

Enhancing agency in green path development: Lessons from the wind energy sector for the emerging battery industry in the Nordic region

Ejike Okonkwo*

Abstract

This paper reviews the literature on wind energy to ascertain the factors that shape agency in the sector's development trajectory and then extract valuable lessons that regional actors can leverage in the emerging Nordic battery industry. The research process is anchored on the READ approach, i.e., readying, extraction, analyzing, and distilling. The results show that agency is shaped by socio-cognitive, economic, geographical, and cultural factors. Actors' actions must, therefore, proactively align the battery development strategies to the cultural context, taking cognizance of the norms, values, stakeholder involvement, and participation. By taking the lessons from the wind energy sector, this paper provides a scientific insight that regional actors can leverage to navigate similar experiences and challenges in the battery development process in the Nordic region easily. This paper advances cross-sector knowledge in the green path development literature.

Keywords: Agency, cross-sector knowledge, green path development, Nordic battery industry, Nordic region, wind energy technologies.

I. Introduction

The battery industry is a strategic green path development initiative for energy transition within the European Union (European Commission 2018). Green paths refer to industrial advancement around products, solutions, or technologies contributing to decarbonization (UNEP, 2011). Change agents, e.g., Schumpeterian innovative entrepreneurship, institutional entrepreneurship, place-based leadership (Grillitsch & Sotarauta 2019), and structural maintenance agents (Jolly et al., 2020) exercise agency essential in the emergence of new green paths (Sotarauta & Beer 2017). Agency refers to an "intentional, purposive, and meaningful action" (Grillitsch and Sotarauta 2019:707), and agents are actors that exercise agency (Jolly et al. 2020). The roles and categorization of these agents are well established in green path development literature (Sotarauta et al. 2021). Research suggests that agents "mobilize the past not necessarily to repeat or avoid what happened, but, instead, to generate new options, by imagining new initiatives for the future" (Garud, Kumaraswamy & Karnøe, 2010:770). In addition, the dynamism of the actors' agency and the factors responsible for these changes are well captured (Sotarauta et al., 2022).

These existing studies have focused mainly on describing the nature of change agents and the various agencies they exercise. However, more understanding of how actors' agency can be strengthened in green path development is needed, especially within the Nordic context where the battery industry is being developed to accelerate decarbonization (cf. Löfmarck et al., 2022). One way of advancing actors' agency is by relying on cross-sector knowledge and leveraging the lessons from past experiences in developing related technologies within the energy sector. Against this backdrop, knowledge across sectors can strengthen the path development process (Grillitsch & Sotarauta, 2019). Broadening the scope of knowledge in the energy transition process is essential (Batel et al., 2013) as "too much reliance on local knowledge without external ties can cause territorial lock-in effects which are harmful to innovation" (Boschma, 2005; Kekezi et al., 2022:292). Cross-sectoral knowledge spillover can thus facilitate the development process of innovations (Glaeser et al., 1992) because diverse sectoral knowledge can be leveraged across sectors (Acemoglu et al., 2016; Malerba et al., 2013). Recent research has also reinforced the importance of creating

* Ejike Okonkwo, School of Management, University of Vaasa, Wolffintie 32 P.O. Box 700, FI-65101 Vaasa, Finland, Email: ejike.okonkwo@uwasa.fi. ORCID: 0000-0003-4622-5785).

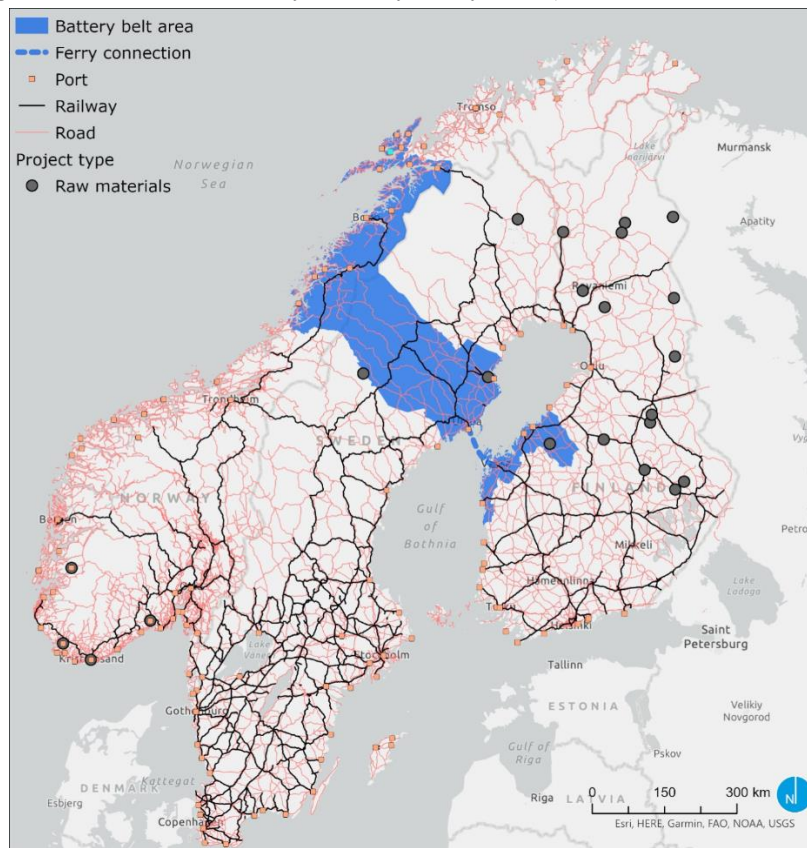
relevant cross-sectoral knowledge for many sectors (Kekezi et al., 2022). Consequently, advancing the understanding of strengthening actors' agency in the transition process requires cross-fertilizing knowledge that “combines expertise across and beyond social sciences because it could increase our understanding of regional development” (Chlebna et al., 2023:230).

