

Supply chain configuration of intensive aquaculture production in Europe – a transaction cost perspective

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- Introduction to RAS production
- Theoretical framework
- Literature review
- Methods
- Results
- Discussion
- Conclusion

Advantages of RAS production

(Wedekind 2008)

- Water saving
- Pollution output reduction
- Location independence
- Better control of the growth conditions
- Independence from seasonal variation
 - Better planning of quality and quantity



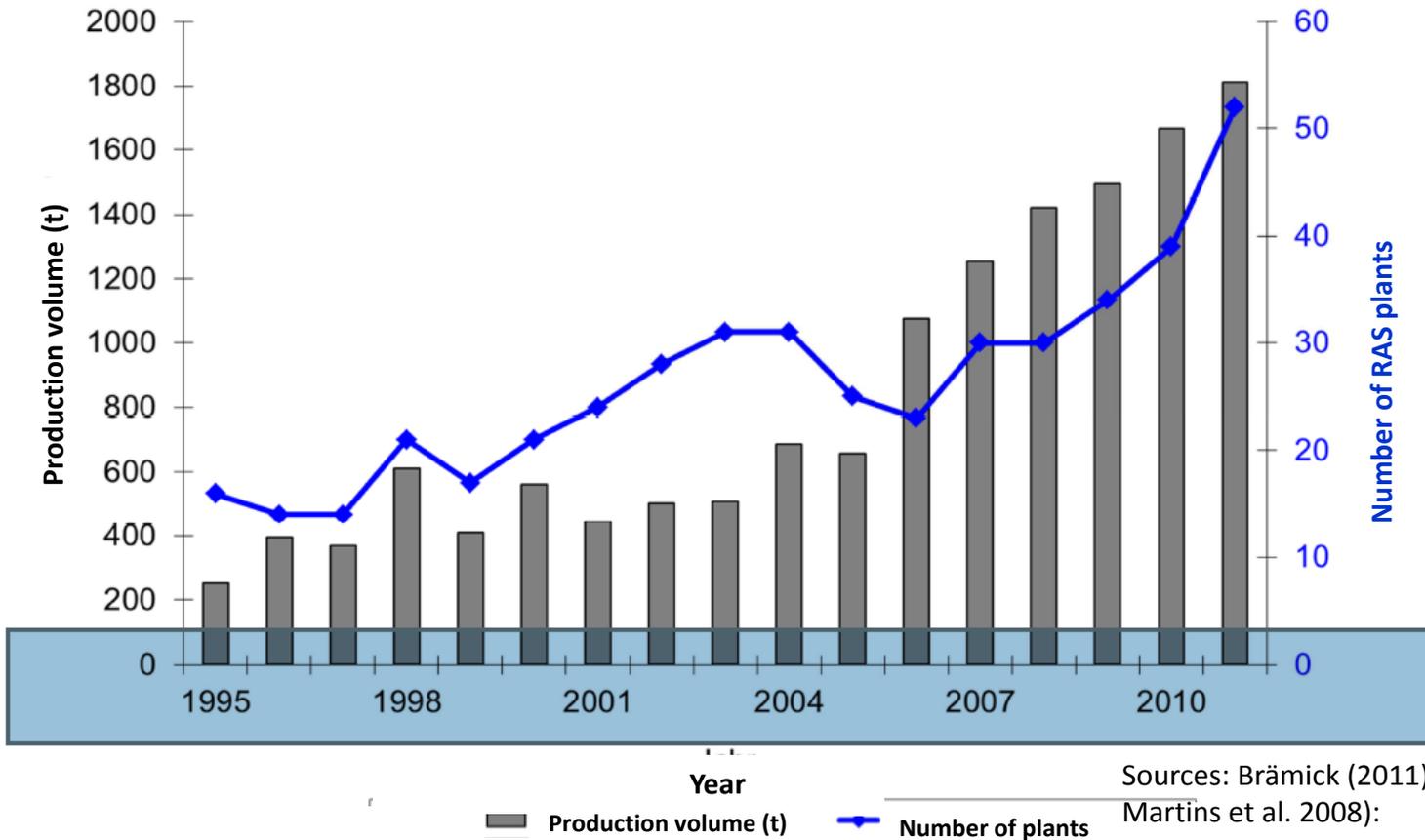
Source:
Bundesverband Aquakultur 2013

The main fish producing countries for RAS in Europe:

