Simulation exploration of the North Italian tomato food value chain for equitable relations and value distribution

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VALUMICS
Food Systems Dynamics

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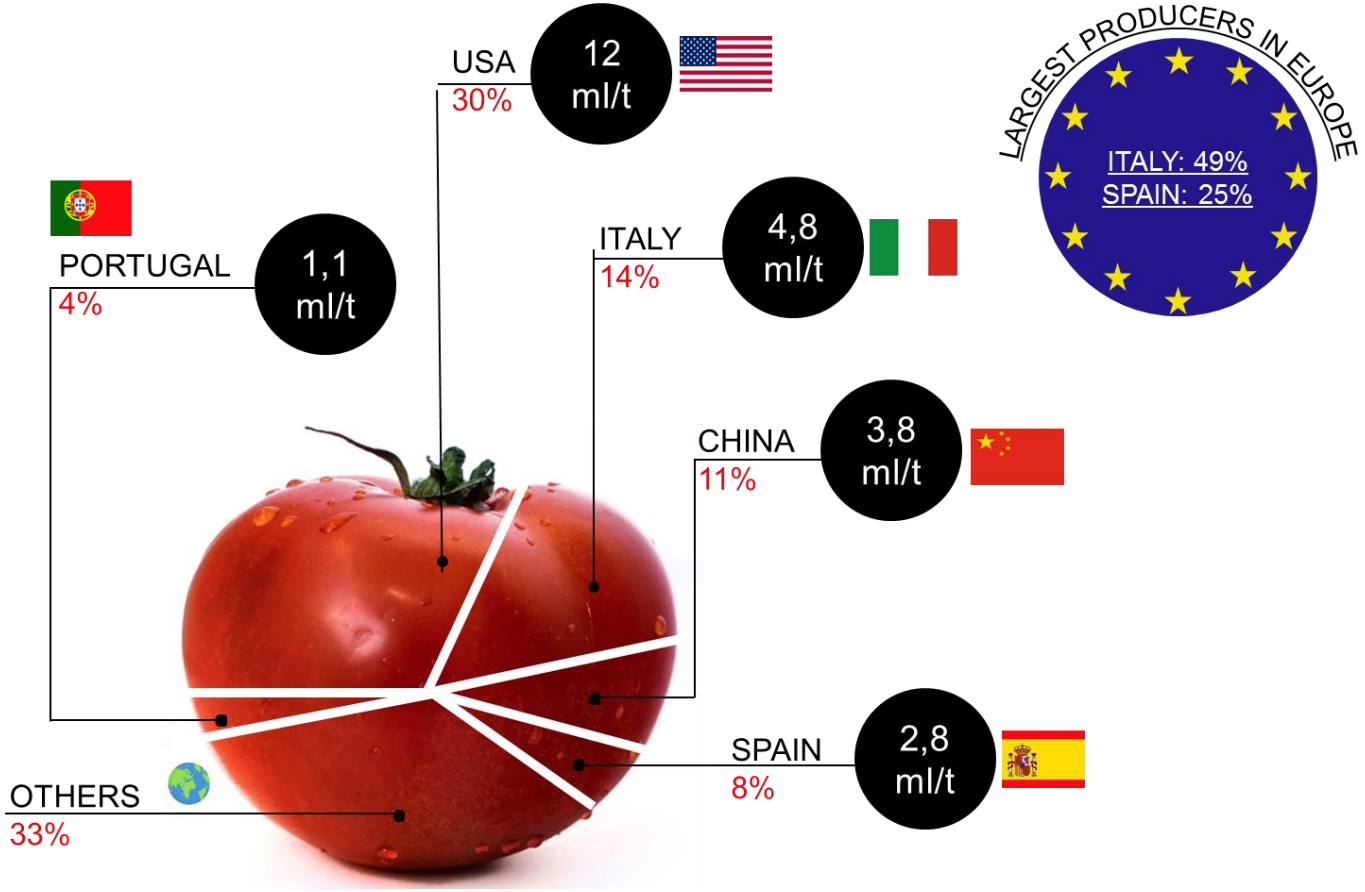
Why North Italy Processing Tomato (1)

The wording "processed tomato" includes tomato paste, puree, and canned tomatoes



- Italy is the second largest producer of processing tomato worldwide (Anicav 2018, Gain 2018)
- Italy is the first exporting country of finished processed tomato products in the EU (Anicav 2018)