Therefore, this paper explores studies that deal with the agency's role in the developmental process of wind energy technologies (WETs), a well-established sector compared to the battery industry. WETs are technological innovations for generating and supplying renewable energy from wind (Herbert et al., 2007; Islam et al., 2013; Tian et al., 2023). The paper draws cross-sectoral knowledge and lessons that could be valuable for enhancing the agency of regional actors (cf. Okonkwo, 2022) in the emerging Nordic battery industry. Knowledge across sectors can strengthen the path development process (Grillitsch & Sotarauta, 2019). To this end, the following questions will guide the study: *What factors shape actors' agency in the developmental process of WETs? What lessons can be drawn from studies on WETs? How can these lessons enhance the agency of regional actors in the Nordic battery industry's green path development process?* The remaining part of this paper provides insight into the Nordic battery context, the theoretical underpinning, materials, and methods, findings from the document analyzed, and the discussion of the valuable lessons that can enhance actors' agency and conclusions.

II. The Nordic battery context for green path development

The Nordic region is developing its battery industry towards an accelerated transition from carbon (Viegand, 2022). Studies have extensively examined the developmental process of the Nordic battery industry in Finland, Sweden, and Norway (Battery Norway, 2023; Löfmarck et al., 2022). They highlight the contextual factors prerequisites for the emerging industry, e.g., natural resources such as copper, nickel, and cobalt. There are completed, planned, and ongoing investments in raw materials development projects, as shown in Figure 1.

Figure 1: The Nordic battery industry ecosystem (Löfmarck et al., 2022:17)



Battery chemical processing plants for nickel sulfate and cobalt refining are also being developed, and some prominent investors operating in Finland include Fortum, BASF, Nornickel, Boliden Harjavalta, and Beowulf Mining (Adolfsson-Tallqvist et al., 2019). Northvolt Ett is a leading company in Skellefteå, Sweden (Löfmarck et al., 2022). In contrast, Freyr, a Norwegian-based company, is responsible for battery development in Norway and Finland. These companies will also leverage the abundance of renewable energy sources in the region to support their operations (Aslani et al., 2013a; Aslani et al., 2013b; Energy Vaasa, 2019). The accessibility to clean energy sources reduces the industry's carbon footprint. Another common feature of the Nordic battery clusters is that the factories are mainly situated near the coastlines and ports for logistical reasons (Löfmarck et al., 2022). From the policy standpoint, the Nordic countries have similar goals in their national battery strategies, such as optimizing local natural resources for energy transition and ensuring a secured supply value chain of critical materials, creating new jobs in green industries, and increasing the visibility of the industry via effective branding, communication, and stakeholder collaboration (ibid). While battery production will contribute to the decarbonization process (Mohr et al., 2020), the industry has developmental challenges, including environmental pollution, ensuring an ethical and sustainable supply of critical materials from outside the region (Dehaine et al., 2020), as well as geopolitical concerns on external reliance of supplies that could create economic dependency (Viegand, 2022; IRENA, 2023).

The importance of actors' agency through institutional collaboration in solving these challenges has been highlighted (Battery Norway, 2023). Interestingly, more spaces for cooperation among regional actors are springing up to devise solutions to some of the challenges, especially on the envisaged transport and logistical connectivity challenges that could affect the supply value chain (Okonkwo, 2022). Due to its emerging phase, the industry will remain dynamic and continually change at different levels (Tuomela et al., 2021), meaning the agency of regional actors will be increasingly needed for governance. Furthermore, as an emerging green path, the battery industry means that actors are preoccupied with navigating the new learning experience that battery production presents. Cross-sectoral knowledge from a similar, well-established wind energy sector could strengthen their agency toward sustainable battery industry development.

III. Theoretical background

Agency in green path development

The energy industry is experiencing a rapid revolution (Sovacool et al., 2020), and human factors such as their agency drive these changes (Coenen et al., 2021). The role of change agents in developing greener industries is increasingly receiving research attention (Sotarauta et al., 2021). It has been suggested that innovative new research approaches to advance studies on decarbonization are vital (Sovacool et al., 2020). Change agents contribute to developing new green paths (Sotarauta et al., 2022). Schumpeterian innovative entrepreneurship, institutional entrepreneurship, and place-based leadership are the main types of agents (ibid: 706). The former seeks and exploits economic opportunities that advance a green path; the rules and regulations are the focus of institutional agency (Sotarauta et al., 2021). Meanwhile, place-based leadership “pools competencies, powers, and resources for creating a stable environment for the firms in the cluster to innovate and grow” (Grillitsch & Sotarauta, 2019:710). These change agents assume different and dynamic roles within any context (Jolly et al., 2020), and their actions are conditioned by the prevailing contextual conditions (Leca & Naccache, 2006).

Change agents' roles in Green Path development

Change agents “have varying capabilities, resources, and power” (Grillitsch & Sotarauta, 2019:706), which can contribute to shaping how energy technologies are seen against the backdrop that knowledge facilitates new paths (Breul et al., 2021), and such knowledge is embedded within a regional context (Binz et al., 2016:180). In other words, they shape the knowledge of innovative technologies using their “discursive power to influence the communicative process, the formation of

visions, narratives, and imaginaries” (Suitner et al., 2022:4). Due to the broad sphere of these agents, this essay will concentrate on place-based leadership for several reasons. Firstly, they provide favorable conditions that promote energy transition by “constructing opportunity spaces for entrepreneurs” (Grillitsch & Sotarauta 2019:713). Secondly, they coordinate and mobilize the resources required to develop a new green path (ibid: 707) and advance energy transition by ensuring increased public engagement and participation (Sovacool et al., 2020).

