**Stimulating Investments in Manufacturing: Can Policy Create Supply Chains from a Void?**

*Michel Leseure*

*School of Mechanical and Design Engineering, University of Portsmouth,*

*Portsmouth, UK*

*Chukwunonyelum Emmanuel Onyeocha*

*School of Engineering Computing and Mathematics, University of Chichester, Chichester, UK,*

*and*

*Dawn Robins*

*School of Business, University of Chichester, Chichester, UK*

**Abstract:** This paper evaluates the effectiveness of a policy, the 2014 UK Supply Chain Plan, that aimed to create a local supply chain in a sector (offshore wind) where the central manufacturing node capabilities and knowledge is not possessed locally. It aims to address the following question: can policy create a new manufacturing supply chain from a void?

**Keywords**: supply chain, policy, offshore wind, behaviour, real options theory

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**Structured Abstract**

**Purpose**

This paper evaluates the effectiveness of a policy, the 2014 UK Supply Chain Plan, that aimed to create a local supply chain in a sector (offshore wind) where the central manufacturing node capabilities and knowledge is not possessed locally. It aims to address the following question: can policy create a new manufacturing supply chain from a void?

**Design/methodology/approach**

A qualitative field research approach is used to derive an original set of theoretical propositions explaining the motivation behind the Supply Chain Plan policy. The outcomes of this policy are examined ten years later in order to provide an opportunity to observe the impact of the policy.

**Findings**

The conclusion is that the policy has been successful in increasing local content, and some of that local content has benefited local manufacturers. However, a lot of the increase in local content has been achieved in non-manufacturing areas or in new areas. The main issue, i.e. the lack of a central manufacturing capability, remains unaddressed. The impact of the local content policy on cost is undocumented.

**Originality**

There is an increasing amount of interest in regional/local supply chains after the Covid-19 pandemic and increasing geopolitical tensions. This paper’s originality is to document with an industry case study the fact that manufacturing knowledge and capabilities are the central growth engine of supply chains, and that creating a new manufacturing supply chain competing with well-established clusters is not a simple matter that can be achieved through a local content policy. Such policies raise critical questions about the policy makers’ implicit valuation of manufacturing technology.

**Quick Value Overview**

**Interesting because:**

Local content requirement policies have for long divided academic and policy makers and are a topical issue today in manufacturing supply chains producing renewable energy equipment. In this paper, we examine the Supply Chain Plan, a policy designed to increase the local content in the UK offshore wind supply chain, and we question the effectiveness and impact of this policy.

**Theoretical Value:**

We discuss many theories that all help to shed some light on the value of the Supply Chain Plan. This includes Porter’s industrial diamond, smart specialisation theory, agglomerative economics, and the behavioural theory of the firm. By gaining insights from all of these theories, we propose a new theory of the effectiveness of manufacturing support policy. These policies can only yield fruits in a specific time window, which is itself determined by the lifecycle stage of the technology and the tension between current and future uncertainty.

**Practical Value:**

The paper will help manufacturing managers better make sense of the motivations behind the local content requirements which can be imposed on them. It will also help to assess whether these policies are an opportunity or a threat, such as an extra transaction cost imposed on their operations.

**Stimulating Supply Chain Manufacturing Growth: Can Policy Create Supply Chains from a Void?**

**Introduction**

The UK Department for Energy and Climate Change introduced in 2014 the ‘Supply Chain Plan’ (DECC, 2014). Developers of wind farms above a certain power output have to demonstrate that they have a robust supply chain plan in place. Although the policy document does not explicitly state local content targets, the whole industry has treated the document as a local content requirement. This means that arrangements have been made to ensure that a substantial amount of parts and services needed for the construction of wind farms in UK waters will be sourced from the UK. The supply chain plan is the spinoff of a consultation process which is summarised in the 2013 *Offshore Wind Industrial Strategy: Business and Government Action* report as follows: *'As part of our new industrial policy, we want to see UK-based businesses grow to create a centre of engineering excellence that delivers cost reduction for UK projects and exports to overseas market. To achieve the vision set out in this strategy, we need to grow our manufacturing base to be world-leading in more areas of offshore wind supply and to achieve levels of UK content in our offshore wind farms which are similar to those achieved by our North Sea oil and gas industry where more than 70% of capital expenditures is through UK-based suppliers*' (HM Government, 2013, p. 2).

The same report estimates that only 30% of offshore wind spending is, on average, sourced from UK suppliers (p. 71). Up to 2014, industrial policy support for the offshore wind sector was centred around innovation, for example with the *GROW: Offshore Wind programme,* a fund for Manufacturing Supply Chain Programme for Regional Growth. In contrast, the supply chain plan adopts a different direction as it does not exclude achieving its 70% target through foreign investment. This is exactly what is happening in Hull with the building of a 'green port' by one of the leading turbine manufacturers in Europe, Siemens, and its partners. The news of this investment has been commented on widely and positively in the national press, which also quoted ministers for stating that this factory is a proof that "*manufacturing has a glittering future in the UK"* (Vaughan, 2016).

The Supply Chain Plan can be seen as a success in terms of regional job creation (1000 jobs in a city with the UK's highest unemployment rates; Vaughan, 2016) but the celebration of Hull's green port is the sort of news item that one would expect to read about an emerging economy rather than a country with a level of technological knowledge such as the UK. The Supply Chain Plan is a policy which is an interesting and unusual case study in the institutional analysis of structural economic change, as it raises many questions.