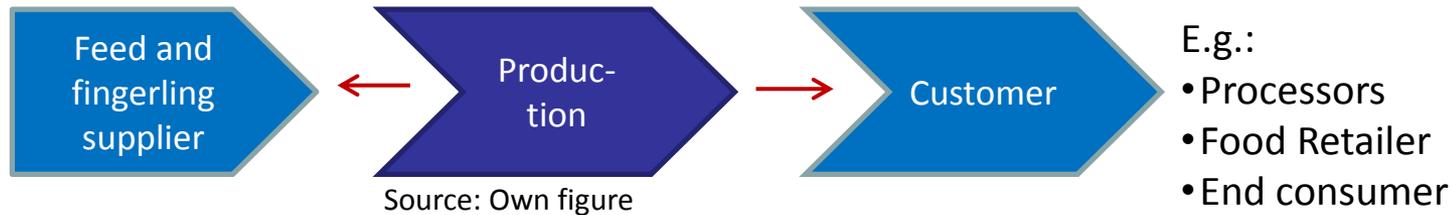
Martins et al. 2008

1. Denmark (trout and eel)
2. Netherlands (catfish and eel and other species)
3. Germany (various species)

Development of RAS production in Germany



- **Production** (Wedekind 2008)
 - High setup costs
 - Relatively high energy expenditure
 - Specific production know how required



- **Business relationships**
 - Uncertainty in the procurement of fingerlings
 - High uncertainty in the sale of the fish
 - Often, no viable prices are achieved

How do producers arrange their business relationships within the supply chain and which recommendations for an adequate supply chain coordination can be given based on the theoretical considerations?

- Identification of the structure and coordination of the supply chain
- Evaluation of the current coordination of the supply chain in RAS production
 - Transaction cost theory

- Literature review
- Expert interviews
 - Development of an interview guideline based on the TCT framework
 - qualitative expert interviews in Germany
 - 8 fish producers
 - 2 fingerling producers
 - 1 processor
 - Transcription and analysis of the interviews

- Transaction costs
 - Costs incurred for the exchange (transaction) of goods
 - Ex-ante: Search and information costs / bargaining costs
 - Ex-post: Monitoring, enforcement and adjustment costs

