UiO : TIK – Centre for Technology, Innovation and Culture
University of Oslo

Modes of innovation in the upstream petroleum industry – past successes, future hindrances?

Taran Thune
TIK Centre for Technology, Innovation and Culture

Outline of talk

- Innovation in the oil and gas industry – important to understand but difficult to measure
- Modes of innovation in oil and gas
- Innovation, turbulence & transformation

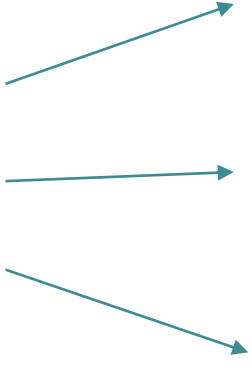
SIVAC looks at innovation and transformation among Norwegian oil and gas supplier firms

Innovation in oil and gas and supplier companies

Deployment of innovations and its role in industrial transformation

How does innovation occur in the petroleum sector generally and what is the role of suppliers specifically?

- Actors and networks
- Investments
- Processes and activities
- Results



Transformations within OG

Diversification to new OG markets

Deployment of petroleum technologies/capabilities in alternative markets and new niches

Perspective: Innovation is key for industrial transformation

The SIVAC project is built on the assumption that innovation is an engine of industrial transformation

1. To understand the potential for future transformation, one needs to understand the generation, selection and implementation of novelty in economic systems
2. Innovation occurs in systems, where different actors play different but complementary roles

The petroleum «fishtank»

Innovation in upstream petroleum and the role of suppliers

- Backdrop – a purported «Norwegian innovation paradox»
- How can it **not** be innovative when it has done all of this?

Characterizing innovation in oil and gas and the role of suppliers

- Methodologically complex task:
  1) What is innovation in this sector?
  2) Who are the petroleum supplier companies?

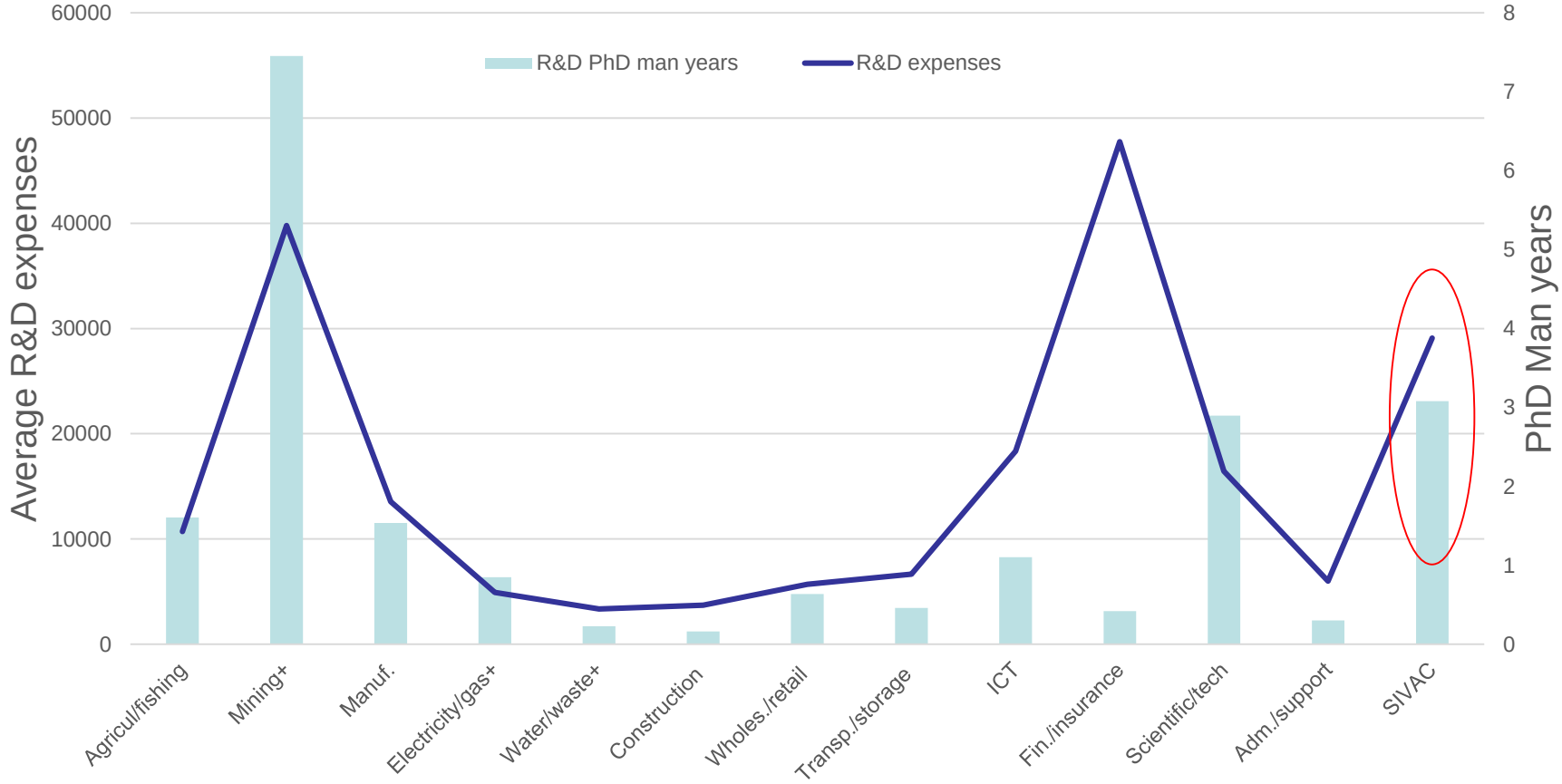
- A pragmatic choice – the “SIVAC sample”

