employment) can elect 5 works councillors; at sites with over 200 FTE one works councillor will take charge of the council’s duties full-time. Agency workers count as FTE with voting rights, once they have been employed for longer than 3 months (Institut für Betriebsräte Fortbildung, 2016).

“Not everyone understands the need for a [works council]. That it has priority over production work. You cannot imagine, how people think, when the company already pays for everything.”

Many workers used to work for small craft workshops in the region where labour standards were lower than at Seawing nacelles.

At Seawing blades, the first works council was elected in 2009. In 2013, about 50 to 60 per cent of the workers and 30 per cent of the agency workers were trade union members (works councillor, Seawing A, July 2013). The works council had eleven members. The works council regularly reminded management to provide for basic health and safety standards, such as protective gear, tools, and time for health and safety training (works councillor, July 2013): “but it’s getting better”. At the time of the first interview on-site in July 2013, the company had sued a works councillor, who had tried to mobilise others in an attempt to improve working conditions, for ‘disturbing company peace’ (*Störung des Betriebsfriedens*) (anonymous).

The Seawing blade factory changed its HR director about every year (manager and staff, ALMP training provider, July 2013; HR department, April 2014), and cooperation between works council and management depended on “chemistry” (works councillor, Seawing A, July 2013). In the past, workers had complained about authoritarian management. However, more recently and in the context of the sector’s slump, one HR manager emphasised the usefulness of social partnership (April, 2014): “If we had no works council, we would have to regulate workforce flexibility by individual agreements, which would be impossible.”

The East-Wind nacelles site’s then forty workers and employees elected a works council for the first time in 2007, when the site was bought by a large multinational manufacturer. East-Wind was the only site where management supported the election of a works council. The works council had to be reconstituted several times, as works councillors kept being promoted into new jobs, while the site was growing (works councillor, July 2013). The works councillor interviewed in July 2013 reported to have a good relationship to the HR department.

However, in 2014 a European Works Council member, also member of the local works council, failed to get involved in *information and consultation* related to a European merger of the site, and did not receive any trade union support in this regard as too few workers were trade union members:

“[Trade union support is] rather weak, weaker than at other companies located in [town], because at [this company] too few employees are trade union members. This is a production and research and development site. Currently, we hardly have any production workers [the site mainly relies on workers from agencies]. And the [research and development] employees tend to not be trade union members.”

Works councillor, November 2014

In contrast to the Danish and German sites, confirming the institutional accounts on weak collective and workplace representation in England, and LMEs in general (Gumbrell-McCormick and Hyman, 2013, Hall and Soskice, 2001, Thelen, 2004, Thelen, 2014), one blade factory had not recognised any trade union (trade union officers, April 2012, February 2014). This was despite being owned by a Danish company, which was familiar with strong social partnership in its home country (cf. Almond et al., 2005, Lamare et al., 2013). It however had non-union worker representatives. The other was still in negotiation about a recognition agreement with Unite at the time of data collection (trade union officer, February, 2014).

To conclude this overview of workplace representation: in Denmark, shop stewards had cooperative relationships with site management, very much in line with the institutional accounts for CMEs (Gumbrell-McCormick and Hyman, 2013, Thelen, 2004, Thelen, 2014). However, at the sites in Germany, the managements' hostility towards social partnership was untypical for the metal sector. In this context, works councillors' impact on mediating transitions for core workers and internally regulating the use of agency workers, might partly be explained by statutory provisions that provide works councillors for co-decision making rights (cf. Rüb and Platzer, 2015). Some managers showed growing recognition of the benefits of involving works councillors, as the HR manager quoted above. The next section explores the role of works councillors in managing transitions in more detail.

5.2. Works councillors mediating redundancies for core workers

As stated by others (Doellgast, 2012: on telecommunication services, Ilsø et al., 2016, Streeck, 1992: on manufacturing) in Denmark and Germany manufacturers and core workers seemed to benefit from the presence of works councillors, when hit by slumps in turbine and labour demand. During the restructuring of Seagull (2011-2013), the shop stewards at the Danish generator factory mediated between management and workers to help the reallocation of workers who were made redundant.

One former HR manager at Seagull (June 2014) stated that the shop stewards welcomed the waves of redundancies, as they and many workers were aware of the company's growing overcapacities in the context of declining demand across the Northern European market. Although it was not possible to interview any shop stewards from Seagull, this anecdote confirms observations of Danish worker representatives supporting the process of 'shrinking' manufacturers 'healthy'. Gain efficiency and freeing up redundant workers for other growing sectors is part of the Danish flexicurity employment model (Andersen, 2015).

At the German East-Wind site, redundancies during 2014 were accompanied by compensation payments. Also, the works councillors achieved to reduce the number of redundancies from the announced one hundred twenty-seven to forty, which were eventually implemented (works councillor, November 2014). Management, works council, and the local labour market authorities agreed on short-time work. All other remaining production workers were hired out to East-Wind's service contractor and third companies by the end of 2014. At the Seagull site the redundancies in 2012 had been accompanied by a social plan, and several skilled workers were offered transfers to the company's service and maintenance department or the turbine repair shop at its former production site (works councillor, July 2013). However, the new generator factory still had overcapacities in mid-2013. When all existing contracts were completed by March 2014, the Seawing blade factory introduced short-time work that had been negotiated between management and works council (HR department, April 2014).

Social partnership but also agency work may explain the relatively conflict-free adaptation of headcounts to workforce needs in Denmark and Germany. Danish trade

unions supported the flexicurity principle⁴⁶, and hence the idea that unproductive sites should restructure, even if this meant reducing their workforce (Andersen, 2015; former HR manager, Seagull). The German East-Wind, Seawing, and Seagull sites negotiated short-time work, and redundancies were accompanied by social plans, making use of regulations provided for in German employment law (Andersen, 2015). Skilled redundant workers were, where possible, transferred to other parts of the plant or hired out to other companies (works councillor, July 2013; HR department, February, 2014; works councillor, November 2014). The latter confirms the benefits of broad vocational qualifications and portable skills in the German dual VET regime (Marsden, 1999, Martin, 2011, Streeck, 1992, Thelen, 2004, Thelen, 2014).

The relatively peaceful redundancies and plant closures in Denmark and Germany were in stark contrast with the industrial dispute on the Isle of Wight during summer 2009 in the context of the temporary closure (2009-2015) of a blade factory (Swarthmore College, *nd*). Workers at the factory reacted much more violently against the shut-down of their plant and requested more generous redundancy payments. The announcement of the closure of both sites, in Newport and East Cowes in April 2009 contained the offer of redundancy packages as small as one thousand pounds despite consultation with the plant's non-union workers representatives (Stevens, 2009). This resulted in protests and occupation of parts of the plant and an office building by the factory workers. Environmentalist and the trade unions engaged in solidarity actions. The closure was originally planned for 31st July 2009 and was realised in August 2009, delayed by the protests. The protests reflect the little fall back options provided by the residual welfare state (Esping-Andersen, 1990), and hence might explain the workers' violent opposition to the shut-down (cf. Korpi, 1978, Korpi, 1983). In Denmark and Germany, not only were worker representatives involved in managing transitions during slumps; they also attempted to manage the use of agency work in peak times. This will be explored in the next section.

⁴⁶ The Danish welfare state would provide generous unemployment benefits and re-skilling for redundant workers to help them returning to employment quickly (Andersen and Svarer, 2007; Bredgaard and Daemmerich, 2013; Bredgaard and Larsen, 2007).

5.3. Company agreements on the use of agency work

Shop stewards and works councillors in Denmark and Germany were involved in regulating the use of agency work. Some company agreements limited the number of agencies a site could hire, and that using an agency had to be approved by the works council (Seagull in Germany). Others required direct hires exclusively from the pool of agency workers on site, and that those agency workers, who worked on the site for longer than a determined period, should be considered for direct employment (West-Wind in Denmark). At the Danish West-Wind site, new hires were recruited from the pool of agency workers:

“...who get to be taken on directly by [the company], forty per months. But not all of the agency workers are being taken on....”

Shop steward, November 2014

When an agency worker had been working for West-Wind for more than one year, the line manager was asked to review the situation, and if she agreed, the worker would be hired directly.

“But they can be hired on a day-to day-basis, so it is very flexible...When an agency worker has been with [the company] for more than one year, the line manager is asked to review the situation, and if she agrees, the worker is hired directly.”

HR manager, October 2014

Because of its company agreement, the German Seagull generator factory worked with only one agency (works councillor, Seagull, July 2013). The company agreement stipulated that per year thirty of the agency workers on-site had to be hired directly. The site would work with one agency only. The works council had to be consulted for every new agency worker and when the site's main agency subcontracted other agencies. At some point, there had been three subcontractors. In the past, the Seagull generator plant had recruited direct hires mainly from the agency workers already on-site. Also at Seawing nacelles, the works council supported direct hires from a pool of agency workers on-site (works councillor, July 2013). The next section discusses the impact of

skill formation (ALMP and VET) and skills on job quality in the offshore wind turbine manufacturing sector.

6. Impact of skill formation on job quality

As the previous chapters on skill formation and industrial policy have shown, policy-makers think that skill formation would help the creation of good jobs. Within the literature, the relationship between skills and job quality is more critically debated (Benassi, 2016, Dieckhoff, 2011). This section discusses the impact of skill formation on job quality: How did the institutional framework socially construct skilled work in the context of new skill profiles? What type of jobs could be accessed through ALMP training and VET? What value did vocational skills have during economic slumps? And finally, what happened to skilled work in the context of automation?