Within the Nordic battery context, regional actors are vital in mobilizing and coordinating information, discourses, and other activities that promote the battery sector, a green industry that contributes to sustainability and decarbonization (Löfmarck et al., 2022). For example, an actor's agency can contribute to the legitimation of the industry through the “development of broader socio-political narratives or frames, based on the assertion of positive future effects and benefits, claims to its competitiveness within existing institutional environments” (MacKinnon et al., 2019:125). While the various actors are actively involved in transforming the industry, they also stand to learn from intra-sectoral research on existing and well-established sectors, such as the wind industry, and how actors within such context navigate the development process of WETs. Enhancing the capacity of agents to influence the narratives in the energy transition process can be advanced by devising “new modalities of public engagement that bring greater transparency, accountability, and humility into the staid politics of project planning” (Sovacool et al., 2020:16). To achieve this will require regional actors to “reflect current challenges and opportunities with past experiences and learning from prior action” (Suitner et al., 2022:4).

IV. Materials and methods

The study adopts the READ approach (Dalglish, Khalid & McMahon, 2020) for document analysis. READ involves *readying* or searching relevant literature on factors that influence agency in the development process of wind energy technologies, *extraction*, or selecting the relevant literature that is useful for the paper, e.g., Table 1 shows how the articles were summarised and categorized based on their focus. The next step involves *analyzing* the literature to understand the key arguments. Lastly, the findings were *distilled* to ensure that only the most relevant aspect of the literature contributing to cross-sector knowledge and valuable lessons that can strengthen the agency of regional actors are reflected in this paper. Table 1 shows the literature examined to enhance the study's credibility and provide a nuanced perspective (cf. Bowen, 2009; Eisner, 1991). Only relevant articles published between 2005 and 2023 were analyzed; additionally, only papers published in English were considered as it ensured the ease of comprehending the materials. The empirical documents about the region support the argument on the imperativeness of cross-sector knowledge for advancing actors' agency within the Nordic region's battery industry (Braun & Clarke, 2013). The Nordic context was selected because it provides a suitable empirical research context where the battery industry is being established, and actors can benefit from the cross-sector knowledge as part of their learning curve viz-a-viz the emerging green industry. Document analysis is cost-effective (Merriam & Tisdell, 2016; Morgan, 2022), easily accessible (cf. Bowen, 2009; Yin, 1994), and suitable for gaining a deeper insight into research problems (Merriam, 1988; Merriam & Tisdell, 2016). Table 1 also shows the findings on the factors that affect the agency under four themes: socio-cognitive factors, economic and cultural values, norms, and discourses, and the level of public engagement and proximity. I made sense of the findings in the discussion, leveraging the agency's theoretical perspective to increase the understanding and the importance of cross-sectoral knowledge in enhancing the agency in green path development.

V. Results

Social-cognitive factors shape agency

Agency towards WETs highly depends on their perceived negative impact (Kardooni et al., 2016) on water quality, health, and air quality (Bertsch et al., 2016; Enevoldsen & Sovacool, 2016; Kardooni et al., 2016). In addition, impacts on animals, environmental aesthetics, shadow flicking,

and aerodynamic noise (swishing sound) lead to annoyance and sleep disorders for residents living close to the technologies (Grilli et al., 2016; Seong et al., 2013; Van der Horst, 2007; Voigt et al., 2019), others include the impact on the landscape leading to “uneven development, squeezed landscapes and place identity” (Hallan & González, 2020:2). These perceived impacts often lead to opposition to wind technologies (Bell et al., 2005; Enevoldsen & Sovacool, 2016; Ioannidis & Koutsoyiannis, 2020; Walker & Cass, 2007; Walker & Eames, 2008; West et al., 2010; Wüstenhagen et al., 2007). Agency toward WETs is also influenced by the perceived positive impacts of the technologies, for example, when they are seen as a source of clean energy that supports decarbonization (Hagen & Pijawka, 2015). In this case, the agency of actors is more inclined toward the social acceptance and legitimization of WETs (Wüstenhagen et al., 2007; Bertsch et al., 2016; Karooni et al., 2016; Vainio et al., 2019). Both negative and positive perceptions sometimes result in the green-green dilemma in exercising agency (that is, choosing between a global good in the reduction of CO₂ and the local bad emanating from wind turbine impact on the landscape (Enevoldsen & Sovacool, 2016), it sometimes also leads to a conflict of interest between key stakeholders with regards to some decisions, actions, and solutions (Voigt et al., 2019). Lastly, perception influences government actors' energy policy decision-making process regarding their support to accelerate the diffusion of renewable technologies (Karooni et al., 2016; Rohe & Chlebna, 2021).

Table 1: Factors that shape Agency and the lessons for actors in the Nordic battery industry

Reviewed literature on WETs development	Findings on factors that shape Agency in WETs	Lessons to enhance Agency in the development of the battery industry in the Nordic region
Bell et al., 2005; Bertsch et al., 2016; Enevoldsen & Sovacool, 2016; Grilli et al., 2016; Hagen & Pijawka, 2015; Hallan & González, 2020; Ioannidis & Koutsoyiannis, 2020; Karooni et al., 2016; Rohe & Chlebna, 2021; Seong et al., 2013; Vainio et al., 2019; Van der Horst, 2007; Voigt et al., 2019; Walker & Cass, 2007; Walker & Eames, 2008; West et al., 2010; Wüstenhagen et al., 2007.	Social-cognitive	Prioritise solving the challenges from battery production, such as the environmental and social impacts, will foster an increased positive outlook and societal acceptance of the new green path.
Bertsch et al., 2016; Enevoldsen & Sovacool, 2016; West et al., 2010.	Economic	As a new green path, the battery industry can thrive when regional actors as change agents create favourable conditions.
Bertsch et al., 2016; Bidwell, 2016; Enevoldsen & Sovacool, 2016; Ioannidis & Koutsoyiannis, 2020; Karooni et al., 2016; Ntanos et al., 2018; Park & Ohm, 2014; Vainio et al., 2019; West et al., 2010.	Cultural values, norms, and discourses	Actors need to take cognizance of the cultural context as it could enhance their Agency in constructing discourses and implementing ideas that foster the battery industry.
Enevoldsen & Sovacool, 2016; Hagen & Pijawka, 2015; Hallan & González, 2020; Karooni et al., 2016; Park & Ohm, 2014; Sotarauta et al., 2021; Wüstenhagen et al. 2007.	The level of public engagement and proximity	The regional actors need to carry the stakeholders along by creating a space where they can be involved and participate in the battery industry development process. Also, the actors need to sustain the location selection decision of the battery industrial sites as it has proven effective in averting proximity-related challenges.