- *Is the petroleum sector more or less innovative than other industries?*

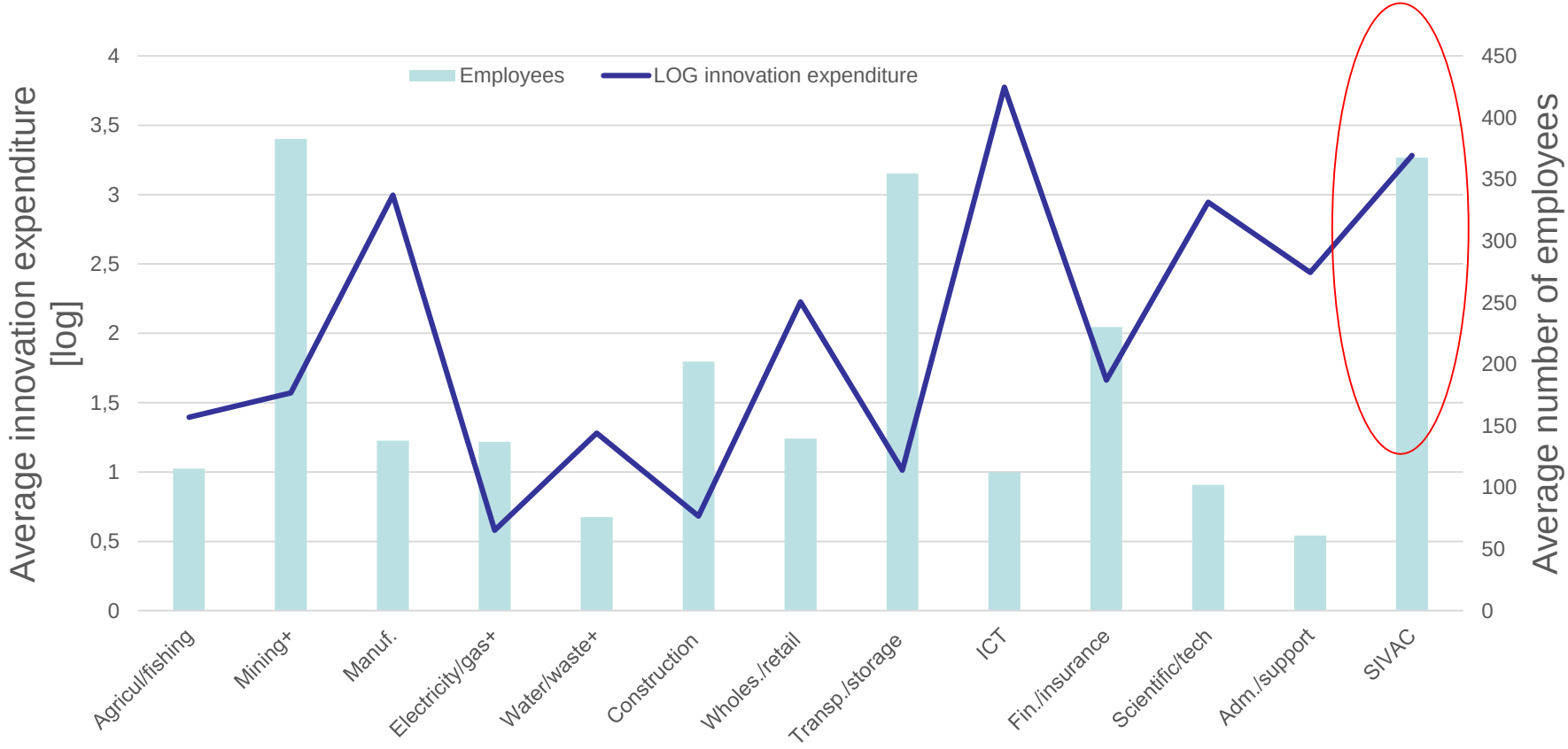
- *Is it innovative in a different way than most other sectors, and if so, what are the consequences?*

How innovative is the petroleum supply industry?