6.1. Social construction of skilled work

Comparative research has shown that skilled work is socially constructed by the political economy's institutions (Rainbird, 1997). What is understood as skilled work differs across countries (Brockmann et al., 2008, Grugulis and Lloyd, 2010, Jobert et al., 1997, Maurice et al., 1986). Management, works councillors, and educators in Denmark and Germany had different views on the skill needs for production workers. While the Danish West-Wind blade factory was at the forefront of development of *Windmøllentechniker* composite technology and engineering apprenticeships, at a German blade factory, an HR manager (April, 2014) emphasised that there was no initial VET for people who worked with composite technologies. Therefore, the work had to be unskilled. In contrast, the works council (July 2013) stated that skills and vocational training were needed, but that there were neither time nor the tools for training. This suggests that the rigidity of the German VET system provided employers with excuses for not training their workforce for occupations “that do not have” an initial vocational apprenticeship (HR department, Seawing, April 2014). At the German Seawing blade factory, the absence of initial VET certificates and corresponding skilled occupations made blade workers unskilled by default.

Moreover, lack of skill formation had real impacts on the quality of blade production (staff, training provider, July 2013; works councillor, July 2013; HR department, April 2014). Originally, Seawing's blade joint venture had been designed to transfer knowledge from the specialist partner company to Seawing (works councillor, Seawing A, July 2013; former site manager, February 2014). However, the specialist stayed ahead in terms of expertise, as Seawing did not train its workforce sufficiently (educator, ALMP training provider, July 2013). After the specialist company left the joint venture in 2011, its workers often returned to the blade factory to undertake repair jobs (works councillor, Seawing A, July 2013; HR department, April 2014; former site manager, Seawing A, February 2014). The next section shows how public skill formation, ALMP and VET, impacted on job quality in different ways.

6.2. Impact of VET and ALMP skill formation

The chapter on skill formation has shown that different types of external skill formation were available to the manufacturers: dual VET, school-based VET sponsored by manufacturers or ALMP, and short-courses sponsored by ALMP. This section compares the types of jobs that could be accessed through ALMP and VET.

The Danish West-Wind sites quickly translated skill needs into public training provision. As described above, the Danish West-Wind blade factory tapped into the regular skill formation regimes for VET and ALMP. It influenced skill formation provided by the technology colleges and AMU centre according to its needs. Unskilled and skilled workers could equally access vocational training in composite technology at the technology college (vocational educator, November 2014). Previously acquired vocational skills seemed less important than the experience in working with composite technologies, which was gained in short-courses and training on the job.

Unskilled blade workers at the West-Wind factory were trained in health and safety (HSE) at the AMU centre using statutory training funds. However, similar to managers at the German Seawing blade factory, HR staff at West-Wind stated that none of this training was necessary:

“Flexicurity and training funds make only sense for skilled and highly skilled workers with high salaries, where there are training needs. In the production, there is basically no need for training. The public money would be better invested into educating people, into providing them with skills that they need for future labour markets, when production sites will be moved to countries, where wages for production workers are lower.”

HR manager, October 2014

In Germany, the generally high proportion of electro-mechanical skill formation across the labour market, as well as migrant labour, seemed to make it harder for newly graduated skilled workers to access direct employment at the manufacturers (educator, ALMP training provider, July 2013; manager ALMP training provider IVET, July 2012; officer, trade union, July 2012). All of the ALMP provider’s graduates of the initial VET for ‘industry electricians with specification wind’ found work at engineering companies. Some had even been offered team leader positions. But others had to accept work from agencies to return to the company that had sponsored their apprenticeship:

“Contract work was initially created to enable companies to buffer peak times. Today it is just a simple employment tool for the companies, which provides them with many advantages in terms of employment law. [The apprentices] have started there through agency work, which was nothing common for them. But they did it anyway, among other things, because they wanted to stay in [town].”

Manager, ALMP training provider, July 2013

In contrast, the apprentices graduating from construction mechanics apprenticeships found work at their sponsoring and training companies (manager, vocational school, May 2013). In England, company-sponsored graduates of the inter-firm training provider were said to be sure to continue being employed in highly skilled machine maintenance jobs by their sponsoring companies (marketing manager, July 2013).

In contrast, the Seawing assembly factory in Northern Germany employed interns through ALMP programmes, but a transition from an internship to direct employment was unusual:

“Sometimes one [worker] is lucky and is hired [by the company], but most people, after completing the short-course, return to the company through agencies. The first step is almost always through agency work and from these agency workers the company once in a while hires one.”

Works councillor, July 2013

Despite skill formation through ALMP training in Germany aiming at mitigating the ‘scarring effects’ of unemployment on job quality (Dieckhoff, 2011), the presence of agencies made it difficult for participants to access stable jobs. Although ALMP IVET courses in Germany were proactively enhancing inclusion by focussing on the ‘disadvantaged’, at the same time, they promoted inequality, or *dualisation* (Palier and Thelen, 2010, Thelen, 2014). This was because of wage differentials between those apprentices who were company-sponsored, in dual apprenticeship, and those who were funded by ALMP programmes. Also, the contractual status during the apprenticeship had knock-on effects on later job security of apprentices. This adds to Dieckhoff’s (2011) findings on continued VET being only a limited remedy against unemployment scarring in institutional regimes with high labour market protection for core workers.

For example, at the Seawing’s nacelles assembly plant, a company agreement established the hiring of apprentices with good and satisfying marks (works councillor, July 2013). Apprentices, who the company sponsored in full-time training at the local ALMP training provider were not covered by this agreement, if they had not been transferred to a dual apprenticeship by the end of their vocational training. Several interviewees at the manufacturers and training providers stated that it was more likely that workers, who were trained through ALMP programmes, ended up working in highly insecure jobs at agencies.

Also, in England, a city council worker, who administered skill-formation subsidies for local enterprises, reported on the reluctance of large companies to hire apprentices during their training and to commit to them long-term (July 2013). The companies were said to prefer keeping headcounts of directly employed workers, including apprentices, low. However, vocational skills benefited directly employed workers during economic slumps, as the next section will show.

6.3. The value of vocational skills

Although managers often denied the need for vocational skills, and despite some evidence supporting the claim that skill formation did not necessarily lead to direct employment (cf. Benassi, 2016), VET had some beneficial effects, in particular because it provided portable skills (Marsden, 1999, Martin, 2011, Streeck, 1992).

6.3.1. During instability of the sector

Four situations, which recall Streeck's initial assumptions on the beneficial effects of high levels of vocational skills in *diversified quality production*, were described by interviewees in Germany (Streeck, 1992): When the two steel components production sites closed because of economic difficulties, some of the workers were transferred to the installation, service and maintenance unit of one manufacturer (manager, vocational school, May 2013). Similarly, when the Seagull site in Germany moved to a new fully automated generator factory, several skilled workers stayed employed at the former site in an initially six-months project. This project aimed at piloting a generator repair shop (works councillor, July 2013). Apparently successful, it continued as a repair factory until present ([Company], 2017). Also at East-Wind, skilled mechanics and electricians, who were not needed in turbine assembly, were temporarily transferred to a company that installed wind turbines for East-Wind and to other companies (works councillor, November 2014). The Seagull blade manufacturer transferred two skilled workers to its nacelle assembly factory when production temporarily stopped (HR manager, April 2014).

Thus, although portable vocational skills did not protect workers from insecure jobs, it did open up a broad range of employment opportunities across the companies and sectors for some and enhanced employment security despite low job security. However, the potential benefits of vocational skills were undermined by automation and process optimisation (cf. Benassi, 2016), as shown by the example of the Seagull generator factory, which is presented in the next section.

6.3.2. In the era of automation and optimisation

Skill formation and the value of skills need to be studied in the context of capitalist pressures to reduce production costs (Grugulis and Lloyd, 2010). The chapter on industrial policy has shown that policy shaped targets. Although the supply for offshore

wind turbines was highly concentrated, industrial policy in Denmark required manufacturers to be technologically innovative. The aim was to “bring down the cost of energy”, partly by saving on production costs (former engineer, Seagull, Denmark, June 2014). This chapter shows that innovation also meant rationalisation of work, and decreasing skill needs and discretion in the labour process for mechanics and electricians (cf. Benassi, 2016, Massey, 1990 [1984]).

Blade manufacturing, the least paid job and, in Germany also ‘least skilled’, across the manufacturers, continued with labour intensive, highly manual processes (Seawing, Seagull, and West-Wind). In contrast, offshore wind turbine assembly sites (East-Wind, Seagull, and Seawing), which employed semi-skilled and skilled electro-mechanics, underwent process and product optimisation that involved deskilling of the labour process. The previous chapter has shown that assembly factories in Germany and Denmark could rely on skilled workers coming out of the national VET and also ALMP regimes. However, skills seemed to become increasingly redundant, as the component supply chains got optimised, which will be shown by the example of Seagull’s Danish and German generator plants.

Initially, Seagull operated a generator production and research and development plant in Denmark. When the company restructured in 2011, it closed its Danish site and expanded lean production at a new green field site in Germany. The introduction of lean production led to redundancies, and a reduction of skill requirements for the production workforce. Before the introduction of lean production, about 30 per cent of the production workers were skilled electro-mechanics and the site employed three *Meister*. After the reorganisation, the aim was to make the production ‘hammer-less’, which meant abolishing the use of craft tools (works councillor, Seagull, July 2013).

