Towards inclusive regional green industry path development: Exploring the complexities in future onshore and offshore wind industry development in Norway

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Introduction: Green industry path development and need for understanding economic, social and environmental impacts

The development of new regional green industries has been a major area of research within the Evolutionary Economic Geography (EEG) Literature (see Grillitsch & Hansen, 2019; Njøs et al., 2020; Zhou et al., 2023; Rodríguez-Pose & Bartalucci, 2024)

Prior literature has also indicated that the environmental and ecological effects of regional green industrial restructuring remain less understood and there is a need for better understanding of how the development of new green industry paths contributes to greater ecological sustainability (Trippl et al., 2020; p 196)

The presence of a new green industry path in a region cannot be assumed to be an example of successful regional economic development or successful regional outcomes benefitting the people as there is also a need for understanding the concerns of the non-participating actors and crucial question of "*what kind of local and regional development and for whom*" (Breul et al., 2021; p 230)

Emerging green discontent

" *In the region of Coastal Norway, opposition to new installations of wind farms and transmission lines led to significant delays with a first local referendum held in 2002 regarding the construction of the Frøya wind farm, a concession granted in 2012 and construction terminated in 2019 (Sovacool et al., 2022). Research has also identified the emergence of a functional dichotomy between the preservation of land with strong agricultural potential and the massive expansion of renewable energy production across rural areas (Poggi et al., 2018). Moreover, the issue of natural landscape alteration has affected the social acceptance of both offshore and onshore wind farms, and only recently there have been attempts to develop quantitative indicators of the visual impact of new wind farms that can be inserted in cost–benefit analyses (Gonzalez & Rodriguez et al., 2022).* " (Rodriguez Pose & Bartalucci, 2024; p 352)

Research question

How can we conceptualize just and inclusive green industry path development that helps in better understanding the critical drivers, actors, conflicting narratives, power relationships, tradeoffs between the diverse (economic, environmental and social) outcomes and prioritizes human and ecological well being ?

