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# The role of state agency in path development: a longitudinal study of two Norwegian manufacturing regions

Markus Steen<sup>a</sup> , Henrik Brynthe Lund<sup>a,b</sup>  and Asbjørn Karlsen<sup>b</sup> 

## ABSTRACT

The role of the state remains underdeveloped in the regional path development literature. This paper analyses how the Norwegian state via different roles (regulator, purchaser, owner, facilitator) directly and indirectly has enabled and influenced path development in two defence-related high-tech manufacturing regions in Norway since the end of the Second World War, notably by contributing to the modification of localised assets and the strategic coupling of those assets to extra-regional defence-related and civilian markets.

## KEYWORDS

path development, state, manufacturing, strategic coupling, agency

JEL B15, H70, L60, N14

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## 1. INTRODUCTION

The path development literature that has emerged primarily within the context of evolutionary economic geography (EEG) has provided important insights into how industries emerge, develop and change over time, and how regional development trajectories are shaped and constrained by institutional, socio-economic and historical legacies (Martin & Sunley, 2010; Isaksen, 2014). There are, however, aspects that remain underdeveloped in this literature, including the role of non-firm actors, exogenous factors and different forms of agency vis-à-vis different forms of regional path development (e.g., Trippel et al., 2018; Grillitsch & Sotarauta, 2020; Jolly et al., 2020; Hassink et al., 2019). In this paper we address what we consider to be an important gap in this literature, namely the lack of attention to the role of the nation-state (for exceptions, see Morgan, 2013; and Dawley et al., 2015). More precisely, previous work has mainly accounted for state agency by looking into its indirect role, for instance in shaping institutional environments, facilitating market development, or otherwise influencing the opportunity space for actors such as firms or regional development agencies. A plausible reason is that the path development literature has mainly dealt with contemporary issues in Western countries, in which direct firm-level intervention by states is less common than in other parts of the world

(e.g., India or China where state-owned enterprises are common; e.g., Lim, 2018) and also less common than in the past – also in Western countries.

The role of the state has perhaps been especially apparent in certain old industrial regions. Morgan (2013, p. 336) argues that:

although old industrial regions are more internally diverse than the collective stereotype suggests, one thing they have in common is the fact that the state looms large ... and the multiple roles of this key institution need to be better understood.


This paper contributes a better understanding of the role of the state by analysing industrial path development in the two old industrial manufacturing regions of Raufoss and Kongsberg in Norway. The main research question that guides our empirical analysis is: How have different and shifting roles of the state enabled and influenced path developments in the two manufacturing regions over time? Our historical analysis unfolds in case narratives that focus on key moments of change, the actions and developments that made those changes possible, and the outcomes in terms of different types and phases of path development (Martin & Sunley, 2022).

During the 19th century, the Norwegian state established a weapons factory in the small town of Kongsberg,

**CONTACT** Markus Steen  markus.steen@sintef.no

<sup>a</sup>Department of Technology Management, SINTEF Digital, Trondheim, Norway

<sup>b</sup>Department of Geography, Norwegian University of Science and Technology, Trondheim, Norway

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and an ammunitions factory at the even smaller Raufoss. The factories and the state-owned companies that operated them were the first of their kind in the country. During the 20th century, both companies diversified into various product groups in defence-related and civilian markets, and in the post-Second World War era they became integral to the Norwegian state's ambition of industrial modernisation. Ultimately, however, the two companies went through processes of vertical disintegration following many years of weak economic performance. While the integrated state-owned companies failed, the knowledge assets and manufacturing expertise formed the basis for what are now, in the 21st century, two of the most advanced high-tech clusters in Norway.

The main contribution of the article is to complement existing conceptualisations of agency for regional structural change by outlining the roles of the state via analytical generalisation. Our analytical framework builds on work of Martin and Sunley (2006) that outlines how economic evolution unfolds over time as an interplay between processes of change and continuity. We posit that sustained regional development hinges on the ability to continuously create and capture value by accessing markets based on territorialised assets. The concept of strategic coupling from the global production network (GPN) approach serves as a useful heuristic in this regard, notably in Yeung's (2009) interpretation that draws attention to the deliberate agentic efforts that enable strategic coupling to occur, to enhance assets, and also to diversify or branch into other relevant markets (Yeung, 2021). To complement existing insights on agency in path development (e.g., Grillitsch & Sotarauta, 2020; Bækkelund, 2021) with a better understanding of the role of the state we draw on the work of Morgan (2013) and Horner (2017). Based on this previous theorisation we suggest that the state influences path development indirectly and directly through four distinct roles: owner, regulator, purchaser and facilitator.

The remainder of the article is structured as follows. Section 2 discusses the literature on regional path development and agency, emphasising the role of the state and the defence industry context, and develops our analytical framework. Section 3 describes the methods and data. The regional development trajectories and the role of state agency are outlined via case narratives in section 4 and discussed in section 5. We conclude and reflect on policy implications in section 6.

## 2. REGIONAL DEVELOPMENT, AGENCY AND THE STATE

### 2.1. Regional path development, agency and the extra-local

The economic geography literature on path development has flourished over the last 10–15 years. As a critique of the prevailing emphasis on 'negative path-dependence' and 'lock-ins', Martin and Sunley (2006) proposed a more fluid and process-oriented perspective on path development. Importantly, this allowed for understanding long-term path continuity without the necessity of stasis

or decline, highlighting how processes of novelty creation and reproduction are often parallel processes. A wealth of studies has since followed, proposing new concepts to the path-development theoretical repertoire, such as regional branching (Boschma & Frenken, 2011) and various types of path development (e.g., creation, extension, exhaustion, renewal) (Isaksen, 2014). The literature has also increasingly recognised that regional industrial development paths are shaped by a complex set of endogenous and exogenous factors (Tripl et al., 2018). The precise reasons as to why and how path trajectories change or remain stable are to a large extent contingent on proactive and/or reactive agentic processes within the context of structural (pre-)conditions that – at least in the short run – remain relatively stable (Grillitsch & Sotarauta, 2020; Jolly et al., 2020) and are, broadly speaking, either enabling or constraining (Martin, 2010).