The job profiles for the Danish plant were documented by a consultant (former HR manager, June 2014), and then translated to the new site in Germany. There the workers’ job profiles were subsequently aligned with the automated production process (works councillor, July 2013). Previously existing job profiles were abolished. Only one *Meister* position remained. Service technicians from the companies that had provided the production machines were permanently at the factory to quickly provide technical support. As the site operated a *zero-tolerance policy*, components from suppliers had to

be delivered without fault or would be returned. The regular quality check already took place at the supplier. Most of the workers' vocational skills were not used in lean production. As a result, work was experienced as significantly less challenging after the introduction of lean production:

“Some of the skilled workers feel that their skills are not used. [The electro-mechanics had turned into machine operators who] only push buttons. They are not asked to have any question about ‘why or how?’ There actually is no need for skilled workers anymore...and so it is better [for the workers] to rotate [jobs], also for ergonomic reasons.... There is no opportunity to show cognitive skills, and therefore also no opportunity to advance.... Some don't bother.”

Works councillor, Seagull, July 2013

The workers were trained across all jobs on the shop floor (works councillor, Seagull, July 2013). The company called this ‘cross-training’. Within the cross-training, workers could achieve four levels of competence. The aim was to maximise flexibility but also to ‘enrich’ jobs. The company provided motivational training for all workers and employees across its sites worldwide.

In contrast to Seagull, which was one of the largest offshore wind turbine manufacturers, batches at the German Seawing and East-Wind sites stayed ‘too’ small and processes were not optimised (former site manager, Seawing, February 2014; works councillor, July 2013). The small size of batches did not allow for ‘learning and process improvement’. Interviewees argued that larger demand was crucial for improving production efficiency and product quality, but in return would reduce demand for skilled work (former site manager, February 2014, also quotes in chapter IV on industrial policy).

The chapter on industrial policy has shown how Denmark, Germany and England differently combined supply and demand side policies over time. This chapter has shown that demand side industrial policy encouraged manufacturers to strongly rely on agency work, that job quality was largely impacted by agency work and low job security. The chapter showed that workplace representation struggled to positively impact on job quality, although at some companies it could negotiate agreements that

regulated the use of agency work. Skill formation seemed to have positive effects on pay, employment security, social relations and job discretion, but not so much on contractual status (direct employment or agency work). And, the positive effect of vocational skills might be undermined by the spread of standardised labour processes (cf. Benassi, 2016). The next section concludes this chapter by summarising the main arguments and their implications.

7. Discussion and conclusion

First this chapter presented findings on the manufacturers' rationales for using agency work. Agencies were used as recruitment tools, as they allowed manufacturers to save labour costs, gain higher degrees of numerical and functional flexibility (cf. Atkinson, 1984, Atkinson and Meager, 1986, Doeringer and Piore, 1985), and to avoid potential scandals over mass redundancies of direct workers. Agency work was also used to keep headcounts of directly employed workers down, contributing to advantageous financial evaluation of the companies (Nachtwey et al., 2015).

It was suggested that agency work was gaining relevance by the way ALMP training was structured in Germany and Denmark: Agencies could identify unemployed jobseekers. Agencies sent jobseekers to ALMP training providers before hiring (in Germany) or while receiving wage-subsidies for them (in Denmark). Therefore, agencies could shift training costs to the public employment services, which is a standard element of Danish flexicurity (Daemmerich and Bredgaard, 2013), but in the German context a rather surprising finding, which highlights employers' increasing disengagement from training. Activation measures by the public employment services also made agency work more acceptable among jobseekers (cf. Dörre et al., 2013). In addition, the pace of and changing subsidy schemes led to highly fluctuating workforce demand. And pressures to cut production costs of wind turbine components drove rationalisation. Highly fluctuating workforce demand and rationalisation negatively impacted job quality.

This chapter compared job quality of core and agency workers at the Danish West-Wind blades and Seagull generator, the German East-Wind, Seagull, Seawing blades and nacelles, as well as, where data was available, three unnamed steel component plants in Germany, and the English Seagull and West-Wind blade factories. The chapter

evaluated the proposition that workers in Denmark and Germany, both characterised as coordinated market economies (Hall and Soskice, 2001, Thelen, 2014, Thelen, 2004), enjoyed patterns of good job quality (job security, direct employment, relatively high pay, social integration, worker representation, and discretion (cf. Holman and McClelland, 2011, Muños de Bustillo et al., 2009, 2011)), whilst workers in England did not encounter these patterns.

The chapter has shown that differences in job quality between Denmark, Germany, and England persisted in some of these aspects – but data could not be accessed on all these dimensions across the countries. Namely, offshore wind turbine manufacturers in Denmark and Germany had well established plants representing the spectrum of steel components, electromechanical assembly, and blade production, while in England, offshore wind blade factories had only recently opened and started producing in 2015 and 2016. This was after the field research for this thesis.

Job security seemed low across all sites due to industrial policy in the manufacturers' domestic and export markets. High numbers of agency workers were used at the German and Danish manufacturing sites. Collective agreements and Equal Pay Agreements regulated pay in Denmark. In Germany, these were only introduced from 2013 onwards because of employers' reluctance to enter social dialogue and weak trade union membership.

The social environment seemed to be tense in the context of changing work pressures dictated by industrial policy. Works councillors and shop stewards however mediated change in workforce needs for directly employed workers. Production organisations, in particular in assembly, developed from skilled and non-routine processes to increasingly standardised and deskilled labour processes to meet demands in scale and cut production costs.

The Danish and German sites all had works councillors or shop stewards, who were members of the metal workers trade unions. While the role of shop stewards was uncontested by management in Denmark, at the German sites works councillors needed trade union support and had to put pressure on management to force it to accept the works councils' statutory prerogatives. In both countries, the trade unions saw their role

in ensuring that standards set by collective agreements were respected. In England, none of the two sites had recognised a trade union at the time of the field research (2012-2014), although one plant had non-union worker representatives. Both manufacturers originated from coordinated market economies, but in the course of their existence had morphed into multinational technology components manufacturers. *Home country effects*, in terms of employment relations, could not be identified (cf. Almond et al., 2005, Lamare et al., 2013).

In Denmark and Germany, plant closures and redundancies involved worker representatives in implementing soft transitions, for example finding alternative employment for workers (cf. Streeck, 1992). In England, one plant closure was accompanied by a very small redundancy package, which led to violent interactions between workers, police, and management. These observations confirm what are assumed to be traditional patterns of employment relations in coordinated and liberal market economies (Gumbrell-McCormick and Hyman, 2013, Hall and Soskice, 2001).

The chapter also confirmed differences in job quality between directly employed and agency workers in Denmark and Germany. Trade unions and works councillors mainly represented directly employed trade union members. Only one German works councillor decided to increase his working time as works councillor to also represent the agency workers on-site. In Denmark, both manufacturers had signed collective agreements with the trade unions. In Germany, the introduction of collective agreements resulted from an extended campaign and was very recent (Dribbusch, 2013). Hence, although Equal Pay Agreements applied to agency workers in both countries, in Germany, Equal Pay initially lacked a collectively agreed reference pay (HR manager, Seawing, April 2014), and differences in the hourly pay of several Euros were reported (trade union officer, July 2012). Finally, the status of agency workers among the workforce seemed to be lower, resulting in a tense social environment ranging from lesser social integration (shop stewards, Denmark, November 2014) to agency workers being targeted by aggressions relating to their contractual status (works councillor, Seawing, July 2013).

Although some agency placements at the German sites lasted for several years (works councillor, East-Wind, July 2013, works councillor, Seawing, July 2013), agency work stayed insecure and placements were interrupted by spells of redundancy, as indicated

by the fluctuating numbers of agency workers. At several German sites, the number of directly employed workers stayed the same over several years, while any increase or decrease in labour demand was buffered by the increase or reduction of the number of agency workers (cf. Atkinson, 1984, Atkinson and Meager, 1986, Doeringer and Piore, 1985, Palier and Thelen, 2010). Only two manufacturers regulated direct hiring from the pool of agency workers at their German and Danish sites through company agreements. It is unknown, if these manufacturers employed agency workers at their English sites.

Findings presented here and in the chapter on industrial policy suggest that job security for directly employed and agency workers across all sites strongly depended on industrial policy. Manufacturers, which did not see any positive prospects in their policy environment, shut down their factories and moved them to countries that promised more lucrative settings: A blade manufacturing site was moved from England to the United States in 2009, and a generator factory from Denmark to Germany between 2011 and 2012. Several German steel companies shut down during 2013 and 2014. Directly employed workers were made redundant at the East-Wind assembly site. All German sites introduced short-time work for their remaining core workers during 2014, and provided up-skilling schemes for unskilled and semi-skilled workers who were at risk of redundancy. In Denmark, short-time work was not used, and this confirms an important difference between German and Danish ALMP that has also been identified by others (cf. Andersen, 2015).

Skill formation through ALMP and VET skill formation providers was however important in Denmark and Germany, and seemed to positively contribute to employment (not job) security in both countries. Skilled electro-mechanics could more easily find jobs at another site or within another sector. However, the positive effects of vocational certificates might be limited in the context of increased automation of production processes, as the case of the Seagull generator plant illustrated (also Benassi, 2016 on automotive production).

A link between the findings presented in chapter V on skill formation and the present chapter can be made: Employers at the German sites were required to implement the on-the-job and HSE training, but the pace dictated by subsidy schemes shifted priority away

from training; and training was lacking at some sites. This was different in Denmark, where HSE training was provided by the AMU centres prior to the placement. But also at Danish sites, on the job training took only place “when there is time” (shop steward, November 2014).

