Skill relatedness and economic restructuring: the case of Bremerhaven

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Evolutionary thinking suggests that past knowledge accumulation influences future growth opportunities. Old industrial regions’ inherited knowledge is often described as obsolete. Particularly, blue-collar workers’ difficulties in redeploying skills have been stressed. This study examines whether the emerging offshore wind-energy industry in Bremerhaven, Germany, can draw on skills from local declining shipyards. Beyond Germany, this new industry has inspired policy-makers to hope for the renewal of shipbuilding centres. Insights from interviews reveal that the blue-collar skill bases of both industries overlap. Declining shipyards provided much-needed experience and skills to the nascent industry. This contribution underscores the fruitfulness of the perspective of related variety with respect to the development of old industrial regions. An overly sharp distinction between ‘old’ and ‘new’ knowledge may obstruct our view of potential growth opportunities.

Keywords: structural change; relatedness; skills; old industrial regions; evolutionary economic geography

Introduction

Evolutionary contributions emphasize that historically shaped knowledge influences a region’s future development (Boschma & Martin, 2010). Inherited skills of old industrial regions (OIRs) are often described as outdated. In particular, blue-collar workers’ difficulties in redeploying skills have been stressed (Danson, 2005). OIRs’ knowledge may therefore appear obsolete, and detrimental to new industries’ growth.

Conversely, the concept of related variety (Frenken, Van Oort, & Verburg, 2007; Van Oort, 2015) suggests inherited skills may constitute an asset if a new industry emerges whose skill requirements overlap with those of a declining industry. Such a setting may allow for adaptive restructuring based on related skills (Boschma & Lambooy, 1999; Tödtling & Trippl, 2013).

This study examines whether the emerging offshore wind energy industry (OWEI) in Bremerhaven, Germany, can draw on blue-collar skills from declining shipyards. Having suffered large job losses, particularly in shipbuilding, Bremerhaven has recently emerged as an OWEI location. As the local shipbuilding industry continues its decline, the city provides an excellent setting for a study addressing shipbuilding skills’ transferability to OWEI in the context of restructuring.
Beyond Germany, OWEI’s rise has inspired hopes for old shipbuilding centres’ renewal. These places are often assumed to possess skills and infrastructure enabling them to benefit from OWEI’s growth. However, research on OWEI firms’ skill requirements is in its infancy.

Applying the concept of related variety to blue-collar skills, this study examines the two industries’ skill requirements and establishes whether OWEI firms employ ex-ship workers. Using insights from 18 interviews, the analysis attributes importance to retraining and the former ship workers’ specific roles in the new industry. The results suggest that the emergence of Bremerhaven’s OWEI cluster constitutes an example of adaptive restructuring involving related variety based on overlapping skill bases. The declining sector provided much-needed skills; which is likely to have accelerated the nascent OWEI’s growth. This study demonstrates the fruitfulness of the perspective of related variety regarding OIRs’ growth opportunities.

Skills and restructuring

The obsolescence of skills figures prominently in the literature. Gregersen and Johnson (1997, p. 480) call for the ‘creative destruction of knowledge’ and urge policy-makers to reduce the cost of forgetting, for example, through social security. According to Maskell and Malmberg (1999) regions should ‘un-learn’ old routines in order to revitalize outdated skills.

Several contributions emphasize that inherited knowledge might not necessarily be burdensome. Boschma and Lambooy (1999) distinguish ‘deep restructuring’ from ‘adaptive restructuring’. Decoupled from old sectors, the former involves the emergence of an industry with fundamentally different skill requirements, akin to Storper’s (2011)
‘American style innovation’. The latter ideal-type refers to new industries building upon existing knowledge. Elements of OIRs’ knowledge may therefore constitute valuable inputs to new sectors.

Boschma and Lambooy’s (1999) ‘adaptive restructuring’ resonates with the concept of ‘related variety’ (Van Oort, de Geus, & Dogaru, 2014). Industries that are related

Figure 2. Main components of an offshore wind turbine.
varieties share complementary competences. This paper applies this concept to blue-collar skills. Combining the observation that regional sectoral structures evolve in path-dependent processes (Neffke, Henning, & Boschma, 2011) with the notion of related variety based on overlapping skill requirements, it becomes clear that inherited skills may constitute an asset: if a new industry emerges whose skill base overlaps with that of a local pre-existing industry, the new industry may be able to draw on existing regional skills. In this scenario ‘‘old economy’’ inputs would facilitate a new industry’s take-off (Bresnahan, Gambardella, & Saxenian, 2001).