First, the Supply Chain Plan is essentially a local content requirement and thus a form of protectionism. In the context of the aftermath of Brexit and of a government sporting the traditional unconditional British allegiance to free trade principles, imposing local content requirements on European exporters is an odd position. An interview of Siemens UK's chief executive (Vaughan, 2016) acknowledges that exports out of the UK will only be considered when the factory brings its costs down; a statement that echoes the typical lack of performance associated with local content requirements (Belderbos and Sleuweagen, 1997; Kuntze and Moerenhout, 2013; Hufbauer et al., 2013; Tomsik and Kubicek, 2006). It is also worth nothing that local contents requirements are often legally challenged (Batra and Bafna, 2018). The Supply Chain Plan is no exception as it the EU started an investigation about the legality of UK local content requirements for the offshore wind sector in 2021.

Second, such cost disadvantages inscribe themselves in a larger debate about the competitiveness of local versus global supply chains. In order for the UK to build wind farms with the lowest lifecycle cost of electricity, relying on a global supply chain benefitting from either competitive or comparative advantage effects (e.g., Christopher *et al*., 2006) sounds like a robust strategy. There is a growing paradoxical tension, especially at the policy making level, between advocating global versus local supply chains, and the UK Supply Chain Plan is a good example of this tension.

Third, the Supply Chain Plan departs from the vertical policies associated with smart specialisation support policy (Foray, 2014) as it does not try to directly stimulate entrepreneurial excellence whereas previous initiatives such as *Offshore: Grow Wind* did.

Finally, the fourth and most challenging issue comes from the fact that UK-based first movers in wind power technology in the 1980s were not deemed worthy of policy support, and the small industry that they formed eventually died off. Thus, the Supply Chain Plan is an attempt to re-create an extinct cluster, but this time, from a void.

The overall objective of this paper is to investigate the conditions under which a local content requirements policy such as the Supply Chain Plan is feasible and valuable. This requires considering the following topical questions for any country willing to develop its manufacturing base: can entire supply chains be created from a void? Are local content requirements an effective way to do so? How can we make sense of the contradictions of policy simultaneously advocating local and global supply chains?

**Offshore Wind: A Global Overview of Markets and Supply Chains**

The wind power industry has grown steadily in continental Europe for the last 20 years, but its recent accelerated growth in 'follower' countries is down to a number of international, European, and national directives with the purpose of reducing carbon emissions and of increasing the share of renewables in national energy mixes. First movers, both in terms of wind energy production and of the fabrication of wind power equipment, were Denmark, Sweden, and the USA. They were the only three countries to generate electricity with commercial wind farms in 1983[[1]](#footnote-1). Wind farms were built in 1986 in India and the Netherlands. In Germany and the UK, wind electricity generation began in 1988. By 2016 though, the UK hosted the 6th largest wind power capacity in the world with 14.5 GW, composed of 10GW of onshore wind farms and 5GW of offshore wind farms. By 2023, UK capacity reached 28 GW, mainly through the construction of new offshore wind farms (14 GW). The largest players are China with 239GW, the USA with 133GW, and Germany with 64GW (2021). In these countries installed capacity is predominantly onshore.

In the late 2010s, the UK almost entirely ceased investing in onshore wind. This can be explained by the relatively small landmass which does not provide much opportunity for siting wind farms especially in a context of frequent social opposition to wind farm projects (Bell et al., 2005; Van der Horst and Toke, 2010). A government ban came into force in 2015, ending all investments. This decision was reversed in 2022. However, the larger coastal areas and their stronger, steadier winds along with much reduced issues of social acceptance means that the UK continued to focus on offshore wind growth. As a result, the UK owns 25% of global installed offshore wind capacity of the global installed capacity, right in the geographical centre of offshore wind growth, Northern Europe. The 10 largest commercial wind farms in operation today are in the North Sea. London Array was for long the largest wind farm in the world with a capacity of 630MW, but has been replaced by Hornsea 2 with a capacity of 1.3 GW. Plans to build more (and larger) wind farms mean that the UK offshore wind market is estimated to be worth more than £100 billion in the next 20 years.

This growth is not without challenges though, as offshore wind electricity has been considerably more expensive than onshore wind (Blanco, 2009). Whereas onshore wind is nearing competitive parity with traditional fossil fuel sources, legacy offshore wind farms can only be operated through subsidies. This subsidisation has been a key feature of the UK energy policy (chronologically through the Renewable Obligation and the Contract for Difference policy instruments). It is likely that the subsidy rate, typically ranging from 50 to 100% of the electricity rate, has motivated the UK government to find ways to demonstrate value for money beyond carbon reduction and increased energy security. Inspired by the examples of a handful of countries where the growth of offshore wind had resulted in the creation of new and vibrant industrial districts, such as Germany and Denmark, the UK, and most European countries, built on expectations that the construction of offshore wind farms would generate economic spillovers resulting in significant local job creation and in the type of structural changes typically associated with smart specialisation. Alas, in the majority of the cases these spillovers did not materialise. For example, the Kent region did not experience significant spillovers, and this, despite being offshore wind first movers in the UK (self-reference removed). This realisation led to the consultation mentioned in the introduction and eventually to the adoption of the Supply Chain Plan.

To better understand the nature of this market, it is useful to consider the product breakdown structure of a wind farm project. A large offshore wind farm, such as London Array or Rampion in Brighton, will typically cost about £2 billion in capital expenditures. 43% of this budget is for the wind turbine manufacturer and 33% for the balance of plant (foundations, cables, and substations), leaving 24% for the developer's installation, commissioning, and project management expenses. Typically, the wind farm is built with an expected 25 years operating life, and annual operations and maintenance expenses will be 3% of the original construction budget. The operations budget includes recurring expenses such as leases, connection fees, operating base, staff, etc, that add up to 50% of the budget. The remaining half of the budget is spent on spare parts.