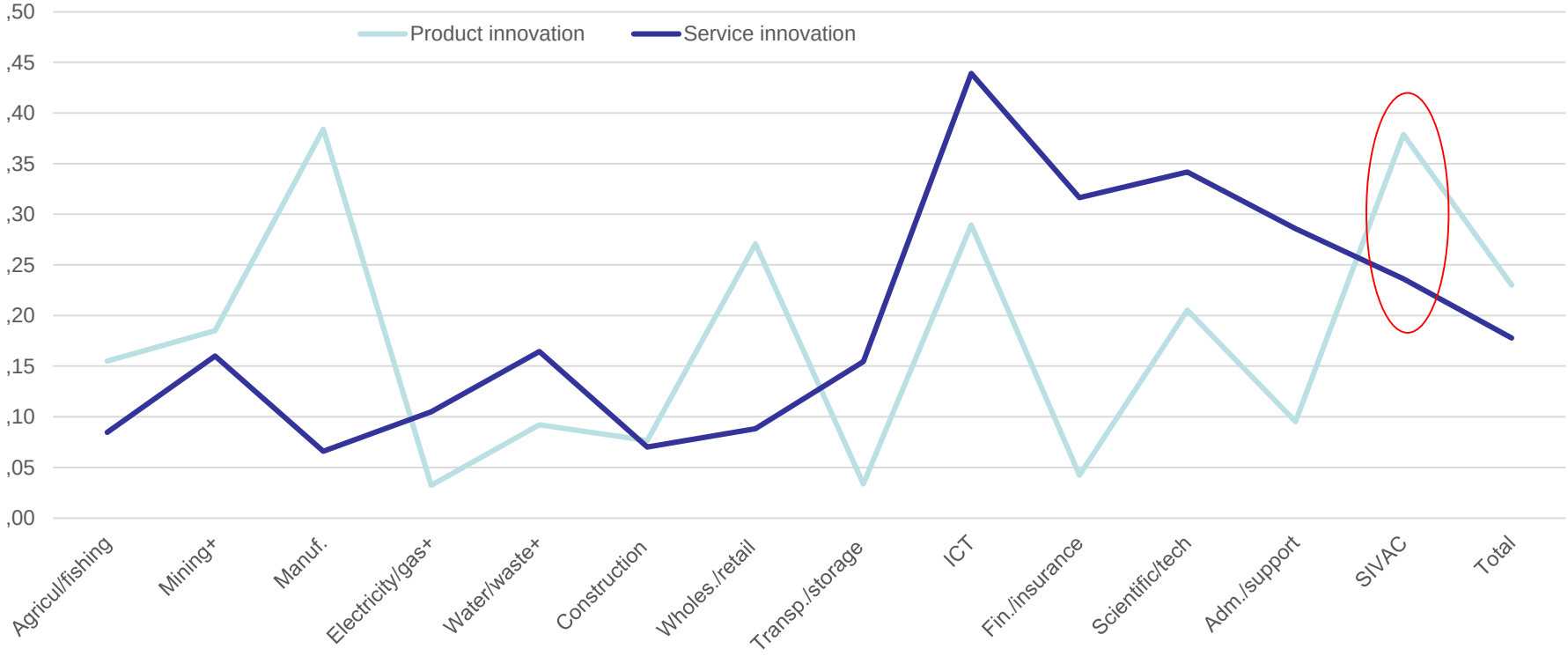
R&D expenses and R&D manpower in Norwegian industries 2014



Supplier industry compared to other industries / Sectors in Norway – innovation expenses and number of employees



Innovation activities among suppliers compared to other industries



How does the petroleum sector innovate?

Modes of innovation

STI-model

- Product development
- Investment in R&D
- Securing rights to technologies
- High formal skill level among personnel

DUI-model

- Collaboration
- Service and service-product integration
- Shared risks, less focus on securing rights to proprietary technologies
- Learning in practice