Since adaptive restructuring involves multifaceted inter-industry interactions, firms’ embeddedness in institutional frameworks – highlighted by the varieties of capitalism literature (Hall & Soskice, 2001) – is of relevance. Skill systems constitute core institutions characterizing coordinated market economies, such as Germany. Vocational training in Germany is collectively organized, with firms, intermediary associations and the state cooperating in skill formation (Busemeyer & Trampusch, 2012).

This paper examines if the growth of Bremerhaven’s OWEI sector can be considered as a case of adaptive restructuring involving related variety based on overlapping blue-collar skills. As institutional arrangements influence adjustment processes, importance will be attributed to firms’ collaboration with external partners.

### Shipbuilding and offshore wind energy in Bremerhaven

Situated at the mouth of the River Weser, Bremerhaven (110,000 inhabitants) belongs to the state of Bremen (see Figure 1). With a specialization in shipbuilding and high unemployment resulting from restructuring, Bremerhaven displays characteristics of an OIR. Crises in shipbuilding and fishing weakened its economy from the mid-1970s onwards. As unemployment reached 25.6% in 2005, Bremerhaven became a notorious symbol of

| Product       | Material                  | Skillsets/occupational profiles                                                                 | Entry requirement    | Ship workers (%) | Retraining required for ship workers |
|---------------|---------------------------|--------------------------------------------------------------------------------------------------|----------------------|------------------|-------------------------------------|
| Ship          | Steel (10–20 mm)          | Welders (29%), construction mechanics (25%), fitters (24%), electricians (12%)                  | 3.5-year apprenticeship | 100              | n.a.                                |
| Substructure  | Steel (70–100 mm)         | Welders (65%), fitters                                                                         | 3.5-year apprenticeship | 45               | 3–6 months                          |
| Tower         | Steel (50 mm)             | Welders (50%), construction mechanics, fitters, electricians                                   | 3.5-year apprenticeship | 60               | 2–6 months                          |
| Nacelle       | Electronic and mechanic parts Synthetic resin, adhesives, wood | Construction mechanics and fitters (60%), electricians, mechatronic technicians               | 3.5-year apprenticeship | 40               | 2 months                            |
| Blades        | Synthetic resin, adhesives, wood | Fibre composite technicians (knowledge of vacuum infusion)                                     | 2-month course        | < 5              | n.a.                                |
decline, although – partly due to investments in logistics and national-level reforms – 2006 marked a reversal of the trend.

Against the backdrop of German shipyards’ increasing exposure to East Asian competition (Eich-Born & Hassink, 2005), Bremerhaven’s former lead industry – shipbuilding – continued to decline throughout the 2000s, with the loss of approximately 1000 workers; the most recent major yard closure occurred in 2009. The remaining shipyards employed approximately 800 workers in 2011 – fewer than logistics (7000), fish processing (2200) and OWEI (1500). Importantly, shipbuilding’s decline overlapped with OWEI’s emergence. Bremerhaven-based OWEI firms established through inward investment since the year 2000 include manufacturers of three of the four major components (see Figure 2) of an offshore wind turbine (OWT): nacelles, blades and substructures. Towers are produced in the same state, in nearby Bremen (55 km from Bremerhaven). With consultancies, training firms and the Fraunhofer Institute for Wind Energy also located in Bremerhaven, the city’s concentration of OWEI-related actors is unique within Germany.

Subsidies cannot fully explain OWEI’s emergence in Bremerhaven; most German coastal counties were allowed to offer similar incentives. First-mover advantages and a visionary development strategy clearly played an important role: municipal and state-level policy-makers implemented OWEI-specific policies nearly a decade before neighbouring Schleswig-Holstein (Mossig, Fornahl, & Schröder, 2010); in 2002, a cluster agency was founded. Further policy instruments included investments in port facilities and provision of land near the port. Northern Germany is also home to a large onshore wind industry, although Bremerhaven is not one of its key locations. Furthermore, descriptions of Bremerhaven’s ‘success story’ point to production sites inherited from shipbuilding; frequently, workers’ skills – the focus of this paper – are emphasized (ECOFYS, 2011).