In addition, the failure to adapt the skill formation framework for composite technology in Germany and the responsibility of employers to run HSE training, as discussed more in detail in the chapter on skill formation, seemed to have partly impacted the social relationships on the shop floor. The absence of skills was a source of frustration and aggression at the German blade factory. While lacking social integration at the Danish blade factory was rather related to the contractual status of agency workers.

An important difference between the three countries was the development of a genuinely domestic industry for wind turbines in Denmark and Germany. This difference can be explained by the broad supply of engineering workers, who were able to work in settings, where no clear assembly instructions existed (works councillor, July 2013; works councillor, July 2013), generators were still in the development phase to serial production (engineer, June 2014), or repair jobs needed to be undertaken (three works councillors, different sites, July 2013).

In England, this broad engineering skill base did not seem to be available for production work (see chapter V on skill formation), due to more lucrative work in installation and maintenance or other sectors (manager, skill formation provider, November 2014; staff, skill formation provider, July 2013). This lack of workforce combined with requirements of high profit margins, lacking component supply chain, and low inclination to high investment, led manufacturers to only establish low-skill blade production sites in England (manager, November 2014). However, in Germany and Denmark, machine assembly also initially requiring skilled or semi-skilled workers tended to be optimised and deskilled.

Common features that are assumed to drive dualisation such as differentiated workplace representation (Eichhorst, 2015), different skill levels (Hassel, 2014), and workfare (Dörre et al., 2013, Greer, 2016) impacted the job quality as previously shown by others. However, their effects were nuanced. For example, skill formation was not a panacea

against bad jobs generally (cf. Benassi, 2016). But institutionalised skill formation provided for broader skill profiles, which might have positively impacted the employment security (fast re-integration into new jobs after redundancy), and the social integration of agency workers.

The previous chapter has shown demand side industrial policy's negative impact on on-the-job skill formation. The present chapter has also shown its negative impact on job quality in terms of job security, in particular the use of non-standard employment, social environment, and discretion. Hence, theories that solely focus on the factors of the supply side, miss half of the equation of what makes the "institutional foundations of the comparative advantage" of political economies and companies (cf. Hall and Soskice, 2001, Streeck, 1992). The way demand side policies provide for investment decisions, scale and pace of investment also plays an important part (cf. Aglietta, 2015 [1979]). The next chapter concludes this thesis with a discussion of the proposed theoretical framework, the key findings, and contribution as well as limitations.

CHAPTER VII: DISCUSSION AND CONCLUSION

1. Introduction

This thesis has explored the impact of industrial policy on skill formation and job quality in the offshore wind turbine manufacturing sector across Denmark, Germany, and England. It developed and applied an analytical and theoretical framework based on regulation theory (Aglietta, 2015 [1979], Boyer, 2005), studies of the offshore wind turbine industry, the marketisation concept (Doellgast and Greer, 2013), and comparative skill formation and job quality literature. The analytical framework has distinguished between supply and demand side industrial policies. This thesis has shown that industrial policy provides exit options (Doellgast and Greer, 2013 based on Hirschman, 1970) for employers, which impact on skill formation and job quality. Consequently, industrial policies have *direct* and *indirect* impact on job quality by how they shape vocational education and training (VET) and active labour market policy (ALMP). This leads to the proposal of a new theoretical and analytical framework. The proposed theoretical and analytical framework constitutes an alternative to the analytical framework of the Varieties of Capitalisms approach. This concluding chapter will show how by reviewing the key findings of this thesis.

2. Theoretical contributions

2.1. Operation in a global space

The Varieties of Capitalisms (VOC) approach focusses on LME and CME's national level institutions (Hall and Soskice, 2001) and it sees firms as contained within these national models (for a critique see Peck and Theodore, 2007, Streeck, 2010). Firstly, the case studies presented in this thesis have shown that industrial policy consists of supply and demand side measures that are designed and implemented at different governance levels. Second, it was shown that the studied firms are operating in a transnational space. This has implications on the power of supply and demand side policies.

2.2. Integration of demand side policy

Furthermore, the VOC's focus on firms' institutional relationships does not take into account demand side policy (Baccaro and Pontussen, 2015: suggest monetary policy or consumer markets as demand side drivers); it is limited to supply side factors – skill formation, relationships to suppliers, access to the labour market, and access to investment capital (Hall and Soskice, 2001). Hence, based on comparative industrial relations literature, and previous research on the offshore wind industry, *supply side policy* has here been defined as public provision of infrastructure and tax credits for manufacturers (Lewis and Wiser, 2007), support for research and development (Simmie, 2012, Simmie et al., 2014), education and training (Hall and Soskice, 2001, Streeck, 1992), and supply chain and process optimisation (Lewis and Wiser, 2007). It has been suggested that supply side policy affects skill formation, in particular VET, and ALMP, and hence, indirectly job quality.

However, industrial policy goes beyond these supply side factors. For example, salient policies are those that determine demand for offshore wind turbines, such as infrastructure grants for their construction (Lewis and Wiser, 2007), electricity price subsidies (Lauber and Mez, 2007, Sovacool, 2013, Toke, 2011), spatial planning and construction regulations for offshore wind turbines (Douvere and Ehler, 2009), target setting for carbon emissions and the use of renewable energy, and the support for marketing, and offshoring (Lewis and Wiser, 2007) (all *demand side policy* dimensions). These policies impact investment in offshore wind farms by developers, which have repercussions on component manufacturers, skill formation and workers' job quality.

2.3. Integrating conflicts of interest

The focus on stability and complementarity of institutions limits the VOC's ability to take into account conflicts of interests that are inherent to capitalism (Streeck, 2010). The analytical framework suggested here accounts for political or dialectical struggles (Aglietta, 2015 [1979]) regarding policy design and implementation. For example, the privatisation of the electricity supply industry across Europe combined with political goals of carbon emission reduction and the increase of renewable energy sources have resulted in sophisticated regulatory interventions by policy-makers, aimed at creating the "right" investment climate (hence, *investor capitalism* as discussed below). Across the three countries, there was the will to expand offshore wind energy technology, to create

‘good’ jobs and revive economically declining regions. However, these political goals had varying support at local, regional, and national levels, in political organisations and among stakeholders.

2.4. Taking into account heterogeneity

Others have stated before that the LME versus CME distinction is too simplistic; policies and hence business strategies do not align to these two typologies (Peck and Theodore, 2007). While the VOC approach finds either competitive market or cooperative coordination depending on the *model* of the political economy, findings discussed within this thesis show a more heterogeneous picture. For example, industrial policy in England became more centralised under the Coalition Government (2010-2015). In England, a coalition of interest for offshore wind turbine deployment emerged (Kern et al., 2014) and was increasingly involved in designing demand side policy; also at a less powerful local level industrial policy took a coordinative turn (Dawley, 2013) and ‘post-hoc’ supply side industrial policy was developed. After about a decade of negotiations between various governmental bodies, important reforms of regional governance, subsidy schemes, and the electricity market, two offshore wind blade factories opened in 2015/2016. Hence, in contrast to institutionalist predictions for LMEs, in England, industrial policy entailed an increase in coordination between stakeholders that mainly represented state and large private businesses’ interests. The quality of highly cooperative or even oligopolistic (de-marketising) policy-making in England is evident in the way industrial policies for the offshore wind sector have been designed. England might be an interesting case for continued study of the impact of industrial policy on governance institutions.

Since the 1970s, industrial policy for wind energy technology in Denmark addressed both supply side and demand side (c.f. Daugbjerg and Tinggaard Svendsen, 2011, Sovacool, 2013). Policy-makers favoured dynamic coordination among a variety of stakeholders and helped the development of common interests (Karnøe and Garud, 2012). As a result, new policies favouring technological change were more broadly accepted. Since the 1990s, offshore wind turbines were developed and installed in Denmark, which laid the ground for the European market leadership of Danish manufacturers (Karnøe and Garud, 2012).

The dysfunctional coordination between many stakeholders in Germany contrasts with the VOC's assumption of institutional complementarity, and rather hints at dialectical struggles between different interests (Aglietta, 2015 [1979]). There was a discrepancy between local economic development policy that promoted the offshore wind turbine industry and national level policy that delayed introducing favourable demand side policies. Conflicts of interest were also discernible in the realm of VET and ALMP. Despite supply side policies that supported wind energy technology since the 1970s (Lauber and Mez, 2007), the offshore wind turbine manufacturers in Germany only slowly developed, peaking in 2012, and dealing with a lack of contracts in 2013/2014. Political struggles had led to a coordination stalemate or deadlock (Smith Stegen and Seel, 2013), delays in regulatory decisions on liabilities, and counterproductive regulations for the industry (seabed allocation for offshore windfarms and inadequate periodicity of subsidy schemes) (demand side policies), which made offshore wind farms in Germany high risk investments.

2.5. Conceptualising interaction

Another weakness of the VOC approach is it lacks the capacity to conceptualise change (Streeck, 2010), other than through *institutional isomorphism* – increasing complementarity of institutions (North, 1990). However, in the literature, common examples of institutional change are: reforms of the welfare state, de-regulation of the labour market, and weakening of trade unions that do not correspond to the VOC's predictions (Greer, 2016). Furthermore, it has been established that these reforms have impacted job quality (for example De Grip and Wolbers, 2006, Dieckhoff, 2011, Doellgast et al., 2009a, Gaure et al., 2008). One powerful explanation is that these changes provide firms with cost-cutting exit options (Doellgast and Greer, 2013 on marketisation). The same mechanism explains the impact of industrial policy on skill formation and job quality in the offshore wind turbine manufacturing industry. Manufacturers, no matter if in Denmark, England, or Germany, make decisions based on cost calculations. Therefore, the way industrial policy shapes costs for manufacturers, impacts on how manufacturers engage in skill formation and commit to their workforce short or long-term.