This evolutionary inspired approach to understanding regional development has tended to devote most attention to firms, thereby downplaying or neglecting the role of non-firm actors such as universities and development agencies in path development (Dawley et al., 2015; Tödting & Tripl, 2018; Hassink et al., 2019; Martin & Sunley, 2022). Grillitsch and Sotarauta (2020) address these shortcomings by conceptualising three distinct forms of change agency and their role in the formation of new regional growth paths. *Innovative (Schumpeterian) entrepreneurship* refers to (mainly) firm-level driving forces behind change that break with existing paths and develop new ones. *Institutional entrepreneurship* relates to how actors (organisations or individuals, or group of organisations or individuals) work consciously, through the leveraging of resources, to change existing institutions (i.e., the 'rules of the game'), and to enable innovative entrepreneurship. Lastly, *place-based leadership* refers to the ability of leaders, be that individuals or groups, to unify actors and coordinate their efforts towards path development in particular regions and places. These agency types are useful not only for understanding path creation, but also more incremental change processes (Bækkelund, 2021; Jolly et al., 2020) on existing industrial development trajectories. Another important contribution of this more comprehensive conceptualisation of agency is the acknowledgement of non-firm actors and processes of asset modification and system building that are often needed to initiate and sustain new economic activities (Tripl et al., 2020). However, while these perspectives recognise the multi-scalar nature of change processes, they do not pay much attention to how regional economies connect with the outside world, nor with the role of the state.

The bridging of the predominantly endogenous view in EEG, and the more relational and multi-scalar GPN framework has been proposed as a fruitful way forward (e.g., Barratt & Ellem, 2019; Yeung, 2021). Inspired by the discussion on how to better account for different types of agency and the interplay between the local and the extra-local, and given our emphasis on the role of the state, we suggest that the key GPN mechanism of strategic coupling (Coe et al., 2004) offers a valuable heuristic for

understanding how territorialised assets (natural resources, skills and capabilities, infrastructure, etc.) are connected to extra-local markets and actors, thereby enabling localised processes of value creation and capture. Strategic coupling is also an important mechanism explaining how regional industrial paths can diversify, for instance by enabling firms to connect to new markets on the basis of already existing assets and activities (Yeung, 2021).

The processes whereby strategic coupling occurs are influenced or mediated by states (or ‘regional institutions’ in GPN terminology) both directly and indirectly (Horner, 2017). For example, states use various measures to attract foreign direct investment (FDI), negotiate specific terms for multinational companies to access domestic markets, or facilitate the internationalisation of domestic firms. Through different types of policies (e.g., innovation, education), states also influence the development and valorisation of localised assets. In short, through leveraging state power and developing institutional mechanisms that enable regions to harness and connect (or couple) assets to extra-regional markets, state agency can be of crucial importance for path development.

## 2.2. The role of state agency in path development

Recent contributions to the path development literature emphasises the need to account for the role(s) of the state in path development more thoroughly (e.g., Tödting & Trippel, 2018). More generally, the role of the state has been accentuated in debates concerning how to address grand societal challenges (Mazzucato, 2011; Morgan, 2013) and (new) industrial policy to revive and transform economies (Bailey et al., 2019).

Drawing on the work of Morgan (2013) and Horner (2017) four distinct (yet also overlapping) roles of the state that have direct and/or indirect effects on the prospects for strategic coupling and industrial path development can be identified. First, the state acts as *facilitator* by assisting firms with innovation and upgrading activities, such as by providing research and development (R&D) funding, tax incentives, or establishing and supporting new education programmes. Through its role as *regulator* the state sets limits and restrictions on firm activities. This occurs for instance through trade policies and agreements, or price controls. In sectors of high strategic priority such as defence or energy, states are often also *owners* of firms (and can thus also be seen as producers). Finally, states are large and important *purchasers*, not least (again) in matters that concern key societal issues including security. In general, we associate the two former state roles mainly with indirect and the two latter roles mainly with direct effects on path development.

These various roles reflect that states also operate at multiple scales, including beyond their given territory (Jessop, 2011). Morgan (2013, p. 322), argues that economic geographers ‘need to incorporate the state into the centre of their analysis because ... it is the pre-eminent institution at the macro-level which fashions the “rules of the game” under which all other institutions, including the

firm, have to operate’. This fashioning of rules occurs through the formulation and implementation of broader horizontal, vertical and spatial policies (e.g., industrial, regional, trade, fiscal, innovation) that both directly and indirectly influence the conditions for regional path development (Chang et al., 2013; Mackinnon et al., 2019).

The unique position of the state as regulator thus relates to its capacity for changing the structures (e.g., policies and transnational agreements) that also frame its opportunity space as an economic agent (e.g., as producer, majority shareholder in private companies). This understanding of the role of the state complements previous work that primarily sees the state as a facilitating actor enabling industrial and regional development indirectly through policy (e.g., Mackinnon et al., 2019). We posit that the significance of different roles is contingent on the institutional characteristics of different countries, reflecting distinctive political economy features that shape the interaction between firms, the state and other actors. The roles of the state also differ over time (e.g., due to shifting industrial policy ideologies) and across sectors. The defence sector is subject to strong regulation and coordination by state institutions, especially in coordinated market economies (CMEs, e.g., Norway and Germany) where states also have roles as owners of key defence-related industry firms (Markusen & Serfati, 2000). However, states can influence the conditions for industrial path development much more directly. The most fundamental expression of this is through direct ownership of productive assets (companies), either partially or in full. As purchasers, states are also important in creating markets and/or enabling market access. The military sector typically articulates sophisticated and often large-scale demand, with an emphasis on performance rather than cost efficiency (Mowery, 2008). Defence-related market governance mechanisms furthermore enable states to use multi- or bilateral agreements to strategically attempt to develop new competence areas (i.e., assets) within their territory. Similar dynamics have been observed in the energy sectors, for instance, with the use of local content policies to support domestic supplier industries.

