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Vertical coordination in food supply chains: challenges and perspectives

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SIDEA-SIEA Conference 2017

Outline

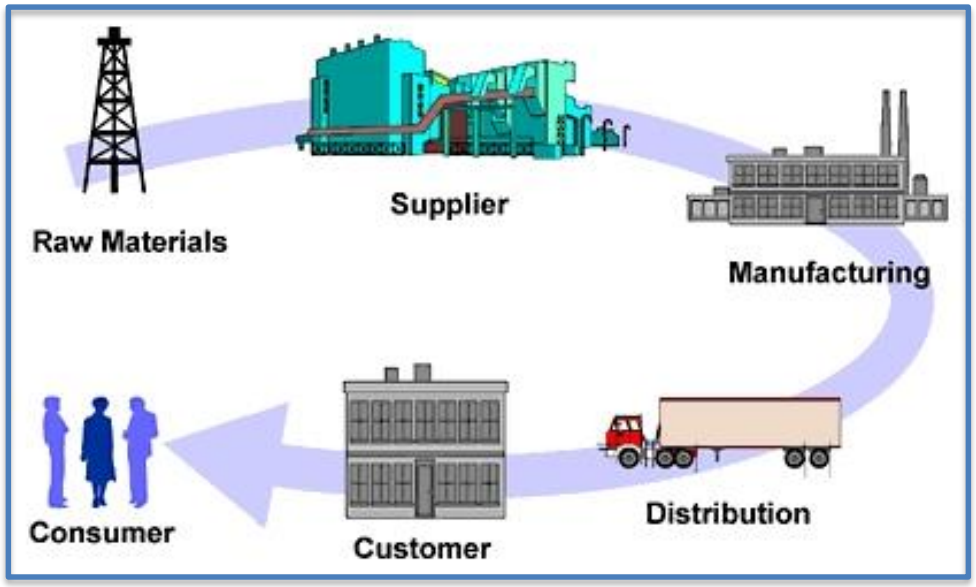
Three parts:

- **Conflicts** of interest and **vertical coordination** in food supply chains
- The **different theoretical approaches** to supply chain analysis
- The role of **internal and external risks** in the vertical coordination

AIMS → which is the **role of risks** in affecting the **vertical coordination** in food supply chains → **factors** which can be classified as **internal and external risks** in food supply chains → Can external risks affect vertical coordination? Is the coordination of food supply chains a tool not only to solve internal conflicts, but also to tackle external risks?

Part 1

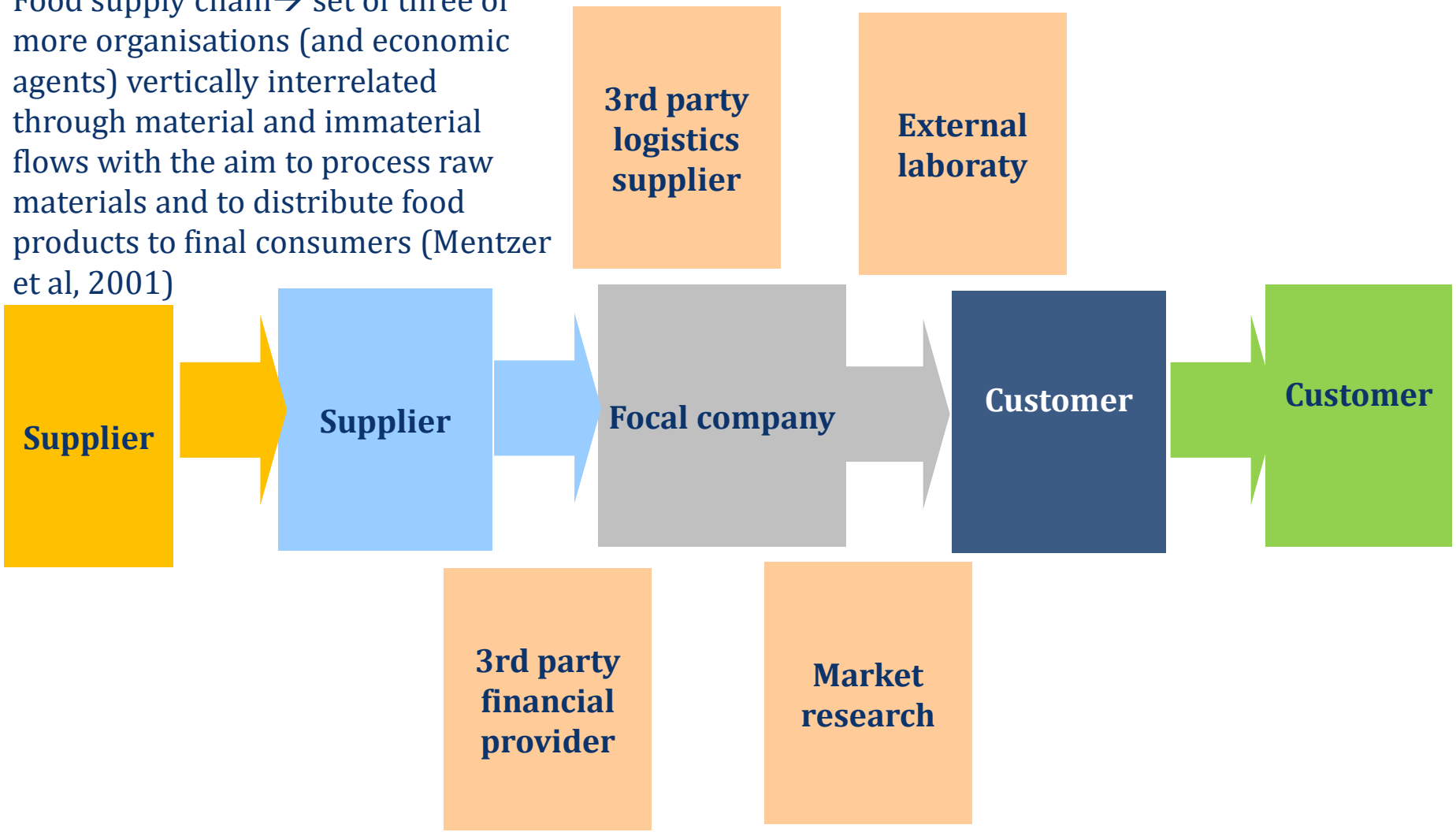
Conflicts of interest and vertical coordination in the food supply chains



http://tedorcg.com/SupplyChain/

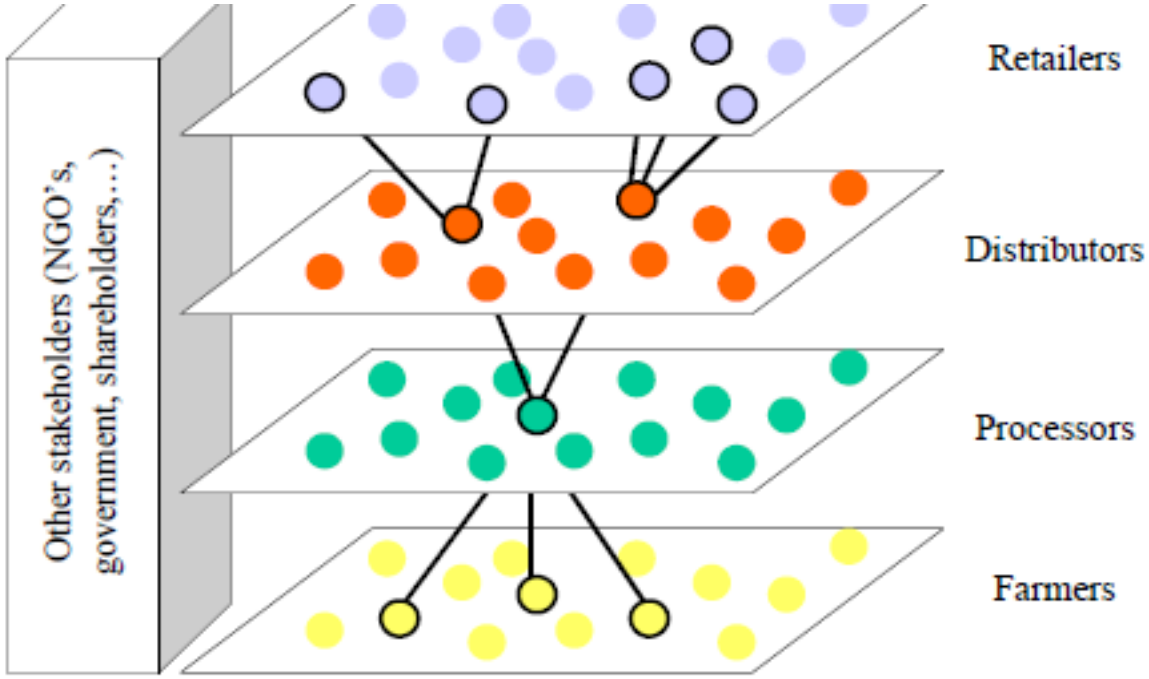
Food supply chain (FSC)