2.6. Not two, but only one capitalism?

As stated above, these case studies have shown variation, which can be explained by divergent interests across actors involved in policy-making. However, it is suggested that the *offshore wind turbine sector* is dominated by one single rationale: As the energy supply industry has been privatised across European countries, the realisation of public policy goals depends on the state provision of incentives that accommodate the demands of private and institutional investors; hence investor capitalism seems a good descriptor of the capitalist regime in which the offshore wind industry operates in Europe. In contrast to the VOC approach, here the regime is transnational and dominates one sector, and not one national model of political economy. The proposed analytical and theoretical framework also makes several contributions to the original debate on investor capitalism, studies of the offshore wind industry, and regulation theory. These are summarised in the following section.

3. Contributions to other debates

a. Investor Capitalism

This thesis has borrowed and re-coined the term *investor capitalism* from earlier debates on the role of shareholders and managers in corporate governance (Conard, 1988, Harmes, 1998, Useem, 1996). The re-coining of the term can be seen as a contribution to that debate in the sense of widening the meaning of investor capitalism to a more overarching characterisation of contemporary political economy dynamics. Secondly, the case studies have shown how investor capitalism fails in influencing companies to make decisions that might provide for the common good (Harmes, 1998) without there being a hard, financial incentive.

b. Previous studies of the offshore wind industry

This thesis provides the first comprehensive comparative analysis of industrial policy, skill formation and job quality in the offshore wind turbine manufacturing industry. Previous research on wind turbine manufacturing and deployment has often engaged with institutional path dependency theory to make a theoretical contribution (Fornahl et al., 2012, Karnøe and Garud, 2012, Simmie, 2012, Simmie et al., 2014). Offshore wind turbine industry studies have so far limited themselves to analyses of the reasons for the varying extent of offshore wind turbine deployment across European countries (Douvere and Ehler, 2009, Söderholm and Pettersson, 2011, Sovacool, 2013, Swider et al., 2008,

Toke, 2011); technology development (Simmie, 2012, Simmie et al., 2014); tentative analyses of the relationship between locally available skill sets and the offshore wind manufacturing industry (Fornahl et al., 2012, Jaax, 2016, Salot et al., 2010); and local economic development policy (Dawley, 2013, Pohl, 2013). However, they have not made any analytical distinction between supply and demand side policies and how they might interact. This thesis has built on this research, and expanded the analysis towards a more structured discussion of supply and demand side industrial policy, skill formation, and job quality.

c. Regulation through supply and demand side policies

Based on regulation theory the distinction between supply and demand side policies has been introduced. To the analytical and theoretical framework developed within French regulation school (Aglietta, 2015 [1979], Boyer, 1997, Boyer, 2005), this thesis adds conceptual nuances in terms of what kind of state policies influence Boyer's (2005, p. 10) technological regime (here *supply side policies*) and the relatively vaguely described "variables contributing to the rate of investment" (here *demand side policies*) across the three countries and within the offshore wind turbine sector. These concepts might, however, be applicable in other sectors (see definitions above). The next section illustrates the empirical contribution – the analysis of new empirical material on how industrial policy impacts on skill formation and job quality in the offshore wind turbine industry.

4. Impact of industrial policy on skill formation and job quality

This thesis explored in how far supply and demand side industrial policies have impacted on skill formation and job quality. The comparative institutional literature would explain skill formation and job quality by a country's production model (Hall and Soskice, 2001, Streeck, 1992), in particular, VET and organised labour, but also by a country's employment regime (Gallie, 2007), here in particular active labour market policy. Skill formation and job quality have often been stated to be interdependent (cf. Dieckhoff, 2008, 2011). How industrial policy impacts on VET regimes, ALMP arrangements, and job quality will be summarised in the following paragraphs.

4.1. ‘Permanent’, ‘ad hoc’, and ‘post-hoc’ skills funding

The comparative VET debate tends to explain different skill formation regimes by societal institutions (Maurice et al., 1986) and historical legacies of specific production regimes (Thelen, 2004). The comparison of skill formation across the three countries confirmed that it is embedded in national VET and ALMP regimes identified in previous debates (e.g. Brockmann et al., 2008, Martin, 2011, Thelen, 2004, Thelen, 2014). However, findings suggest that industrial policy also impacts on VET and ALMP, which indirectly affects job quality.

Skill formation has been analysed in terms of training offered, funding, participation of employers, and type of participants (Busemeyer and Trampusch, 2012). The combination of both VET and ALMP training regimes resulted from the iterative research process. Field research revealed that within the offshore wind turbine manufacturing industry, both play a role and interact with one another. The interaction between both regimes showed interesting patterns, particularly in Germany: ALMP training seemed to fill a gap in training provision caused by the only slowly adapting VET regime; but undermined employer engagement in dual skill formation.

Skill formation was to varying degrees integrated in existing VET regimes – most strongly in Denmark (hence termed *permanent*). In Germany particularly, skill formation through ALMP short-term programmes was part of temporary local economic development policies (hence termed *ad hoc*). Additional skills funding was made available in England once the manufacturers, which would locate to the region, were known. Their requirements were then integrated in the funding provisions (hence termed *post hoc*).

4.1.1. Impact on the participants

The increase of skills funding (supply side industrial policy) in England and Germany led to an increase in skill formation offers. Skill formation varied across the countries in terms of inclusion of disadvantaged participants (Thelen, 2014). In Germany, supply side industry policy supported ALMP training and the access of disadvantaged jobseekers to internships and sometimes also jobs in the industry. ALMP training was also used to buffer against redundancies. During the sector’s slump in 2013/2014, VET

training modules, funded by ALMP, were available to unskilled workers at the turbine manufacturers.

4.1.2. Impact on employer engagement

Despite ALMP and VET in the sector fitting with the commonly described institutional models, employers' engagement in skill formation and in the institutionalisation of newly emerging skill profiles seems to be better explained by *exit* and *entry options* provided by industrial policy. In England, funding increases for skill formation aimed at mitigating the effects of poaching across local incumbent employers, and additional public funding for skill formation went directly to the employers. Consequently, one blade factory did not engage with external skill formation providers. However, the second blade factory very recently began working with a local college. Together, the two cases illustrate the well-documented fragmentation of skill formation in England (e.g. Clarke and Wall, 1998).

Furthermore, training providers in Germany and Denmark worked closely with the manufacturers on the design of skill formation (cf. Helms Jørgensen, 2014, Hippach-Schneider et al., 2007). New skill profiles emerged for work with composite technologies and employers across the countries responded differently. The differences in the ways providers and manufacturers pushed forward the recognition of respective vocational occupations within the national VET regime can be explained by cost cutting exit and entry options (cf. Doellgast and Greer, 2013). In Denmark, West-Wind pushed forward the institutionalisation of VET of wind turbine engineers and blade workers, as once the training was part of the national curriculum, public funding would be available. In Germany, no manufacturer engaged in the institutionalisation of VET, as its establishment would have required employers to become engaged in dual vocational education, and bear higher training costs than when relying on temporary ALMP training programmes. In England, manufacturers did not engage with the institutionalisation of VET. This was pushed forward independently by training providers and certification bodies.

4.1.3. Knock-on effects on skill formation providers

Additional skills funding also had disruptive knock-on effects on skill formation providers in England and Germany (cf. Hipp and Warner, 2008), as it provided windows of opportunity for the skill formation providers and their competitors to grow, but unclear prospects of sustained demand for training. Disruptive effects through funding increases in England and Germany are a surprising finding from a VOC perspective, as both are assumed to be examples of ideal typical and stable arrangements due to institutional complementarity (Hall and Soskice, 2001). Similarly, the way that skill formation providers in both countries dealt with additional funding is opposed to what is suggested by the VOC approach.

In England, training providers reacted by increasing their collaboration, slightly expanding their workforce, but mainly using funding from successful skills funding bids for infrastructure investments, and otherwise opted for labour intensification. While in Germany training providers expanded (new site and staff) and, when too many competitors entered the market, downsized again. Across the countries, Danish skill formation providers were not affected, as manufacturers tapped into the regular VET and ALMP training funds.

4.2. Demand side policy impacted work-based training

In Denmark and Germany, manufacturers encountered VET and ALMP institutions that were prone to provide for dual and school-based skill formation and re-skilling (c.f. Helms Jørgensen, 2014, Hippach-Schneider et al., 2007, Thelen, 2004, Thelen, 2014); while manufacturers depended on demand from their largest export market for offshore wind turbines – which at the time of writing was the United Kingdom. The pace and scale of subsidy schemes for offshore wind turbines, delivery deadlines, and technological innovation particularly undermined work-based skill formation (shop stewards in Denmark, November 2014; works councillors in Germany, July 2013). In Germany, manufacturers only reluctantly, if at all engaged in dual VET, and strongly relied on ALMP. In Denmark, manufacturers traditionally had access to training at technology colleges and AMU centres.

However, demand side policy positively impacted on training offer at *inter-firm training providers* (Denmark and Germany), once it provided more long-term perspectives for the expansion of wind technology and offshore wind. Here again, the power of exit and entry options becomes visible – utilities in Germany saw these long-term perspectives for wind technology and engagement in skill formation as a window of opportunity to take influence on the establishment of uniform technical standards, with potential repercussions on the power relationship between utilities and component manufacturers. Overall the findings on skill formation indicate that the manufacturers did not actively engage in skill formation when they had to bear the training costs, confirming the use of exit options (cf. Doellgast and Greer, 2013), and demand side industrial policy in did not support long-term skill needs. The next paragraphs discuss findings on the impact of industrial policy on job quality.