A very simplified representation of an offshore wind supply chain is a 3-level linear supply chain composed of the user (typically a utility company), the developer (who will typically operate the facility for the first five years after construction), and the first-tier level of suppliers. Key players in the first tier are the turbine, cables, and foundations manufacturers. The turbine manufacturers have their own traditional manufacturing supply chains. Whereas supplying to other first tier suppliers requires a specialist trade (e.g. cables), the turbine manufacturers rely on a much more diverse set of suppliers. This, along with the high percentage of the budget going into the turbine, explains why the turbine supply chain has been the main focus of policy. Ten companies hold 72% of the global market share for turbines: 1 from Denmark, 2 from Germany (1 based on the acquisition of a Danish operator), 2 from the US (including the merger with a Spanish manufacturer), 2 from India, and 3 from China. Although the UK has a number of firms manufacturing small scale as well as mid-size turbines suitable for onshore installations, the only firms that could have been players in the offshore sector either went out of business in the 1980s or were bought out and knowledge moved to Scandinavia. There is currently no firm in the UK with the ability to manufacture offshore turbines matching modern specifications. There are UK businesses with experience of foundations manufacturing (for oil and gas platforms), subsea cables production, as well as a few foreign-owned specialist manufacturing centres (e.g. blades).

**An Industrial Strategy Perspective**

Given the context described in the previous section, is the Supply Chain Plan a sensible and promising industrial policy? It is tempting to try to find an answer to this question by relying on the traditional industry view of strategy, i.e. by using Porter's Diamond (Porter, 1998). Given the high rate of building offshore wind farms in the UK, the demand conditions are certainly very strong. There are sufficient factor endowments in terms of material and knowledge as well as related industries (the offshore oil and gas sector). However, when considering industry structure and rivalry and the ability to maintain a competitive advantage through innovation, there are no large player or alliances that can fulfil this role.

A similar conclusion can be reached by using the lenses of smart specialisation. Entrepreneurial discovery is at the heart of the process of smart specialisation, and in the absence of any entrepreneurs invested or willing to invest in this area, nothing will happen.

To counter this position, Lewis and Wiser (2007), in their comparative study of several countries industry policy support mechanisms for wind power supply chains, conclude that "*whether new wind turbine manufacturing entrants are able to succeed will likely depend in part on the utilization of their turbines in their own domestic market, which in turn will be influenced by the annual size and stability of that market. Consequently, policies that support a sizable, stable market for wind power, in conjunction with policies that specifically provide incentives for wind power technology to be manufactured locally, are most likely to result in the establishment of an internationally competitive wind industry*". This conclusion suggests that the Supply Chain Plan is a feasible and worthy initiative but it has to be mitigated by the fact Lewis and Wiser's (2007) conclusion is based on an historical examination of first mover countries only. All these benefited from direct and indirect support from their government to develop a local wind power industry (see Lewis and Wiser for a full account of the different policy instruments used) and worked initially at a national scale before the industry became truly global. The only case study that could be compared to the UK is Japan, a late entrant with no prior experience in the sector (Lewis and Wiser, 2005), that now has 3 large scale turbine manufacturers. The idea that a cluster can be created from a “void” echoes Davies and Ellis (2002) report of the successful creation of business clusters in the absence of an innovation core. This is similar to the research of Allan et al. (2023) who use an economic input-output model to demonstrate that local content is beneficial to the UK both in economic and environmental terms: in their model an implicit assumption is made that one can create local content from a void. To conclude, there is an industrial debate between local content requirements advocates (Lewis and Wiser, 2007; Allan et al., 2023) and economists that criticise them as ineffective policy instruments (Kuntze and Moerenhout, 2013).

**Theoretical Conjectures: A Behavioural Perspective on Industrial Strategy**

This paper examines these opposing viewpoints from the theoretical perspective of the behavioural theory of the firm (Cyert and March, 1963). Cyert and March challenged the classical theory of the firm's proposition that managers maximise shareholder's wealth. As most managers make decisions in contexts best described with bounded rationality and imperfect information they look for satisficing solutions that are good enough to please shareholders, rather than make optimal decisions. The behavioural theory of the firm offers many theoretical lenses that can be used to investigate the behaviour of decision makers. Cyert and March (1963) explain that in the face of uncertainty and different decision alternatives, organisations are likely to divide into different coalitions, and the process of decision making becomes a process of establishing the power or dominance of a coalition. They also replace the idea of optimising with the concept of an organisational search. Different coalitions will adopt different directions of search. March (1991) contrasts explorative searches (innovation and experimentation) vs. exploitation (the use of tested and known business models) and concludes that there is an optimal trade-off between exploration and exploitation. Gavetti and Levinthal (2000) compare cognitive searches that look forward and analyse conditions for change to take place with experiential searches, which look backward before making a decision. They conclude that the ability to change a cognitive representation is important for adaptation. Coalitions have been associated with the role of ideology in decision making, and especially with the existence of irrationality in organisational action (Brunsson, 1982) and for explaining the escalation of commitment to a course of action (Staw, 1981).

The behavioural theory of the firm has never been previously applied at the policy making level, but policy makers belong to organisations which are exposed to problems of equal, if not higher, complexity than firms. They, too, have to make justified decisions under uncertainty to please a vast array of stakeholders. A behavioural theory of industrial strategy means that policy makers cannot make optimal decisions about which sectors to support and which policy mechanisms they should use. As they face too much uncertainty and ambiguity, they are likely to form different coalitions that engage in different directions of search and look for a satisficing, “good enough” solution. Lewis and Wiser (2007) point out that nearly all countries using wind turbines are attempting to establish a local supply chain, and this, regardless of their level of capability, experience, knowledge, and timing of entry. In other words, all are *searching* for a way to create a new promising industrial sector and its associated jobs. The fact that the 2013 *Offshore Wind Industrial Strategy* makes a direct reference to the oil and gas sector as the benchmark to be used suggest an experiential search, i.e. one where a past economic success should be replicated*.*