This furthermore points to the relevance of *strategic coupling*. Successful long-term strategic coupling hinges on territorialised assets and resources being valuable and of sufficient quality. In GPN terminology (Coe et al., 2004, p. 474), territorialised assets are valuable ‘only if they fit the strategic needs of global production networks’. To sustain path development, assets (e.g., knowledge and skill base, infrastructure) therefore need to be modified in accordance with changing demand and market conditions (Trippel et al., 2020). States can therefore enable or at least increase the chances of strategic coupling by supporting asset modification, for instance through education programmes, research funding or supporting the development of new infrastructure. On the other hand, and perhaps especially in the defence sector, states can attempt to secure that those assets do in fact result in value creation and capture by using its roles as regulator and purchaser

to set the terms on which domestic and foreign firms compete for contracts.

Finally, the defence industry market is volatile in the sense that demand mirrors shifting geopolitical tensions and (international) conflict levels. Faced with declining or uneven demand for defence products, some defence manufacturers have developed dual-use technologies for both defence and civilian purposes (Molas-Gallart, 1997). More generally, a broad range of technologies developed for military use (often developed with state R&D funding) have subsequently diffused into various civilian sectors (Mazzucato, 2011). Within a path development model, this suggests that innovation in the defence industry that diffuses into other sectors or allows companies to branch into new markets can ensure that a regional industrial path evolves and remains dynamic.

### 2.3. Analytical framework

To examine the roles of the state in long-term path development within the two Norwegian high-tech manufacturing regions Kongsberg and Raufoss we employ an analytical framework that directs attention to change and continuity at the analytical level of a regional industrial path (Martin & Sunley, 2006). As such we distinguish between mechanisms of upgrading and branching. Upgrading refers to instances of revitalisation or renewal of a particular type of activity such as defence-related manufacturing. Branching denotes the initiation of economic activities oriented towards markets/sectors that are new to the region, often involving the reuse of existing regional assets and capabilities. In other words, both entail (localised) asset modification in some form or another.

Both branching and upgrading can be seen to materialise through the process of strategic coupling (Yeung, 2021). Through strategic coupling, localised assets are 'matched' with the needs of extra-local actors in GPNs, thereby allowing for (sustained) regional industrial path development. Here we are particularly concerned with state actions that allow for such connections being forged, both deliberately and more unintentionally. We posit that regional opportunity spaces change over time at least partly because of how the state enacts different roles. As such we distinguish four key state roles as discussed in section 2.2: owner, regulator, purchaser and facilitator (Morgan, 2013; Horner, 2017). The enactment of these roles naturally occurs in interaction with the (also differentiated and changing) agency of other non-firm and firm actors, as expressed through asset modification and the realisation of strategic couplings.

A longitudinal study, such as the one undertaken here, certainly needs to account for changes over time. For instance, the neoliberal era and the 'golden age of privatisation' of state-owned enterprises occurring across Organisation for Economic Co-operation and Development (OECD) countries from the late 1980s to the early 2000s (OECD, 2019) also made its mark in Norway. However, while the Norwegian state retains majority shareholder position in companies of key national interest within defence as well as within energy, state-owned

companies have become relatively autonomous in relation to state politics and directives (Lie, 2016).

Given the timespan covered in our analysis it is impossible to flesh out industrial development trajectories in detail. We therefore focus on main development phases characterised by relative stability in terms of regional economic structures, innovation activities and market orientation (Grillitsch & Sotarauta, 2020). These phases are separated by key moments of change that provide new opportunity spaces and alter path trajectories. Given the need for historical contextualisation and periodisation (Martin & Sunley, 2022) to understand the role of the state over time, our empirical analysis is chronologically ordered and distinguishes (1) a preformation phase before the Second World War, wherein the two state-owned companies were established, (2) a phase (1940s–80s) in which substantial branching and upgrading occurred, and (3) a final phase (1990s onwards) starting with demergers and subsequent upgrading and cluster development.

## 3. RESEARCH DESIGN AND SETTING

EEG-inspired path development research has tended to concentrate on events taking place from the 1990s onwards, albeit with some notable exceptions (e.g., Morgan, 2013; Jolly et al., 2020). The effect is that 'there is plenty of time in contemporary EEG, but there is not much long real time and very little history' (Henning, 2019, p. 607). To analyse the shifting roles of the state in regional (path) development of two industrially related regions over a relatively long time period we employ a longitudinal narrative-based case study approach. In this way we heed the recent call from Martin and Sunley (2022, p. 67) who argue that 'to understand how a specific spatial economic configuration has evolved requires tracing the causal history of that evolution'. This calls for history-informed research strategies, and for historical causal investigation. The aim of this investigation is thus not generalisation, but to uncover the 'generative processes, events, and actors' decisions that account for the evolutionary unfolding of that particular case (or very few cases) (p. 77).

We chose two relatively similar cases, namely the Kongsberg and Raufoss clusters. Both find their origins in state-owned defence-related companies (Kongsberg Våpenfabrikk (KV) and Raufoss Ammunisjonsfabrikk (RA), respectively) and have become important industry clusters in the relatively small Norwegian manufacturing sector. In both cases, the legacy from the two state-owned companies with regards to explaining current-day cluster features (e.g., firm structure, market orientation, specialised knowledge bases) emerged as a salient theme in many interviews. For example, a former chief executive officer (CEO) of KV (interview, 2017) argued that it was difficult to understand recent developments in the Kongsberg cluster without acknowledging 'the knowledge and culture we had [in KV]'. While the validity of such retrospective claims can be questioned (Henning, 2019), the inspiration they provide is unquestionable.