4.2.1. Strengthening agencies

This thesis has focussed on objective aspects of job quality such as job security, the use of standard (direct) or non-standard (here: agency work) employment, pay, work organisation and social integration of agency workers (Muños de Bustillo et al., 2009, 2011). The initial proposition on job quality was that workers in Denmark and Germany, both coordinated market economies (Hall and Soskice, 2001) and generous welfare capitalisms (Esping-Andersen, 1990), would enjoy patterns of good job quality, while workers in England, a liberal market economy with residual welfare state, would not (Gallie, 2007, Holman and McClelland, 2011). Findings have shown that despite differences in welfare state institutions, skill formation regimes, and organised labour, jobs in all three countries were affected by supply and demand side policy, and jobs were highly insecure.

The case studies confirmed the rationales of employers for using agency work. These have been discussed in the industrial relations and sociology of work literature, namely: the opportunity to save costs through numerical and functional flexibility (Atkinson, 1984, Atkinson and Meager, 1986, Doeringer and Piore, 1985), the ability to gain better capital ratings in a financialised economy (Nachtwey et al., 2015), and the impact of active labour market policy (for example Berg and Vikström, 2009, Dieckhoff, 2011, Dörre et al., 2013, Gaure et al., 2008, Greer, 2016, Pollman-Schult and Büchel, 2005). However, they have also shown that across Denmark and Germany large numbers of

agency workers were used because of volatile industrial policy and political pressures to reduce production costs.

The manufacturers, aware of their dependence on changing demand side industrial policy, only committed to a very small directly employed workforce. Largely using agency workers, manufacturers gained flexibility, tightly matched labour demand and headcounts, and controlled labour costs. Agencies became a principal tool for recruitment of offshore wind turbine manufacturers in Denmark and Germany, maintaining the core-periphery model (Palier and Thelen, 2010) despite trade union organisation and the demand for skilled work. The findings confirmed that trade union and workplace representation and the introduction of Equal Pay Agreements had only limited effect in reducing the differences in job quality between directly employed and agency workers in terms of job security, pay and social relationships at work (cf. Helfen et al., 2015 on Germany). It is unclear if the blade factories in England employed agency workers. Here, jobs were also insecure and dependent on industrial policy. When a blade manufacturer shut down its factory in 2009, because of unfavourable planning regulations and subsidy schemes, five hundred workers immediately lost their jobs.

4.2.2. Dynamic relationship between skills and job quality

Findings were particularly interesting regarding the relationship between skills and job quality, and how this relationship was impacted by supply side industrial policy, the temporary increase of funding for ALMP training and VET. Earlier comparative debates suggested that CMEs provide for more extensive vocational skills (Estevez-Abe et al., 2001, Hall and Soskice, 2001, Marsden, 1999), and skilled and high quality jobs (Doellgast, 2012, Doellgast et al., 2009a and b). Vocational skills would allow redundant workers to move into new skilled jobs (Streeck, 1992). LMEs would provide low-skill jobs to low-skill workers (Brockmann et al., 2008, Hall and Soskice, 2001.).

In contrast, the case studies have suggested a more dynamic relationship between skills and job quality. They have shown that in early stages of the offshore wind turbine industry, the manufacturers provided skilled jobs on the shop floor, because products and supply chains were not yet fully optimised (East-Wind and Seawing nacelles in Germany; Seagull in Denmark). This suggests that a broad vocational skill-base was important for the emergence of a genuinely domestic wind turbine industry in Denmark

and Germany. Its absence in England, and unfavourable demand side policy since the 1990s (Gross and Heptonstall, 2010, Mitchel, 1996), explain why the country had no genuine domestic offshore wind turbine industry. Blades, mainly built by relatively low-skilled manual labour, with few primary components provided by globally operating suppliers (manager, November 2014; manager, January 2014; manager April, 2014), were the only type of large offshore wind turbine components produced in England.

4.2.3. Skills were not a panacea against bad jobs

However, skills were not a panacea against bad jobs (cf. Benassi, 2016, Keep and Mayhew, 2010). Hence, the distinction between periphery and core labour cannot be based on skill levels; and this thesis explains this partly as an outcome of industrial policy. In Denmark and Germany, agency workers and core workers worked alongside each other on the shop floor, often doing the same jobs (initially functional flexibility, ‘all core outcome’ and later, in some cases, ‘all periphery outcome’ (Hakansson and Isidorsson, 2012)). Demand side industrial policy initially led to the use of skilled agency workers, because it only provided unclear perspectives of the sector and production processes and supply chains were not yet optimised; while in the long-term, demand side policy supported the development of peripheral manufacturing jobs through cost cutting pressures, and supply side policy supported supply chain optimisation and labour process standardisation. Skill demands by manufacturers decreased (cf. Benassi, 2016, Braverman, 1974, Massey, 1990 [1984]). For example, the German Seagull site, ready to invest in automated production during its global restructuring, rationalised the labour process, deskilled jobs, and re-evaluated job profiles and pay levels at its new ‘greenfield’ site.

However, the shape of demand side policy (subsidy schemes, seabed allocation) in Germany put time pressure on production. It also led to batches that were too small at most of the German sites of those manufacturers that could not win contracts in the growing UK market. Small batches undermined labour process optimisation and reduced opportunities for product improvement (former manager, January 2014). Hence, in Germany, skill formation continued to play a role for job quality, however in an unexpected way, as detailed next.

4.2.4. VET and ALMP buffered redundancies and reinforced dualisation

In Germany, the sector's slump and ALMP perpetuated *dualisation* between (skilled and unskilled) directly employed and (skilled and unskilled) jobseekers/redundant agency workers. A vocational qualification helped redundant directly employed skilled workers at East-Wind and Seawing blades, and two steel manufacturers to find new jobs internally or externally. At Seagull and Seawing blades, unskilled directly employed workers were offered ALMP-funded VET training modules during short-time work. While skilled and unskilled agency workers were not offered any skills training within the sector. To conclude this section, supply and demand side industrial policy impacted directly and indirectly on skill formation and job quality. The next section discusses the strengths and weaknesses of this thesis.

5. Strength and weaknesses: generalisability and limitations

One weakness is the limitation of the research to one sector, which might limit generalisability of the findings across sectors. However, this focus allowed for an empirically strong in-depth study and cross-national comparison (Eisenhardt and Graebner, 2007, Yin, 2014). The findings are also limited by the type of data collected and analysed, here mainly interview data collected by the researcher, and documents available in the public domain, which served as proxies for more detailed and direct observation of decision-making processes across actors. Obstacles in terms of operationalising the research design were, in particular, financial and time resources as well as access. For example, it was impossible to interview policy-makers at regional, national, and European level.

However, the findings are supported by a rich empirical base of a relatively large quantity of interviewees, document analysis and secondary data, which provided insights into the offshore wind turbine manufacturing industry, skill formation, and job quality, from many different angles (Yin, 2014). This combination of sources enabled triangulation and reached the point of theoretical saturation (Glaser and Strauss, 1967, Yin, 2014).

Covering countries, which are characterised by different institutional models across relevant theoretical dimension, such as production model (Hall and Soskice, 2001), welfare state (Esping-Andersen, 1990), and skill formation regime (Brockmann et al., 2008, Thelen, 2004, 2014), the comparative research design provided for findings that have a strong theoretical and empirical grounding (Yin, 2014). It is suggested that the theoretical framework developed and the findings presented here might be applicable to sectors with similar characteristics in terms of dependence on state support.

6. Significance of research

This thesis made empirical and theoretical contributions. It provided a comparative analysis based on a new theoretical framework and has shown that industrial policy matters for skill formation and job quality. This theoretical contribution was based on the analysis of novel empirical material on industrial policy, skill formation, and job quality in the offshore wind turbine manufacturing industry.

Further, it is suggested that, while industrial policy is sector specific, the analytical distinction between supply and demand side policies, the idea of a dynamic match of industrial policies resulting from deliberation among various systemic stakeholders (also depending on the substance of the sector) and state actors might be helpful tools for analysis of other sectors; as well as might be the combined analysis of ALMP and VET for understanding dualisation, skill provision in specific areas of work, and deskilling.

This thesis has contributed to the comparative industrial relations debate by providing a critique and an alternative to the Varieties of Capitalisms approach (Hall and Soskice, 2001). Initially, the three countries were chosen as they are deemed to represent specific types of political economies and welfare states. However, having gained insights into the very detailed regulatory issues at stake within each country's offshore wind turbine sector, it is now harder to consider any of the three as a clear example of a corporatist-coordinated or competitive-market variety.

The combination of old and novel ways of studying industrial policy, skill formation, and job quality in this thesis allowed for a new perspective of the studied cases. Denmark came out as providing the most coordinated industrial policy and skill formation, but that was not without political struggle. As in other countries, the

manufacturers used agency work and offshoring based on cost calculations. Germany showed examples of failed coordination, competition between VET and ALMP training, and regulatory conflicts. England introduced a highly-coordinated governance system for offshore wind turbine industrial policy. In terms of skill formation and job quality, the marketisation framework suggested by Doellgast and Greer (2013) proved useful for explaining employer strategies. Employers used exit options from existing institutional relationships, such as dual vocational education and training, provided by industrial supply and demand policies.