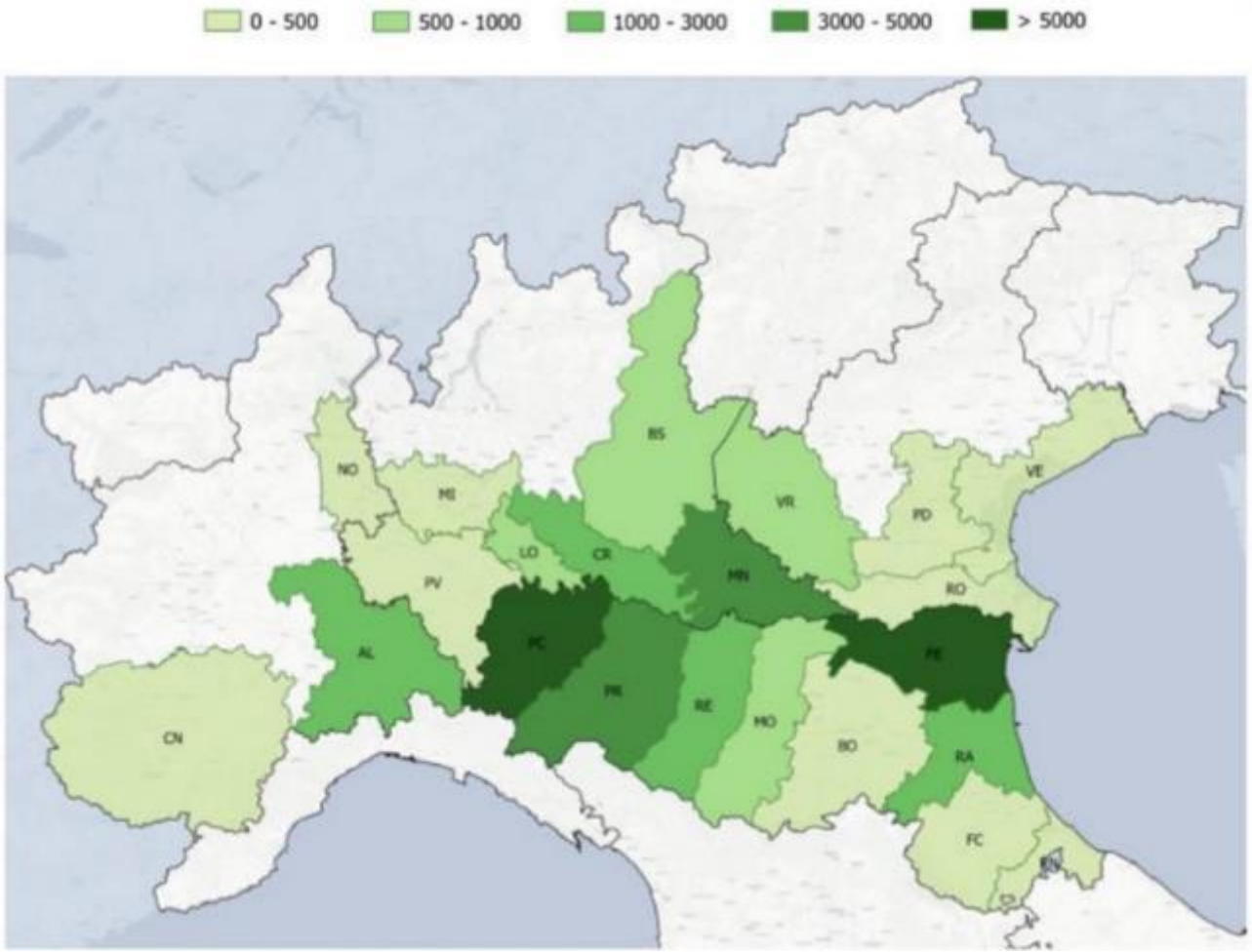
Why North Italy Processing Tomato (2)

Two main national districts: North and South Italy

PROXIMITY

Production area in IBO 37.071 ha (2020):

- ❖ Emilia-Romagna (70%)
- ❖ Lombardy (20%)
- ❖ Piedmont (6%)
- ❖ Veneto (4%)



Processed tomato cultivated areas in North of Italy per province (hectares). Source: Agricoltura.it (2020).

Governance level

Governance that allows both vertical and horizontal integration

Level 1 - Single companies and cooperatives (both producers and processors)

Level 2 - Producer Organizations (PO)

- Negotiation, bargaining, programming with the processors
- Collection of payments
- Mutualism (solidarity mechanisms are activated)
- Control of the disciplinary of production

2007 → District of Processing Tomato, that evolved in 2011 into the IBO

Level 3 - Inter-branch Organization Processing Tomatoes of Northern Italy (IBO). It includes:

- Producer Organizations, the Processing Companies, the cooperatives, the Professional Organizations and Entrepreneurial Associations
- Promote integration process of the industry
- It does not intervene actively in trade negotiations

OI POMODORO DA INDUSTRIA NORD ITALIA

Important factors: PRICE NEGOTIATIONS producers and processors

Negotiations between producers and processing industry (IBO is not included) →

Reference price (raw material): it is mainly based on the historical prices paid in the past.
NB: reference price is not a minimum price. This price can vary according to qualitative parameters.

In 2018 → 79.75 €/t
In 2019 → 86 €/t (+8%) signed on the 3rd of May (it is supposed to be in Jan/Feb).

- ❑ Tomato farmers (within the IBO) limit the number of hectares for tomato production.
- ❑ Long term relationship based on collaborations and trust

Important factors: COMMERCIAL RELATIONSHIPS producers and processors

Processed tomato is produced on a contractual basis.