Given the selective memory of study participants and resulting problems of historical validity, Henning (2019) problematises the use of (qualitative) interviews in longitudinal studies. Seen in hindsight or retrospect, developments are easily over-rationalised and simplified, whereas other alternative developments could justifiably also have taken place (Steen, 2016). In their plea for taking history more seriously in (evolutionary) economic geography, Martin and Sunley (2022) call for the use of qualitative historical data to grasp the complexity of long-term regional development processes. Our analysis is therefore mainly based on secondary sources, particularly archival data and historical volumes covering the two regions in general and the companies KV and RA in particular. Due to the key role of these two companies in the industrial development of Norway (Wicken, 2009; Onsager et al., 2007), their history and recent development have been thoroughly documented by historians and social scientists (e.g., Wang & Grøndalen, 1996; Øyanger, 2014; Sogner & Petersen, 2014; Johnstad & Utter, 2015). Especially historical volumes documenting the companies' histories contain a wealth of data (covering the period 1814–2014) that in combination with various reports, media archives and previous research is used to construct the case narratives. We also conducted 22 semi-structured interviews<sup>1</sup> (2015–19) with representatives from firms (mainly managers), educational institutions, R&D institutes, cluster organisations and industrial networks from the two regions (see Table A1 in Appendix A in the supplemental data online). These interview-based data yielded important insights into more recent developments, and confirmed and to some extent complemented data from various documents.

#### 4. REGIONAL INDUSTRIAL PATHS AND THE ROLE OF STATE AGENCY

The Kongsberg technology agglomeration currently comprises about 20 companies and approximately 4000 employees, of which more than 70% are employed in the five largest companies. Core activities among cluster firms are production of technological equipment and systems for the offshore, maritime, aircraft, automotive, and defence industries. Most of the Kongsberg cluster firms produce small (or one-off) batches of complex system products and have a common specialisation (knowledge base) in systems engineering.

The Raufoss manufacturing cluster has five core companies (mainly in automotive and defence) and a network (TotAl-gruppen) of 46 small enterprises, which mainly serve the core cluster companies. All in all, the companies and small enterprises have about 5000 employees. Raufoss firms share a knowledge base in material technology (light-weight metals, composites) and manufacturing automation and typically do mass production.

Both regions are semi-peripherally located in the inland, in the eastern part of Norway, outside of the major labour region around the capital city Oslo (Figure 1).

In the following we first briefly describe the pre-formation phases in the two regions before tracing developments through two phases in the post-Second World War era.

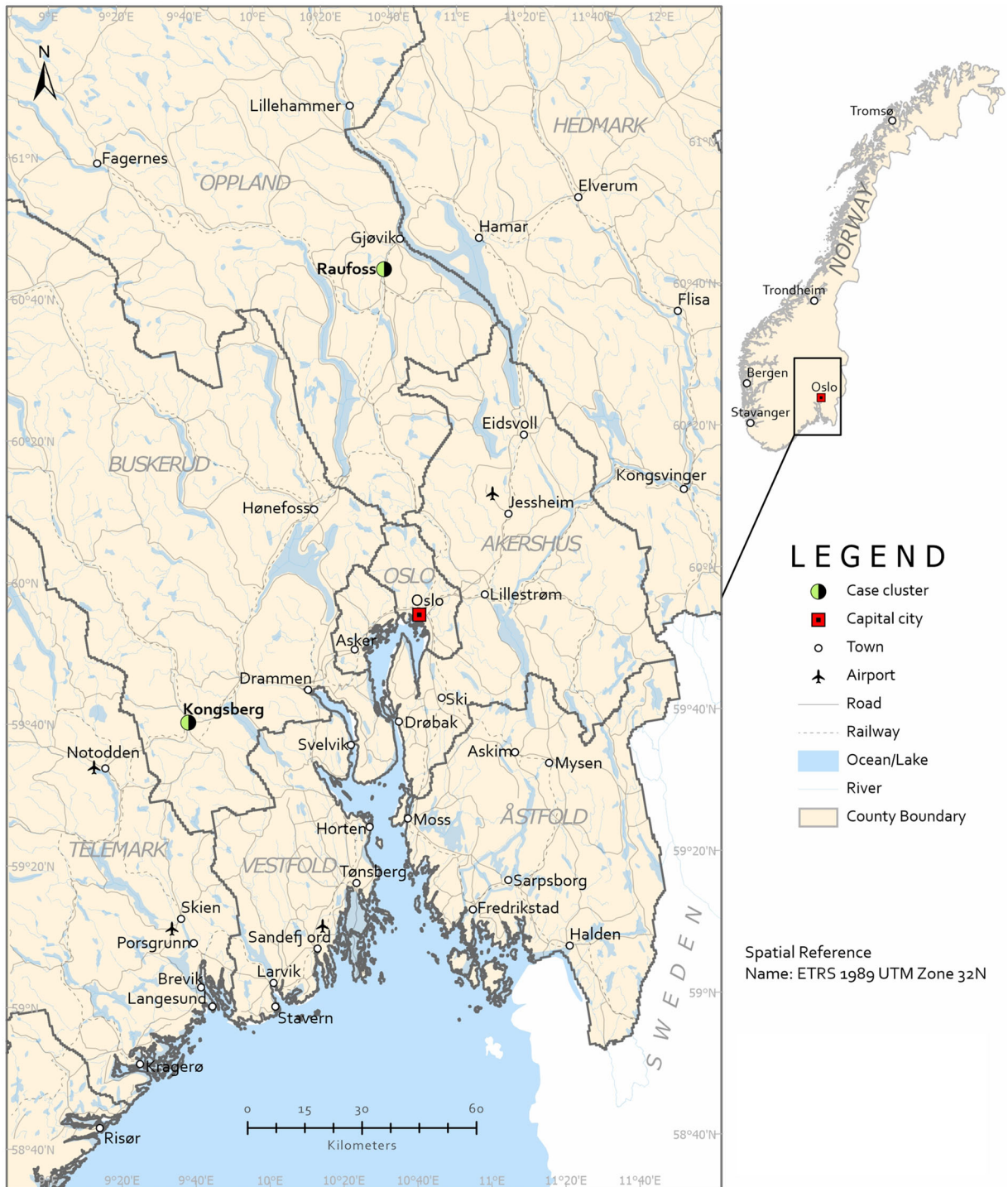
##### 4.1. Preformation phase: before the Second World War