7. Outlook

Private sector delivery of public policy goals creates a paradox – industrial policy provides temporary demand side incentives, while also lowering worker protection at the supply side by active labour market policy, vocational education and training, and the support of supply and process optimisation. However, the impact of VET and ALMP on job quality is dynamic, depending on how far the maturing industry still requires (skilled) labour, and on how far demand side policy promotes the industry. This hints at three wider problems: the scaling back of welfare state provisions that have historically protected workers in transitional phases caused by structural change (Daguerre and Etherington, 2014, Daemmerich and Bredgaard, 2013, Greer, 2016), the continuing weak collective representation of workers and particularly agency workers (Helfen et al., 2015, Lillie et al., 2014), and the way supply and demand side industrial policies are shaped. In the context of investor capitalism, which favours the implementation of public policy goals by the private sector, questions for future research should address how industrial policies could be shaped in ways that provide more employment stability for all workers, and keep corporate demands of investors in check, while providing adequate investment environments.

APPENDICES

Appendix 1 Comparative table on skill formation providers

	Denmark		Germany		England			
	Tech college	AMU	Vocational school	IVET ALMP provider	CVET ALMP provider	Inter-firm training provider	Inter-firm training provider	College B
Type	IVET (some CVET), "up to 20 different modules"	CVET (some IVET), health and safety	IVET 'pilot'	IVET 'pilot'	CVET	CVET	IVET/CVET	nd
Regime	VET/ALMP	VET/ALMP	VET	ALMP	VET	ALMP	VET	nd
Flexibility of training delivery	H	H	L	M	H	Nd	L; nd	nd
Employer participation in training and funding	West-Wind and Seagull use dual IVET, full public funding	West-Wind and Seagull use CVT, mainly public funding	Steel component companies: school-based and dual options, short-term variety of public funding options	East-Wind, Seawing, third unidentified company: school-based and dual options, short-term variety of public funding options	Mainly ALMP funded, school-based and at Seawing	For energy utilities, not manuf., employer -funded	Local SMEs, not West-Wind, funded by government and short-term public subsidies, as well as individual participants	Seagull recruitment events, new built engineering centre for training, nd on funding arrangements
Course participants	16-24 year olds	Above 24 years	Local youth	Dis-advantaged applicants	Unemployed and long-term unemployed, workers at Seawing plant, workers at risk of redundancy	Skilled workers employed at utilities	Local school-leavers	Highly skilled workers

nd = no data, H = high, L = low, M = medium

Appendix 2 Initial question matrix on skill formation

Intermediary/ Dependent variables		Operationalisation	Field research
Dimension	Sub-category	Answers to questions:	Source, triangulation
Location	School-based, firm-based, dual	Where does skill formation take place?	Training provider, employer, apprentice
Influence on curriculum	Public authorities, firms, employers organisation, trade unions, apprentice	Who determines the content of the training? Who can take influence on the curriculum and how? Can you give an example?	Training provider, employer, public body, interest group, apprentice
Funding	Public authorities, firms, employers organisation, trade unions, apprentice	Who is funding? What kind of funding?	Training provider, public body, employer
Content	Task-based, holistic, occupational	What is the content of the training? How is it regulated?	Documents, training provider, apprentice, employer
Level within training system	Initial or continued vocational training	What kind of training do you deliver?	Training provider, employer, trade union, works council
Labour market outcome	Standard employment, non-standard employment; at, below or above vocational level	How to professional biographies of participants develop after the training?	Training provider, employer, trade union, works council
Entry requirements	Previous education, positive discrimination criteria, membership to professional bodies or categories, employment status	What are the prerequisites for entering in the training programme? What qualifications do participants have when entering the training?	Training provider, written regulations
Skill needs		In which circumstances, for what reason, do workers receive training? How important is informal or formal training for professional development?	Trade unions, works council, employers, former apprentices, training providers
Formal vs informal training		When and where does the training take place? How is the training documented? How is the training certified?	

Appendix 3 Initial question matrix on job quality

Dependent variables		Operationalisation	Field research
Dimension	Sub-category	Related Questions	Source, triangulation
Match to a certain type of production system	Fordism	How is production organized (occupational groups, tasks, professions)?	Experts on the sector, producers, industry organisations
	Post-Fordism	How is the supply chain structured?	
	Low-road	Where are single producers within the supply chain located?	
	High-road	How is the contribution to the product distributed along the supply chain?	
	HPWS	What kinds of skills are necessary?	
	Diversified	How complex is the production process from the point of view of the occupational groups?	
	Quality Production	How much discretion? How much routine? When is learning of new skills necessary? How do you deal with this? How is this organized? Teamwork, conveyor belt work, hierarchy? What is the ratio production to research and development?	
Match to a certain type of employment practice	Ratio of core versus periphery	How many workers are on permanent, temporary, contingent and auxiliary, and agency contracts?	Employer, works council, within company or plant employee representative
		How many are fulltime, part-time?	
		How many women and male workers?	
		Where are these employed?	
		How many skilled and unskilled? What jobs do they do?	
		What and who determines what job workers do? How many long-term staff and new staff do you have?	
Match to a certain type of labour market	Internal, sector, regional, national, European, world	Where do manufacturers recruit?	Employer, Training provider, apprentice
		How do they recruit?	

Appendix 4 Grid connected offshore wind farms in Denmark

	MW	# turbines	Turbine type	Developers/owners	Year of grid connection
Vindeby	5	11	Bonus B35/450	DONG Energy	1991
Tunø Knob	5	10	Vestas V39/500	DONG Energy	1995
Middelgrunden	40	20	Bonus Energy, 2MW	20 turbines are equally shared between Københavns Energi and Middelgrundens Vindmøllelaug, a private cooperative partnership. SEAS Wind Energy Centreon manage its operations in behalf of the owners.	2000
Horns Rev I	160	80	Vestas V80-2.0 MW	60% Vattenfall, 40% DONG	2002
Rønland	17	8	Siemens SWT-2.3-93, Vestas V80-2.0 MW	Vindenergi ApS, Harboøre Møllelaug I/S, Thyborøn-Harboøre Vindmøllelaug I/S	2003
Nysted	165	72	Bonus B82/2300, Siemens SWT-2.3-82	Pension Denmark, Stadtwerke Lübeck, DONG	2003
Samsø	23	10	Bonus B82/2300, Siemens SWT-2.3-82	Samso Municipality, private investors, Difko A/S	2003
Frederikshavn	7	3	Nordex N90/2300, Vestas V90 3MW, Bonus/Siemens 82.4 2.3 MW	DONG Energy	2003
Horns Rev II	209	91	Siemens SWT-2.3-93	DONG Energy	2009
Avedøre Holme	11	3	Siemens SWT-3.6-120	DONG Energy	2010
Sprogø	21	7	Vestas V90-3.0 MW	Sund & Bælt Holdung A/S	2009
Rødsand II	207	90	Siemens SWT-2.3-93	E.ON Climate & Renewables 20%, SEAS-NVE Energy Group 80%	2010

Based on data provided by www.4coffshore 2015

Appendix 5 Grid connected offshore wind farms in Germany

Wind farm	MW	# turbines	turbine type	Developer	Grid connection
Alpha Ventus	60	12	6 X M5000 AREVA, 6 X 5M Senvion, former Repower	Stiftung Offshore-Windenergie	2010
EnBW Windpark Baltic 1	48	21	SWT-2,3-93 Siemens	EnBW Erneuerbare Energien GmbH	2011
Bard Offshore 1	400	80	5 MW BARD	BARD Holding GmbH	2013
Riffgat	108	30	SWT-3.6-120 Siemens	Offshore-Windpark Riffgat GmbH & Co.KG	2014

Based on 4coffshore 2015

Appendix 6 Grid connected offshore wind farms in the United Kingdom

Site	MW	# turbines	Turbine type	Developer	Begin of operation	O&M base	Installation base
Blyth Offshore	3.8	2	V66-2MW Vestas	E.ON UK Renewables 100% since 2007, Shell Renewables, Nuon Uk, AMEC Wind	2000	Blyth	Howdon Yard, River Tyne
North Hoyle	60	30	V80-2.0 MW Vestas	Beaufort Wind Ltd the company part of Zephyr investment fund, of this 1/3 is owned by RWE Npower Renewables	2003	Mostyn Port	Mostyn
Scroby Sands	60	30	V80-2.0 MW Vestas	E.ON UK Renewables	2004	Great Yarmouth	Great Yarmouth, Lowestoft
Kentish Flats	90	30	V90-3.0 MW Offshore Vestas	Vattenfall, wind farm originally owned by predecessor of DONG, Elsam	2005	Whistable	Felixtowe
Barrow	90	30	V90-3.0 MW Offshore Vestas	DONG Energy and Centrica, bought from Warwick Energy Limited in 2003	2006	Barrow	Belfast
Beatrice	10	2	5M Senvion	SSE Renewables and Talisman UK JV: 50/50	2007	Buckie	Nigg Cromarty Firth
Burbo Bank	90	25	SWT-3.6-107 Siemens	DONG Energy	2007	Liverpool	Mostyn
Lynn & Inner Dowsing	19 4.4	54	SWT-3.6-107 Siemens	Centrica Renewable Energy Ltd 50%, EIG 50%	2009	Grimsby base	Skegness Esbjerg
Rhyl Flats	90	25	SWT-3.6-107 Siemens	RWE Npower Renewables, UK Green Investment Bank 24.95%, Greencoat UK Wind PLC 24.95%	2009	Mostyn Port	Mostyn
Gunfleet Sands I	10 8	30	SWT-3.6-107 Siemens	DONG Energy 50.1 %, bought from GE in 2007, and 49.9 stake sold to Marubeni Corporation in 2011	2010	Brightlingsea	Harwich
Gunfleet Sands II	64. 5	18	SWT-3.6-107 Siemens	DONG Energy	2010	Brightlingsea	Harwich
Robin Rigg	18 0	60	V90-3.0 MW Offshore Vestas	E.ON UK Renewables	2010	Workington	Maryport Workington and Whitehaven Belfast
Thanet	30 0	10 0	V90-3.0 MW Offshore Vestas	Vattenfall	2010	Ramsgate	Mostyn Dunkirk
Walney I	18 3.6	51	SWT-3.6-107 Siemens	DONG Energy 50.1% / SSE Renewables 25.1%/ Ampere Equity 12.4% / PGGM 12.4%	2011	Barrow	Barrow and Mostyn