Source: Own source

Economic factors shape agency

The agency of governmental actors expressed through its policies is shaped by their assessment of the potential contribution of green innovation on the economy regarding job losses and the contestation that could ensue (Enevoldsen & Sovacool, 2016). In this regard, the government agency is exercised by providing economic incentives such as subsidies, tax waivers, and grants, primarily to renewable start-ups (niches), and such actions increase stakeholders' interest in developing innovative technologies (West et al., 2010). On the private or individual level, the market condition influences the agency of landowners to be indisposed in participating in the development process of WETs when they fear that their property value will depreciate due to the deployment of WETs, the agency of other investors could be damped due to project implementation delays (Enevoldsen & Sovacool, 2016). Studies also show that people from higher-income households often exercise supportive agency towards WETs because they see renewables as essential technological evolution within society; hence, they are more disposed to purchase them (Bertsch et al., 2016).

Cultural values, norms, and discourses shape agency.

Agency toward WETs is shaped by cultural norms, values, and discourse (West et al., 2010). The three types of discourse that exist within different cultural contexts include the individualistic discourse, which does not regard climate change as an essential environmental threat; moreover, the reliance on renewable energy is seen as non-essential, while climate issues and energy transition are viewed as sensationalized and as a pretext for further taxation of the public (ibid: 5742). Next is the hierarchist discourse, which finds WETs to be an appropriate and valuable tool in mitigating climate change only if the government accelerates its mitigation efforts by improving its cognitive and organizational capacity (ibid: 5743). The Egalitarian discourse emphasizes the urgency of energy transition and the importance of WETs; it claims that due to political reasons such as canvassing for support from big industries and the pro-fossil fuel electorates, the government is apathetic and is not taking significant measures to decarbonize some sectors (ibid: 5742). Subsequent studies reinforce the cultural contextual dimension of agency, arguing that within some contexts, WETs **are** seen as “a symbol of human progress and sustainability; in others, it is perceived as disturbing structures, unrelated to the historical and natural characteristics of landscapes and as an element of industrialization” (Ioannidis & Koutsoyiannis, 2020:22). Age is another cultural aspect that influences agency, it has been suggested that middle-aged and risk-averse people are less disposed to technological changes (Bertsch et al., 2016). People in this age bracket assume the roles of critics are often agnostic to technological changes compared to the younger generation, who are more disposed and adaptable to change (Enevoldsen & Sovacool, 2016).

The mainstream media also shapes discourses and the information available to the public because they provide the bases for knowledge formation, perception, concern, actions, and behaviors toward WETs (West et al., 2010). Information reduces the ambiguities and complications associated with renewable technologies and increases interest in their adoption (Kardooni et al., 2016), especially among well-informed people (Ntanos et al., 2018; Vainio et al., 2019). Due to the importance of information in shaping agency in the development process of green innovation, inadequate or incorrect information, e.g., on either the impacts or the benefits of WETs, influences public perception, social trust, and the likelihood of opposition to WETs (Park & Ohm, 2014; Enevoldsen & Sovacool, 2016). One reason for the above situation is that the mainstream is not always impartial, as it is sometimes used to promote the vested interest of its funders or sponsors (West et al., 2010). One way to avoid such a scenario is by explicitly explaining the objectives and goals for green innovation to community members (Bidwell, 2016; Enevoldsen & Sovacool, 2016).

Agency is shaped by proximity and public engagement.

Geographical location plays a role in shaping agency because of the different contextual conditions. In some cases, in rural areas, for example, WETs are seen as an innovation that can be leveraged to harness abundant yet underexploited local natural resources. In such a situation, most

members of the public exhibit supportive actions toward green technology (Enevoldsen & Sovacool, 2016); this is also often the case in contexts where concerns about climate change are prioritized (Kardooni et al., 2016; Park & Ohm, 2014). The agency of the government and investors in the location selection for the deployment of WETs elicit different forms of reaction from the public, meaning that the proximity of residential areas of the local communities to WETs influences their attitudes and actions (Hallan & González, 2020). The acronym 'Not in my Backyard' (NIMBY) explains how proximity affects agency in the sense that the actions and behaviors of residents change at various stages of the development process of WETs, especially when they discover that these technologies are located close to them (Enevoldsen & Sovacool, 2016).

Concerning public engagement, studies show that critics are one of the actors that exercise agency in developing green innovation (Sotarauta et al., 2021). When key societal stakeholders are not included in the planning and implementation of WETs in terms of “procedural justice and distributional justice,” they tend to become critics and, in some cases, oppose the installation process (Enevoldsen & Sovacool, 2016:179). The opposite is often the case when the developmental process is perceived as fair, equitable, and just regarding the planning and implementation, and this consequently shapes the agency of the stakeholders to be more accepting and trusting of the actions of the government and investors (Wüstenhagen et al., 2007). There is often a sense of belonging when the public is actively engaged via the provision of ample opportunities and incentives for involvement and participation in various forms, such as investors, planners, or evaluators (Enevoldsen & Sovacool, 2016; Hagen & Pijawka, 2015).