- ❑ **Framework Contract** within the Interbranch Organization sets the general rules

- ❑ **Detailed Supply/Delivery contracts** set specific contract-by-contract conditions

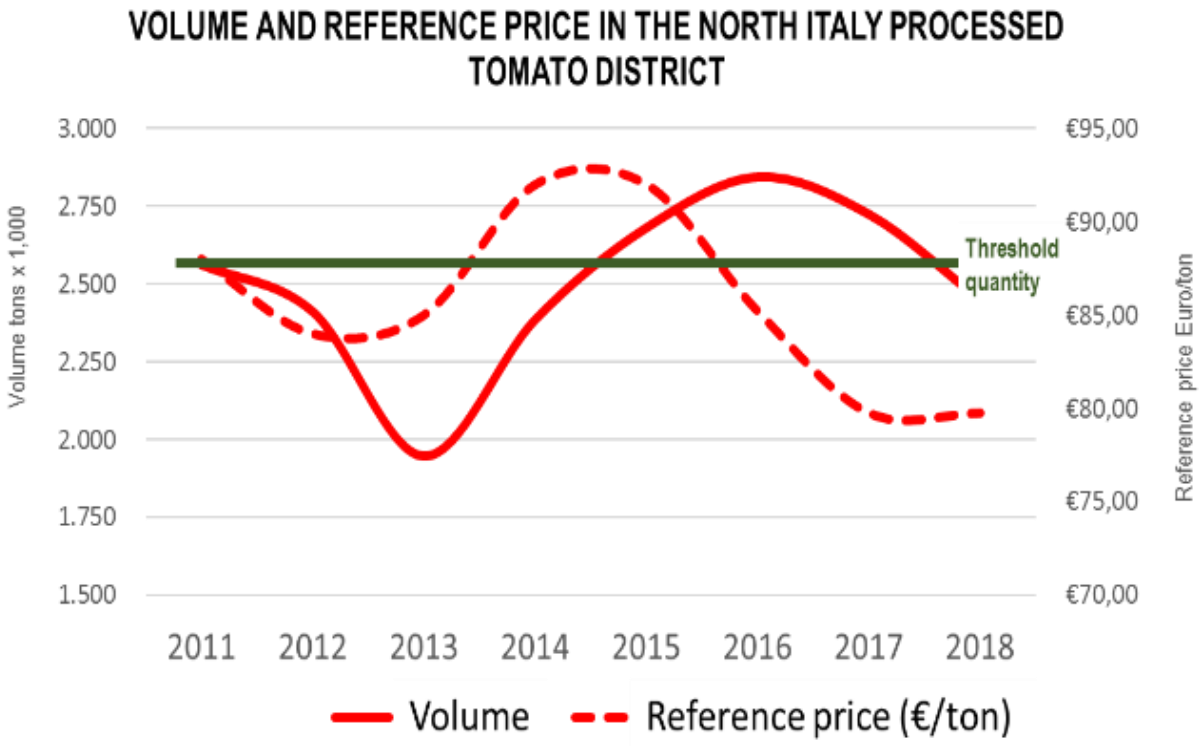
Trading: between the members of IBO.
A premium and a penalty on price method is used as an incentive/deterrent against misconduct.

Single producers are not allowed to contract directly but through the POs.

Clause of selling no more than 10% of the produce to stakeholders outside the IBO

North Italian tomato market specifics and important factors

- Inter-Branch Organization involving Producer Organizations and Processors
- Price negotiations every year
- Reference price
- The price at which the raw tomato was purchased (depending on the reference price and its variations)
- The quality attributes of the supplied products
- The competition on processed tomato items sold in a given market area
- Climate variability
- Domestic and global market