The town of Kongsberg was established in 1624 following the discovery of rich silver deposits. In 1814, after gaining independence from Denmark, the Norwegian state decided to establish a weapons factory (KV) in Kongsberg with the Ministry of Defence as owner. This decision was mainly the result of military–strategic considerations to locate the factory away from the Swedish border (Onsager et al., 2007). In the early phase, state-owned companies were not allowed to compete with private Norwegian companies, and production was mainly defence related. The most important product was the Krag-Jørgensen rifle, which was produced for the US Army between 1892 and 1898. In the early 1900s, KV diversified into civilian markets, which by the interwar period accounted for 55% of production (Øyanger, 2014).

A shift from craft to 'modern' industrial activities in the Raufoss region first started in 1886, when the Norwegian government decided to relocate the state-owned ammunition factory from the capital to Raufoss (Johnstad & Utter, 2015). Like the KV case, the decision to relocate was due to military–strategic reasons and fear of a potential Swedish invasion. RA early on expanded by adding gunpowder, grenade fuses and cannon shells to its line of products. The company was heavily influenced by shifting business cycles resulting from geopolitical affairs. RA benefitted from increased demand for ammunition during the First World War, which enabled the company to invest in new buildings, production machinery and laboratory equipment. Due to market fluctuations the Norwegian Parliament granted funding for pursuing diversification into civilian production in 1919, which constituted more than 50% of the production by the late 1940s (Johnstad & Utter, 2015). Thus, the state had already facilitated industrial branching in both regions before the Second World War through its role as owner and regulator. However, the decades that followed would entail an intensification of diversification activities.

##### 4.2. Path development phase I: industrial branching, 1940s–80s

Norway's entry into the North Atlantic Treaty Organization (NATO) in 1949 was to be a key moment of change for both regions. As the two dominant Norwegian weapons and ammunition manufacturers, KV and RA gained access to the inner-NATO market. This ensured predictability in contracts and a shielded market which remains important for the defence industry in the two regions to date. To help rebuild the European defence industry, the US government established an Offshore Procurement Programme in 1952, whereby the United States bought European-made defence products for other allied European countries. For RA and



**Figure 1.** Location of Raufoss and Kongsberg.  
 Source: Michael Ogbe, Department of Geography, NTNU Trondheim, December 2019.

KV, this entailed several bilateral agreements between the Norwegian and US governments pertaining to specific defence products that underpinned the strategic coupling of the two regions to demanding external customers. Enabled by the state as regulator, this solidified the industrial (manufacturing) paths in the two regions not only in the early post-Second World War era, since various offset agreements between Norway and other NATO countries have constituted the main market for the defence-related manufactures in both Raufoss

and Kongsberg ever since the early 1950s (Fevolden & Tvetbråten, 2016).

A crucial condition that laid the basis for branching at both Kongsberg and Raufoss until the early 1980s was that the state granted KV and RA ample resources for research and (product) development with substantial freedom to explore. In fact, both state-owned companies had recurrent deficits and received economic government bailouts several times (in the 1950s and 1980s) (Wang & Grøndalen, 1996; Øyangen, 2014). This reflects how KV and RA

were deliberately assigned to be 'locomotives' in the industrial modernisation of Norway in the post-Second World War era. It also illustrates how the state acts as facilitator, enabling substantial asset modification via R&D. Another and more indirect way in which the state as facilitator shaped developments at Raufoss and Kongsberg was by developing the broader defence-related national innovation system (Wicken, 2009). For instance, the state-owned Norwegian Defence Research Establishment (FFI) was established as an independent research institute in 1946 (Øyangen, 2014). FFI became a key knowledge and technology provider for RA and KV as well as for other defence-related manufacturers in Norway. In the case of RA, close cooperation with FFI enabled the company to commence production of rocket fuels in 1947, a *de facto* upgrading of defence-related activities at Raufoss. This laid the foundation for subsequent development and production of Sidewinder rockets in the late 1950s and ASRAAM rocket engines in the 1980s (Wang & Grøndalen, 1996).

A similar upgrading process, and a simultaneous reorientation from civilian production that had become dominant by the 1940s, occurred at Kongsberg. In 1954 licence production contracts for Bofors L/70 (Swedish) artillery canons were obtained by the state, through a bilateral agreement with the US government, as part of the US Offshore Procurement Program (1952). Despite their experience with production of the L/60, KV did not have the required competence nor production facilities to produce the much more advanced servo-controlled L/70 canons. However, the KV board persuaded the Norwegian government to finance the expansion of the production facilities, an important example of asset modification to enable upgrading. This marks the first steps in the development of a systems engineering knowledge base, which would develop into a key comparative advantage for KV (Øyangen, 2014).