The preceding sections have shown that many agglomerative economics/smart specialisation theories can be invoked and interpreted to justify the Supply Chain Plan, but not always in a convincing way. These interpretations clash with supply chain theory which supports the idea of seeking economic benefits from global supply chains. There is supply chain theory advocating regional supply chains for optimal cost performance (instead, they are that are more responsive but more expensive). This theoretical maze is akin to the situation described in Koontz’s seminal management theory jungle (1961). The key motivation behind this paper is that in the absence of existing manufacturing knowledge, it is very unlikely that a new supply chain can be created and we propose that a behavioural theory of industrial strategy provides a better frame to justify and analyse the Supply Chain Plan. We illustrate this with three conjectures justifying the Supply Chain Plan based on the use (or misuse) of theories:

Conjecture 1 (exploitative, neo-mercantile coalition): There exists in UK policy maker circles a dominant coalition which is concerned with the political argument that UK taxpayers are not getting enough for the high subsidies paid to the offshore wind sector, and that the real beneficiaries of these subsidies in monetary terms are foreign manufacturers and utility companies. This dominant coalition therefore considers that the creation of a UK-based manufacturing sector is a fair and justified offsetting mechanism. The goal is solely to create jobs, ideally in areas in need of regeneration, i.e. addressing current political targets. Whether or not actual spillovers will take place is not necessarily a prime consideration, and this coalition may be content with the idea that the knowledge base of the sector in the UK may remain that associated with contract manufacturing, with only limited technology transfer taking place. In other words, this coalition is happy with the idea that their plan is about exploiting a sovereign right and can only generate benefits in the short term, whilst offering limited and uncertain growth potential.

Conjecture 2 (exploration, invest in smart specialisation coalition): UK policy makers have been impressed by the global strength and size of emerging offshore wind clusters and by the accounts of Germany and Denmark (see for example Bergek and Jacobson, 2003). Further inspired by the fact that for different reasons the UK has created a strong and stable domestic demand, policy makers see in offshore wind an ideal sector for vertical policy support, i.e. an off-the-shelf solution to their problem of 'identification and discovery' (Foray, 2014). This resulted in the categorisation of offshore wind as a promising 'smart' investment. However, initial attempts to create clusters such as the Centre for Offshore Renewable Energy (COREs) were not all successful and classic R&D support (such as *Offshore: Grow Wind*) did not lead to the emergence of strong local first tier suppliers. This raises the question of why further policy efforts are being made? Thus, if proposition 2 is true, it raises the following question: is the Supply Chain Plan is a case of escalation of commitment? Escalation of commitments rarely, if ever, lead to satisfactory outcomes.

Conjecture 3 (exploration, follower advantage collation): UK policy makers are well aware of the numerous past market co-ordination failures in the establishment of a UK-based offshore wind supply chain but believe that this is an industrial sector where a follower may eventually lead the industry by benefitting from the loss of real option value to first mover advantage (Cottrell and Sick, 2002). In this theoretical explanation, the Supply Chain Plan is a means to a very long-term goal, that of displacing first movers from their competitive position.

Table 1 compares the alignment of the creation of the 2014 Supply Chain Plan and the 2013 Offshore Wind Industrial Strategy with theories and framework underpinning each proposition.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Conjecture 1 | Conjecture 2 | Conjecture 3 |
| Underpinning supporting theories | Behavioural theory of industrial strategy | First mover advantagePorter’s DiamondSmart specialisationAgglomerative EconomicsTechnological Innovation Systems (TIS) | Real options theory |
| Alignment with Supply Chain Plan (2014) | Yes | Paradoxical: can a cluster be created from an entrepreneurial void? | Same as proposition 2, adding the possibility of a long-term process. |
| Alignment with Offshore Wind Industrial Strategy (2013) | No | Yes | Yes |

*Table 1. Summary of theoretical underpinnings of Conjectures*

Table 1 shows that we consider the 2014 Supply Chain Plan to be a departure of the 2013 Offshore Wind Strategy, which was compatible with the search for a new cluster. Even though Lewis and Wiser (2007) argue that conjecture 2 is compatible with local content requirements, we consider this to be a misuse of clustering and agglomerative economics theory. We cannot rule out the possibility of a longer game plan, captured by conjecture 3.

**Methodology**

*Longitudinal Qualitative field research*

The methodology used in this paper is longitudinal qualitative field research. Qualitative field research is more commonly used in sociology and anthropology (Burgess, 1982) than manufacturing management research. In this paper, our methodology is adapted from the use of qualitative field research in more related disciplines, such as management accounting (Ahrens and Chapman, 2006) and information system research (Lee and Liebenau, 1997). The purpose of this section is to provide a methodological discussion of the key features of qualitative field research and to justify our methodological choice.

Ahrens and Chapman (2006) argue that a unique charateristic of qualitative field research is that theory, method, methodology, and knowledge gains are intertwined rather than following the traditional stepwise process of positivist methodology. Their argument, specifically in relation to theory, often creates a dilemma for positivist researchers. For those, “*qualitative field studies can seem to be more storytelling, at best useful for exploring issues and creating tentative theories that can later be tested by proper scientific methods*”. In positivist research, theory is associated with a functional orientation (Malina and Selto, 2001). In the context of our research problem, a positivist approach would for example question if the supply chain plan has increased local content and by how much? It has (figures will be provided in the findings section), but these numbers are not particularly useful in answering the broader range of issues and questions that we raised in the previous section. Another positivist research question could be: What is the impact on the cost of electricity of the Supply Chain Plan and the relationship between local content percentage and cost? Aside from the obvious measurement issues associated with controlling from other influences on cost, the data is simply is not available. If it were, it would be unlikely to ever be made public. This leaves the option of conducting a survey of developers. The response rate is likely to be low given the political sensitiveness of the question and the fact that data will be considered commercially sensitive. This implies a non-representative sample, and therefore being constrained into qualitative, small sample, research. However, informed with multiple theories that propose different interpretations of the field, we argue that qualitative field research is a valid and productive observational approach through which we can answer our research questions. The scope of our research is not to propose functional laws related to local content (there is extensive economics research suggesting that local content requirements achieve little), but to explain events in the field that we observed through multiple theories.