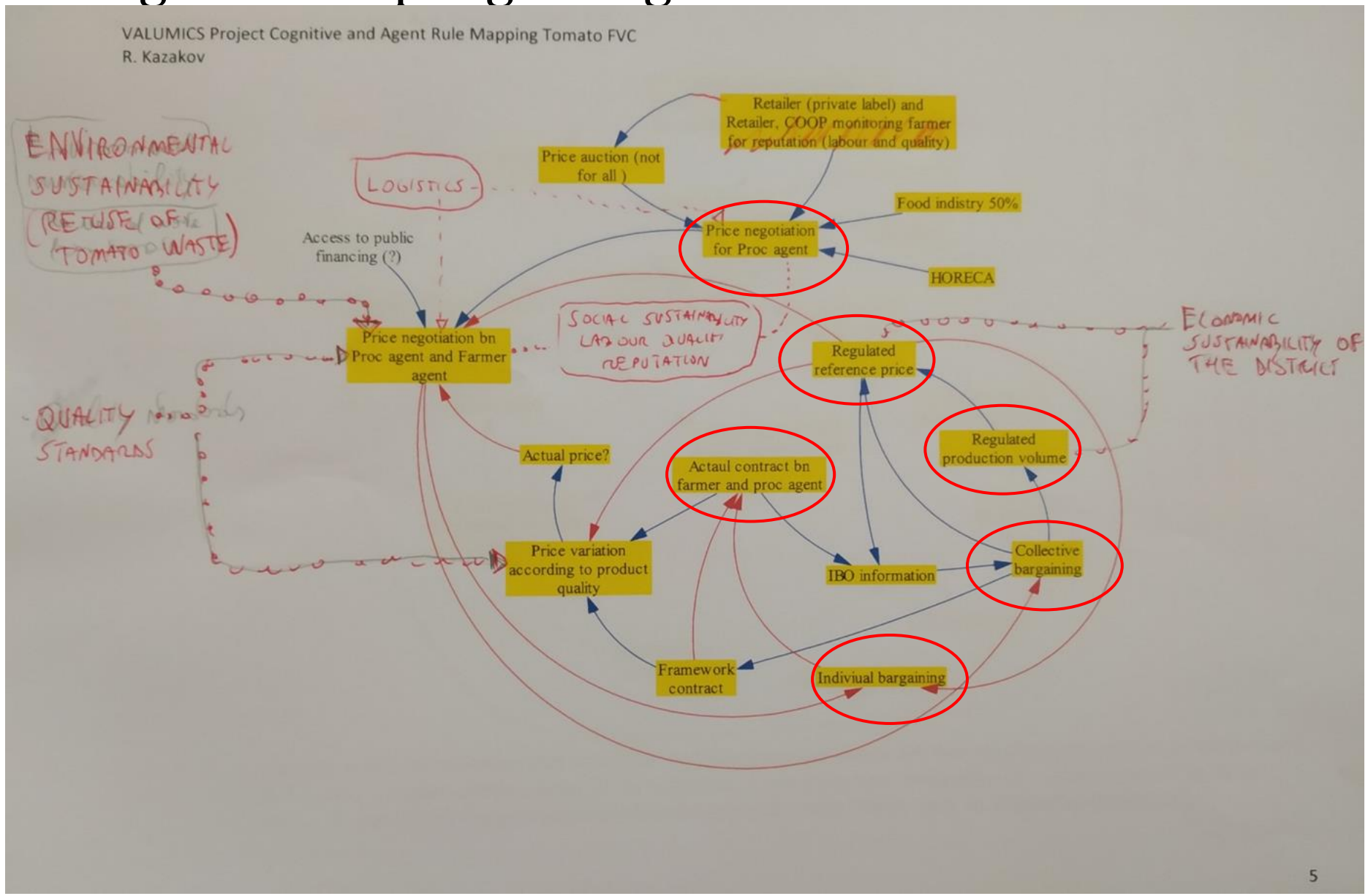
Conceptual framework

- Food value chain systems are viewed as complex adaptive systems emerging out of market agents' interactions and market price regulation
- Managing such systems is explored through the stages of mapping their behaviour and then simulation of intervention scenarios
- The paper focusses on the problem of fairness related to price setting and price distribution, and illustrates how techniques like cognitive mapping and agent behaviour mapping are used for system analysis and agent rules definition and what are possible scenarios for public policy interventions in regards to improving the system from a more sustainable and ethic perspective?

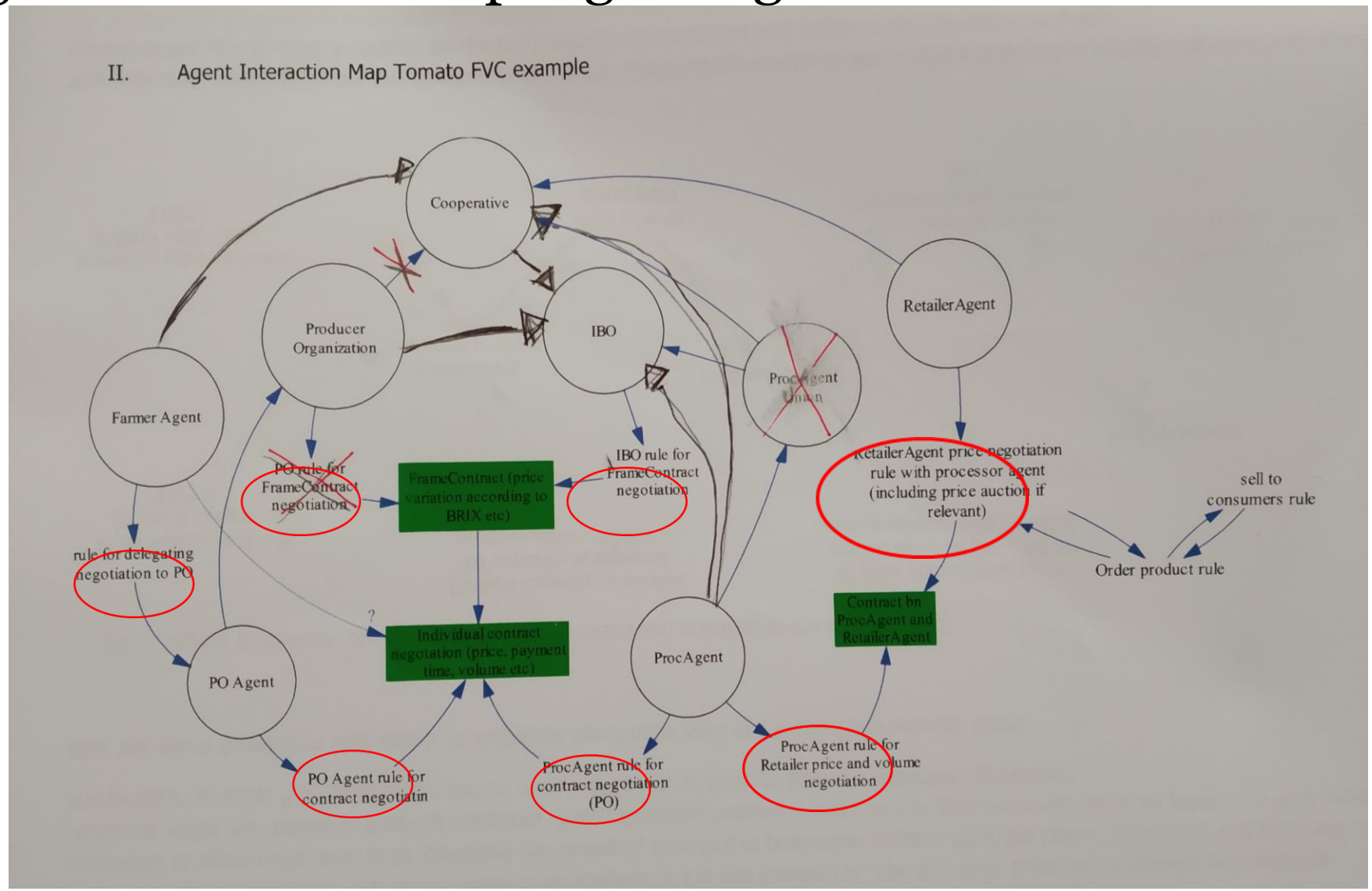
Agent decisions and behaviour exploration: what if scenarios