Food supply chain→ set of three or more organisations (and economic agents) vertically interrelated through material and immaterial flows with the aim to process raw materials and to distribute food products to final consumers (Mentzer et al, 2001)



Food supply chain

- Structure of a complex supply chain →Chain networks



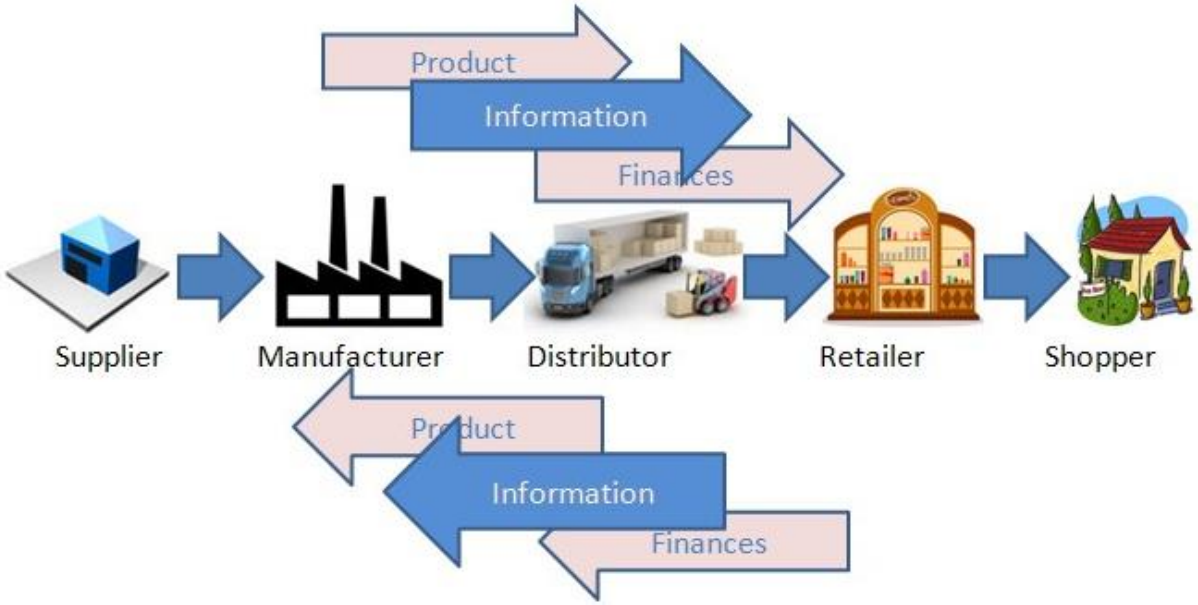
Adapted from Lazzarini et al. 2001

Food supply chain

Functioning of the chain →

Chains function through several **distinct** but **interrelated flows** (upstream and downstream) :

- Products
- Services
- Finances
- Information
- Knowledge



Conflicts of interest in food supply chain

- Following the **neoclassical theory** → in FSCs single companies try to maximise profit (Π) → vertical interrelations → max Π of company *j* implies a reduction in costs (*TCj*) that are strongly related to the revenue (*TRi*) of the supplier *i* → **conflict of interests**

$$\text{firms} \quad i \rightarrow j \rightarrow k$$

$$i \rightarrow max\ \Pi_i = TRi - TCi$$

$$j \rightarrow max\ \Pi_j = TRj - TCj\ (TRi)$$

$$k \rightarrow max\ \Pi_k = TRk - TCk(TRj)$$

Conflicts of interest in food supply chain

$transaction\ qi \rightarrow from\ i\ to\ j$

$i \rightarrow max\Pi_i \rightarrow maxTRi$

$j \rightarrow max\Pi_j \rightarrow minTRi$

$transaction\ qj \rightarrow from\ j\ to\ k$

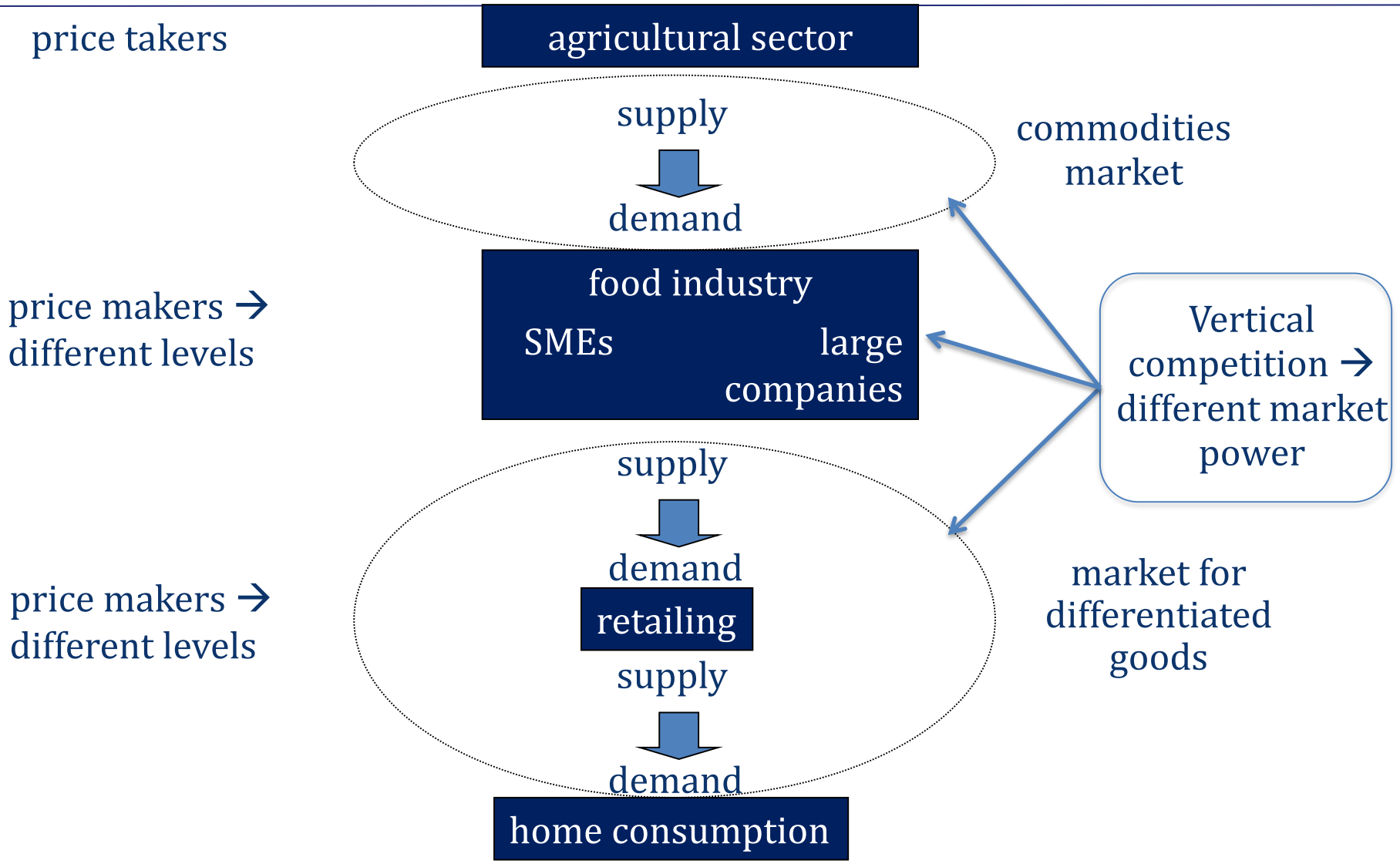
$j \rightarrow max\Pi_j \rightarrow maxTRj$