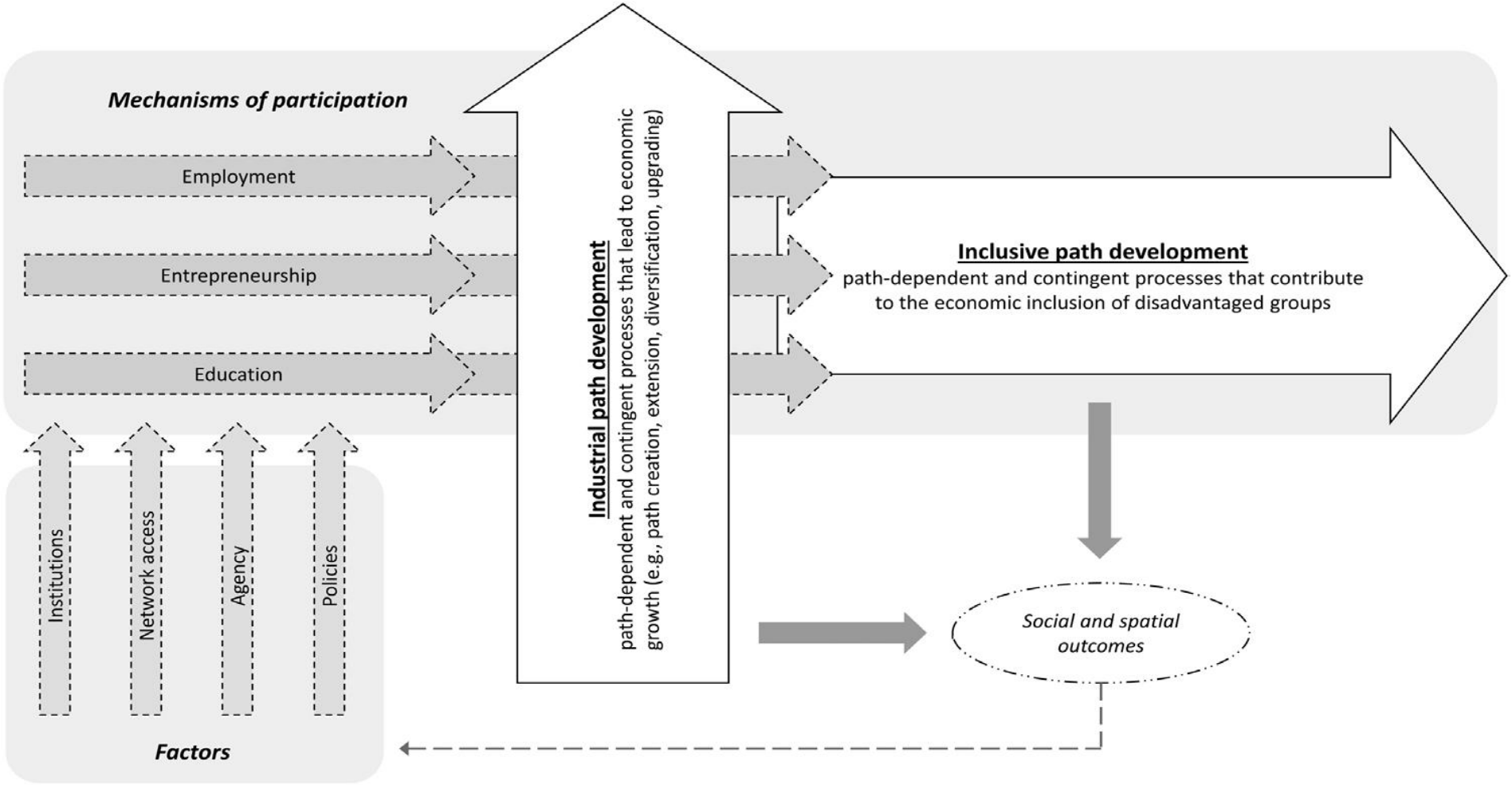
Theoretical background

Emphasis on uunderstanding the green regional restructuring process in the prior literature by identifying the role of regional assets (e.g. natural, infrastructural and material; industrial; human and institutional) (Isaksen et al., 2020; Trippl et al., 2020); change and reproductive agency at individual and system level (Grillitsch & Sotarauta, 2020; Sotarauta et al., 2021; Benner, 2024), regional structural pre-conditions (Trippl et al., 2020), multi-scalar institutional environment (MacKinnon et al., 2019) and narratives (Nilsen & Njøs, 2022; Calignano & Nilsen, 2024)

Conceptual models for inclusive path development (Benner, 2023) and green and just path development (Eadson & Van Veelen, 2023)