- What if farmers were not organized in Producers Organizations in the processed tomato VC in the North Italy district?
- What if retailer were also part of the inter-branch organization in the processed tomato VC in the North Italy district?
- What if there was no “reference price” in the processed tomato VC in the North Italy district?
- What if there wasn’t a control (and a limit) in the average productivity allowed/expected by each farmer of the North Italy district?
- What if consumptions trends were (very) negative/positive?
- What if minor productions (eg. Organic processed tomato) would become dominant?
- What if the conditions of the workers were more/less strictly controlled?
- What if the environmental impact was more/less strictly controlled?
- What if price auctions between producers and processors were abolished?

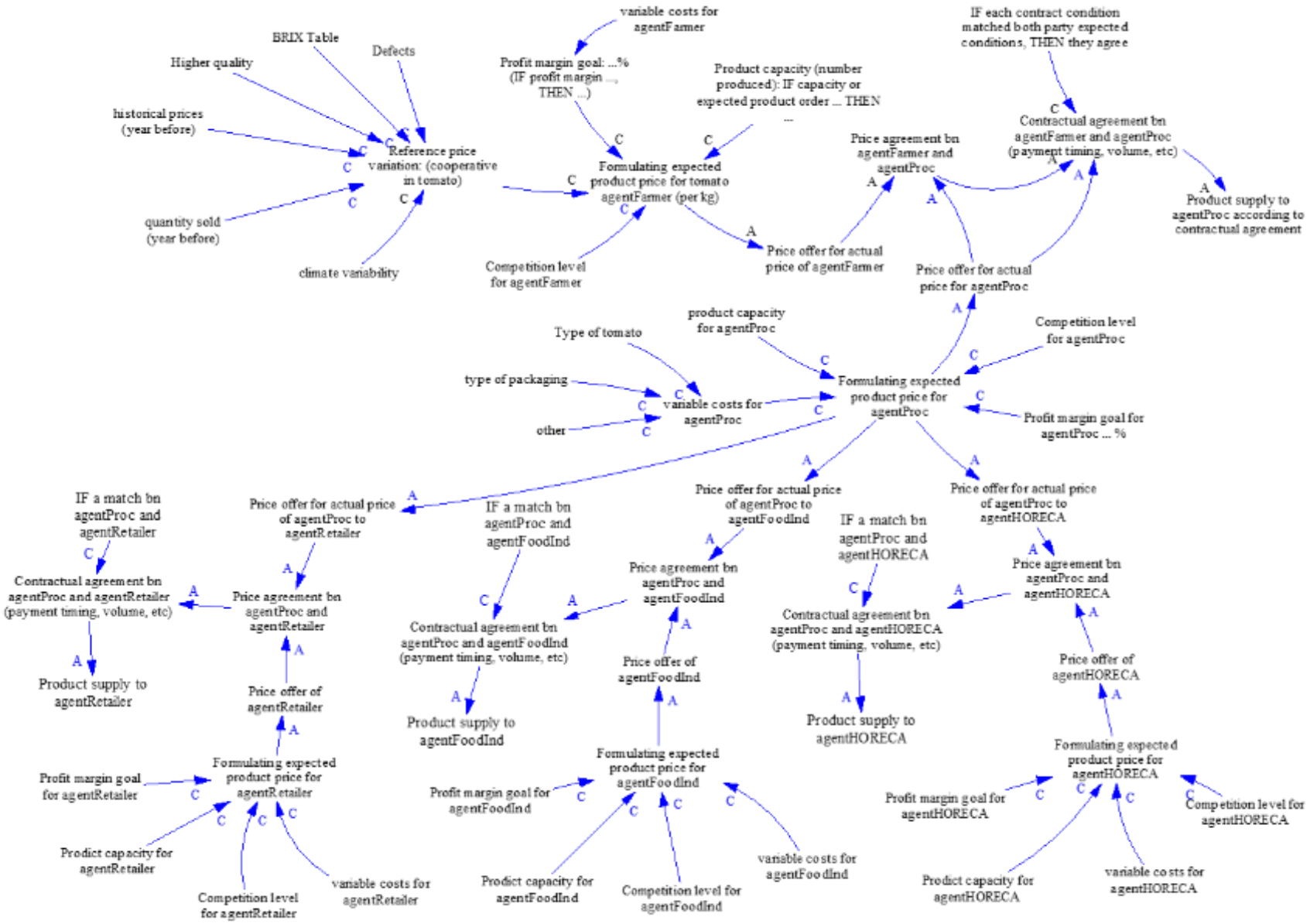
Cognitive map regarding tomato market FVC



