Dealing with the variability and heterogeneity of raw materials: the governance of sustainable fruit-based supply chains

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Agricultural products are living materials characterized by their variability and heterogeneity.

This complexity makes difficult for growers and processors to control the food quality which is increasingly relevant and demanding.

Quality has evolved towards a more comprehensive concept that beyond the organoleptic and nutritional attributes, involve the respect for sanitary, social and ecological considerations.

Our research question is:

How do firms manage the variability and the heterogeneity of fruits within the supply chains?

Approach

Institutional frame

Grower

• Apple, Mango
• Key points
• Problems
• Technical specifications
• Coordination

1st Processing

• Juices, puree compote, dried
• Key points
• Problems
• Coordination

2nd Processing

• Flavours
• Ingredients
• Beverages
• Technical specifications

Distribution / Consumer

Coordination
Theoretical Framework:

- The agricultural supply chains are receivers and providers of ecosystem services.

They:
- Benefit from natural resources and,
- Supply food, non-food products and services (Le Roux et al., 2008).

- Agriculture supply chains are social-ecological systems interacting within natural, social, economic, institutional and technological dimensions (Moraine et al., 2015).

(Based on Menard, 2017)
### Methodological strategy:

#### Hazards in Apples & Mangoes transactions

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Identification of hazards (Based on EU Food Safety Alert)
To the question:

• What factors are source of variability and heterogeneity?

Interviewees answered:

Variability and heterogeneity mainly arise because of:

Climate, varieties, choice of crop management

Beside organoleptic aspects, sanitary hazards are also source of variability and heterogeneity
Findings

- Managing of variability and heterogeneity

Grower - first processor stage,
- Official/private standards and private agreements:
  - To measure
    - Physical/chemical characteristics (e.g. size, brix)
    - Organoleptic characteristics (e.g. color, texture)
  - To fix limits and tolerances:
    - Level of pathogens (toxins)
    - Contaminants (pesticide residues, heavy metals, radioactivity)
  - Other: varietal mix, origin of food materials
  - Parameters → from generic to customer-specific

First processor stage,
- The homogenization and standardization of the industrial product
- The valorization of the heterogeneity as means of differentiation
Institutional linkages

**Macro-institutions**
- WTO rules
- European Union
  - Ministries (Agriculture, Economy and Health)
  - - Technical regulations, standards, testing and certification procedures.
  - - SPS measures
  - Food law
  - Marketing standards

**Meso-institutions**
- Departmental government
- Research organizations
- Growers associations (e.g. Association Producteurs Pomme-Poire) → Collective Eco-friendly Label
- Industrial associations → Fruit Juice Association Code

**Micro-institutions**
- Consumer/customer demands translates into product specifications (Industrials, Distribution, Consumers)
- Contracts: Commercial terms
  - Quality provisions
  - Quality design
  - Quality control
  - Quality improvement
  - Technological functions (decisions on production)
- Supply of Food materials → Processing → Product properties

**Enforcement**
- Legal:
  - Inspections
  - Courts
  - Arbitration
- Informal:
  - Firm reputation

Based on Menard (2017); Luning & Marcelis (2007)
Supply chain configurations

1. Growers → Cooperatives → Wholesaler → Processors
   (e.g. firms: N^2; N^24)

2. Growers → Cooperatives → Centralized purchasing → Processor → Market
   (e.g. firm: 17)

3. Grower(s) → Partnerships → Integration → 1st Processor → 2nd/3rd Processor
   (e.g. firms: N^1; N^3; N^5)
Supply chains of apples and mangoes are mostly oriented to the fresh market (mostly non processing dedicated crops)
Conclusion:

Variability and heterogeneity:

- Intrinsic characteristics of agricultural products and strongly linked with food quality.
- Increase in transaction costs (e.g. measurement).

- Coordination of actors within the supply chains through:
  - Multilayer institutions influencing technological decisions (e.g. Mesolevel: label for responsible supply chain management e.g. Vergers écoresponsables)
  - Homogeneization and standardization of the industrial product (predominant strategy)
  - Valorization of the heterogeneity as means of differentiation
- As specific investments increase transactions are governed by tighter forms of governance.
Thank you for your attention