Research question and methodology

To examine the central question, whether Bremerhaven’s recently established OWT manufacturers can draw on blue-collar skills from ailing shipyards, the analysis addresses three subordinate questions:

- Do the broad blue-collar skill requirements for the production of the four OWT components overlap with those of Bremerhaven’s shipyards?
- To what extent do OWEI firms employ former yard workers?
- If OWEI firms do employ former ship workers: how much retraining is needed and which agents collaborate in retraining efforts?

Given contextual factors’ importance for structural change, this paper adopts a qualitative case study approach. This choice is also motivated by the absence of OWEI-specific identifiers in official employment data. The analysis relies on 18 interviews, conducted in Bremerhaven during July 2011, as the main source of data. In addition to 10 businesses, interviewees included four vocational training providers and representatives of the city’s cluster agency, job centre, development agency and chamber of workers.

For each of the four components, a representative of one manufacturer was interviewed. Since there is no tower manufacturer in Bremerhaven, a Bremen-based firm was chosen instead. The city of Bremen also suffered large job losses in shipbuilding.
and its socio-economic structure resembles that of Bremerhaven. Both cities form the city-state of Bremen (one of 16 German Bundesländer) and OWEI firms in both places are organized in one cluster agency.

To identify skills used by Bremerhaven’s shipyards, two interviews were conducted with yard representatives. Four interviews with engineering consultancies proved crucial for obtaining access to manufacturers and facilitated the understanding of production processes. Firm interviewees held the positions of head of human resources, director of production or managing director.

**Comparison of skill requirements of both industries**

Regarding the first research question, the interviews revealed that the blue-collar skills used in both industries overlap. The crucial link is the reliance on steel in a maritime context. As stressed by the production director of Bremerhaven’s substructure manufacturer, ‘yard workers grew up with steel – that helps a lot. Whether we can use them here is a matter of talent and the right training’. The findings also provide a clear answer to the second research question: manufacturers of three out of four OWT components extensively employ ex-ship workers. Table 1 provides a summary of the findings.

Retraining requirements and patterns of training collaboration – the focus of the third research question – vary across components. In the production of substructures (anchoring turbines on the seabed) most workers perform welding tasks. Seams are generally not straight-lined and the steel is up to five times thicker than in shipbuilding, making the welding challenging. Engineers emphasized higher quality standards, as repairs are more difficult than in shipbuilding. Only about every 10th welder coming from shipbuilding immediately passes the substructure welding test, while 30–40% are found suitable for in-house training, lasting three to six months. Some initially deemed insufficiently skilful receive training from Bremerhaven’s chamber of crafts, which offers 54 welding modules, allowing precise skill upgrading. The head of welding training previously worked in both shipbuilding and substructure production, suggesting that training is tailored to the transition from the declining to the new industry.

Welding is also the key activity in tower production, although with straight-lined seams and limited steel thickness it is less challenging than in substructure production. Depending on dexterity and experience, ship workers require two to six months of retraining, which is conducted both in-house and in cooperation with virtual training providers (VTPs). Experienced ex-ship workers often act as mentors for younger colleagues.

The heart of the turbine – the nacelle – houses the gearbox, generator, brake and sensors. Production processes differ from those at substructure and tower producers: welders are not needed and many tasks resemble classic machine construction. In particular, electricians and construction mechanics who previously installed motors in yards possess skills that can be applied after two months of in-house retraining. Additionally, a VTP offers a five-month course for workers with a relevant apprenticeship or three years of experience in electronics-related fields.

Rotor blade production uses fibre composites made of wood, resin and adhesives. Wooden forms are stiffened by repeatedly adding layers of plastics – a labour-intensive process. Skill requirements are lower than for the other components: primarily, workers must know the main fibre composite technique (vacuum infusion), but a basic knowledge of the underlying chemical processes is also required. Experience in handicraft is useful, but no apprenticeship is required. The number of ex-ship workers
in Bremerhaven’s blade production is negligible. Coming from various fields, workers typically have fragmented career paths.