$k \rightarrow max\Pi_k \rightarrow minTRj$

$\rightarrow \boldsymbol{market\ price}$
$(and\ quantity)$

$\boldsymbol{p_i}\ (\boldsymbol{qi})\ and\ \boldsymbol{pj}(\boldsymbol{q_j}), \rightarrow \boldsymbol{transaction}$

Conflicts of interest in food supply chain



Conflicts or coordination in the food supply chain

- In the FSC there is a strong **price conflict → vertical competition →** all firms have **private goals**
- As the focal company deals with other businesses such as suppliers or buyers, is the ***simultaneity*** of competition and co-operation possible? → both **private goals** and **common goals**
- Several cases:
  - **Vertical integration →** wine SC, short SC
  - **Cooperatives**
  - **Private label supply chains**
  - **Food safety, quality and sustainability standards →** traceability
  - **Logistics**

Vertical coordination

- **Vertical coordination** → set of tools/ways to manage exchanges in FSCs, coordinating strategic behaviour and increasing the efficiency of FSCs (Sodano, 2004) → different levels
- **Cooperation** → collaboration among the economic agents of the FSCs to reach a goal
- **Governance** → ways of making the vertical exchanges among the economic agents of the FSCs
- Types of transaction **governance**:
  - market
  - hybrid forms
  - hierarchies

Vertical coordination

- Types of transaction governance in food chains
  - **markets** → spot market, commodity exchange, future markets, fruit & vegetables market
  - **hybrid forms** → contracts, agreements, inter-professional agreements, **standards**
  - **hierarchies** → vertical integration, cooperatives
- Degree of **vertical coordination**
  - spot markets
  - contracts, agreements, traceability, quality standards (PDO, PGI), sustainability standards (IPM), organic, private labels
  - cooperatives
  - vertical integration

Vertical coordination

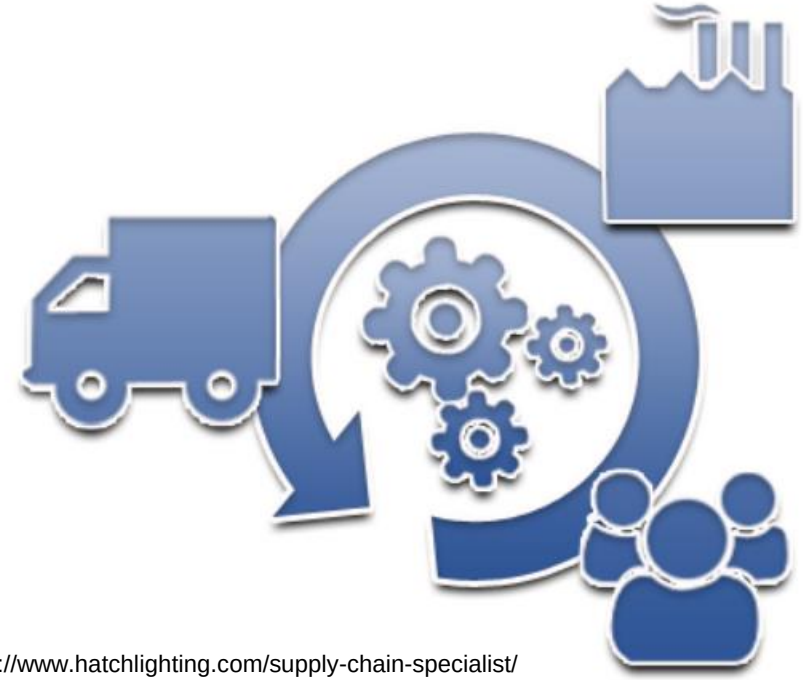
Classification of the standards

Several voluntary standards are present within food supply chains → Such standards can be **classified in different ways**, mainly depending on the object of the analysis:

- type of stakeholder involved → B2B or B2C
- scheme owners → **private standards**, **public standards**, **civil society standards**
- types of product involved → specific product, categories, all products
- legal validity → national or international
- **level of standard complexity** (for ex. traceability)→ simple scheme or complex (type of procedures, etc.) → different levels of vertical coordination

Part 2

The different theoretical approaches to supply chain analysis



http://www.hatchlighting.com/supply-chain-specialist/

Theoretical approaches to supply chain analysis

Several theoretical approaches:

- **Economic approaches**
  - Neoclassical theory
  - New Institutional Economics
- **Managerial approaches**
  - Supply chain management (Matopoulos et al., 2007; Ringsberg, 2014)
  - Organization theory (individual)
- **Behavioural approaches**
- **Sociological approaches**

Supply Chain Management

Definition of Supply Chain Management (SCM)

SCM is the integrated planning, coordination, and control of all **logistical business processes and activities** in the supply chain (SC) → All businesses along the chain **work together and communicate effectively** → **joint responsibility** for delivering a product to consumer demands

Aim of Supply Chain Management → to deliver superior consumer value at lower cost to the SC as a whole while satisfying the requirements of other stakeholders in the SC → **improving competitiveness of the value chain as a whole**

Reduce costs! *Increase efficiency!*

$$\frac{\text{Net Profit}}{\text{Total Asset}} = \frac{\text{Net Profit}}{\text{Net Sales}} \times \frac{\text{Net Sales}}{\text{Total Asset}}$$

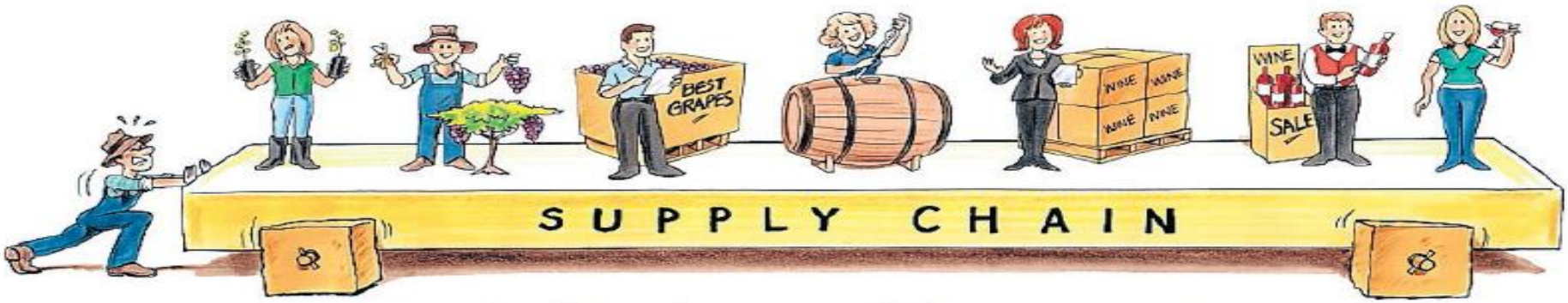
Supply Chain Management

Value vs. Supply Chain

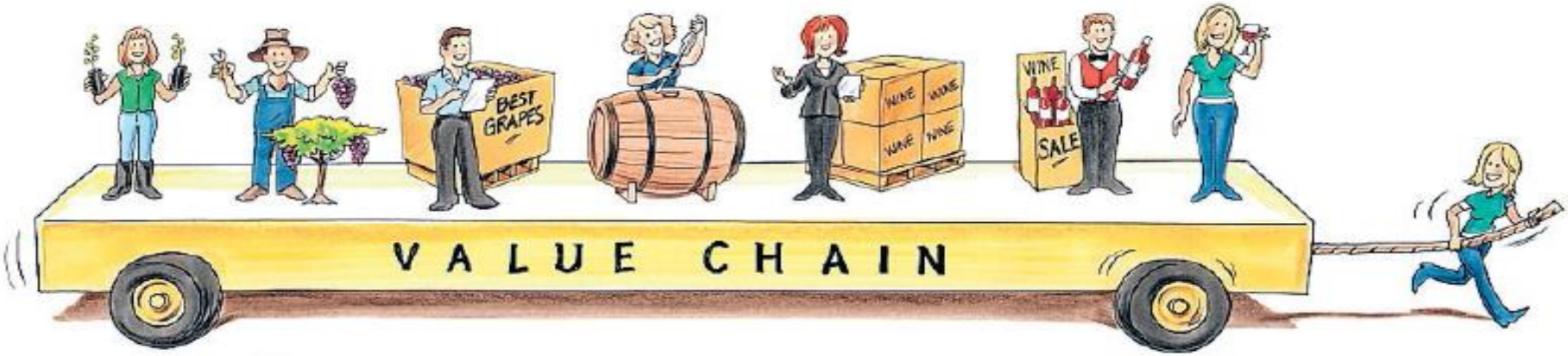
- **Value chain**
  - A **value chain** is a collection of businesses ranging from primary producers, processors, distributors and retailers, consumers→ Every step from raw materials to the final end user
  - The **value is created through interrelated activities** which **progressively generate added value** through a sequence of stages to achieve a **common goal**
  - **The ultimate goal** is delivery of **maximum value** to the end user in a specific market segment
- **Supply chain**
  - Every activity that gets raw materials and subassemblies into manufacturing operation
- These terms are often used interchangeably