*The Field*

The first phase of the project happened when the authors were involved from 2012 to 2015 in 3 separate applied research projects commissioned respectively by a regional interest group, a local government, and the INTERREG Channel European Union programme. The projects investigated the potential and feasibility for local businesses and regions to become involved in offshore wind supply chains. For 3 years, the authors collected data and performed analysis to develop recommendations about how to 'make the most' out of offshore wind opportunities. This required extensive involvement with all stakeholders at a local, regional, and national level and for this reason our methodology is best described as qualitative field research. Our data sources and method of data collection are described in the next section. Through these projects, we have been active participants of the ongoing search for the development of the offshore wind sector in the UK, and this gives us the ability to characterise behaviours, values, and coalitions that we have observed. Our focus was not so much on compiling a list of independent factors but more on the dynamics (or lack thereof) between these factors. Technology Innovation Systems (TIS; Bergek *et al*., 2008) confirm that these dynamics are of central importance to achieve effective agglomeration economics effects.

The second phase of this research took place in the academic year 2022/23, 7 years after the last applied research project. We also tracked and reviewed all the government and associated parties’ publications about the offshore wind supply chain and critically examined the extent to which our recommendations were followed or ignored. We also examined if what has happened in these 7 years has confirmed our research conclusions and which of the three conjectures above has best withstood the test of time.

*Projects*

The authors were first contracted to populate a database of potential suppliers for the new Rampion windfarm before building started off the coast of Brighton. This was done by mapping local businesses areas of expertise against a detailed breakdown structure provided by the client. This led to a follow-on project for the Kent region. Kent is interesting as a region in the context of this paper for two reasons. The first is that it is there that the first UK offshore wind farms were built (Kentish Flats and Thanet). It is also within reach of other 'first mover' wind farms (Greater Gabbard and Gunfleet sands) and is the home of London Array. The second reason is that local economic spillovers were much lower than expected (self-reference removed). Therefore, Kent is an ideal 'test bed' to analyse the root causes of lack of local economic spillovers. The project was to extend the supplier mapping exercise for Kent but also to promote the sector and to provide recommendations to the region about how to stimulate local small business engagement with the industry. As part of the Kent supply chain project, several interactive workshops were organised in order to capture the perceptions of local businesses in terms of the opportunities and barriers associated with offshore wind. The last workshop included an exhibition where potential suppliers could see a range of spare parts that could be supplied.

The third project was Channel-MOR, an INTERREG Channel project. The objectives of Channel-MOR were to provide recommendations to regions in the Channel Arc Manche area in order to facilitate and promote the uptake of MRE opportunities by local businesses. The Channel Arc Manche regions include all coastal Channel regions, from Brittany to Nord-Pas de Calais on the French coast and from Cornwall to Norfolk on the British coast. The MRE technologies that were considered were offshore wind, tidal energy and wave energy. The authors led the Channel-MOR workpackage which was about promoting the sector's opportunities to SMEs and providing recommendations to regions about facilitating and stimulating regional transitions towards the energy sector. Channel MOR was a very large 11 partner project with a total budget of €1 million, and our workpackage involved extensive data collection, interactive workshops, and promotion events. This also included attending many industry events (such as the annual All Energy Conference but also industry meetings about the offshore wind supply chain). It provided the authors with a genuine immersive experience with the sector and the opportunity to meet with all stakeholders.

In order to better describe the richness and breadth of our dataset, it is best to describe it as 4 separate subsets:

* The first subset includes formal data collection mechanisms, designed specifically to collect viewpoints about the creation of a local supply chains. This includes a survey of 58 industry participants and 17 workshops. Workshops involved a diversity of stakeholders and ranged in group sizes from 5 to 60 participants.
* The second subset includes informal and unstructured data gathered throughout the projects. This subset is more akin to an observation dataset. A non-exhaustive but illustrative list of data gathering events includes conversations with clients, presentation made by industry actors about their perceptions of the upcoming local content regulations, conversation with turbine manufacturers about their view on local content requirement, and reactions to our conclusions from participants in our projects.
* The third data set is a subset of the survey results. The survey was designed to perform a SWOT analysis of the development of a local supply chain in the Channel Arc Manche region. In the strategic opportunity section, the design of the survey included rating seeking global market opportunities vs. other more traditional opportunities. This provides an insight into the view of respondents in terms of seeking local-content only (conjecture 1) or broader economic benefits (conjectures 2 and 3).
* The fourth data set is made up of the post-2014 government, or government-sponsored, publications about the local content of UK offshore wind farms.

*Data Analysis*

Figure 1 displays our research approach and explains how we use the 4 data sets to apply our “test of time” to three conjecture presented above. Data set 1 was used in the initial projects as the empirical support for our overall recommendations to industry and policy makers in 2014. These conclusions were presented in key thematic findings, which we reuse in the findings sections to structure our 2014-2024 test of time analysis. Our conclusions were against local content requirements. Our position was grounded on global supply chains, Technological Innovation Systems, and agglomerative economics theory. Our viewpoint was that the opportunity to create a manufacturing centre of excellence for turbines was past and long gone. Although it may be possible to rely on foreign direct investment to achieve this, our recommendation was to seek more promising opportunities, which we labelled “new spaces”. These new spaces provided an opportunity for entrepreneurial investments where the principles of smart specialisation and Technological Innovations Systems would work and eventually results in new manufacturing sectors. Industry and even policy makers supported our conclusion (dataset 2). The publication of our reports was simulatenous to the publication of the Supply Chain Plan. The fact that local content requirements became an official regulation, and accepted with a sense of resignation by industry (dataset 2), motivated our monitoring of the new policy over time.