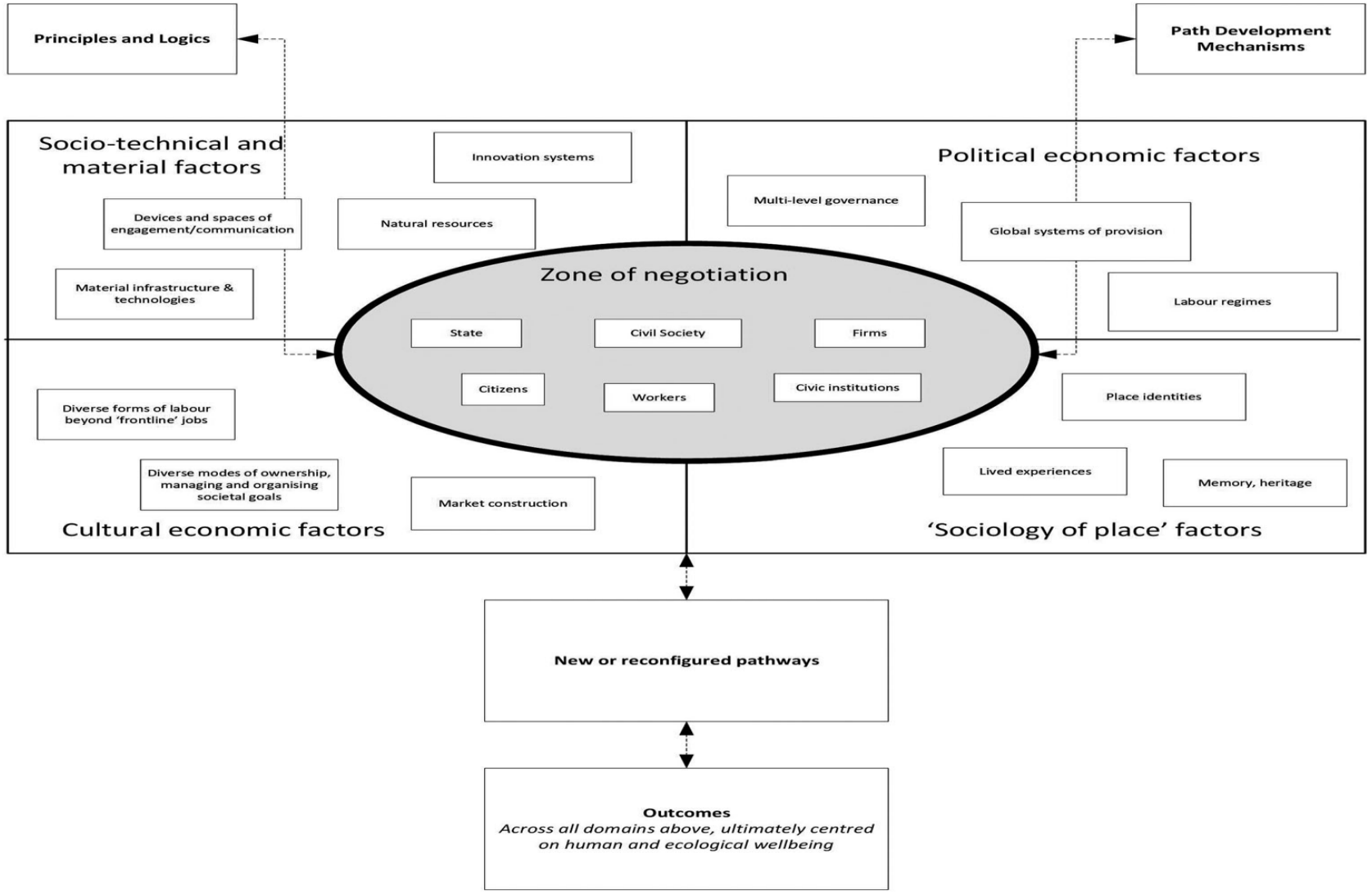
Utilizing a process perspective for studying regional path development by connecting the historical and future developments (see Jolly et al., 2020; Sotarauta & Grillitsch, 2022; Gong, 2024)

Inclusive path development model



Source: Benner, 2023a; p 449

Green and just path development as a theory of change



Source: Eadson & Van Veelen, 2023; p 227

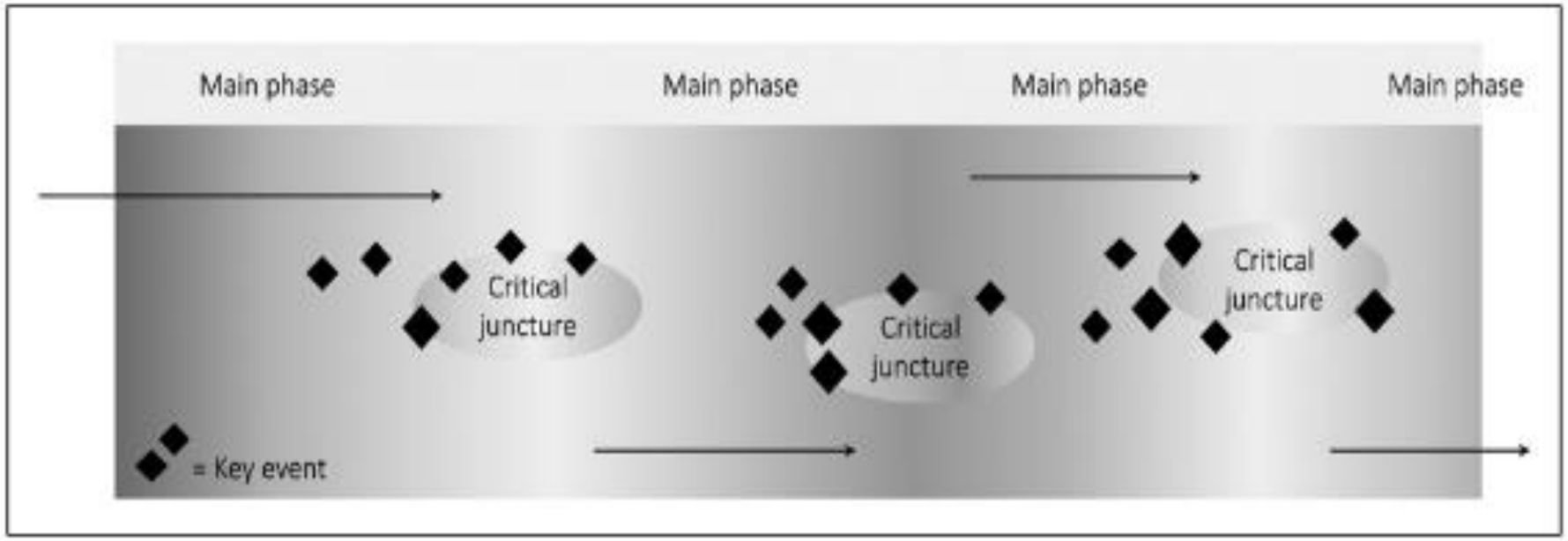
Mapping actors and agency for analyzing regional structural transformation over time