Behavioral assumptions

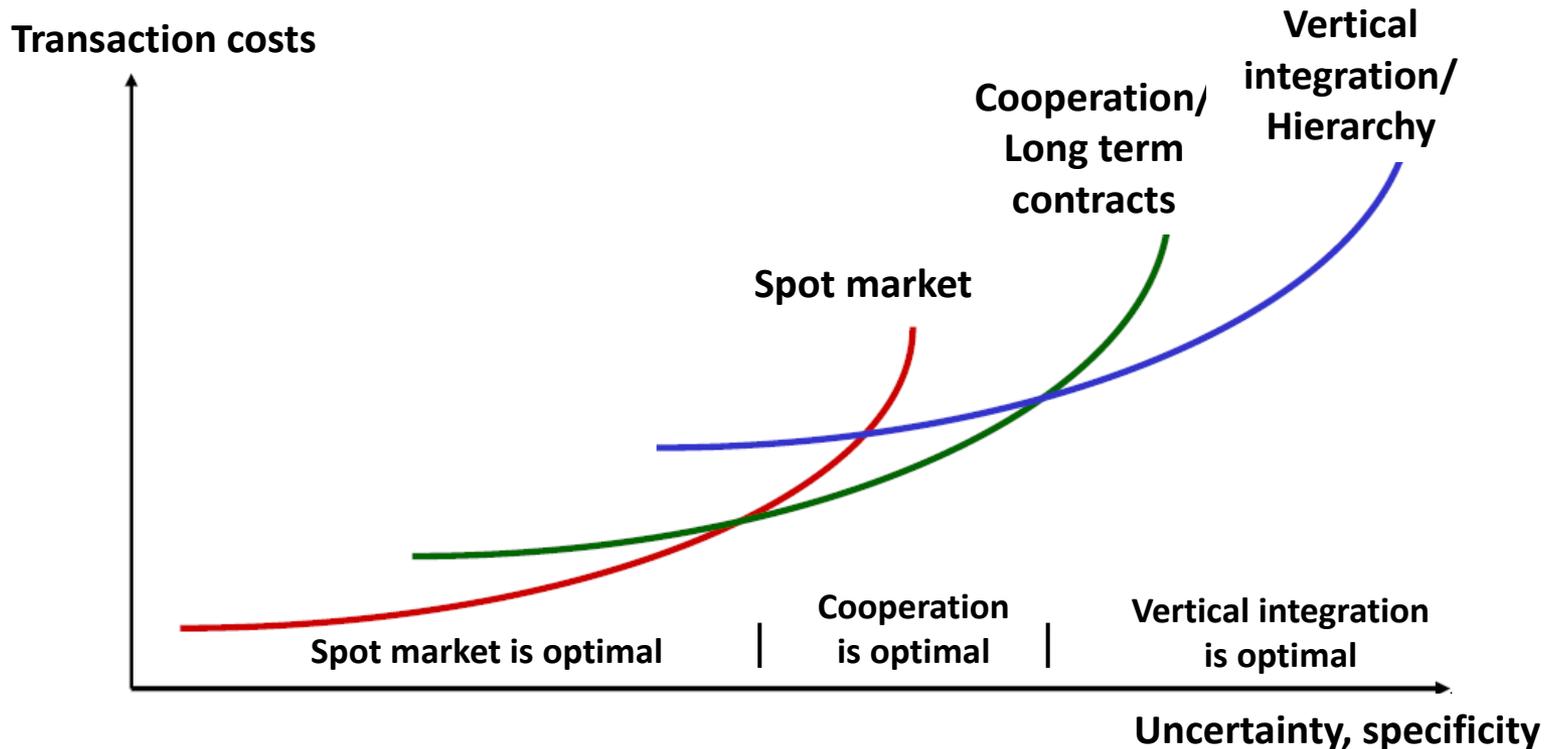
- Bounded rationality
- Opportunistic behavior

Variables

- Specificity
 - The extent to which a physical or human investment has a higher value to one specific transaction than for all other possible transactions
- Uncertainty
 - Parametric uncertainty
 - Behavioral uncertainty

Main conclusion:

- **Uncertainty** and **specificity** of a transaction increase transaction costs
- The higher the extent of specificity and uncertainty in a business relationship, the more worthwhile it is to integrate vertically



Source:
Williamson 1975

- Only a few studies about the coordination of aquaculture supply chains were found
- Some of them used a TCT framework
E.g.: Pereira and Gameiro 2007; Aarset et al. 2000; Tveteras and Kvaloy 2004

Results

- Tendency toward closer vertical coordination
Van Duijn et al. 2010; Tveteras and Kvaloy 2004
- Reasons for a closer vertical integration
 - Risk reduction /sharing (because of existent uncertainty)
Van Duijn et al. 2010; Pereira and Gameiro 2007; Aarset et al. 2000; Tveteras and Kvaloy 2004
 - Strengthen the market position
Van Duijn et al. 2010 ; Tveteras and Kvaloy 2004
 - Generate efficiency and cost savings
Van Duijn et al. 2010 ; Tveteras and Kvaloy 2004



Source: Own figure

- E.g.:
- Processors
- Food Retailer
- End consumer

How to measure uncertainty and specificity?