Supply Chain Management

Paradigm shift



Traditional supply chain - supply push



Sustainable value chain - consumer demand pull

Supply Chain Management

Why chain management?

Chain management can help a company

- improve **productivity** and efficiency
- reduce **inventories**
- reduce **costs**
- develop, maintain and manage **profitable relationships** with customers/suppliers and other business partners
- **understand what makes value** for the final customer
- **deliver better services** and enhanced economic value to customers

Economic theory on supply chain

- ***Neoclassic theory***
- ***New Institutional Economics*** → based on bounded rationality, imperfect information and opportunistic behaviour → **different approaches**:
  - **Information economics** (Akerlof, 1970) → the consequences of information asymmetry in vertical exchanges → adverse selection
  - **Contract theory**
    - **Theory of incomplete contracts** (Grossman and Hart, 1986) → contracts cannot specify what is to be done in every possible contingency → bounded rationality
    - **Principal-agent theory** (Jensen and Meckling, 1976; Holmstrom, 1979): agency relationship, in which one party (the principal) delegates another party (the agent), who performs that work → adverse selection models and moral hazard models
  - **Property right theory** (Coase, 1960; Alchian and Demsetz, 1972) → 'the rights of individuals to the use of resources' (Alchian, 1965) →historical and institutional context that shapes and changes property rights
  - **Transaction Cost Economics** (Williamson 1985, 1996) → transaction attributes and costs influence **transaction governance**

Transaction Cost Economics

Objective

Choose the most efficient governance form for transactions → transaction cost minimisation

Transaction Costs

- Information costs
- Negotiation costs
- Monitoring costs

Transaction characteristics

- Frequency (recurring, occasional)
- Uncertainty
- Asset specificity (unspecific, mixed or idiosyncratic investment)

Transaction governance-forms

- Market
- Hybrid forms
- Hierarchy

Transaction Cost Economics

Transaction characteristics

- asset specificity
- uncertainty
- frequency

Transaction costs

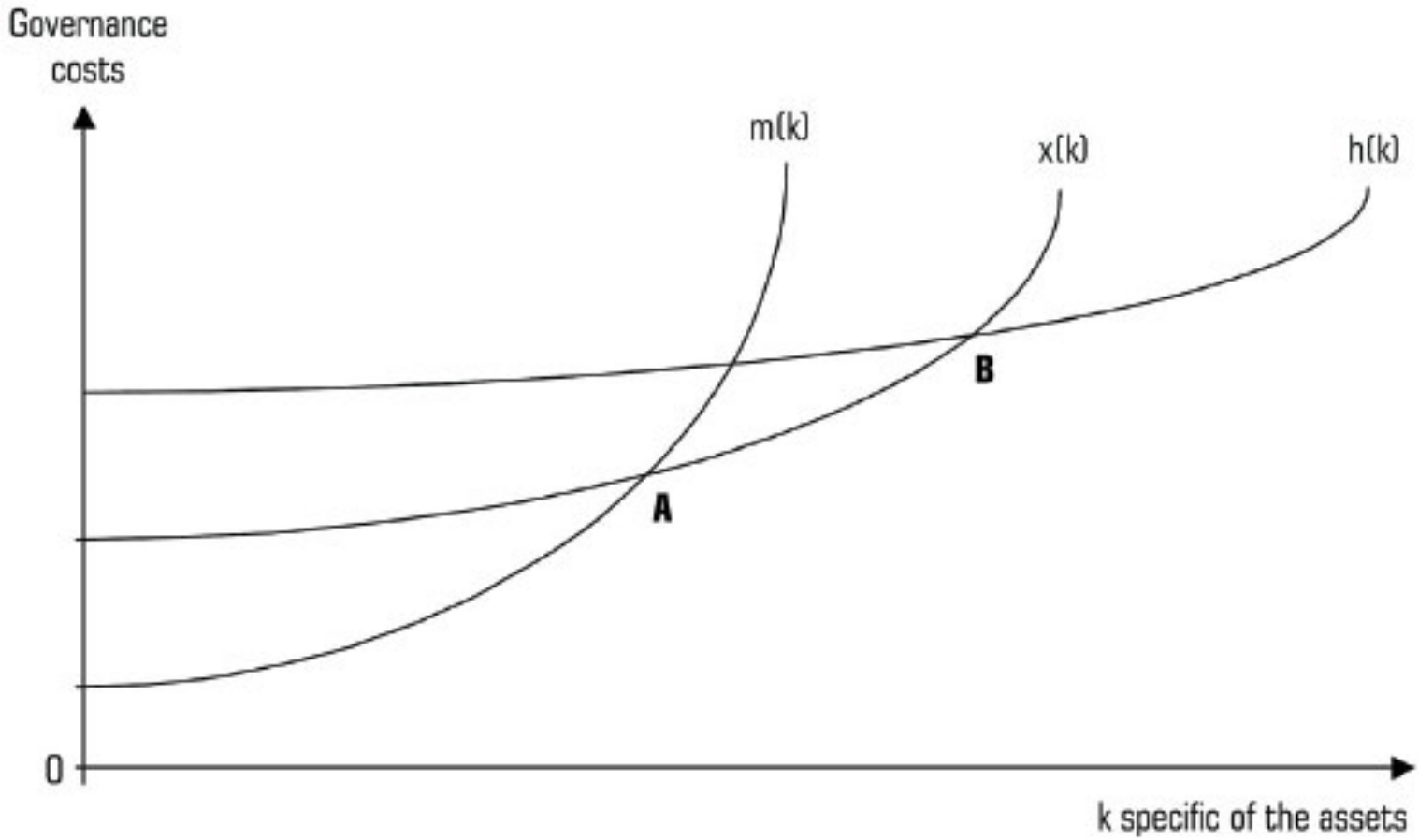
- information
- negotiation
- monitoring