Multiple types of actors exercising different types of agency

1. New firms (e.g., start-ups or new public-private open test and demonstration initiatives)
2. Incumbent firms (e.g., large, influential firms in the regional industry)
3. Facilitating actors (e.g., universities, educational facilities, business development organizations, industry organizations, cluster organisations, science parks, and incubators)
4. Public policy actors (e.g., municipalities, regions, regional development agencies, and national-level agencies and ministries)
5. Fringe actors (e.g., civil society, ordinary citizens, user associations, environmental movements)

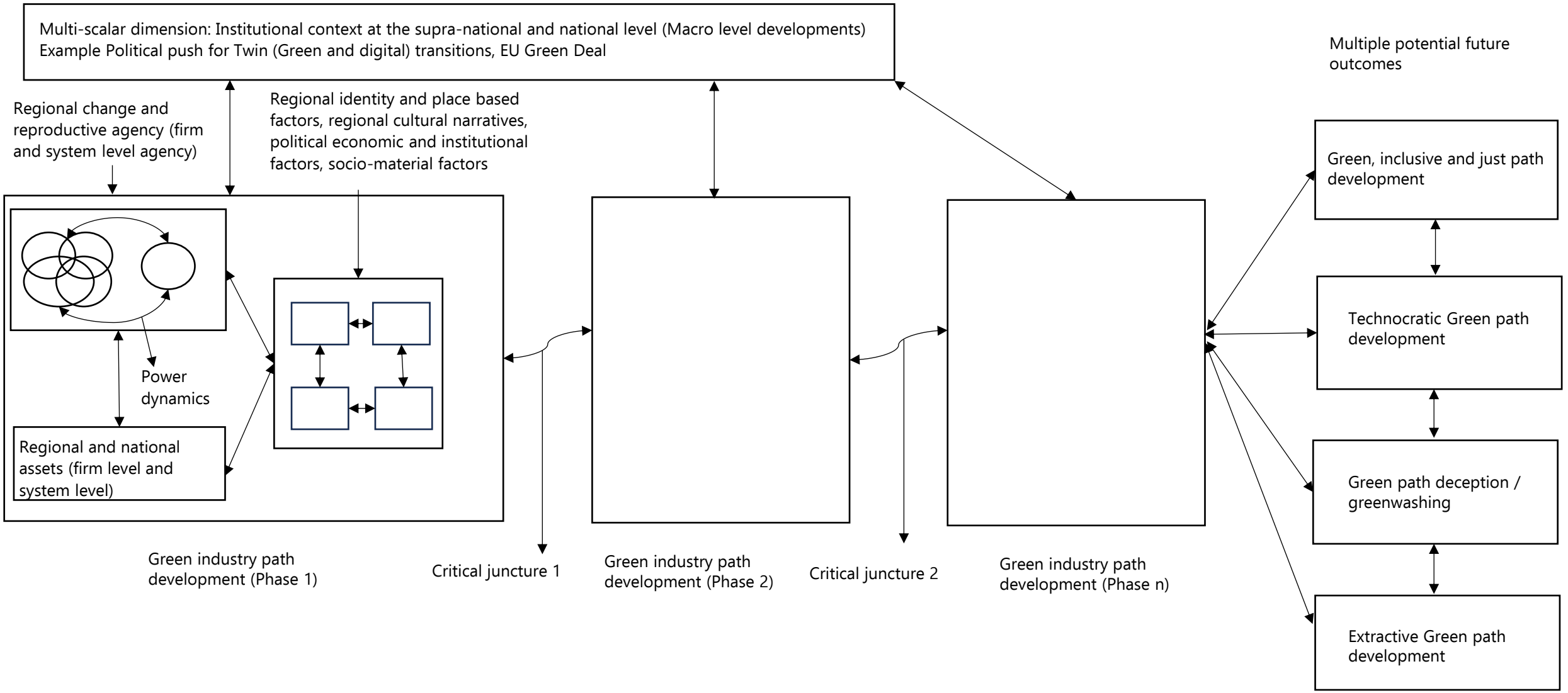
Source: Jolly, Grillitsch & Hansen, 2020; p 180