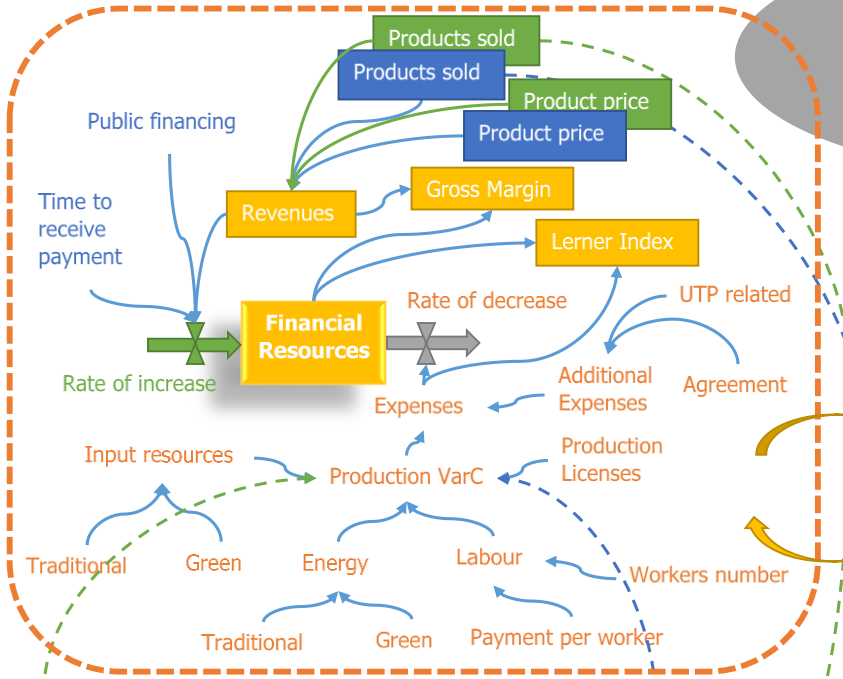
Agent interaction map regarding tomato market FVC



Agent behaviour rule map regarding tomato market FVC

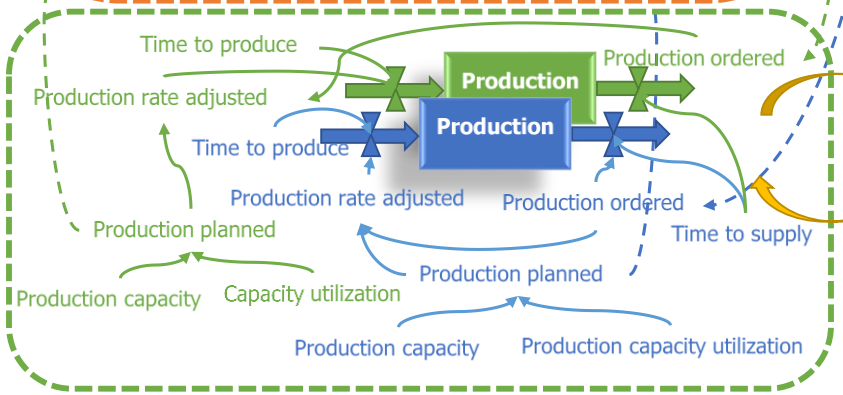


Conceptualizing the tomato market FVC from a hybrid perspective



Environment factors:

Product Price on stock markets, Global supply and demand, Sustainability and production (quality and price) regulation, Environmental conditions, social movements



FVC Agents (Category I, II, III for each level)

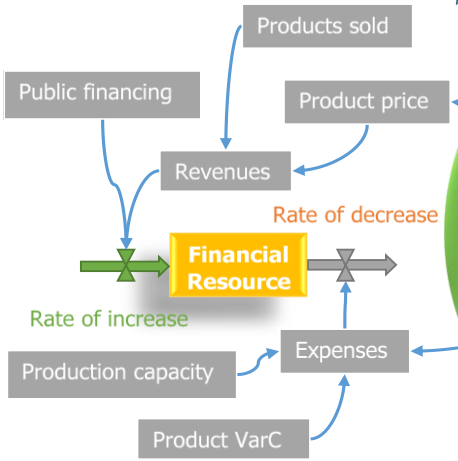
Attributes (parameters)

