

What are the implications of cultivated protein for Norwegian dairy, aquaculture, and meat industry actors? Findings from an interview study

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Motivation

- Biosynthetic protein targets complex socio-environmental challenges
- Imply many disruptions: food production, land use, health, attitudes...
- What are the implications for Norwegian food producers?

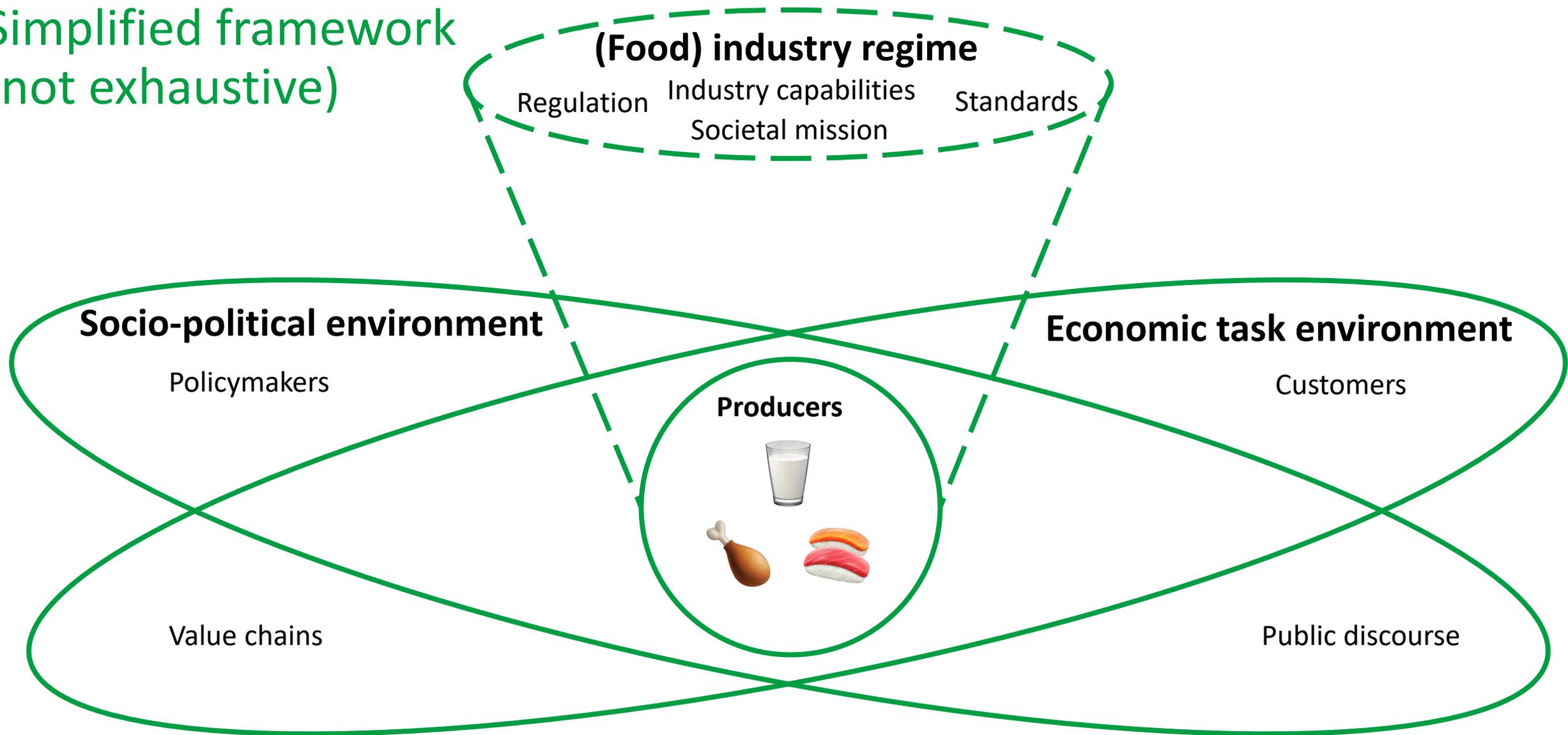
Triple embeddedness framework (TEF)

large incumbent firms can play a role in addressing grand challenges, by developing and marketing (radical) technical innovations [but] tend to be reluctant to develop radical solutions

- Geels 2014: 261

- TEF helpful for organizing reactions and responses to biosynthetic protein, as they pertain to Norwegian food system
 - Without requiring a normative position or assessment of feasibility

Simplified framework (not exhaustive)



Analytical benefit: Identify source/focus of pressures/strategies

Informants by organization type

Farmer association a
Civil society organization a
Civil society organization b
Civil society organization c
Civil society organization d
Dairy industry a
Dairy industry b
Meat industry a
Meat industry b
Research and development a
Food industry (startup) a
Food industry (established) a
Dairy industry c
Meat industry c
Food regulation
Research and development b
Media
Civil society organization e
Government think tank
Food industry (startup) b
Seafood industry a
Seafood industry b
Seafood industry c
Research and development c
Farmer association b
Government
Meat industry d
Food industry (established) b