Measurement of uncertainty

Parametric uncertainty

- Uncertainty with regards to suppliers (e.g. procurement of feed and fingerlings)
 - Uncertainty of factor supply
 - Uncertainty of factor prices
 - Uncertainty of qualities
- Uncertainty with regards to customers (e.g. food retail or end consumer)
 - Sales uncertainty
 - Price uncertainty

Behavioral uncertainty (opportunistic behavior of business partners)

- Suspect
- Duration of the business relationships
- opportunistic behavior (potential and observed)

Measurement of specificity

Specificity with regards to suppliers

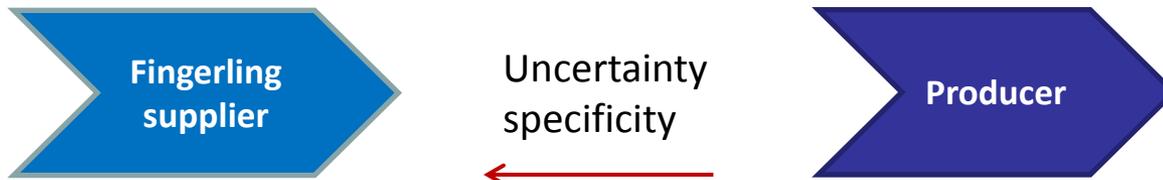
- *Dependence on suppliers*
- *Specific investments*

Specificity with regards to customers

- *Dependence on customers*
- *Specific investments*

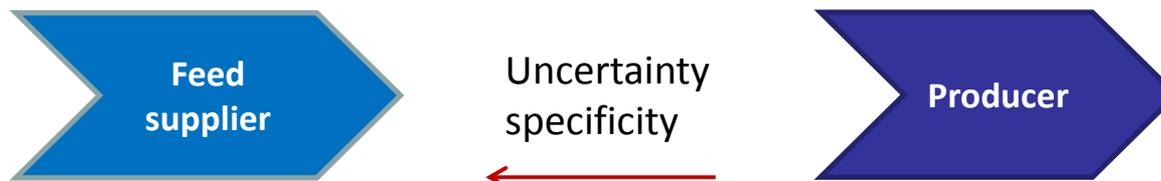
Fingerling supplier	
Uncertainty	high
Uncertainty of factor supply	very high
Uncertainty of factor prices	medium
Uncertainty of qualities	very high
Behavioural uncertainty	low to medium
Specificity	medium
Dependence on suppliers	medium to high
Specific investments	low

➤ *Close vertical coordination is recommended based on TCT*



Feed supplier	
Uncertainty	low
Uncertainty of factor supply	low
Uncertainty of factor prices	medium
Uncertainty of qualities	low
Behavioural uncertainty	low
Specificity	low to medium
Dependence on suppliers	medium
Specific investments	low

➤ *Close vertical coordination is not necessary*



Customer	
Uncertainty	high
Sales uncertainty	very high
Price uncertainty	High
Behavioural uncertainty	medium to high
Specificity	medium
Dependence on customers	medium to high
Specific investments	low to medium

➤ *Close vertical coordination of processing and marketing is recommended based on TCT*



Comparison of the Current market coordination and theoretical recommendations

Current market coordination

Business partner	Spot market	Long term contracts	Vertical integration
Feed supplier	+++	0	0
Fingerling supplier	+	+	+
Customer	+	+	++(Processing/Marketing)

Theoretical optimal market coordination (red boxes)

Business partner	Spot market	Long term contracts	Vertical integration
Feed supplier	+++	0	0
Fingerling supplier	+	+	+
Customer	+	+	++(Processing/Marketing)

- Trend towards cooperative companies with horizontal and vertical integration



But:

- Some producers only use spot markets

- Tendency towards vertically and horizontally integration
 - Reduction of uncertainty (TCT)
 - Strengthen the market position
Van Duijn et al. 2010 ; Tveteras and Kvaloy 2004
 - Generate efficiency and cost savings
Van Duijn et al. 2010 ; Tveteras and Kvaloy 2004
- Some producers only use spot markets
 - High level of trust (reduction of behavioral uncertainty)
 - High production uncertainty and small producers
 - Inability to ensure fulfillment of the contracts

- Uncertainty is an important reason to integrate vertically (as assumed by the TCT)

Not all observations can be explained by TCT

- Further explanations for closer coordination
 - Improvement of bargaining/market power
 - Improvement of efficiency and saving costs
- Further explanation for less coordination
 - Low reliability in production process

Limitations of the Study

- Small number of interviews so far
- The market conditions for different species differ significantly

- Further Interviews of members of the supply chain from Germany, Denmark and Holland
- International online survey of RAS producers (quantitative)

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