VI. Lessons that can enhance actor’s agency in the Nordic battery industry

Knowledge across sectors can strengthen green path development (Grillitsch & Sotarauta, 2019); this section analyses the many valuable lessons that regional actors can leverage from studies on WETs towards advancing the Nordic battery industry. Firstly, as the battery industry is being developed, regional actors as change agents need to work on reducing the environmental and social impact of the new green industry because the perceived and actual impacts shape how they are seen (social cognition), which consequently could foster or impede the developmental progress of new path, e.g., via social acceptance and legitimization. Empirical studies within the Nordic context have identified the numerous benefits of battery production (Adolfsson-Tallqvist et al., 2019; Battery Norway, 2023; Löfmarck et al., 2022). However, the industry's challenges still abound and must be addressed proactively and efficiently. For example, health issues, child labor exploitation, and reducing battery production's environmental and sustainability impact (Viegand, 2022:89-101). The actor, therefore, needs to “reflect these current challenges and opportunities with past experiences and learning from prior action” (Suitner et al., 2022:4), leveraging lessons from the development process of WETs.

Proximity affects agency in green path development, as studies on WETs indicate (Enevoldsen & Sovacool, 2016). Most battery plants are near coastlines and ports to reduce logistical and transportation costs and flows (Adolfsson-Tallqvist et al., 2019; Löfmarck et al., 2022). There have not been significant proximity challenges in the development phase of the battery industrial sites in the Nordic region, especially compared to the challenges with WETs. One reason is that battery factories are primarily located in remote areas, usually far away from residential settlements, meaning that regional actors have made the right decision on the location of the battery industry. Such actions reinforce the notion that change agents can exercise their agency in coordinating and mobilizing the resources required to develop a new green path (Grillitsch & Sotarauta, 2019). Studies from WETs reveal how dynamic the development process of renewable technologies is as attitudes towards them change over time. Therefore, as impressive as the location decision has been, the battery industry is still evolving, so many projects have yet to be established. Given this dynamism, regional actors must sustain the current location selection decision for the industry as a proactive and preventative measure against the emergence of proximity-related challenges. Additionally, regional actors must sustain their efforts in continually finding solutions to addressing any possible proximity-related challenges that can influence accessibility to the industry, such as transport and connectivity

challenges. Interestingly, there is increasing regional cooperation on knowledge co-creation through emerging networks that serve as a space for strengthening transport connectivity and the supply value chain (Battery Norway, 2023; Okonkwo, 2022).

Green path development comes with different opinions and backlash, as studies on WETs have shown, e.g., where stakeholders either support or oppose the development process. Hence, cultural context and the prevailing ideologies and values influence the development process of innovative technologies (West et al., 2010). Although, to a large extent, the existing ideas on the transition to green technologies receive broad support in the Nordic countries due to the high sustainability concerns. Still, Nordic society is not immune to the various discourses (individualistic, hierarchist, or egalitarian). Therefore, being aware and cognizant of them is one of the valuable lessons for regional actors in the developmental process of the Nordic battery industry. Regional actors must still be prepared to face backlash and criticism from societal stakeholders, especially from regimes that may be agnostic to change. Consequently, actors are expected to increase their tolerance threshold and doggedness towards differing, contrasting, and or constructive ideas and opinions that may emerge as the battery industry is developed.

Effective public engagement strengthens support for the battery industry because increased engagement and participation enhance human agency toward green paths (Sovacool et al., 2020). The awareness level of the emerging industry among the populace needs to be improved. Interestingly, recent research has begun to draw attention to regional actors' potential roles in bridging the knowledge gap on the current energy transition initiative within the region (Okonkwo, 2023). Regional actors such as the government and companies can thus increase stakeholder involvement through "intentional, purposive, and meaningful actions," as this will foster the new green path (Grillitsch & Sotarauta, 2019:707). For instance, continuously creating opportunity spaces (Grillitsch & Sotarauta 2019:713) for increased involvement of the stakeholders in the different stages of the battery industry's developmental process will safeguard their interests.

Furthermore, such spaces will serve as favorable conditions for the increased attraction of investors and a skilled workforce, which are some of the essential needs within the Nordic battery industry (Kvarken.org, 2022). Other challenges in developing WETs involve "procedural and distributional justice" (Enevoldsen & Sovacool, 2016:179). Actors within the Nordic battery context can avert similar issues through intentional and purposeful action to engage all the stakeholders, leveraging their prerogative to resources and power (Grillitsch & Sotarauta, 2019).

Branding is one of the vital and yet underexplored ways to increase the knowledge of the battery industry within the Nordic context (Löfmarck et al., 2022). Knowledge shapes experience (Wood, 1970), and being informed on the prevailing green initiatives unfolding within a context facilitates the development of a new path, e.g., via an increase in public support (Binz et al., 2016; Breul et al. (2021). Regional actors as change agents need to optimize their discursive power to "influence the communicative process, visions, narratives, and imaginaries" (Suitner et al., 2022:4) by leveraging cross-sectoral knowledge from the developmental process of WETs. Thus, the task of branding the battery industry should reflect the interdependence and interaction of multiple change agents (Grillitsch & Sotarauta, 2019; Sotarauta et al., 2021; Sotarauta et al., 2022). The implication is that promoting the battery industry must be a collective effort for firm and non-firm actors rather than relegating such responsibilities to a few organizations to be "primarily saddled with advancing market cooperation and promotion" (Löfmarck et al., 2022:53). While branding the industry, it is vital for regional actors to ensure a discretionary use of their access to powers in propagating genuine information about the battery industry. Achieving this will require "greater transparency and accountability" (Sovacool et al., 2020:16). For example, areas of weakness that require more dedication and improvement must be acknowledged, such as environmental sustainability concerns (cf. Viegand 2022).