The state also played a key role in the strategic coupling of both KV and RA to the Swedish automotive industry. Due to strict import regulations limiting car sales in Norway in the 1950s, the Swedish car manufacturer Volvo engaged in negotiations with the Norwegian government to get permission to expand sales. An agreement was reached in 1957, in which Volvo, in exchange for selling 3000 additional cars, had to teach RA and KV how to produce automotive parts, reflecting the state's strategy at the time to expand automotive-related manufacturing in Norway. Volvo also had to agree to co-finance new production lines, and to ensure that in the event of any future production in Norway, RA and KV 'would be given preference if these companies were able to produce the car parts in question' (Øyangen, 2014, p. 117, authors' translation). Through these regulatory measures, the Norwegian state thus enabled both RA and KV to develop new assets and branch into automotive manufacturing. This episode of regulatory intervention was a key moment of change in terms of path development, as manufacturing of automotive parts continues to be a core industrial activity, particularly in the Raufoss region.

The regulator role on behalf of the state was also prominent in the commencement of gas turbine production at KV in 1969, which constituted branching into the then nascent-phase Norwegian offshore petroleum market. This branching was enabled by introduction of local content requirements by the Norwegian state vis-à-vis the international petroleum companies. KV's gas turbines were moreover based on state-funded inhouse R&D. Although KV's gas turbines were technologically inferior compared with turbines that were otherwise available on the market, and initially intended as auxiliary power units for Norwegian merchant ships, the major US oil and gas (O&G) company Phillips became its number one customer. According to the KV production manager at the time, 'the Phillips management recognised the Norwegian authorities as KV's marketing department' (Øyangen, 2014, p. 197, authors' translation).

The experience KV gained as gas turbine manufacturer was subsequently used as an argument for locating jet engine production to Kongsberg. Orchestrated by the state acting as both regulator and purchaser, this occurred as a result of an offset agreement that entailed Norway buying F-16 jet fighters from Lockheed Martin (US). According to Øyangen (2014, p. 239, authors' translation):

KV's experience from gas turbine production was used for all that it was worth in the effort to secure the F-16 contract, while in reality there was no strong connection between production of KG2 [gas turbine] and the jet engine.

The founder of the KV gas turbine division even stated that the claimed technological connection was 'a solely political argument' (p. 239). The jet engine component production (beginning in 1976), which was clearly a priority of the state, paved the way for KV branching into the aerospace industry. Strategic coupling to the aerospace sector also occurred at Raufoss. In 1991, RA used its experience in rocket fuel and engine production to develop the separation mechanism for the Ariane space rocket (Wang & Grøndalen, 1996).

#### 4.3. Path development phase II: demergers and cluster development, 1990s–present

Following the changing ideals regarding state ownership in Western economies in the 1980s and 1990s (OECD, 2019), both KV (in 1987) and RA (a series of processes starting in 1991) experienced demergers, accentuated by company-level economic crises due to accumulated deficits (Sogner & Petersen, 2014; Johnstad & Utter, 2015). As a result, both companies were split up into private companies (Figures 2 and 3), whereby those that were defence-related retained the state as the largest shareholder, albeit marking the end of complete state ownership and direct financial support to R&D and manufacturing infrastructure. Following these key moments of change, the new companies largely mirrored the different product divisions (i.e., defence, automotive, O&G, aerospace) within RA and KV, respectively. While reducing the state's potential for influencing strategic business decisions in the



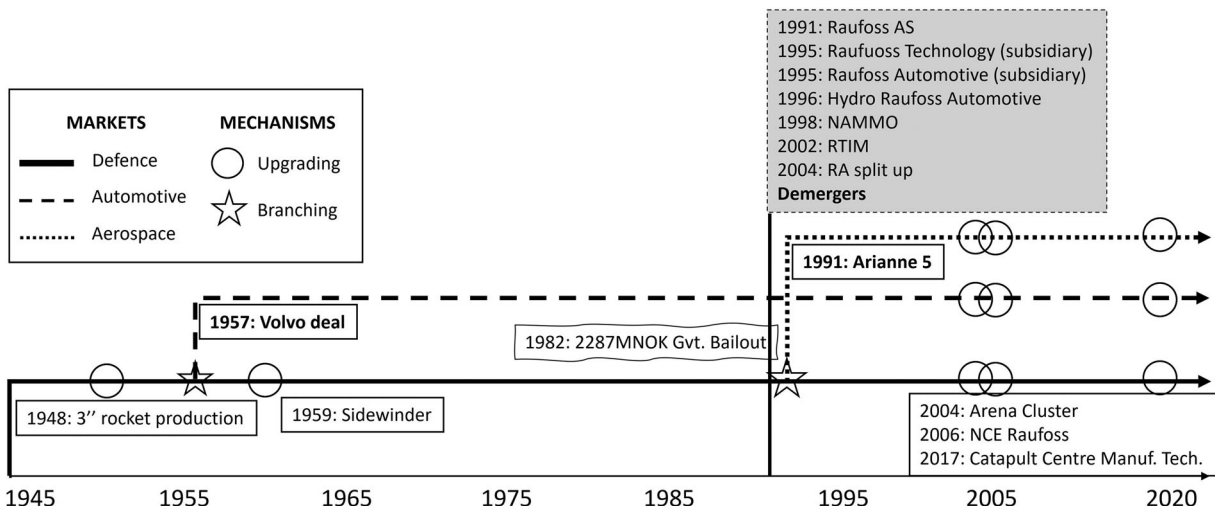


Figure 2. Industrial path development in the Raufoss region, 1945–2020.

companies, this also implied a shift in the role of the state in path development, especially in direction of facilitating asset modification via new forms of industry and innovation policy that emerged in the 1990s. It is nonetheless important to note that the state continues to enact its role as regulator with regards to for instance defence-related offset agreements and thus also to be a significant purchaser.