$$TC = f\,(AS, U, F)$$
$$\quad\;\; + \quad + \quad -$$

Types of governance

market, hybrid forms, hierarchy

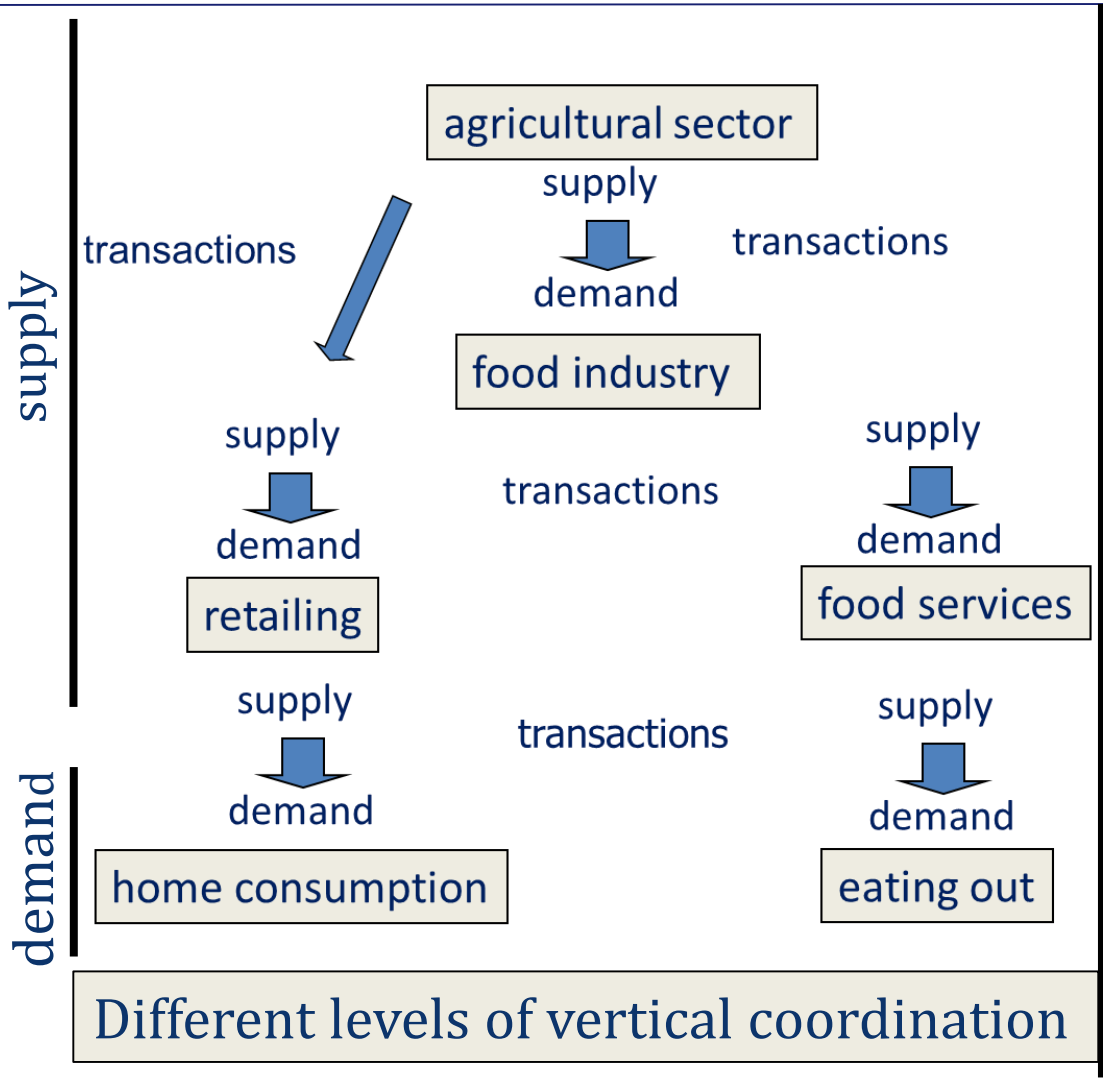
Figure 1_ Governance mode costs and asset specificity degree

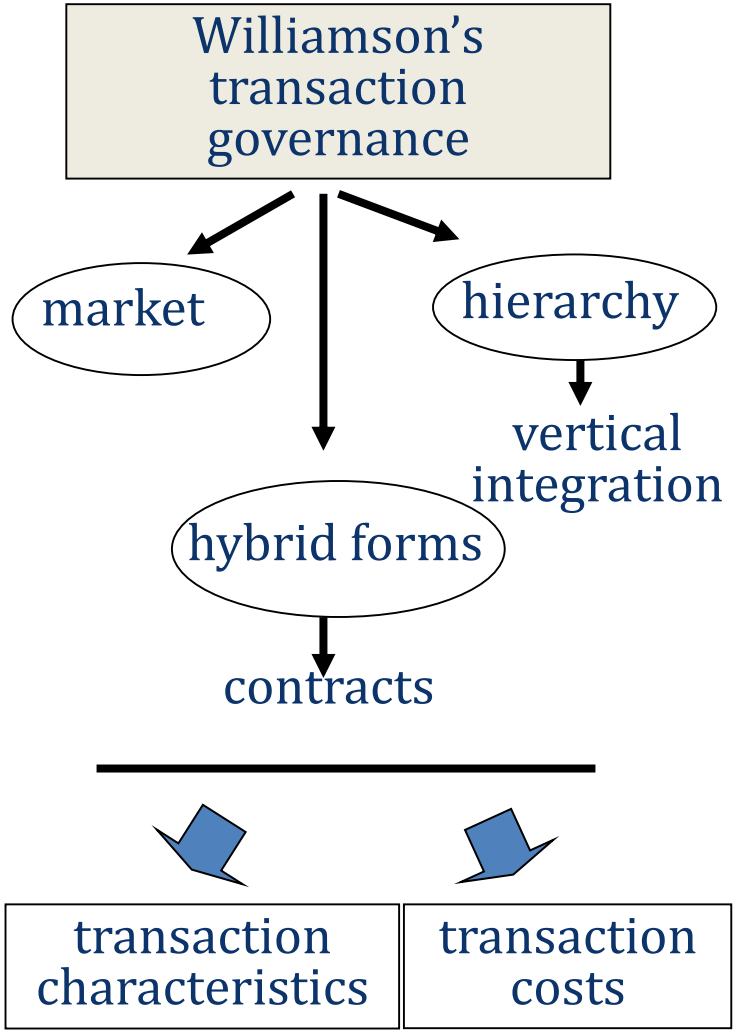


m(k) = governance via market;
x(k) = governance via contractual rules (hybrid);
h(k) = govenance via hierarchy.

Source: Williamson (1975).

Transaction governance in FSCs

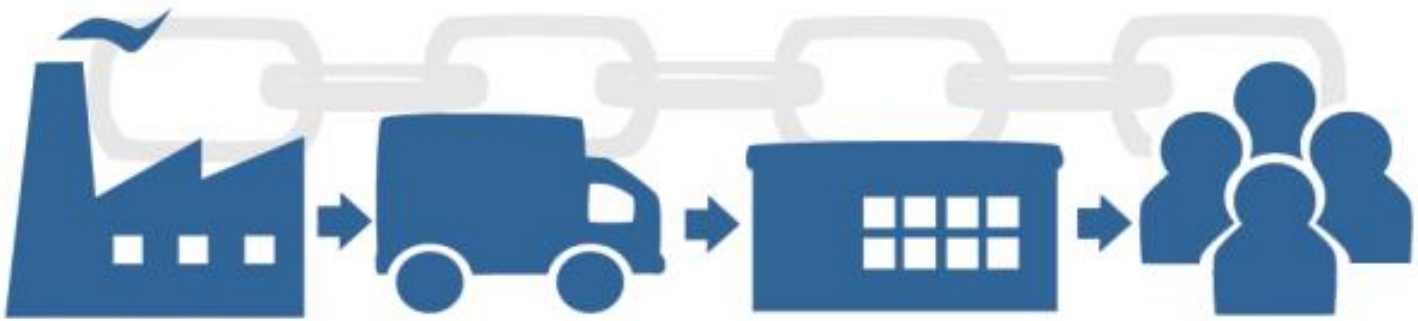




Carbone, 2017

Part 3

The role of internal and external risks in vertical coordination



http://www.clearspider.com/avoiding-unethical-supply-chain/

Specificities and risks in FSCs

- Specificities of FSCs → agricultural and food activities depend on many factors:
  - Natural resources and land→ animals and plants have specific needs
  - Type of soil→ fertility, flatland, hillside, mountain → slope, sun exposure, etc. → land productivity
  - Water availability→ irrigation
  - Climate conditions→ sunlight, warm/cold temperature, rain, wind, etc.
  - Pest diseases
  - Food safety risk
  - Price volatility
  - World consumption changes
  - Socio-politic changes
  - Market globalization
  - Growth of some economies (China, India, Korea, etc.)

- Importance of **natural resources** and the **economic environment** → external risks → **can these risks be included in the analysis of vertical coordination**?