Bremerhaven’s blade manufacturer cooperates with two external agents. In a cooperation typical of collective skill formation (Busemeyer & Trampusch, 2012), the Fraunhofer Institute, renowned for application-oriented research rather than blue-collar training, imparts chemistry-related knowledge, while a VTP offers practical classes. Successful participants require two additional months of plant-based training.

Discussion

Notwithstanding the overlap in skill requirements, the redeployment of blue-collar workers’ skills required a substantial retraining effort based on close collaboration between firms, VTPs and the Fraunhofer Institute. With new, tailored training programmes, the agents involved in skill formation display a striking ability to commit to the common objective of easing ship workers’ transition to the new industry.

The findings shed a light on strong linkages between key stakeholders, as exemplified by the chamber of crafts’ welding trainer having worked in both industries. Internships of workers receiving training from VTPs constitute a further important feedback channel facilitating the alignment of VTPs’ programmes with firms’ requirements. Fraunhofer’s unusual involvement to ensure the new industry’s skill supply chimes with Maskell and Malmberg’s (1999) emphasis on efforts to move beyond established routines. The results also demonstrate that collective skill formation enhances firms’ ability to respond to changing conditions (Hall & Soskice, 2001). Germany’s dual apprenticeship system provides workers with polyvalent skills (Streeck, 2012), which seems to have facilitated ex-ship workers’ transition.

While other factors (especially proximity to seaports) may have been decisive for the new industry’s emergence, the findings demonstrate that the declining sector provided skills to the nascent industry, probably accelerating its growth. As one engineering consultant explained:

> with the dimensions of the offshore projects we are currently working on, we don’t have the time to first train welders for 3.5 years – we need them now. And the only place where you can find such numbers of welders here are shipyards.

The economic value of this ‘old economy’ input is likely to go beyond the sheer number of hours worked by former shipbuilding workers: as evidenced by yard workers’ role as mentors, they provided much-needed experience to the youthful industry and thereby contributed to its growth.

Conclusions

Skills associated with OIRs’ former lead industries are often described as outdated. This study investigated whether Bremerhaven’s emerging OWEI cluster can draw on skills from declining shipyards. The analysis revealed that (1) both industries’ skill requirements overlap, (2) after retraining for two to six months, ship workers find employment in the production of three of four OWT components, and (3) OWEI firms extensively hire former yard workers. Reflecting characteristics of Germany’s model of collective skill formation (Busemeyer & Trampusch, 2012), firms closely collaborate with VTPs.
Both industries can be considered as related varieties based on overlapping blue-collar skills. The emergence of Bremerhaven’s OWEI resembles the adaptive restructuring delineated by Boschma and Lambooy (1999), rather than Storper’s (2011) ‘American style innovation’. Resonating with contributions that stress that past knowledge accumulation shapes growth opportunities (Iammarino, 2005), knowledge stemming from Bremerhaven’s trajectory facilitated OWEI’s emergence.

While this analysis confirms the partial transferability of ship workers’ skills to OWEI, it should not be interpreted as an appeal to create OWEI clusters in all regions with ailing shipyards. The pitfalls of policy-copying are well documented (Hospers & Beugelsdijk, 2002). Shipbuilding’s decline and OWEI’s emergence overlapped in Bremerhaven, limiting the findings’ applicability to regions with larger time lags between those processes. However, in places where both sectors are co-located, retraining programmes may carefully consider OWEI as one potential employment field for ship workers.

Most importantly, this study underscores the fruitfulness of the perspective of related variety with respect to OIRs’ growth opportunities. The unsuitability of ‘old’ skills for ‘new’ industries might have been overemphasized in the past. An overly sharp distinction between ‘old’ and ‘new’ knowledge may obstruct our view of potential growth opportunities. Rather than hoping for a radical restructuring, policy-makers in OIRs may examine opportunities to build upon inherited knowledge. The findings suggest that restructuring does not inevitably require ‘unlearning’ in the sense of disremembering old skills. Instead, the abandonment of established routines may be required to design new institutional arrangements in order to revitalize old skills and facilitate a nascent industry’s growth. Policy measures could encompass efforts to identify skill requirements of local related varieties and the coordination of collaborative retraining initiatives.

**Disclosure statement**

No potential conflict of interest was reported by the author.

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