Methods

- 28 interviews over 2 years
 - Including a workshop with four participants
- Range of attitudes to topic, but consistent focus on implications for Norwegian food producers
 - Grocery sector absent
- Video introduction offered
- Transcripts analysed for (1) implications for sector, and (2) TEF-embeddedness
- Range of terminology used in interviews,
 - **cellular/cultured food (CF)** used here

- Next: interesting and at times conflicting examples of «pressures» and «strategies»

«Pressures» in the Triple embeddedness framework

the reorientation of incumbent industries towards radical innovations that address grand challenges will require pressures from consumers, policymakers, civil society, and social movements. The accumulation of such pressures may stimulate incumbent firms to overcome lock-in mechanisms and reorient towards more radical innovations.

- Geels 2014:261

- Factors that may prompt behaviour change

Varying views on plausibility and demand

Veldig interessert i det, **følger tett** det som skjer, hva ulike selskaper gjør

- Food industry (startup) b

vi har **ikke noe uttalt politikk** på det i vår organisasjon

- Farmer association a

Inputen er ikke bærekraftig. **Mulig vi kommer dit, men en er ikke der i dag**

- Government think tank

unge i dag er mer opptatt av hvordan maten produseres

- Dairy industry c

Aquaculture pressure examples

Environment	Description	Example quote
Economic task environment	Society prefers 'natural' over 'unnatural'	<i>jeg vet at kundene og forbrukerne er veldig skeptiske til alt som ikke er naturlig fremstilt. ... dette [biosyntetiske proteiner] kan jo på en måte bli litt av det samme</i> - Seafood industry a
Socio-political environment	Threats to coastal settlement patterns	<i>det vil bli oppfattet som en trussel mot tradisjonelle bosettingsmønstre og hvordan folk har organisert fiskeriindustrien i Norge</i> - Seafood industry b

Dairy pressure examples

Environment	Description	Example quote
Economic task environment	Dairy has competitive advantages over CF: too complex to recreate, Broad nutritional value	<i>Melkematisen er så kompleks at det å stykke den opp og kjemisk fremstille den for så å sette den sammen igjen er nok ikke der de [CF] velger å gå.</i> - Dairy industry c
Economic task environment	CF is a 'manufactured' customer need	<i>At vi skaper på en måte noe kundebehov, og jeg tror egentlig det er det som er, jeg tror ikke alt, alle kundebehovene som er egentlig så nødvendig ... økonomer som kanskje ser at her kan vi skape noe, her kan vi få til noe.</i> - Dairy industry a

Meat pressure examples

Environment	Description	Example quote
Socio-political environment	CF could undermine Norwegian distributed agriculture and settlement	<i>det ville gått veldig hardt utover den spredte bosettingen i Norge, bygdene, ... som ... store utfordringer med bosettingspolitikken og den politikken vi har rundt å befolke hele landet.</i> - Meat industry c
Economic task environment	CF resonates more with consumers who are disconnected from the landscape	<i>jeg tror det at de fleste som er litt kobla på landskapet, tror jeg ikke labkjøtt vil gå så veldig hjem hos. Men det kan sikkert, ja, ja, jeg vil påstå det, at hvis man er litt løsrevet fra landskapet, så er det, høres det kanskje fornuftig ut.</i> - Farmer association a

Cross-cutting (food production) pressure examples

Environment	Description	Example quote
Socio-political environment	CF's cultural landscape implications raise political, tourism questions	<i>vil Norge gro mer eller mindre igjen av syntetiske produkt, er jo et spørsmål. Ønsker vi et gjengrodd Norge?</i> - Dairy industry a
Task environment	Limited potential in Norway to transition to growing protein-rich crops	<i>Det vi ikke kan produsere mye av i Norge er proteinrike vekster, på grunn av klimaet</i> - Food industry (established) a
Regime	Decision making in Norwegian food system is concentrated among small number of grocery chain category managers	<i>Kategorisjefer bestemmer hva som skal ligge i hyllene i butikken. Hvor stor andel plantebasert. ... Det er nesten de som bestemmer. Folk tar valg basert på hvor mye ... Hvor stor skal plantehylla være i [grocery chain]? Det er tre personer som bestemmer det.</i> - Food industry (startup) b

73 distinct pressures discussed in interviews...