VII. Conclusions

Knowledge across sectors strengthens the agency in green path development. The paper drew valuable lessons that regional actors can leverage to advance the emerging Nordic battery industry by examining the factors that shape agency in the wind energy sector. Agency is shaped by socio-cognitive, economic, geographical, and cultural factors. Being strategic and proactive in navigating these factors and addressing potential challenges is a valuable lesson that regional actors must leverage in the developmental process of the battery industry. In practical terms, this paper is relevant in providing the necessary clues to public and private actors working to advance the battery industry, regarded as a strategic aspect of energy transition within the European Union. The emerging industry is a new experience for many actors because battery production has been concentrated in Asia until recently. Therefore, as actors in the Nordic region and across the EU countries continue their learning curve in battery development, they can leverage the points highlighted in this paper to enhance their agency. Theoretically, the paper advances the cross-pollination of knowledge through the elaborate synthesis of the literature on wind energy in advancing understanding of green path development within the Nordic context compared to other existing studies (Sotarauta et al. 2021; Sotarauta et al., 2019), which provided only a glimpse of literature on wind energy sector in green path literature. As the development of the battery industry in the Nordic region continues, the agency of regional actors will be increasingly needed to advance the industry. In that case, more cross-sector knowledge will be needed as they can further strengthen the actor's agency towards accelerated decarbonization. While the idea in this study is plausible, the paper only provides one option on how actors' agency can be strengthened; the author considers this paper limited in that there could be more nuanced ways the agency could be fostered. Future research could extrapolate cross-sector knowledge from a comparative lens by gauging actors' opinions on how their agency could be advanced.

References

- Acemoglu, D., Akgigit, U., & Kerr, W. R. (2016). Innovation network. *Proceedings of the National Academy of Sciences*, 113(41), 11483–11488. <https://doi.org/10.1073/pnas.1613559113>
- Adolfsson-Tallqvist, J., Ek, S., Forstén, E., Heino, M., Holm, E., Jonsson, H., ... & Roschier, S. (2019). Batteries from Finland. https://www.businessfinland.fi/globalassets/finnish-customers/02-build-your-network/bioeconomy--cleantech/batteries-from-finland/batteries-from-finland-report_final_62019.pdf
- Aslani, A., Helo, P., Feng, B., Antila, E., & Hiltunen, E. (2013a). Renewable energy supply chain in Ostrobothnia region and Vaasa city: Innovative framework. *Renewable and Sustainable Energy Reviews*, 23, 405-411. <https://doi.org/10.1016/j.rser.2013.03.012>
- Aslani, A., Naaranoja, M., Helo, P., Antila, E., & Hiltunen, E. (2013b). Energy diversification in Finland: Achievements and potential of renewable energy development. *International Journal of Sustainable Energy*, 32(5), 504-514. <https://doi.org/10.1080/14786451.2013.766612>
- Batel, S., Devine-Wright, P., & Rangeland, T. (2013). Social acceptance of low carbon energy and associated infrastructures: A critical discussion. *Energy Policy*, 58, 1-5. doi.org/10.1016/j.enpol.2013.03.018
- Battery Norway (2023) Report on the Nordic battery value chain. < <https://battery-norway.no/report-on-the-nordic-battery-chain/>>. 19.05.2023.
- Bell, D., Gray, T., & Haggett, C. (2005). The 'social gap' in wind farm siting decisions: explanations and policy responses. *Environmental Politics*, 14(4), 460-477. <https://doi.org/10.1080/09644010500175833>
- Bertsch, V., Hall, M., Weinhardt, C., & Fichtner, W. (2016). Public acceptance and preferences related to renewable energy and grid expansion policy: Empirical insights for Germany. *Energy*, 114, 465-477. <https://doi.org/10.1016/j.energy.2016.08.022>
- Bidwell, D. (2016). The effects of information on public attitudes toward renewable energy. *Environment and Behavior*, 48(6), 743-768. <https://doi.org/10.1177/0013916514554696>
- Binz, C., Truffer, B., & Coenen, L. 2016. Path creation as a process of resource alignment and anchoring: Industry formation for on-site water recycling in Beijing. *Economic Geography* 92(2), 172–200. [doi:10.1080/00130095.2015.1103177](https://doi.org/10.1080/00130095.2015.1103177)
- Boschma, R. (2005). Proximity and innovation: A critical assessment. *Regional Studies*, 39(1), 61–74. <https://doi.org/10.1080/0034340052000320887>
- Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*, 9(2), 27-40. <https://doi.org/10.3316/QRJ0902027>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. <http://dx.doi.org/10.1191/1478088706qp063oa>