The development of innovation funding schemes constituted important elements in the new generation of innovation policy that was introduced around the turn of the millennium to stimulate localised clusters and innovation systems (Isaksen, 2009). With funding from the national cluster development programme (established in 2002), NCE<sup>2</sup> Raufoss was established in 2006, focusing on the territorial embedding and upgrading of existing knowledge bases related to automation and light-weight materials that had been developed over decades in

defence-related as well as civilian production at RA. The NCE Raufoss cluster organisation contributed to the further specialisation of the region when becoming part of the Norwegian Catapult Programme in 2017. NCE Systems Engineering was established at Kongsberg in 2006, focusing on harnessing systems engineering as a key knowledge base (Sogner & Petersen, 2014) – the core asset that had been developed in KV during the several decades leading up to the demerger.

These policy measures enabled more prominent place-based leadership (Grillitsch & Sotarauta, 2020) in both regions, notably orchestrated by the local cluster organisations. By initiating various R&D, innovation and education programmes, the cluster organisations have played key roles in continued asset modification needed to sustain competitive advantages in both defence-related and civilian markets. An important element in cluster development has been to develop and solidify linkages to extra-

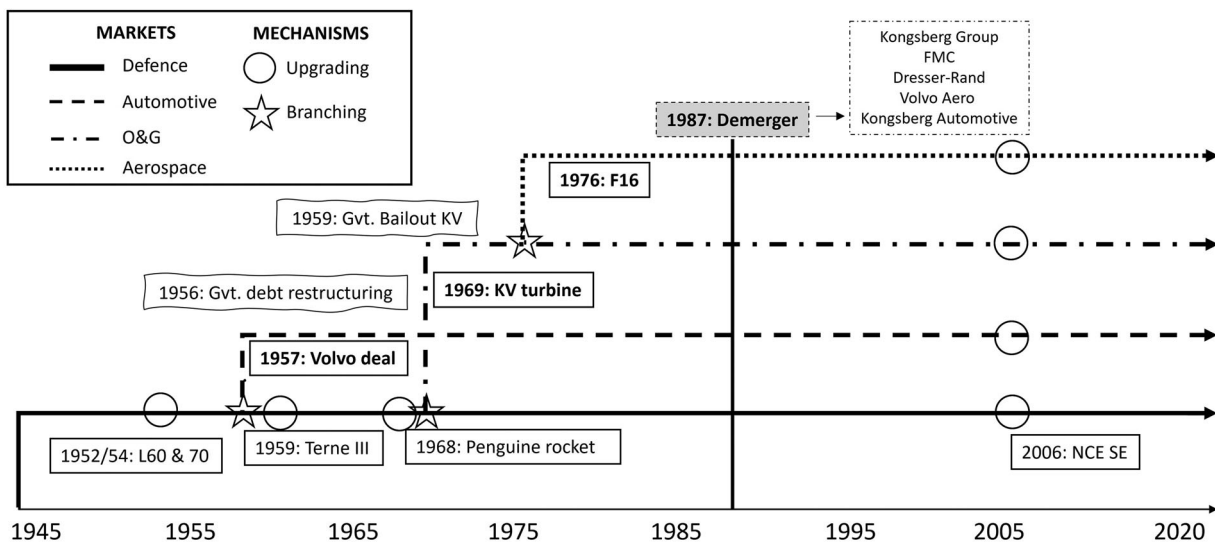


Figure 3. Industrial path development in the Kongsberg region, 1945–2020.

regional knowledge and research institutions, both nationally and internationally (Karlsen et al., 2021). As of 2021, the Kongsberg and Raufoss clusters remain frontrunners in terms of technology and knowledge development in the Norwegian manufacturing industry, whereas the core defence-related remnants of KV and RA (Kongsberg Gruppen and Nammo, respectively), both are among the world's 100 largest weapons manufacturers (DefenseNews, n.d.).

## 5. DISCUSSION

The legacies of the current Kongsberg and Raufoss clusters can both be traced to the establishment of state-owned manufacturers of weapons and ammunition in the 19th century. Norway's NATO membership enabled the state to negotiate offset agreements which secured both KV and RA market access for their defence-related products. Indeed, Fevolden and Tvetbråten (2016) identified offset agreements between states as the most important policy instrument for defence-related industrial development (upgrading) in Norway in the post-Second World War period. Branching into civilian markets was also enabled by the state. Our analysis furthermore revealed how offset agreements for military production (which are still used) also led to asset modification that successively enabled firm branching into new (civilian) markets.

The examples of securing automotive parts production at both Raufoss and Kongsberg for Swedish Volvo, and the production of gas turbines for the domestic offshore petroleum industry, furthermore serve to illustrate the roles of the state as regulator and owner (Horner, 2017) in enabling strategic coupling beyond the defence realm. Both examples reflect how the state during key moments of change used different policy domains to influence path developments in desired directions. This strategic coupling ensured both upgrading and branching (both relying on asset modification) into markets that remain important in the two regions to date (Figures 2 and 3).

In this way, the case narratives display an 'evolutionary unfolding' (Martin & Sunley, 2022) in which state agency was a decisive causal factor in shaping path developments. The causal relationships are however intricate in the sense that different instances of change (e.g., upgrading, branching) created new opportunity spaces both for the firms and for the state. In some cases (e.g., the Volvo agreement), the state secured contracts and market access that both demanded and involved asset modification. Such instances of asset modification in turn enabled further upgrading and new branching opportunities, thereby preventing the two path trajectories moving into stasis or decline.

Path developments at Raufoss and Kongsberg have thus been both directly and indirectly influenced by state agency. This state agency has been enacted in different and often complementary ways over the years via four distinct roles: as facilitator, regulator, owner and purchaser. The state as owner was influential all the way up until vertical disintegration of the two state-owned companies towards the end of the 20th century. The role of purchaser

(for defence-related products) has direct influences on path development and remains important to date. The role as facilitator has mainly had indirect influences (by supporting innovative entrepreneurship within the state-owned companies), and shifted from supporting mainly firm-level R&D to supporting cluster and innovation system developments. The role of regulator has mainly also had indirect effects, with the exception of, for instance, the 'Volvo deal' which had a very direct influence on path development by allowing for branching.