Path tracing methodology with illustration of main phases, key events and critical junctures



Source: Sotarauta & Grillitsch, 2022; p 91

Analytical perspective



Source: Own

Case of Norwegian onshore and offshore wind energy industry

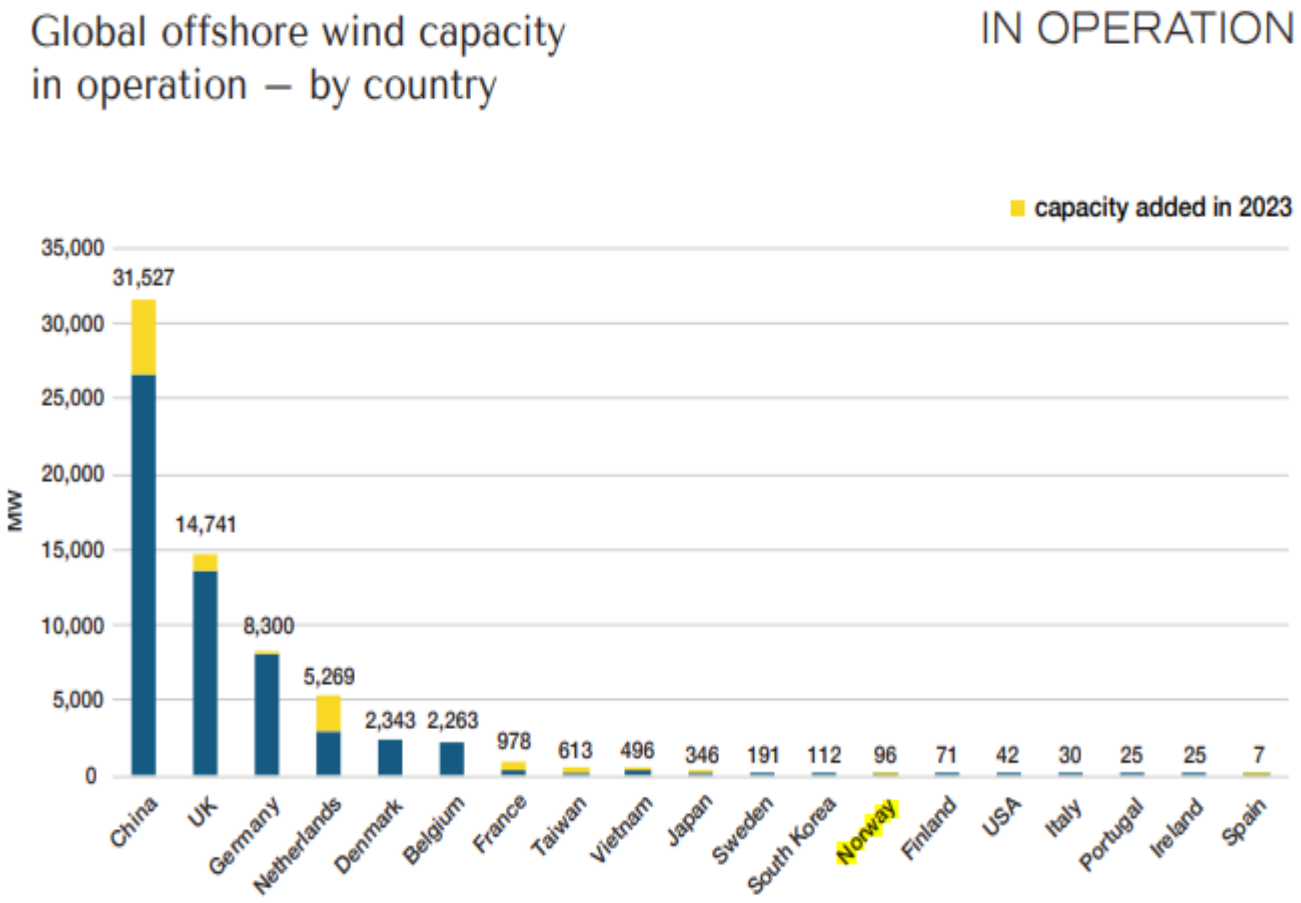
Norwegian onshore wind industry: Early beginning in 1998 and emerged from the concerns regarding the environmental impacts of large-scale Hydropower development

