

Transition pathways towards more sustainable salmon aquaculture

Transition pathways and governance

This brief summarises key findings from exploration of transition pathways for salmon aquaculture based on integration of Multi Level Perspective framework and an adapted Global Value Chain governance framework for the salmon value chain

Farmed salmon

- ✓ *Efficient sea-based production system*
 - ✓ *Salmon an important source of nutrients in healthy diets*
 - ✓ *Demand more than supplies*
 - ✓ *Producer driven value chain*
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Key challenges

- ✓ *Sea lice, disease, escape, eutrophication, algal blooms, climate change,*
 - ✓ *Public image*
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Sustainability transitions of food systems

An understanding of the dynamics of sustainability transitions, how they come about and evolve, drivers of change and structural inertia, can assist policy makers in their quest to bring about wide-ranging system transformations. Various transition theory frameworks have been developed and applied, but the Multi-Level Perspective (MLP)¹ is one of the more prominent ones and has been applied to various integral socio-technical systems including food. While the MLP framework includes policy as one dimension of the socio-technical regime, the role of power and politics in shaping transitions of socio-technical systems, mainly in the form of resistance to change has been under-theorized.

In order to focus more on actors' motivation or resistance to change, this study incorporated elements of governance analysis based on an extended GVC governance model² which was adapted to salmon⁴ and applied with the MLP framework thus resulting in an integrated theoretical framework for analysing transitions.

Salmon aquaculture and governance

Sea-based salmon aquaculture is one of the most advanced and most efficient animal-based food supply chains. Salmon is a rich source of protein, healthy fats and micronutrients necessary in the promotion of healthy diets. There are, however, several local environmental impacts associated with sea-based salmon aquaculture, such as sea lice, escapements, disease, eutrophication, and algal blooms as well as carbon emissions from the whole value chain e.g., in relation to feed production and transportation of feed and products.

The governance structure of a value chain provides information about interfirm relations and power dynamics within the chain. The Global Value Chain (GVC) governance model³ was used in the VALUMICS project to study the governance forms in food value chains, including the salmon aquaculture value chain. The governance of the global salmon value chain is a hybrid of national state led governance and voluntary third-party certifications and the inter-firm relationships can vary from free market exchanges to a hierarchy governance of integrated firms. The large integrated salmon firms are typically owned by the producers who drive technical innovation. Structural changes through mergers and acquisitions provide large producers an advantage of scale and they appear to have a strong bargaining power against the supermarkets, the lead firms in the value chain (Olafsdottir et al., 2019a,b; D5.1).

The powerful position of aquaculture producers and the mutual dependencies of business actors, aiming to maximize their profit, and the government, depending on businesses to provide jobs, tax payments and economic growth, highlights the importance of considering the role of power and resistance or motivation to change in transition studies.

¹ Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, 36, 399–417. doi:10.1016/j.respol.2007.01.003

² Gereffi, G., & Lee, J. (2016). Economic and social upgrading in Global Value Chains and industrial clusters: why governance matters. *Journal of Business Ethics*, 133(1), 25–38. doi: 10.1007/s10551-014-2373-7

³ Gereffi, G., Humphrey, J. & Sturgeon, T., (2005). The governance of global value chains. *Review of International Political Economy*, 12(1), pp.78–104.

Integrated framework for analysing transitions

Stakeholders' views

Industry and expert interviews and focus groups were conducted which provided information about the farmed salmon value chain in the context of the MLP framework.

Current regime

Governance structure affords flexibility and capacity for adjustment through incremental improvements

Power asymmetries and vested interest in current regime

The governance structure of the farmed salmon value chain points to power asymmetries. Large integrated producers are in a powerful position in the chain and are heavily invested in the traditional form of sea-based salmon farming

Landscape pressures

- ✓ *Climate change*
- ✓ *Supply & demand*
- ✓ *Global crisis*

The findings from the study as depicted in Figure 1 highlights the most prominent macro-trend developments and pressures (the socio-technical landscape), the current state of the value chain (the socio-technical regime), and the various solutions (niche-innovations) currently under development. The previous governance analysis of the farmed salmon value chain⁴ the interactions between the different levels and specifically the reactions of the current regime to landscape pressures were placed in a value chain governance perspective and looming niche-innovation breakthroughs.