Name, Number, ProdCapacity per product category (Total and CapUtilization), ProdVarCosts per product category (Labour, Energy, Input Resources, Licenses), ProductPrice, Revenues PerProduct, TimeToProduce, TimeToSupply, TimeToGetPayment, Input Resources NeededForProduction, TradeAgreement Contents (ProductCategory, ProductQuantity, Product Quality, ProductPrice, TimeToPay, TimeTo Supply, Other Expenses (distribution, promotion, unsoldProduct)), Product demand per product category

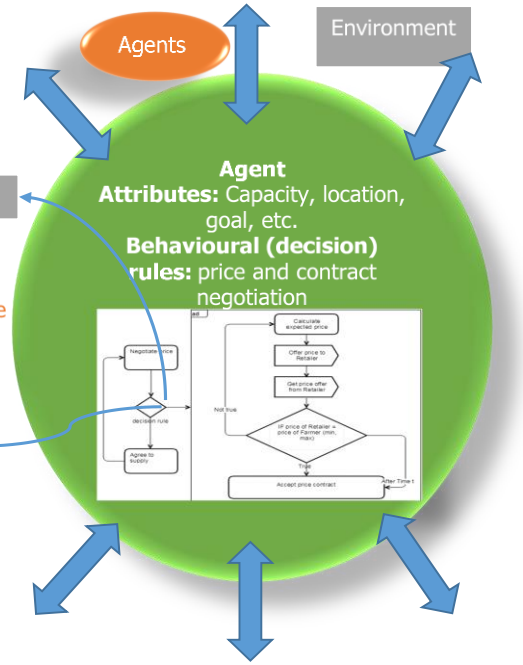
Agents decisions (behaviour rules):

Production (TotalCapacity, % Utilization, Production Adjustment), Price setting and negotiation, TradeAgreement negotiation, ProductOrder, ProductSupply, BuyProduct per consumer category, Product switch per consumer category, ChangeInProduction (due to competition, demand, capabilities), Opportunistic Behaviour (ChangeBuyer, ChangeSupplier, ChangePrice, ChangeAgreement Conditions

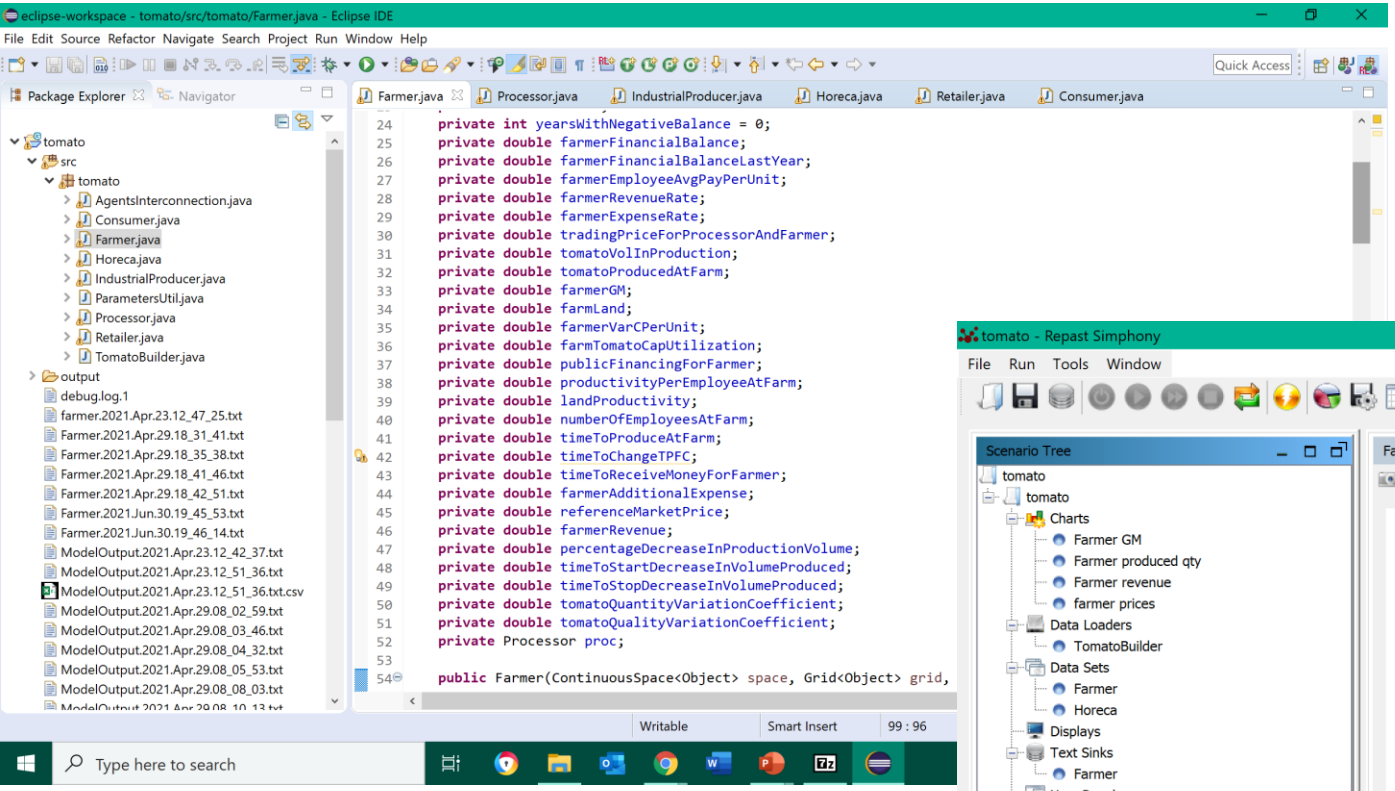
System dynamics simulation of financial resource flows