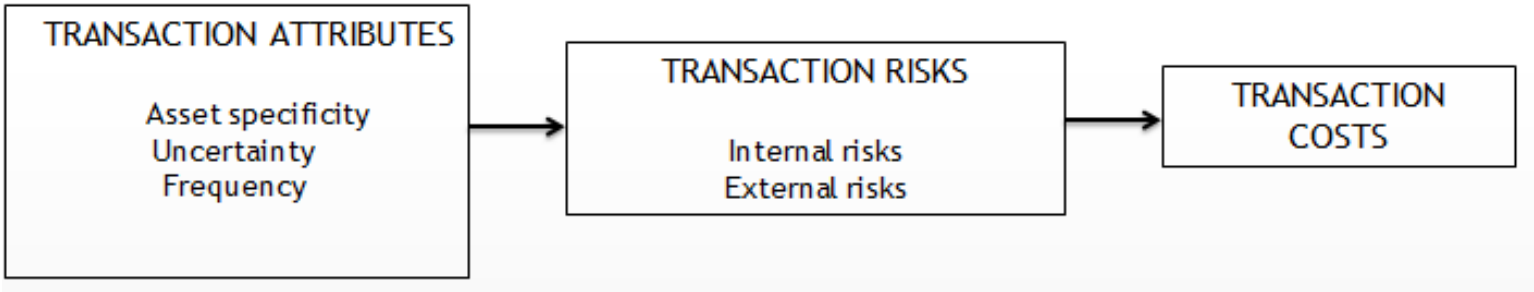
The role of risk in TCE

Towards an extended transaction cost perspective → the concept of **transaction risks**

- **Transaction risks**: any current or future hazard (event) with a significant **negative impact** → It is either specific (accidental, unpredictable events) or systematic (high probability, "predictable" events)
- Systematic risks → **INTERNAL RISKS** → depend from economic behaviour (bounded rationality, opportunistic behaviour).
- Specific risks → **EXTERNAL RISKS** → related to changes in the **economic environment** independently from the firm's economic behaviour.

Factors affecting transaction governance

Transaction cost economics and the perspective on the role of transaction risks (Billitteri et al., 2013; Wever et al., 2012; Geyskens et al. 2006)



- **High internal risks perceived→ high level of vertical coordination**
- **High external risks → flexible forms of transaction** governance → debate in the literature
- TCE theorizes on the effects of internal risks on vertical coordination → **what about the simultaneous presence** of systematic and specific risks on **vertical coordination**? debate on the effects of different types of risks on vertical transaction organization (Wever et al., 2012; Geyskens et al., 2006; Das and Teng, 2001).

Risks and vertical coordination: a model

We propose the following model (Sheu and Gao, 2014; Saak, 2012; Panico, 2011; Fischer et al., 2010; Van de Vrande et al. 2009; Pouliot and Sumner, 2008; Wang and Zajac, 2007; Hobbs, 2006; Hobbs, 2004)

$$VC = f\ (IR, ER, \text{control variables})$$

Internal risks External risks

Where:

- VC: kind of vertical coordination governance adopted
- IR: internal risks
- ER: external risks
- Control variables: firms structural characteristics, product characteristics, (Kim and Roberts, 2016; Dyah Kusumastuti et al., 2016) and supply chain complexity (sectors and stakeholders involved) (Eckerd et al., 2017)

Literature review and data collection

Research questions for the **literature review** and **empirical analysis**:

- Which **factors** can be classified as **internal and external risks** in FSCs?
- Which is the **role of external risk** in affecting **vertical coordination** in FSCs?

Methodology

- Systematic literature review (Transfield et al., 2003)
- Database used: Scopus, Emeraldinsight, Wiley, Science direct
- Keywords: agri-food supply chain management, agri-food supply chain collaboration, agri-food vertical coordination
- Time span: no time limits
- Document type: articles and reviews → academic journals
- Export date: 25 May 2017

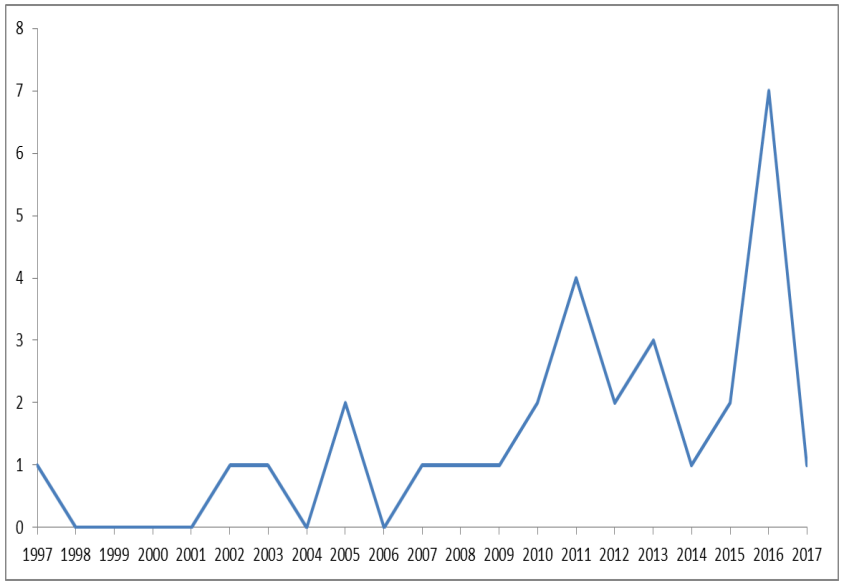
Procedure

- **First step**: database extraction →advance search: search for title, abstract , keywords → document results: Scopus: 45 articles; Science direct: 21 articles; Emeraldinsight: 15 articles; Wiley: 9 articles.