*Figure 1. Data Analysis Approach*

In the following section, we present the finding from this monitoring of the impact of the policy over the last 10 years. We start with a content analysis from dataset 4 before moving on to an itemised *ex post* analysis of our 2014 conclusions.

**Findings**

*The Evolution of Local Content from 2014-2024*

Table 2 summarises the key findings from our review of the government literature on offshore wind after 2014. Local content is defined as sourcing parts or components from UK manufacturers and exclude content subcontracted to foreign manufacturers. Conversely, content bought by a wind farm from a foreign supplier that subtracts supply to a UK firm counts as local content (DECC, 2015a).

|  |  |  |  |
| --- | --- | --- | --- |
| **Years** | **Local content and source** | **Key figures** | **Examples and comments** |
| 2015 | 43% Data supplied by 10 UK offshore wind farms between 2009 and 2013. First systematic measure and used as the baseline thereafter.(DECCb, 2015) | Highest performers have 73% local content. 57% local content for the initial development stage. Construction and manufacturing are the lowest phase at 18%. | Cost performance mentioned but not discussed in relation to local content.Example: 1. Isle of Wight blade manufacturing. 2. Siemen’s blade and turbine assembly planned for 2017 in Hull. |
| 2017 | 48%Data supplied by 8 wind farms. (Renewable UK, 2017) | OPEX content is 75% (2% growth). Development up to 73%.11% increase for CAPEX expenses. | Acknowledges that growth in local content is fuelled by inward investment in the UK. The report mentions an export opportunity but does not discuss it in details.Examples: Dong and Siemens in Hull. |
| 2019 (updated in 2020) | The original target of 50% content has been reached and a new target of 60% for 2030 is set.(HM Government, 2020) | No breakdown figures. | Creation of Offshore Wind Growth Partnership scheme, aiming to improve the competitiveness of the supply chain in order to face the challenge of increasing global competition.Humber and East Anglia described as “emerging” clusters thanks to pre-existing manufacturing base and oil and gas experience.Report promises an update in measurement technology, more transparency, and the reporting of UK export figures.Report discusses traditional transaction cost issues (payment, barriers to entry for SMEs).Examples includes “new spaces”. |
| 2021 | The report uses 8 wind farms to report an overall UK content of 48%, but introduces a distinction between Scottish and UK content.(BVG Associates, 2021) | The Scottish content is 44% (18% after adjustment for installed capacity) for Scottish projects and less than 1% for non-Scottish UK projects. Overall UK CAPEX content is 12%. Substations and installations are the main contributors with manufacturing turbines only score a 7% UK content. | A detailed road map for reaching the 60% target is presented. Towers and floating foundations manufacture are identified as the priority investment. This is followed by blade manufacturing and monopile foundations.  |
| 2023 | The report confirms the 60% target for 2030.(DAI Global, 2023) | No breakdown figures. | The report is a review that frames the Supply Chain Plan in a legal context. It concludes that the UK remains cautious in its approach after the success of the EU legal challenges against local contents requirements for offshore wide (2021) although it is monitoring the adoption of more direct policies by the US.  |

*Table 2. Evolution of local content*

The information contained in table 2 will be discussed in each of the following sections, that revisit our 2014 conclusions.

*Not acknowledging the challenge of competing with existing clusters & lack of co-ordination at an early growth stage*

Many of our interviewees and participants were fully aware of the level of competitiveness of first-movers (e.g. Germany and Denmark) and also of the long, often tedious, technology development processes that firms from these countries had to go through. Very much in line with the title, participants were sceptical that the UK could, from a void, overtake the outcome of 30 years of R&D and TIS dynamics (Bergek and Jacobson, 2013; Jacobson and Lauber, 2006). In contrast, the policy stance is uncompromising: there is no reason why the oil and gas benchmark of 70% cannot be matched. This is an important issue as it means that policy ignores the anchor tenant's hypothesis, i.e. the fact that a local large R&D firm (in this case, first mover turbine manufacturer) stimulates the creation of a cluster and of spillovers (Agrawal and Cockburn, 2003). It is at an early stage that the anchor tenant recruits entrepreneurial partners and structures knowledge flow and activities. In the specific case of turbines, there is no anchor tenant in the UK and although structuring activities exist, they are being implemented at a very late stage of the TIS dynamics. Many of the small businesses that we interviewed and that participated in workshops also stressed the very high transaction costs and entry barriers associated with the sector today, which they compared to a 'gentleman's club'. It is very likely that these transaction costs were lower in the early growth stage. It is noteworthy that the 2020 *Offshore Wind Sector Deal* report still discusses this issue, 6 years into government efforts to increase local content.

The lack of alignment with smart specialisation framework is why we question the validity of conjecture 2, i.e. the idea that the UK can create a new cluster. In the seven years that followed the implementation of the supply chain plan, the government has however been very active in supporting local content. In 2020, the government’s position paper *Offshore Wind Sector Deal* publications reported a local content rate of 50%, a 3% increase in the local content reported in 2017. It also identified a new target of 60% local content. The fact that there is a general consensus about the fact that 60% is as high as local content can get acknowledges, much after the publication of the Supply Chain Plan, that UK supply chains cannot compete within the technical core components (i.e. turbines), and therefore not only that conjecture 2 is not credible but that conjecture 3, seeking a late mover advantage, does not seem credible either.

The increase to 50% has been achieved in part by following one of our recommendations, i.e. capitalising on existing industrial strengths. For example, there were a number of cable manufacturers which had the technical capability of competing in the industry, but were usually rejected for administrative reasons. These suppliers benefited from the Supply Chain Plan in that it provided an incentive to remove non-technical barriers in order to demonstrate a “fair-play” access to the supply chain. However, the 50% content was not only achieved by supplying traditional parts and components. As our conclusion in 2014 was that competing with established clusters was impossible, we recommended exploring “new spaces”, i.e. new technological innovations that provided room for differentiation and a pathway to entering the industry without too much competition. The evidence supporting the fact that UK content has reached 50% shows that it is achieved in part by these “new spaces”. For example, *Offshore Wind Sector Deal* gives the example of an innovative subsea robotics exploration system, which can be used both at the development and maintenance stages. Thus, the 50% achieved today is not computed on the same basis as that used seven years ago, and that a large part of the growth has been in peripheral activities and services rather than the manufacturing core of the offshore wind supply chain (i.e. turbines).