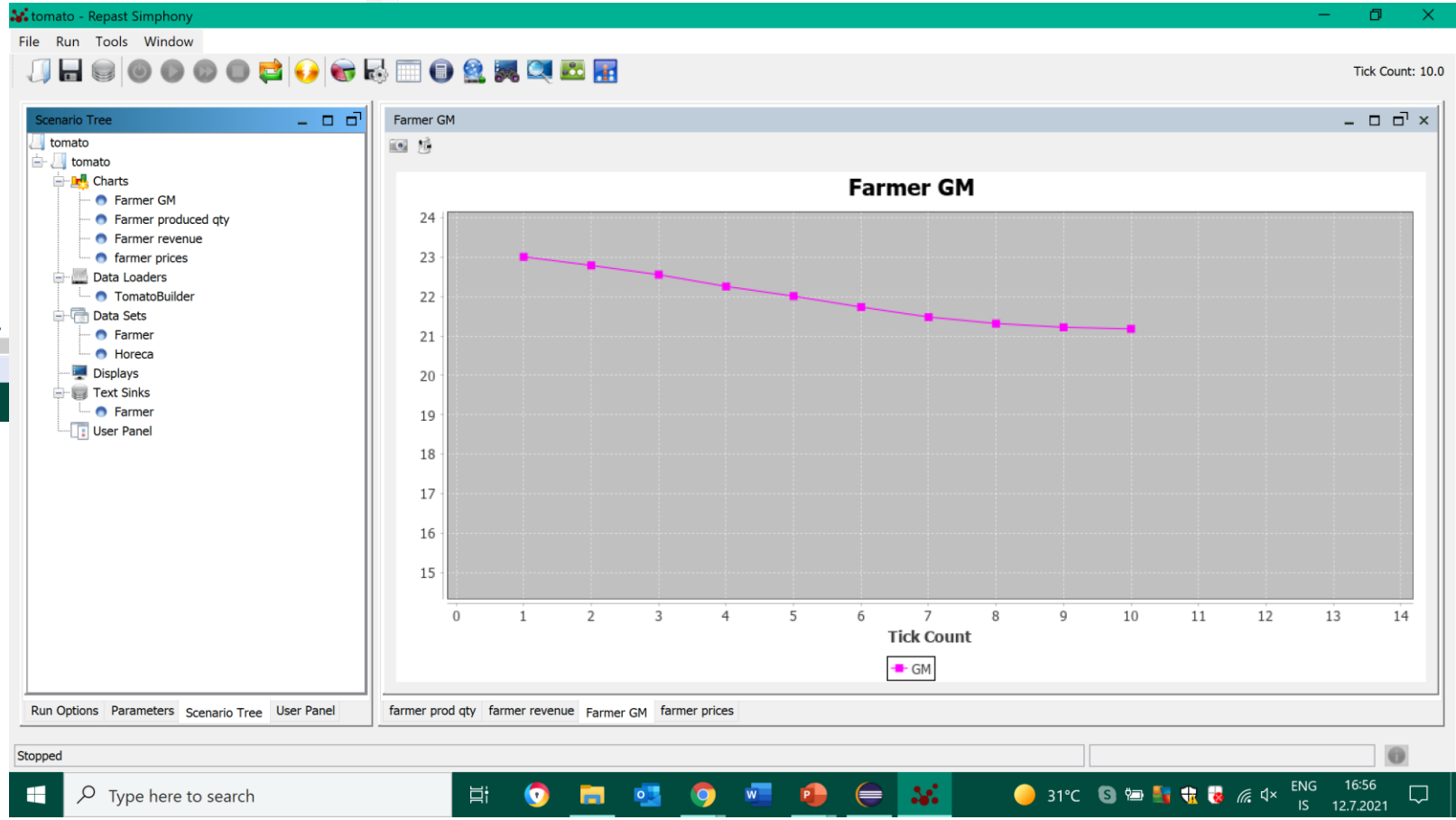


Agent based simulation of FVC actors behaviour



Agent behaviour rules and production and financial flows in Repast





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THANK YOU

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http://valumics.eu

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