Modes of innovation among petroleum supply firms: A combined model

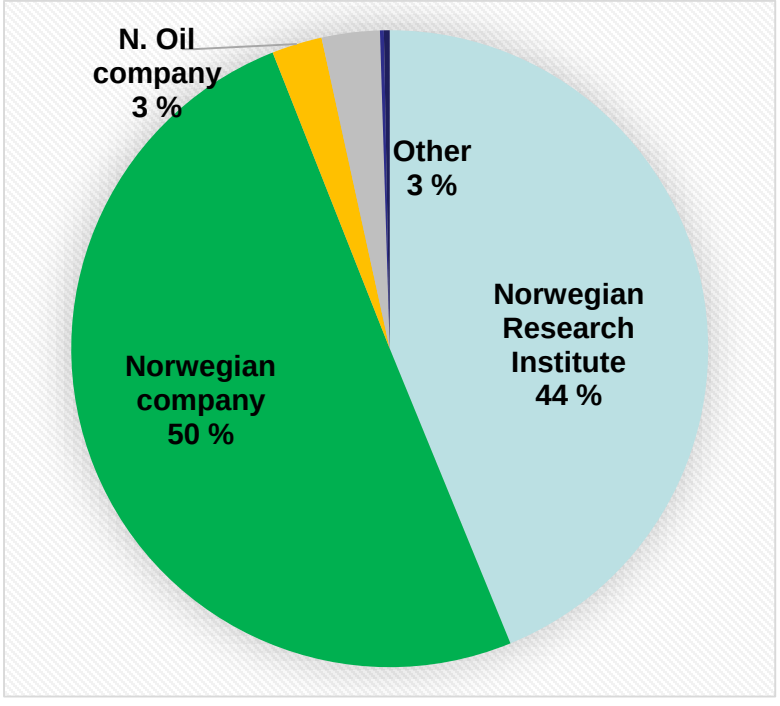
- Petroleum suppliers (and oil companies) score highly on both modes
- But the DUI-mode is far more important for innovation performance (sales from new products/services)
- This implies that for suppliers, investment in R&D is less important for innovation performance than innovation collaboration

	Industry (NACE 03	SIVAC	All companies	Mining and Quarrying	ICT	Finance and insurance	Scientific service sector
Variable							
STI	0,671*** (0,108)	0,606*** (0,223)	0,658*** (0,069)	**0,481* (0,301)**	0,717*** (0,184)	**0,785** (0,680)**	0,592*** (0,195)
STI squared	-0,244*** (0,016)	-0,224 (0,032)	-0,235*** (0,011)	-0,209 (0,44)	-0,341*** (0,034)	-0,653* (0,144)	0,171 (0,029)
DUI	0,239*** (0,183)	**0,433** (0,387)**	0,212*** (0,116)	**0,760*** (0,476)**	0,180 (0,276)	0,470** (0,561)	0,097 (0,334)
DUI squared	-0,122 (0,035)	-0,250 (0,071)	-0,109** (0,109)	-0,713*** (0,097)	-0,06 (0,056)	-0,484** (0,110)	-0,05 (0,071)
Ans_lg (control)	0,109*** (0,162)	0,119* (0,336)	0,074*** (0,089)	0,058 (0,329)	0,143*** (0,262)	0,348*** (0,408)	0,143*** (0,295)
R^2	0,333	0,347	0,286	0,17	0,244	0,251	0,242
N	1155	275	3192	159	470	160	324

* P<0.1 ** P<0.05 *** P<0.01

Collaborative innovation and the role of suppliers

- Collaboration is a main mechanism for innovation in the sector
- Networks in the sector are dense and dominated by a few actors
- Supplier companies are peripheral in the network
- Frequently manage collaborative projects



Share of petroleum related R&D projects where a supplier firm act as project manager (NRC data)

A successful model – but with considerable risks of “lock-in”

- High degree of dependence on few clients
- Bespoke innovation and customization is costly
- Risk adversity
- Incremental technology development
- A over-embedded network
- Informal, high degree of institutionalized trust

What happens to the innovation model if demand decreases or the technological problems to be solved are radically new?

The prevalent innovation model is good for handling turbulence

- Industry-wide engagement in programs to increase efficiency, process innovation, standardization and cost-cutting
- Spreading risks through use of collaboration and public-private partnerships
- Use of slack resources for innovation projects whilst demand is low (temporarily)
- Support from policy and public resources

But a deeper crisis is unfolding for high tech supplier companies

- The current situation is not only seen as a “slump” but as transformative crisis that demands more radical solutions
- Suppliers have to continue to invest in technology development and verification themselves
- High degree of uncertainty about the ability to recoup investments and the future demand
- Need to engage in business model innovation, but uncertain about how to do it

Implications for policy

- Norway's most innovative industry – is it possible to transform and strengthen it?
  - Lessen dependence on clients
  - Increased diversification (and policies to support this process)
  - Build sustainable innovation models at system level
  - Use public investment to support business model transformation as part of R&D&I support, not only target the «tech» part

Further information

- Presentation is based on the work by Erlend Simensen, Jakoba Sraml Gonzalez, Taran Thune & Ole Andreas Engen

- Forthcoming in "***Transformations in the Petroleum Innovation System: Lessons from Norway and Beyond***" (Routledge, 2018)