Norwegian offshore wind industry: Early beginning in the 2000s, the Oil and gas operators, together with suppliers, conducted feasibility studies, but developments started to take place from 2009 onwards when Statoil deployed the world's first full-scale floating wind turbine (Hywind). Offshore wind energy emerged due to the significant export opportunities for the petro-maritime industry in Norway (Steen & Hansen, 2018)

Existing literature on Norwegian onshore wind industry (e.g. Blindheim, 2013; Normann, 2021b; Nilsen & Njøs, 2022; Fjellheim, 2023a; Fjellheim, 2023b; Korsnes et al., 2023; Karam, & Shokrgozar, 2023; Kaltenborn et al., 2024; Vasstrøm & Lysgård, 2021; Vasstrøm & Lysgård, 2024; Mósesdóttir, 2024)

Existing literature on Norwegian offshore wind industry (e.g. Normann, 2015; Heidenreich, 2016; Steen & Hansen et al., 2019; MacKinnon et al., 2019; Hanson et al., 2019; MacKinnon et al., 2022; Nytte et al., 2024; Havinga et al., 2024; Skjølsvold et al., 2024; Nygaard et al., 2024)

Installed capacity of onshore and offshore wind energy industry in Norway



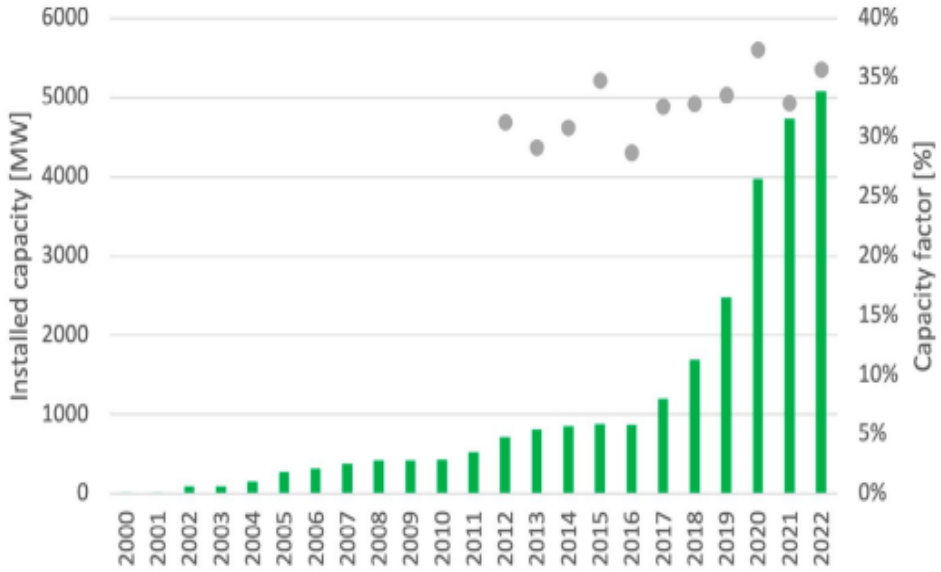


Figure 1: The columns represent accumulated onshore wind power capacity in Norway from 2000 – 2022. The dots represent the corresponding capacity factor in the given year.