Our case narratives also revealed that no substantial branching into new market areas has occurred in the two regions since the RA and KV demergers. Many of the 'new' companies that were formed after the demergers were acquired by large multinational companies. These subsidiaries have apparently not been in a corporate position to undertake the type of exploration that enabled their existence in the first place. We speculate that these companies are primarily positioned as suppliers in relatively captive relationships with their customers. On the other hand, they have been able to focus on their core competences (in line with key managerial ideas over the last decades) and turned activities that in the era of state ownership created (economic) losses into profitable lines of business. Our findings suggest that this continued asset modification and upgrading in more recent decades has been supported by local cluster initiatives that indirectly have been facilitated by the state. A final reflection is that the branching or diversification processes witnessed at Raufoss and Kongsberg, in which the state has played important roles, stands somewhat in contrast with the micro-level determinants of branching as postulated by conventional EEG.

## 6. CONCLUSIONS AND POLICY IMPLICATIONS

This paper has examined the shifting role of the state in long-term path development in two Norwegian manufacturing regions. We developed an analytical framework that distinguished between mechanisms of upgrading and branching, suggesting that both materialise in strategic coupling and require asset modification. While previous research (e.g., Dawley et al., 2015) mainly discussed the more indirect effects of state agency (e.g., in facilitating innovation, regulating markets) on such processes, our historical analysis displayed how states may be capable of shaping regional path trajectories also much more directly.

The two case study regions Kongsberg and Raufoss, which are currently home to two of Norway's most advanced high-tech clusters, were purposefully selected because of their shared historical industrial origins in the form of state-owned companies operating within defence-related (and increasingly also civilian) manufacturing. Regarding the state's roles as facilitator and regulator, the effects on path development were mainly indirect as suggested by previous research. As for the state's roles as purchaser and owner, these had very direct effects on path developments, notably by ensuring strategic coupling in

the form of continued upgrading of manufacturing activities and the enabling of branching into new markets. Our analysis furthermore revealed that these causal mechanisms (upgrading and branching) and the roles of the state in relation to them were conditioned by earlier (similar) path developments. The analysis thereby illustrates the value of historical investigation (Martin & Sunley, 2022) in understanding today's economic landscape. As argued by Hall (1962, p. 9, cited by Martin & Sunley, 2022), 'the present makes no sense until it is related to the evolutionary process which has produced it'. Importantly, using case narratives to unpack evolutionary processes allowed for an examination of the causal relationships between state roles, shifting contexts, and mechanisms of path development.

While various forms of state agency were crucial to how and why these high-tech clusters emerged and developed, we do not thereby suggest that the state always chose the 'right' strategy, at least not intentionally, nor that other (including local) actors were unimportant in shaping path developments. By contrast, and most obviously, developments in the two regions cannot be explained without recognising firm-level innovation in the two state-owned companies. Also, many of the outcomes of state support were unintentional, such as the development and production of gas turbine technology at Kongsberg that would form the basis for branching into aerospace. Nonetheless, we conclude that the state largely facilitated this innovation activity, for instance by providing ample funding for R&D (as owner) and by securing contracts for RA and KV products (as purchaser) especially within but also outside the realm of defence-related procurement. Supporting the development of the broader national innovation system was also important, albeit more indirectly. The role of the state as facilitator continues in new forms after the demerger of the two state-owned companies, notably in supporting upgrading and asset modification (Lund & Karlsen, 2020; Karlsen et al., 2022).

By highlighting the shifting roles of the state in path development, this paper contributes to the burgeoning cross-fertilisation between EEG and GPN theory (Barratt & Ellem, 2019; Yeung, 2021), and by implication adds to our understanding of path development as an outcome of different types of agentic processes, and endogenous as well as exogenous factors. This tracking of generative processes over time allows for theorising connections between contexts, agency (state roles) and output (Martin & Sunley, 2022), but the research approach also limits the scope for empirical generalisation. Our findings and conceptual contributions on the different roles of the state thus need to be seen in relation to context. In the cases studied here, context-specific factors include geopolitical structures (e.g., NATO membership) and political traditions associated with the particularities of the Norwegian social democracy (as a variant of a CME type economy). We nonetheless assume that similar findings, albeit with varying degrees of importance regarding different state roles (over time), can be expected also in other contexts where state ownership has been or remains

relatively normal due to strategic national interests, such as in energy and transport. Comparative cross-country, cross-sector and longitudinal research designs will be needed to substantiate our propositions.

As regards broader policy implications, the findings in this paper are of relevance notably to debates on how to deal with grand societal challenges and revitalising economies (e.g., Morgan, 2013; Bailey et al., 2019). This relates to the need for radical innovation and transformative change (e.g., related to energy and climate, aging societies), while maintaining jobs and welfare. Here, state de-risking of private sector innovation is important, especially when market prospects for new technologies and solutions are highly uncertain (Mazzucato, 2011). States can also support and incentivise more firm-level exploration by strengthening market formation through regulations and procurement measures. As for certain hard-to-reach goals (e.g., decarbonising specific sectors), where private sector ability or willingness to make necessary investments is unlikely to suffice, full or partial state ownership may be necessary in order to achieve desired outcomes.

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## DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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## NOTES

1. All study participants agreed to be identified in the form presented in this article and supplementary material online.
2. NCE refers to the Norwegian Centre of Expertise in the official national cluster development programme.

## ORCID

Markus Steen  <http://orcid.org/0000-0002-0956-2662>  
 Henrik Brynthe Lund  <http://orcid.org/0000-0002-4348-4338>  
 Ashbjørn Karlsen  <http://orcid.org/0000-0002-7645-5066>

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