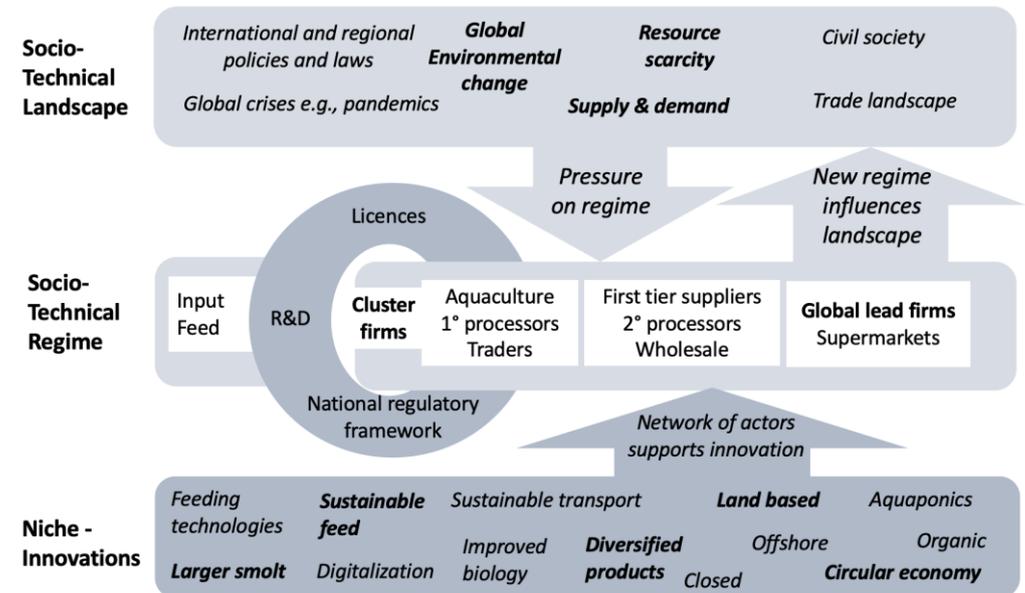


Figure 1. Summary findings through the integrated framework (based on existing frameworks^{1,2,4}) Source: Gudbrandsdottir et al., 2021

In terms of innovation and industrial development, the success of salmon farming in Norway is based on close cooperation between industry actors, governmental bodies and research institutes which contribute to a strong cluster. The hybrid form of governance, which is a mix of traditional state-based regulations (such as licenses) and voluntary instruments (such as certifications), indicates flexibility and ability to adjust. There are powerful value chain actors and networks of actors with vested economic interests in sustaining the current regime. Specifically, large integrated producers are in a powerful position in the chain, and they are heavily invested in the traditional form of sea-based salmon farming. Their hybrid governance structure also makes it easier for them to adjust to landscape pressures through incremental adjustments (symbiotic niches) to the prevalent technology of open net pens.

Concluding remarks on transition pathways

Although landscape pressure, specifically related to global environmental change and changing consumer preferences, seems to be reasonably high and on the rise, it continues to be offset by the resistance to change by powerful actors in the regime and their ability to adapt and align their production network enough to alleviate some of the pressure. Furthermore, competitive niche-innovations, such as land based, and offshore farming systems, do not seem to be sufficiently developed to compete with the highly efficient traditional sea-based farming systems. Therefore, a gradual transformation towards more sustainability within the current regime with, mainly, regime driven innovations and refinements is the most likely future.