*Idealisation*

Through the Channel MOR project, we observed a slight bias in the recruitment of our participants. All of them were very positive and enthusiastic, to a point that would affect rational decision making. This can be described by idealisation, the process of over-valuing and augmenting a value or idea to the extent that it cannot possibly be challenged (Brown and Starkey, 2000). One participant called for an end to the 'gold rush' mentality that surrounds offshore wind and for a more realistic assessment of the challenges and likely outcomes. It is difficult to provide more support for the existence of behavioural biases in the search for a supply chain. In contrast, we found that the latest local content publications are more moderate, as illustrated by the acknowledgement that 60% local content is the maximum possible.

*Cognitive Tie Between Production and Use, and Local, not Global aspirations*

The behavioural theory of the firm tells us that both cognitive (forward looking) and experiential (backward looking) thought processes, and the balance between the two, will shape the direction of searches (Gavetti and Levinthal, 2000). Our research showed a strong cognitive tie between the erection of a wind farm and the development of a supply chain, and this for all participants (regional officers, businesses, etc.). In the rest of this paper, we will refer to this link as a “derivative asset”, i.e. a manufacturing asset whose importance is derived from another (the wind farms).

It is true that such a tie was essential for first-mover turbine manufacturers. It is also true that, in their early phases of growth, these manufacturers benefited from local content requirements (Lewis and Wiser, 2007). As these manufacturers grew this use-production tie disappeared. For example, the industry leader, Vestas, exports 99% of its production (Lewis and Wiser, 2007). However, it is the account of the early growth stage that has been strongly imprinted in policy makers.

In our survey of experts performed in 2014 (self-reference), we show that this cognitive tie persisted, and it is only within our own project network that we found respondents willing to dissociate the economic opportunities arising from wind farms than from the manufacturing of equipment. Yet, the notion of “local content” remains a key concern at a national level, although the 2021 BVG Associates report re-introduced a stricter focus on local content by differentiating UK from Scottish content. Similarly, the initial reports about local content did not report on the export potential of UK suppliers, although anecdotal examples are provided and global aspirations are mentioned. The fact that after all these years there is still an explicit concern to report local content figures rather than “global market share” lends support to conjecture 1, which was eventually acknowledged as a limitation of policy in the 2020 Offshore Wind Sector Deal report.

*Offshore Wind, not Energy*

The vast majority of our participants were interested in offshore wind and more generally, offshore renewable energy. They generally had little knowledge and interest in the overall energy sector. This is counter to the strong knowledge exchange dynamics that one would expect to see in smart specialisation. In fact, the only region in the Channel MOR project that was in a position to adopt growth strategies (and had already done so) was the East of England (Norfolk and Suffolk). It not only benefited from their oil and gas experience but also from their very proactive all-energy interest group, EEEGR (East of England Energy Group) that perfectly matches the description of a smart specialisation learning network. This region is a successful case study of first tier market entry in the installation, servicing, and maintenance areas. It was our conclusion in 2014, and this is why we find their presentation as an “emerging cluster” in a 2020 report somewhat delayed.

In our final recommendations, we concluded that if indeed seeking a follower advantage strategy (conjecture 3) is not feasible that it would be wise to seek first mover advantage in related areas (e.g., tidal energy, floating wind) as the timing for developing cluster-type advantage is right. Although there are support mechanisms and position papers about these alternative sectors, the latest policy publications and reports show an endearing focus on offshore wind. This means that the original logic behind the Supply Chain Plan remains unchanged: it is because offshore wind farms are being built in the UK that content should be sourced locally. The fact that newer and potentially more promising technology growth areas are not replacing concerns of local content reveal an exploitation focus rather than an explorative mindset, i.e. it is safer for a policy to support exploiting a known and established growth sector than to explore the possible emergence of another. This lends support to conjecture 1. Again, more recent reports (e.g. the 2021 report and its road map to 60%) do mention floating wind as a key opportunity, although the focus remains on foundations rather than turbines.

*Search for local content or cost reduction?*

It is worth stressing that the increase in local content is the only evidence of impact that is available in the report that we have reviewed. For example, the impact on the Supply Chain Plan on the cost of building an offshore wind farm in the UK is undocumented. When considering the fact that cost reduction is one of the most written about topics in the offshore wind literature, including in the recent paper *Offshore Wind Sector Deal,* it is odd that none of the policy publications about the implementation of the Supply Chain Plan consider the impact of cost. As the main academic criticism of local content requirements in an increase in product cost, the fact that policy publications do not discuss cost impact suggests that there is no industry-level cost benefit, or none that can be easily evidenced. This is typical of what happens to policies based on the reasoning of conjecture 1.

**Discussion**

The findings all suggest that the Supply Chain Plan is a case of neo-mercantile reasoning (conjecture 1) that fails to recognise the geo-political supply chain and industry dynamics which are at the heart of research on smart specialisation and technology innovation systems. The supply chain policy argument of Lewis and Wiser (2007) is based on the business history of first-movers. There is no evidence that this policy is seeking a follower advantage, nor is there any evidence that the Supply Chain Plan and subsequent policy documents are seeking such an advantage. Nor is there any evidence that policy makers are making a distinction between a first mover strategy and a follower strategy. The Supply Chain Plan clearly has had an impact, i.e. an increase of local content from 30% to 50% in 10 years.