- Breul, M., Hulke, C., & Kalvelage, L. (2021). Path formation and reformation: studying the variegated consequences of path creation for regional development. *Economic Geography*, 97(3), 213-234. <https://doi.org/10.1080/00130095.2021.1922277>
- Chlebna, C., Martin, H., & Mattes, J. (2023). Grasping transformative regional development—Exploring intersections between industrial paths and sustainability transitions. *Environment and Planning A: Economy and Space*, 55(1), 222-234.
- Coenen, L., Hansen, T., Glasmeier, A., & Hassink, R. (2021). Regional foundations of energy transitions. *Cambridge Journal of Regions, Economy and Society*, 14(2), 219-233. <https://doi.org/10.1093/cjres/rsab010>
- Dalglish, S. L., Khalid, H., & McMahon, S. A. (2020). Document analysis in health policy research: the READ approach. *Health Policy and Planning*, 35(10), 1424-1431. <https://doi.org/10.1093/heapol/czaa064>
- Dehaine, Q., Michaux, S. P., Pokki, J., Kivinen, M., & Butcher, A. R. (2020). Battery minerals from Finland: Improving the supply chain for the EU battery industry using a metallurgical approach. *European Geologist*, 49, 5-11. <http://dx.doi.org/10.5281/zenodo.3938855>
- Glaeser, E. L., Kallal, H. D., Scheinkman, J. A., & Shleifer, A. (1992). Growth in cities. *Journal of Political Economy*, 100(6), 1126–1152. <https://doi.org/10.1086/261856>
- Eisner, E. W. (1991). *The enlightened eye: Qualitative inquiry and the enhancement of educational practice*. Toronto: Collier Macmillan Canada.
- European Commission (2018). Europe on the move – Sustainable mobility for Europe: Safe, connected and clean. https://eur-lex.europa.eu/resource.html?uri=cellar:0e8b694e-59b5-11e8-ab41-01aa75ed71a1.0003.02/DOC_3&format=PDF
- Energy Vaasa (2019). Establishing a battery factory? 09.06.2019 <<https://www.gigavaasa.fi/wp-content/uploads/2019/11/gigavaasa-battery-factory-brochure-web-1.pdf>> 11.17.2021.
- Enevoldsen, P., & Sovacool, B. K. (2016). Examining the social acceptance of wind energy: Practical guidelines for onshore wind project development in France. *Renewable and Sustainable Energy Reviews*, 53, 178-184. <https://doi.org/10.1016/j.rser.2015.08.041>
- Garud, R., Kumaraswamy, A., & Karnøe, P. (2010) Path dependence or path creation? *Journal of Management Studies*, 47(4), 760–774.
- Grilli, G., Balest, J., De Meo, I., Garegnani, G., & Paletto, A. (2016). Experts' opinions on the effects of renewable energy development on ecosystem services in the Alpine region. *Journal of Renewable and Sustainable Energy*, 8(1), 013115. <http://dx.doi.org/10.1063/1.4943010>
- Grillitsch, M., & Sotarauta, M. (2019). Trinity of change agency, regional development paths and opportunity spaces. *Progress in Human Geography*, 44(4), 704–23. doi:10.1177/ 0309132519853870
- Hallan, C., & González, A. (2020). Adaptive responses to landscape changes from onshore wind energy development in the Republic of Ireland. *Land Use Policy*, 97, 104751. <https://doi.org/10.1016/j.landusepol.2020.104751>
- Hagen, B., & Pijawka, D. (2015). Public perceptions and support of renewable energy in North America in the context of global climate change. *International Journal of Disaster Risk Science*, 6(4), 385-398. <http://dx.doi.org/10.1007/s13753-015-0068-z>
- Herbert, G. J., Iniyar, S., Sreevalsan, E., & Rajapandian, S. (2007). A review of wind energy technologies. *Renewable and Sustainable Energy Reviews*, 11(6), 1117-1145.
- Ioannidis, R., & Koutsoyiannis, D. (2020). A review of land use, visibility, and public perception of renewable energy in the context of landscape impact. *Applied Energy*, 276, 115367. <https://doi.org/10.1016/j.apenergy.2020.115367>
- IRENA (2023), Geopolitics of the energy transition: Critical materials. International Renewable Energy Agency, Abu Dhabi. <https://www.irena.org/Publications/2023/Jul/Geopolitics-of-the-Energy-Transition-Critical-Materials>.
- Islam, M. R., Mekhilef, S., & Saidur, R. (2013). Progress and recent trends of wind energy technology. *Renewable and Sustainable Energy Reviews*, 21, 456-468.
- Jolly, S., Grillitsch, M., & Hansen, T. (2020). Agency and actors in regional industrial path development. A framework and longitudinal analysis. *Geoforum*, 111, 176-188. <https://doi.org/10.1016/j.geoforum.2020.02.013>
- Kardooni, R., Yusoff, S. B., & Kari, F. B. (2016). Renewable energy technology acceptance in Peninsular Malaysia. *Energy Policy*, 88, 1-10. <https://doi.org/10.1016/j.enpol.2015.10.005>
- Kekezi, O., Dall'erba, S., & Kang, D. (2022). The role of interregional and inter-sectoral knowledge spillovers on regional knowledge creation across US metropolitan counties. *Spatial Economic Analysis*, 17(3), 291-310. <https://doi.org/10.1080/17421772.2022.2045344>
- Kvarken.org. (2022) Cooperation is needed when trying to attract a skilled workforce. 06.04.2023. <<https://www.kvarken.org/en/cooperation-is-needed-when-trying-to-attract-skilled-workforce/>>.