⁴Olafsdottir, G., Mehta, S., Richardsen, R., Cook, D., Gudbrandsdottir, I.Y., Thakur, M., Lane, A. and Bogason S.G. (2019b). Governance of the farmed salmon Value Chain from Norway to the EU. *Aquaculture Europe* 44 (2): 5-19. DOI: <https://doi.org/10.5281/zenodo.5494436>

Niche-innovation development

Competitive niche-innovations (e.g., land-based on-growing) are currently insufficiently developed to compete with highly efficient sea-based net pen systems

From a food system perspective, salmon constitutes a healthy source of animal protein with relatively lower environmental impact compared to other animal protein sources. No niche so far can resolve the reliance of farmed salmon on feed ingredients from plant or marine-based proteins, and alternative feed sources come with their own drawbacks and possible unintended consequences. For salmon aquaculture to grow sustainably, livestock pressures on the environment due to feed provision would have to be achieved concurrently. Moreover, no single niche innovation as identified here adequately addresses the various sustainability challenges of the farmed salmon value chain. In addition, most of the policy-making focus has been on the production-side while there are several opportunities to address large sustainability challenges along the entire value chain e.g., through value-added activities and reduced reliance on air freight at the transportation stage.

Policy Recommendations

✓ *Broadening stakeholders' perspectives, in particular policymakers and NGOs, and reframing aquaculture challenges in a food system perspective is important for transitioning the industry towards more sustainability. The whole salmon value chain and its role in the wider food system must be considered when assessing sustainability outcomes*

✓ *Seafood has an important role to play in sustainable and healthy diets due to its nutritional profile and its relatively lower environmental footprint than most of livestock production. Integration of fish in food policy especially in relation to the protein transition, i.e., reducing the amount of animal proteins in diets, is crucial.*

Key sources for further information

This brief highlights results from the VALUMICS salmon case study analysis as reported in the deliverables and publications listed below. To discuss the research presented in this brief, please contact respective authors:

Contributing VALUMICS partners and authors:

- University of Iceland, Contacts: Gudrun Olafsdottir, go@hi.is; Nina Maria Saviolidis nms@hi.is; Ingunn Yr Gudbrandsdottir iyg1@hi.is; Sigurdur G Bogason sigboga@hi.is
- SINTEF Ocean, Norway, Contact: Maitri Thakur, maitri.thakur@sintef.no

Deliverable report:

Olafsdottir, G., Mehta, S., Richardsen, R., Cook, D., Gudbrandsdottir I. Y. Thakur, M., Lane, A. and Bogason S. G (2019a) Governance of the farmed salmon value chain from Norway, Chapter 7. In Barling, D. and Gresham, J. (Eds.) (2019) Governance in European Food Value Chains. VALUMICS “Understanding Food Value Chains and Network Dynamics”, funded by European Union’s Horizon 2020 research and innovation programme GA No 727243. **Deliverable: D5.1**, University of Hertfordshire, UK, 237p. <https://doi.org/10.5281/zenodo.4956324>

Scientific publicationsArticles and on-line webinars:

Gudbrandsdottir, I.Y., Saviolidis, N.M., Olafsdottir, G.; Oddsson, G.V., Stefansson, H., Bogason, S.G. (2021). Transition pathways for the farmed salmon value chain: industry perspectives and sustainability implications. Sustainability 13, no. 21: 12106. 2021, <https://doi.org/10.3390/su132112106>

Olafsdottir, G., Mehta, S., Richardsen, R., Cook, D., Gudbrandsdottir, I.Y., Thakur, M., Lane, A. and Bogason S.G. (2019b). Governance of the farmed salmon Value Chain from Norway to the EU. Aquaculture Europe 44 (2): 5-19. DOI: <https://doi.org/10.5281/zenodo.5494436>. Available at: <https://valumics.eu/wp-content/uploads/2019/10/Valumics-AES-vol44-2-sept2019.pdf>

Gudbrandsdottir, I. Y., Saviolidis, N.M., Olafsdottir, G., & Bogason, S. G. (2021). *Transition pathways for the farmed salmon value chain*. Online presentation at: <https://valumics.eu/final-event/>

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