Source: Global Offshore Wind Report, 2024, p 8 (https://wfo-global.org/wp-content/uploads/2024/04/WFO-Report-2024Q1.pdf); IEA, 2022; p 3 (https://iea-wind.org/wp-content/uploads/2023/10/Norway_2022.pdf)

Critical phases in the development phase of onshore and offshore wind energy

Onshore wind energy

1998-2010: Early path development phase supported by a gradual shift from large-scale hydropower development
2010-2019: Acceleration phase with regulatory and policy challenges
2019- onwards: Emerging controversies and conflicts due to the violation of the rights of the Indigenous Sami communities

Offshore wind energy

2000- 2009: Early path development phase focusing on export opportunities
2009- 2017: Increasing involvement of key O&G suppliers and diversification opportunities for the petro-maritime sector but lack of domestic market development
2017- 2022: Increased interest in the development of the OWP sector with an emphasis on floating offshore wind
2022-onwards: Increasing concerns for domestic Offshore wind capacity development due to energy security, geopolitical tensions associated with the Ukraine war leading to ambitious plans for large-scale domestic market development, and increasing environmental and social concerns

Comparison between onshore and offshore wind energy industry in Norway

	Onshore wind energy	Offshore wind energy
Supportive actors	Ministry of Energy, Norwegian Water Resources and Energy Directorate (NVE), wind turbine manufacturers and project developers	Ministry of Energy, Norwegian Offshore Directorate, NVE, Norwegian Environment Agency, FME NorthWind, Statoil, Oil and gas industry and their related suppliers, Offshore Norge, Norwegian Offshore Wind, Energirådet'
Critical actors	Sami and other indigenous communities, Civil society, NGOs, environmental activists, tourism and nature organizations, public, Supreme Court of Norway	Norwegian Fishermen's Association, WWF Norway, Bellona, Naturvernforbundet
Key regional assets	Natural assets, Infrastructural and material assets, industrial assets, institutional assets, human assets	Natural assets, Infrastructural and material assets (e.g. ports), industrial assets, institutional assets, human assets
Multi-scalar policy framework	Mis- alignment between horizonal (energy), vertical (industrial), market creation and spatial (Planning) policies (Lack of suitable spatial planning mechanisms and licensing process)	Mis- alignment between horizonal (energy), vertical (industrial), market creation and spatial (Planning) policies (Lack of domestic market development)
Key narratives supporting the industry	Meeting climate change objectives and meeting political goals to increase share of renewable energy apart from large scale hydropower development, energy self sufficiency and security and efficient production of low cost energy, creation of a domestic industry and potential for job creation	Meeting climate objectives, contribution to national and regional development and generating economic value, development of a strong export driven industry originating from the Oil and gas industry, ensuring security of energy supply, reducing cost of energy
Critical narratives	Visual and health concerns, noise, use of land, impact on wild birds and animals, impact on reindeers and their traditional migration patterns, conflicts with wildlife and negative impacts on land, conflicts with tourism activities and friluftsliv	Need for significant cost reduction and anticipated high electricity prices, negative visual and environmental impacts, risks on birds and marine wildlife, conflicts with fishing industry and other industries (petroleum, shipping and military surveillance)
Economic, environmental and social trade-offs	Limited industrial and economic development in rural and peripheral regions; Asymmetric power relations between the National state and Saami communities lead to greater colonial dispossession and violation of human rights, erosion of traditional indigenous knowledge and practices	Cost effective expansion of offshore wind industry for export vs enhancing security of supply, supporting resource nationalism and energy sovereignty; protecting the interests and rights of workers in the oil and gas industry; concerns related to electrification of oil and gas platforms and reduce electricity available for other industries; emerging environmental impact on coast and seascapes, birds, and marine life.

Discussion and conclusion

Developing an analytical perspective for understanding inclusive and just green path development by building upon the earlier conceptual models in the evolutionary economic geography (EEG) literature by also emphasizing the trade-offs between the economic, environmental and social dimensions

A process perspective that studies long term regional inclusive green and just path development by studying the critical junctures, critical events and different phases of path development is required to study both positive and negative path development outcomes in order to reduce the potential empirical bias and better analyze the benefits of green path development and for whom ?

Identifying different and potential outcomes that can be in conflict with each other in the future i.e. (1) Green, inclusive and just path development ; (2) Technocratic green path development process; (3) Green path deception/greenashing and (4) Extractive green path development

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Thank you for your time and attention!

Questions and suggestions are welcome !