- Leca, B., & Naccache, P. (2006). A critical realist approach to institutional entrepreneurship. *Organization*, 13(5), 627–651. <https://doi.org/10.1177/1350508406067007>
- Löfmarck, A., Lepola, A., Martinsen, K. G., Utriainen, M., Ilomäki, R. & Rintamäki, S. (2022) Nordic battery belt logistics local and regional supply chains and logistics solutions. <<https://www.kvarken.org/projekt/nordic-battery-belt-logistics-localregional-supply-chains-and-logistics-solutions/>>. 25.05. 2022.
- MacKinnon, D., Dawley, S., Pike, A., & Cumbers, A. (2019). Rethinking path creation: A geographical political economy approach. *Economic Geography*, 95(2), 113-135. <https://doi.org/10.1080/00130095.2018.1498294>
- Martin, R., & Sunley, P. (2006). Path dependence and regional economic evolution. *Journal of Economic Geography* 6, 395–438.
- Malerba, F., Mancusi, M. L., & Montobbio, F. (2013). Innovation, international R&D spill overs and the sectoral heterogeneity of knowledge flows. *Review of World Economics*, 149(4), 697–722. <https://doi.org/10.1007/s10290-013-0167-0>
- Merriam, S. B., & Tisdell, E. J. (2016). Basic qualitative research. *Qualitative research: A guide to design and implementation*. 4th ed. San Francisco, CA: Jossey-Bass.
- Merriam, S. B. (1988). Case study research in education: A qualitative approach. San Francisco: Jossey-Bass.
- Mohr, M., Peters, J. F., Baumann, M., & Weil, M. (2020). Toward a cell-chemistry specific life cycle assessment of lithium-ion battery recycling processes. *Journal of Industrial Ecology*, 24(6), 1310-1322.
- Morgan, H. (2022). Conducting a Qualitative Document Analysis. *Qualitative Report*, 27(1). <https://doi.org/10.46743/2160-3715/2022.5044>
- Ntanos, S., Kyriakopoulos, G., Chalikias, M., Arabatzis, G., & Skordoulis, M. (2018). Public perceptions and willingness to pay for renewable energy: A case study from Greece. *Sustainability*, 10(3), 687. <https://doi.org/10.3390/su10030687>
- Okonkwo, E. (2023). Technological Transition to Electric Aviation in the Kvarken Region: A Review of the FAIR Reports (Finding Innovations to Accelerate the Implementation of Electric Regional Aviation). *Journal of Geography, Politics and Society*, 13(1), 42-54. <https://doi.org/10.26881/jpgs.2023.1.05>
- Okonkwo, E. (2022). An overview of the Nordic Battery Belt: An emerging network for cooperation within the Nordic battery cluster. *Fennia-International Journal of Geography*, 200(1), 52-67. <https://doi.org/10.11143/fennia.120695>
- Park, E., & Ohm, J. Y. (2014). Factors influencing the public intention to use renewable energy technologies in South Korea: Effects of the Fukushima nuclear accident. *Energy Policy*, 65, 198-211. <https://doi.org/10.1016/j.enpol.2013.10.037>
- Rohe, S., & Chlebna, C. (2021). A spatial perspective on the legitimacy of a technological innovation system: Regional differences in onshore wind energy. *Energy Policy*, 151, 112193. <https://doi.org/10.1016/j.enpol.2021.112193>
- Seong, Y., Lee, S., Young Gwak, D., Cho, Y., Hong, J., & Lee, S. (2013). An experimental study on annoyance scale for assessment of wind turbine noise. *Journal of Renewable and Sustainable Energy*, 5(5), 052008. <https://doi.org/10.1063/1.4821811>
- Sotarauta, M., & Beer, A. (2017) Governance, agency and place leadership: Lessons from a cross-national analysis. *Regional Studies*, 51, 210–223.
- Sotarauta, M., Hansen, T., Jolly, S., & Suvinen, N. (2019). Green Path Development and Change Agency in Nordic Regions.
- Sotarauta, M., Suvinen, N., Jolly, S. and Hansen, T., 2021. The many roles of change agency in the game of green path development in the North. *European Urban and Regional Studies*, 28(2), pp.92-110. <https://doi.org/10.1177/0969776420944995>
- Sotarauta, M., Kurikka, H. & Kolehmainen, J. (2022). Change agency and path development in peripheral regions: from pulp production towards eco-industry in Lapland. *European Planning Studies*, 31(2), 1-24. <https://doi.org/10.1080/09654313.2022.2054659>
- Sovacool, B. K., Hess, D. J., Amir, S., Geels, F. W., Hirsh, R., Medina, L.R., Miller, C., Palavicino, C.A., Phadke, R., Ryghaug, M., & Schot, J. (2020). Sociotechnical agendas: Reviewing future directions for energy and climate research. *Energy Research & Social Science*, 70, p.101617. <https://doi.org/10.1016/j.erss.2020.101617>
- Suitner, J., Haider, W., & Philipp, S. (2022). Social innovation for regional energy transition? An agency perspective on transformative change in non-core regions. *Regional Studies*, 57(8), 1498-1510. <https://doi.org/10.1080/00343404.2022.2053096>
- Tian, H., Soltani, M. N., & Nielsen, M. E. (2023). Review of floating wind turbine damping technology. *Ocean Engineering*, 278, 114365.

- Tuomela, P., Törmänen, T., & Michaux, S. (2021). *Strategic roadmap for the development of Finnish battery mineral resources*. Technical Report. https://tupa.gtk.fi/raportti/arkisto/31_2021.pdf
- UNEP, U., 2011. Towards a green economy: Pathways to sustainable development and poverty eradication. *Nairobi, Kenya: UNEP*. <https://www.unep.org/resources/report/pathways-sustainable-development-and-poverty-eradication>
- Vainio, A., Varho, V., Tapio, P., Pulkka, A., & Paloniemi, R. (2019). Citizens' images of a sustainable energy transition. *Energy, 183*, 606-616. <https://doi.org/10.1016/j.energy.2019.06.134>
- Van der Horst, D. (2007). NIMBY or not? Exploring the relevance of location and the politics of voiced opinions in renewable energy siting controversies. *Energy Policy, 35*(5), 2705-2714 <https://doi.org/10.1016/j.enpol.2006.12.012>
- Wiegand, J. (2022). *Batteries in the Nordics: Changing for Circularity*. Nordic Council of Ministers.
- Voigt, C. C., Straka, T. M., & Fritze, M. (2019). Producing wind energy at the cost of biodiversity: A stakeholder view on a green-green dilemma. *Journal of Renewable and Sustainable Energy, 11*(6), 063303. <http://dx.doi.org/10.1063/1.5118784>
- Walker, G., & Cass, N. (2007). Carbon reduction, 'the public' and renewable energy: engaging with socio-technical configurations. *Area, 39*(4), 458-469. <http://dx.doi.org/10.1111/j.1475-4762.2007.00772.x>
- Walker, G., & Eames, M. (2008). Environmental inequalities: Reflections on a transdisciplinary seminar series. <https://doi.org/10.1080/13549830802475468>
- West, J., Bailey, I., & Winter, M. (2010). Renewable energy policy and public perceptions of renewable energy: A cultural theory approach. *Energy Policy, 38*(10), 5739-5748. doi.org/10.1016/j.enpol.2010.05.024
- Wiegand, J. (2022). *Batteries in the Nordics: Changing for Circularity*. Nordic Council of Ministers. <https://norden.divaportal.org/smash/record.jsf?pid=diva2%3A1660257&dsid=-380>
- Wood, L. J. (1970). Perception studies in geography. *Transactions of the Institute of British Geographers, 129-142*.
- Wüstenhagen, R., Wolsink, M., & Bürer, M. J. (2007). Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy, 35*(5), 2683-2691. <https://doi.org/10.1016/j.enpol.2006.12.001>
- Yin, R. K. (1994). *Case study research: Design and methods* (2nd ed.). Thousand Oaks, CA: Sage.