We question whether initiatives like the Supply Chain Plan are really desirable when they risk displacing investment and motivation in more balanced (exploration/exploitation) policies. Instead vertical policy support favouring R&D and structuring entrepreneurial discoveries in 'new spaces' connected to the offshore wind sector as identified in the Channel-MOR project (tidal, wave, energy storage, condition monitoring, subsea connectors, and smart transmission) would seem to be much more promising avenues with long term growth potential. We found some evidence that this has happened thanks to the supply chain plan, but rarely, if ever, in manufacturing activities. The fact that the UK offshore wind supply chain is built on a central component “manufacturing void” remains a significant issue that policy has not been able to address so far. When all academic theory points out to the central role of a pivotal firm in the development of a cluster/supply chain, how can we explain the insistence on trying to create a supply chain in the absence of that node?

Recent theoretical developments in real options research can be used to provide an answer to that question. Posen et al. (2018) explains that traditional real options theory has been based very closely on financial real options, where it is assumed that there can be no behavioural biases and learning effects when making investment decisions. They challenge the assumptions in the case of real options and propose a behavioural theory of real options. As the theoretical underpinnings of this paper is the behavioural theory of the firm in the context of investing in manufacturing facilities, it naturally intersects Posen’s et al. (2018) behavioural real options theory. We have already mentioned the problem of idealisation in the findings section. Idealisation can create a bias in the value of investments in the offshore wind equipment supply chain, both for firms but also for policy makers. Decision makers bias can be reduced by learning from feedback, meaning that uncertainty is a dynamic construct. To capture this, Posen et al. (2018) introduce the concept of contemporaneous uncertainty, the current uncertainty about the value of an asset and the concept of prospective uncertainty, the value of that same asset in the future.

The idea of supporting, from a void, the creation of a turbine manufacturer in the UK is no small matter. It could be compared to the decision by the US to develop a local electronic chips manufacturing industry to reduce their global supply chain vulnerability. In the case of offshore wind, the prospective uncertainty of creating pivotal manufacturing nodes is low. Simply put, given the strategic investments planned in offshore wind farms in the next decades, both in the UK and globally, there will be a steady and growing demand. This is precisely what motivates the UK offshore wind industrial strategy and the supply chain plan. However, in the case of UK offshore wind, there is considerable contemporaneous uncertainty, for all the reasons mentioned in the findings section. The days of first-movers are long gone, and an investment in a turbine factory in the UK, when facing well established and new global competitors, is highly risky. Whereas the real options logic would normally suggest postponing or staging the investment, Posen et al. (2018) argue that not accounting properly for contemporaneous uncertainty would increase downside risk. We argue that the private sector and UK investors are well aware of that downside risk, which is why nobody wants to fill in the void.

Figure 2 proposes a manufacturing value framework capturing this theoretical proposition. It distinguishes the value of a manufacturing asset today and in the future. This distinction is defined by an uncertainty profile, which is shown as a the red “filter” band in figure 2. It is shown as being constant but could be an increasing, or decreasing, uncertainty profile. Industry makes investment decisions based on private good value, i.e. return on equity for investors and consumer utility for the product. Policy makers consider economic value but are also concerned with social good value, as measured by number of jobs created and/or environmental benefits.



*Figure 2. Optimal Timing of Manufacturing Investment Policy Support*

Based on the research presented in this paper, our theoretical propositions are:

**Proposition 1:** If a manufacturing technology derives value from its novelty, manufacturing policy is needed early, in the high value time policy time window, when both contemporaneous and prospective uncertainty are high.

**Proposition 2:** A well-established, low value manufacturing technology can be supported by late policies (in the low value policy time window) when contemporaneous and prospective uncertainty are low. This, for example, is how low value manufacturing have moved to China through waves of intense offshoring.

**Proposition 3:** A policy like the Supply Chain Plan in the late policy time window when contemporaneous uncertainty is high can neither be successful nor productive. It only creates a transaction cost borne by manufacturers and customers.

**Proposition 4:** It is a cognitive and behavioural mistake to tie the fate of two technologies. The UK should be content with the success of their offshore wind policy without having to link that success to the offshore wind (equipment) supply chain.

**Conclusion**

Although the Supply Chain Plan has fulfilled its main objective, i.e. to increase local UK content in UK wind farms, the policy literature tells us nothing of the impact that it has had on cost and the overall wealth of the sector. Writing this paper at a point in time where one of the main turbine manufacturers (Siemens) is struggling financially and when legal challenges against offshore wind local content requirements are increasing, we argue that the additional hurdles created by local content requirements are not helping the industry. In this paper, we customised the behavioural theory of the firm to a behavioural theory of industrial strategy. As initial attempts did not yield results, the Supply Chain Plan is akin to a “policy tantrum” that seeks local content through a more forceful way but that ignores the challenge of smart specialisation’s entrepreneurial discovery, the complex Technological Innovation Systems dynamics, and the anchor’s tenant hypothesis.

Our main theoretical contribution is that policy to support manufacturing growth can be successful but only in specific time windows which are a function of the maturity of the technology and its dynamic uncertainty profile. In more practical terms, policy cannot create a supply chain from a void. The US CHIP and Science Act, whereby US policy makers are committing $280 billion to reshore electronic chips manufacturing in the US is an example of a serious commitment to stimulate a manufacturing supply chain. The $280 billion are designed to reduce contemporaneous uncertainty. In the case of the UK offshore wind supply chain, local jobs creation is valued but the development of manufacturing technology was not when it should have been. These findings have wider implications as the UK develops its Industrial Strategy underpinned by regional and national Science and Innovation Audits, founded on principles of smart specialisation. Many of these emphasise the importance of developing regional supply chains, although it is not always clear what the existing capabilities for these supply chains are.

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1. All statistics in this section are from the International Energy Statistics database, www.eia.gov, and the Global Wind Energy Council, www.gwec.net. [↑](#footnote-ref-1)