...suggesting complicated path ahead for CF

	Aquaculture (15)	Dairy (13)	Meat (24)	Cross-cutting (21)
Soc-pol	<p>CF can be seen to threaten coastal settlement patterns organized around aquaculture</p> <p>Society prefers 'natural' over 'unnatural'</p> <p>Generational shift happening towards CF acceptance</p>	<p>CF will be assessed for sustainability, energy, cultural landscape</p>	<p>CF could undermine Norwegian distributed agriculture and settlement</p> <p>CF aligns with animal welfare, veganism and climate issues</p> <p>CF could make Norway dependent on international corporations for food security</p> <p>Today's lack of alternatives makes the political cost of challenging animal husbandry prohibitive</p> <p>There is a lack of political will to support CF</p>	<p>Culprit ruminants make communication difficult for producers</p> <p>CF industry more likely to develop in urban areas</p> <p>Norwegian sourcing a priority</p> <p>CF's cultural landscape implications raise political, tourism questions</p> <p>UN SDGs is systemic framework conditions for relevant policy</p> <p>Fears: rural decline, technology-dependent food security, authenticity loss</p> <p>Hopes: sustainable food industry, food literacy, food security</p> <p>CF proponents ignore complex interconnections</p> <p>Global diet recommendations ignore Norwegian needs and resources</p>
Task	<p>CF could become a competition risk for aquaculture</p> <p>Aquaculture's advantages over CF include 'natural', health benefits</p> <p>CF and animal products both target a growing protein market</p> <p>Fish feed likely route for CF entry into aquaculture value chain</p> <p>Developments in CF should be monitored by aquaculture</p> <p>There is higher receptivity to CF abroad than in Norway</p> <p>Currently CF is not of concern, and a strategic response is not necessary</p> <p>If seafood could be produced anywhere, Norway would lose competitive advantage</p>	<p>Dairy has competitive advantages over CF: too complex to recreate, Broad nutritional value</p> <p>Dairy vulnerable to ripple effects from decline in meat consumption</p> <p>CF could reinforce demand for 'natural' products</p> <p>Dairy is monitoring CF as a precaution</p> <p>Competitive advantages of CF over dairy: biosafety</p> <p>CF is a 'manufactured' customer need</p> <p>CF part of growing demand for synthetic and hybrid drink products</p>	<p>CF means competition in processed meat segment</p> <p>Beef cattle more competitive with CF than pork and poultry</p> <p>CF currently monitored as R&D area but not as near-term competitor</p> <p>CF consumer acceptance, cost-effectiveness of production, and sustainability, would prompt behavior change in meat industry</p> <p>CF might jeopardize Norway's relatively sustainable food production</p> <p>Norway nearly self-sufficient for meat and eggs, no import demand</p> <p>Norwegian consumers less receptive to CF than internationally</p> <p>Animal welfare motivations for CF are less relevant in Norway</p> <p>CF cannot become more efficient than animals</p> <p>CF could prompt increased attention to animal welfare</p> <p>CF has an easier path to Norwegian market than a new meat producer</p> <p>CF relevant to on-going search for protein feed ingredients</p> <p>High increase in protein demand expected over coming decades</p> <p>Sector has competitive advantages over CF: Increasing consumer concern with ingredients</p> <p>CF resonates more with consumers who are disconnected from the landscape</p>	<p>Norway, and increasingly EU, becoming regenerative; challenge to CF</p> <p>The coming protein shortage means seller's market</p> <p>Aquaculture more sustainable and competitive with CF than red meat</p> <p>Norwegian consumers are guided more by price than by sustainability</p> <p>CF more likely than plant-based products to replace traditional protein</p> <p>Limited potential in Norway to transition to growing protein-rich crops</p> <p>Limited systematic monitoring of CF by Norwegian food industry</p> <p>Import of CF is more likely than domestic Norwegian production</p> <p>Easier for farmers to transition away from animal use, than fisheries</p>
Regime	<p>Aquaculture sector is expected to document sustainability</p> <p>Aquaculture's societal mission includes distributed settlement</p> <p>The grocery chains define food standards such as 'no GMO'</p> <p>Norway's aquaculture processing expertise could be relevant for CF</p>	<p>Dairy supports rural settlement as social good</p> <p>CF technology might be combined with dairy infrastructures for new products</p> <p>Dairy's current collection model is expensive</p> <p>Dairy industry is producer-owned and transition to CF would require major changes to owners' operations</p> <p>Dairy highly regulated industry (production volume, competition, health)</p>	<p>UN SDGs guide meat sector developments</p> <p>Meat industry has landscape and employment benefits</p> <p>Higher prices for natural/authentic meat in response to CF could lead to better animal welfare and work conditions for farmers</p> <p>Impact of CF on meat industry more dramatic outside Norway, due to lower potential for transition towards organic production</p>	<p>In Norwegian cooperative model, owners unlikely to move towards eliminating own industries</p> <p>Norwegian Red cattle is bred for both dairy and beef, so that reductions in dairy production reduces beef availability</p> <p>Decision making in Norwegian food system is concentrated among small number of grocery chain category managers</p>

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