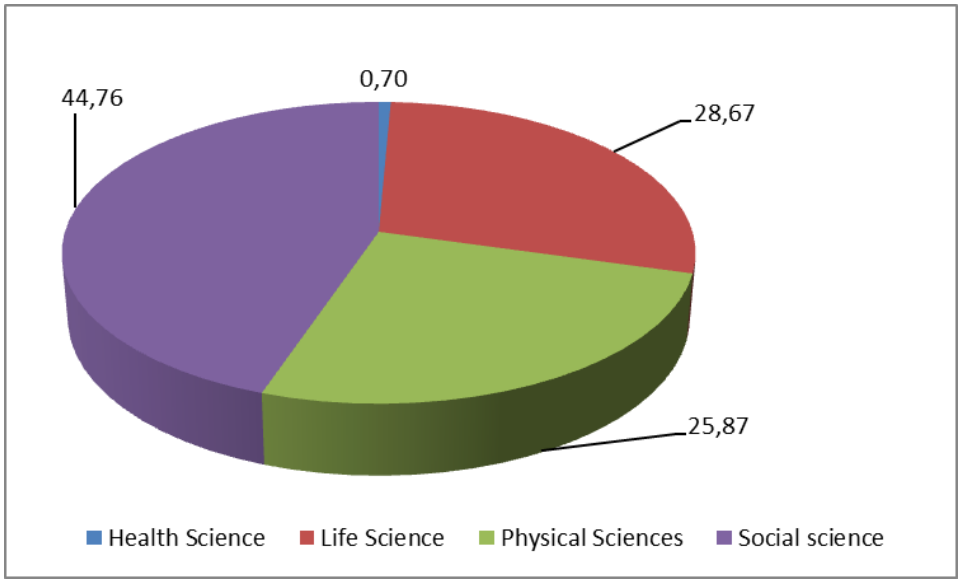
Literature review and data collection

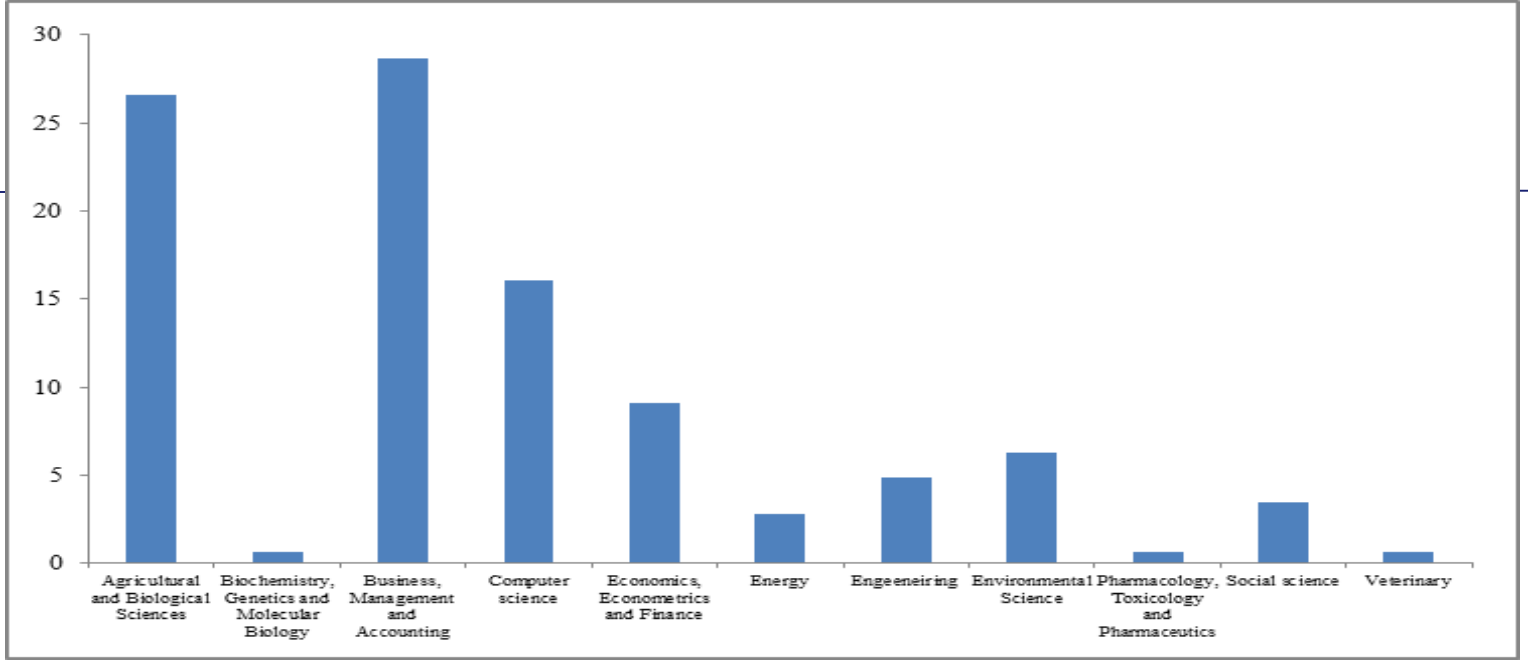
- **Second step**: selection of the articles on the basis of the research aim through an analysis of the titles and the abstracts of the articles → Among the articles selected we extracted the related citing articles → total 119 articles
- **Third step**: analysis of the titles and the abstracts of the articles and selection of the citing articles → Final dataset: **84 articles.**

Trends of publications

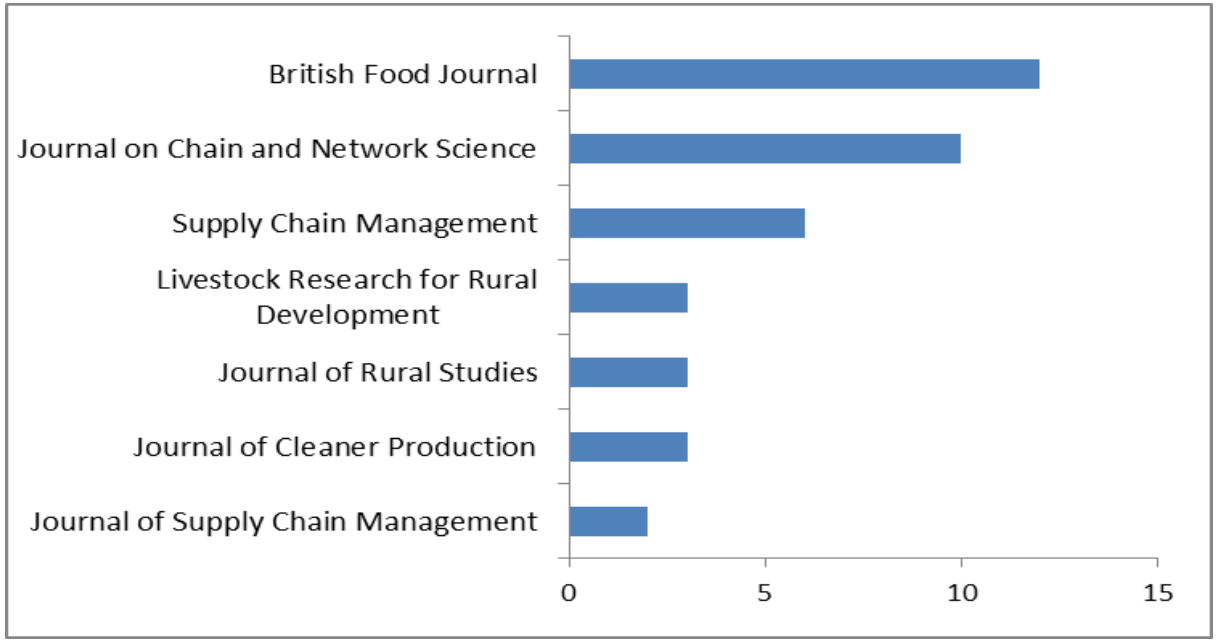


Distribution of articles (Scopus categories)

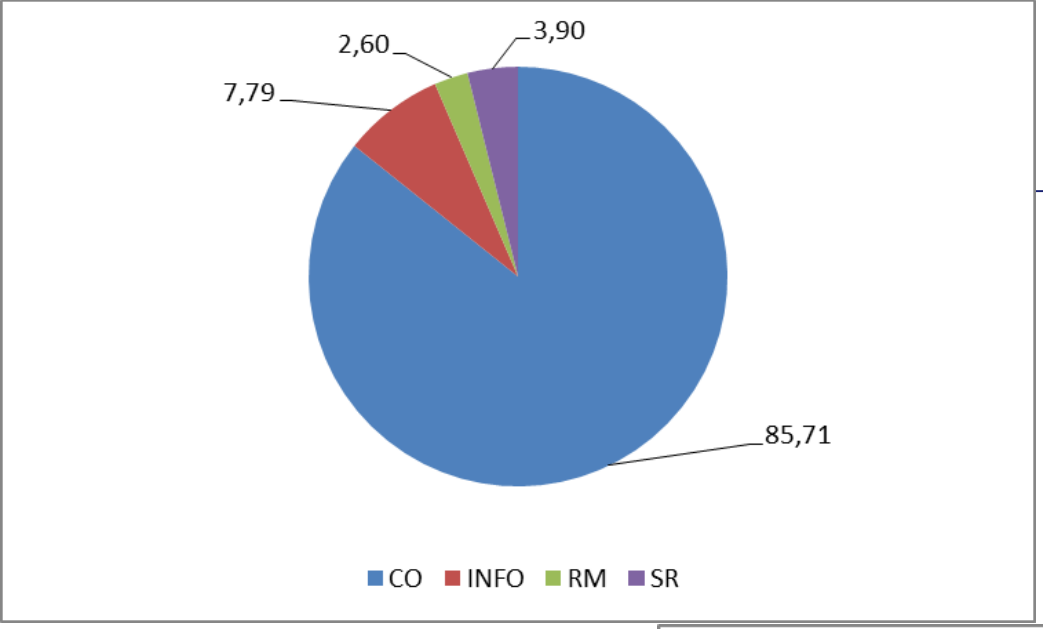




Article distribution (Scopus subcategory)