Grid connected offshore wind farms in the United Kingdom (continued)

Site	MW	# Turbines	Turbine type	Developer	Begin of operation	O&M base	Installation base
Greater Gabbard	504	14	SWT-3.6-107 Siemens	SSE & RWE Npower Renewables	2012	Lowestoft	Harwich Verbrugge Zeeland
Ormonde	150	30	5M Senvion	Vattenfall	2012	Barrow	Belfast
Sheringham Shoal	316.8	88	SWT-3.6-107 Siemens	Scira Offshore Energy Ltd originally owned 50/50 by Statoil and Statkraft, since 2014 UK Green Investment Bank owns 20% of the stakes	2012	Wells-next-the-Sea	Great Yarmouth
Walney II	183.6	51	SWT-3.6-120 Siemens	DONG Energy / SSE Renewables/ Ampere Equity / PGGM	2012	Barrow	Barrow and Mostyn
Gunfleet Sands III - Demonstration Project	12	2	SWT-6-120 Siemens	DONG Energy	2013	Brightlings ea	Harwich
Lincs	270	75	SWT-3.6-120 Siemens	Centrica, DONG and Siemens Project Ventures, JV: 50/50	2013	Grimsby	Esbjerg Port of Yarmouth
London Array I	630	17	SWT-3.6-120 Siemens	DONG Energy 25% / E.On Renewables 30% / Masdar 20%/ La Caisse de depot et placement du Quebec 25%	2013	Ramsgate base, employing 60 technicians and 20% support staff	Ramsgate Harwich
Teesside	62.1	27	SWT-2.3-93 Siemens	EdF ER	2013	Hartlepool	Port of Tees Hartlepool
West of Duddon Sands	389	10	SWT-3.6-120 Siemens	Scottish Power/DONG Energy	2014	Barrow	Belfast Barrow construction facility

Based on database of 4coffshore 2015

Appendix 7 Comparison of regulatory institutions and governance bodies

	Denmark	Germany	England
Interpretation of 'national' case	Compromises and shared interests across actors	Energy policy is highly politicised, perpetuated disagreement between actors, 'institutionalised conflict of interest'	Late emergence of joint support for offshore wind
Government	Centralised	Federal	Centralised
Other important industrial policy actors	Municipalities and regions, industry associations, trade unions	Political parties, organised interest of incumbent and new electricity utilities, between trade unions, and governments of the <i>Länder</i>	Changed frequently over the years
Trigger for wind industrial policy	OPEC embargoes in the 1970s	OPEC embargoes in the 1970s, 1986 Chernobyl nuclear accident, nuclear accident at Tepco's Fukushima power plant in 2011	Increasing influence of European Union climate policy since the 2000s
Long-term aims	Since 1970s: independence from imported fuels, phase-out of the use of oil and gas, reduction of carbon dioxide emissions	Unclear and changing, since Fukushima nuclear accident, permanent exit from nuclear energy	Unclear and changing, under Coalition Government (2010-2015) supportive of offshore wind and nuclear
Impact of EU directives on electricity market liberalisation	Assimilation without radical change in policy orientation	EnBW, RWE, E.ON, and Vattenfall, the big four energy utilities became more powerful actors	As US investors withdrew, continental utilities rapidly amalgamated the electricity supply system
Electricity supply industry	The Danish Energy Agency, the public enterprise Energinet.dk, and the Danish Energy Regulatory Authority, local not-for-profit monopoly companies, large national electricity suppliers	EnBW, RWE, E.ON, and Vattenfall, Bundesnetzagentur, small utilities, municipalities	Ofgem, National Grid, Big six energy utilities: British Gas (owned by Centrica), EDF, Npower (RWE), E.ON, Scottish Power, and SSE.
Industry interest organisations	Danish Wind Energy Association, and Offshore.dk, represent about 500 supply chain companies	VDMA, OWIA, regional interest associations WAB, Renewable Energy Hamburg, Wind Energy Network, Wind Comm	RenewableUK, Renewable Energy Association
Trade unions	Dansk Metal, 3F, HK	IG Metall	Unite
Local government	Local economic policy includes variety of sectors, tax credits to wind turbine manufacturer	ERDF funding during 1990s and early 2000s, large port infrastructure investments to accommodate offshore wind industry's needs, facilitation of network between manufacturers, research institutes, and training providers	Weak, but since abolition of RDAs in 2012, public-private LEPs have become increasingly important for acquisitions of governmental development funds

Appendix 8 Comparison of supply side policies

Supply side policy	Denmark	Germany	England
Infrastructure support	Likely, hard to retrace, tax credits to component manufacturers	ERDF funding during 1990s and early 2000s, large port infrastructure investments to accommodate offshore wind industry's needs, also federal development funds available for structurally weak regions	Under Lew Labour Grants for Business Investment scheme, a £60m funding pot for Assisted Areas for renewable energy related investments at ports
Research and development support	Since 1970s, National Risø research institute and Danish Technical University (DTU) collaborate with manufacturers, help of emergence of duopoly of offshore wind turbine producers	Fraunhofer institutes, Alfred Wegner Institute, universities, and some polytechnics	Since 2002, controlled by public-private Low Carbon Trust, since 2013 public-private Low Carbon Innovation Co-ordination Group (LCICG)
Funds for research and development for energy technology	Selected time period for illustration: 350m kroner in 2005 750m in 2009, 1.1bn in 2010	Federal funding between 1974 and late 1990s between 150m and 80m Euros per year for different types of renewable energy technologies	Since 1980s, steadily declining research funding for renewables, low point: £2.2m for direct research funding in 2002, since then increase in research funding; under Coalition Government 10m offshore wind technology grant, 5m go to Siemens
Education and training	Aimed at maintaining countries expertise in wind turbine technology, Broad and inclusive, state-funded, employer subsidies	Dual VET for mechanical and electrical occupations, ALMP modules, state funded university and polytechnic degrees	Skill gap deplored by industry, fragmented VET provision
Supply chain and process optimisation	Supported by municipalities (eg. funded by ESF grants), government funded Vaeksthus, industry associations, and research at universities	No support, had to be funded by manufacturers	Since 2013, £20m Offshore Wind Supply Chain Growth Programme and Advanced Manufacturing Supply Chain Initiative (AMSCI), which allocated £120m

Appendix 9 Comparison of demand side policies

Demand side policies	Denmark	Germany	England
Public subsidies for building wind turbines	Since 1979, for individual, local cooperative, and municipal investments; excluded large electricity utilities; Since 1985, planned, gradual expansion of large utilities' wind farms, gradual reduction of subsidies as technology became cheaper, Long-term subsidies for wind turbines, robust electricity grid allows integration of decentralised electricity generation, Cost-sharing agreements regarding grid connection	Federal investment funds available for renewable electricity generation systems, eg. through KfW, Large amounts of renewable electricity technology installed by small regional electricity utilities, community investment funds, and individuals since the 1980s, large utilities lost an important market share, Since 2012, disputes between developers and grid provider over liabilities in case of late connection of offshore wind farms, as statutory regulations lacked	Under New Labour, Offshore Wind Capital Grant Scheme for developers of Round 1 and 2 projects, £102m, and a maximum of £10m per project or 40 per cent of total costs could be funded; under Coalition, Government: £54bn for offshore wind
Electricity price subsidies	Since 1981: FiT	Since 1988, FiT for onshore wind, but many legal changes: 1998 Electricity Supply Industry Reform Act, 1999 Privatisation of ESI, 2000 Renewable Energy Source Act, Renewable Energy Source Act 2004, amendments of the Electricity Supply Industry Act in 2005, 2006, 2009, 2012, 2014, "climate of uncertainty" in 2012	Varying, dysfunctional for onshore wind; since 2009 more favourable subsidy schemes for offshore wind, after banding review that took into account higher costs of offshore wind, instable prospects during EMR and banding review in 2010-2012
Spatial Planning and Construction Regulation	Danish Energy Authority provided a "one-stop-shop", tender by government	Free, administrative allocation of seabed in 'priority areas' for offshore wind 30 to 100 sea miles from the shore in water up to 50 metres deep	Six rounds tendered by Crown Estate since 2000; developers involved in choosing seabed for developments, planning bodies streamlined under Coalition Government
Targets for CO ₂ emission reduction	30 per cent by the year 2020, 80 per cent-95 per cent by 2050	80-95 per cent by 2050	80 per cent by 2050, periodic review by CCC to avoid premature scrapping technologies in use
Targets for energy from renewables	100 per cent by 2050	80 per cent by 2050	15 per cent by 2020
Marketing and offshoring	Government against 'green protectionism' across EU, offshoring supported by government programmes, trade unions are not opposed	Trade unions and policy-makers prefer inward investment to offshoring	Support inward investment

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