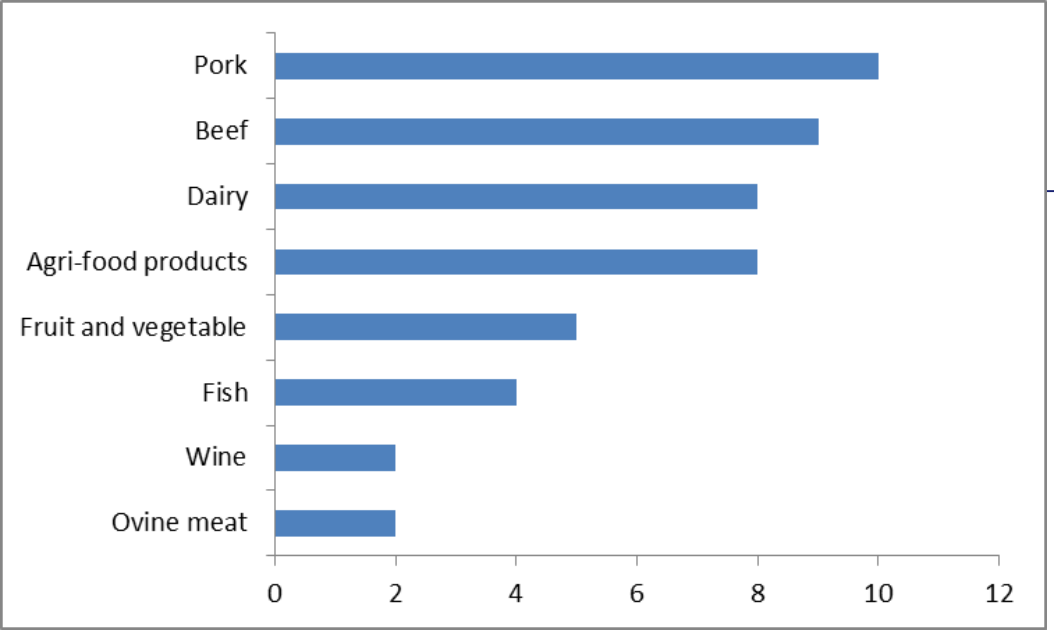
Main scientific journals



Types of supply chain coordination

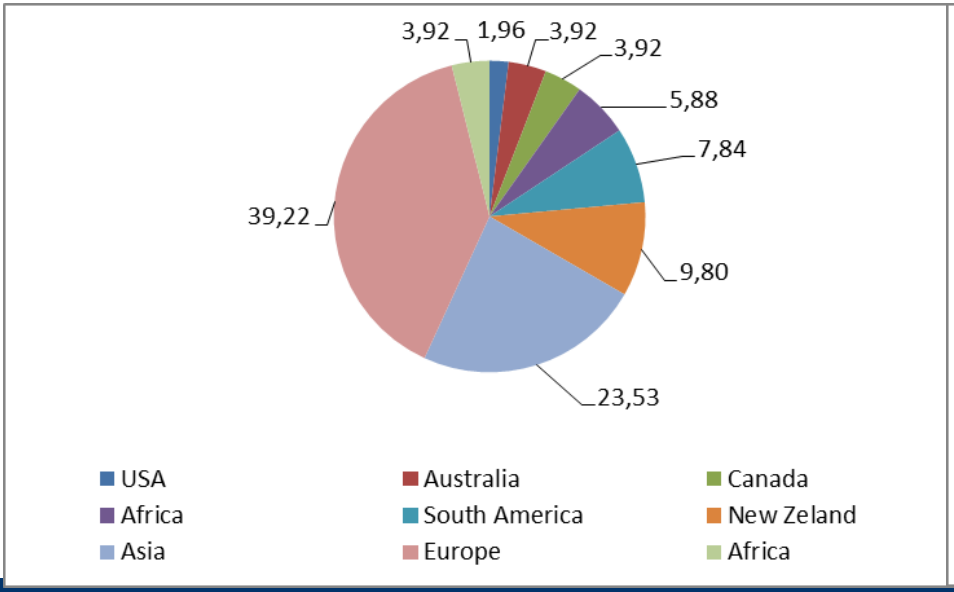
CO: supply chain governance; INFO: supply chain information sharing; RM: supply risk management; SR: supply chain resilience

Types of vertical governance investigated

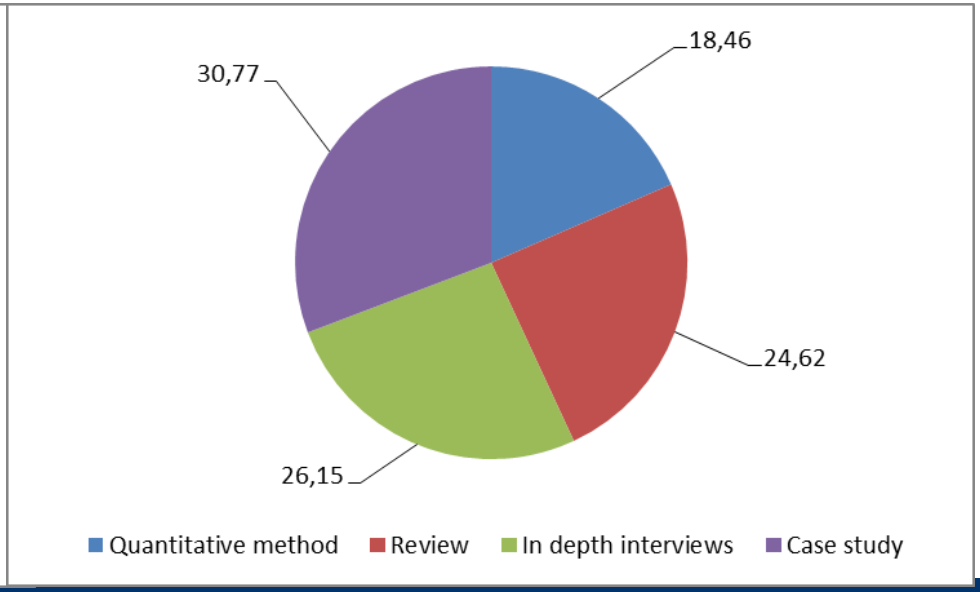


Main agri-food products investigated

Geographical area of investigation



Study methodology



The identified risks

Internal risks	Frequency of risk identification (%)	External risks	Frequency of risk identification (%)
Quality management	21,1	Normative uncertainty	13,7
Information asymmetry	11,6	Demand uncertainty	5,3
Power asymmetry	9,5	Climate change	2,1
Specific investments	8,4	Price uncertainty	2,1
Transaction costs	4,2	Cultural diversity	1,1
Trust	4,2	Demographic changes	1,1
Production efficiency	3,2	Economic crisis	1,1
Human asset specificity	2,1	Globalization	1,1
Firm reputation	2,1		
Geographical proximity of suppl.	1,1		
information costs for suppl. selection	1,1		
Moral hazard	1,1		
Suppliers libility management	1,1		
Cognitive uncertianty	1,1		
Market competition	1,1		

Vertical coordination and transaction risks

- Which is the **role of external risk** in affecting the **vertical coordination** in FSCs? **What about the simultaneous presence** of internal and external risks on **vertical coordination**? Is the coordination of FSCs affected **not only by internal risks** (to solve the internal conflicts), but **also by external risks**?
- We made an **empirical analysis** → first attempt to **evaluate** the relations between **different transaction risks** and the **level of vertical coordination** in FSCs → Stranieri S., Orsi L., Banterle A. (2017)
- **Aim** → to evaluate how **internal and external risks** impact on the **governance** of supply chain relationships
- We focused on **voluntary traceability standards** as alternative forms of transaction governance → complex (high level of vertical coordination) and flexible traceability (low level of vertical coordination)

Main results

- **Survey** based on a questionnaire to Italian agri-food firms with a voluntary third-party traceability standard
- **Ordinal regression analysis** → dependent variable: level of coordination provided by traceability → independent variables: transaction internal risks, external risks, firm structural characteristics
- Statistically significant **positive link** between **internal risks** and level of **vertical coordination**
- Statistically significant **negative link** between **external risks** and **level of coordination**
- Moderation analysis → it seems to suggest that the **decision on the level of vertical coordination** depends on the **risk perceived as most important**

Concluding remarks

- ***Simultaneity*** of competition and co-operation is possible in FSCs → both **private goals** and **common goals → different levels** of vertical coordination
- In the last decade **growth of hybrid forms** of governance of transactions → important role played by safety, quality and sustainability **standards (ex. traceability) → collaboration** may lead to better chain performance and benefits for the single firm of the FSCs
- Both **SCM approach and TCE approach** underline the importance of **governance**
  - SCM highlights the value creation and the planning of activities
  - TCE underlines how governance is affected by transaction characteristics and costs → different governance depending on market efficiency and costs of use
- Both **internal risks** and **external risks** can affect **vertical coordination** → internals risks increase the vertical coordination level → more research is needed to understand the role of external risks → they can push towards flexible forms of vertical coordination

Thank you for your attention!

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