# Making Mental Models of Dynamic Systems Comparable – supplemental material

## 1 Variables ordered by their frequency

The following Table 1 contains the set of variables which belong to more than one of the nine articulated MMDS in the study providing the data for this paper. They are presented in decreasing order.

*Table 1: The frequency of variables in the set of nine MMDSs*

| Variable | Frequency |
|---|---|
| *price of wine* | 9 |
| *costs* | 8 |
| *production costs* | 8 |
| *profits* | 6 |
| *sales* | 6 |
| *demand for wine* | 5 |
| *differentiation* | 5 |
| *dominance of large vineyards* | 5 |
| *local partnerships between vineyards* | 5 |
| *marketing costs* | 5 |
| *price of grape* | 5 |
| *production* | 5 |
| *revenues* | 5 |
| *average quality demanded* | 4 |
| *energy costs* | 4 |
| *importance of volume in the majority business model* | 4 |
| *market power of large vineyards* | 4 |
| *marketing efforts abroad* | 4 |
| *alternatives to wine* | 3 |
| *associativity* | 3 |
| *consumption per capita* | 3 |
| *cost effectiveness* | 3 |
| *degree of adjustment of company size* | 3 |
| *distributors* | 3 |
| *economic growth in major markets* | 3 |
| *fair trade* | 3 |
| *identification with the country brand* | 3 |
| *innovation* | 3 |
| *innovative wines* | 3 |
| *investment in winemaking capacity* | 3 |

| | |
|---|---|
| mechanization | 3 |
| organic vine production | 3 |
| personnel costs | 3 |
| production area | 3 |
| quality | 3 |
| territorial rootedness | 3 |
| value added | 3 |
| vineyard size | 3 |
| wine category | 3 |
| ability to sell in supermarkets | 2 |
| artificial inputs | 2 |
| authentic narrative | 2 |
| brands of big vineyards | 2 |
| consumer desire for novelties | 2 |
| demand for cellaring | 2 |
| demand for wine with sustainable production | 2 |
| domestic per capita consumption | 2 |
| domestic price of wine | 2 |
| export market prospects | 2 |
| failures | 2 |
| Fair Trade prime | 2 |
| foreign sales | 2 |
| frauds | 2 |
| identification with the region brand | 2 |
| international per capita consumption | 2 |
| labor supply | 2 |
| leasing of wine cellar | 2 |
| liquidity | 2 |
| margin | 2 |
| natural conditions | 2 |
| novelty of Valley | 2 |
| number of artisan vineyards | 2 |
| price of wine in export markets | 2 |
| production per hectare | 2 |
| professionalization | 2 |
| purchase of grapes from other producers | 2 |
| recognizability of the wine | 2 |
| rural desertion | 2 |
| size of distributors | 2 |
| sustainability | 2 |
| taxes | 2 |
| time to market | 2 |
| volume needed to be profitable | 2 |
| wine culture | 2 |

# 2 The selected variables

This section contains the variables which have been selected for one of the four reasons elaborated in the main paper: being included in a sufficient number of MMDS (frequency) of at least one group of MMDSs, being distinctive for one vineyard, input or output variable, and variables needed to conserve a feedback loop.

## 2.1 Selected for frequency

| Variables | Frequency | G1 | G2 |
|---|---|---|---|
| *price of wine* | 9 | 1 | 1 |
| *costs* | 8 | 1 | 1 |
| *production costs* | 8 | 1 | 1 |
| *profits* | 6 | 1 | 1 |
| *sales* | 6 | 1 | 1 |
| *demand for wine* | 5 | | 1 |
| *differentiation* | 5 | 1 | 1 |
| *dominance of large vineyards* | 5 | 1 | 1 |
| *local partnerships between vineyards* | 5 | 1 | 1 |
| *marketing costs* | 5 | 1 | 1 |
| *price of grape* | 5 | 1 | 1 |
| *production* | 5 | 1 | 1 |
| *revenues* | 5 | 1 | 1 |
| *average quality demanded* | 4 | 1 | 1 |
| *energy costs* | 4 | | 1 |
| *importance of volume in the majority business model* | 4 | | 1 |
| *market power of large vineyards* | 4 | 1 | 1 |
| *marketing efforts abroad* | 4 | 1 | 1 |
| *alternatives to wine* | 3 | 1 | 1 |
| *associativity* | 3 | 1 | |
| *consumption per capita* | 3 | | 1 |
| *cost effectiveness* | 3 | | 1 |
| *degree of adjustment of company size* | 3 | 1 | |
| *distributors* | 3 | 1 | |
| *economic growth in major markets* | 3 | 1 | |
| *fair trade* | 3 | 1 | 1 |
| *identification with the country brand* | 3 | 1 | |
| *innovation* | 3 | | 1 |
| *innovative wines* | 3 | | 1 |
| *investment in winemaking capacity* | 3 | | 1 |
| *mechanization* | 3 | | 1 |
| *organic vine production* | 3 | | 1 |
| *personnel costs* | 3 | 1 | 1 |
| *production area* | 3 | | 1 |
| *quality* | 3 | | 1 |

| | | | |
|---|---|---|---|
| *territorial rootedness* | 3 | | 1 |
| *value added* | 3 | | 1 |
| *vineyard size* | 3 | 1 | |
| *wine category* | 3 | 1 | |
| *artificial inputs* | 2 | | 1 |
| *authentic narrative* | 2 | 1 | |
| *consumer desire for novelties* | 2 | | 1 |
| *demand for cellaring* | 2 | | 1 |
| *demand for wine with sustainable production* | 2 | | 1 |
| *domestic per capita consumption* | 2 | 1 | |
| *failures* | 2 | | 1 |
| *frauds* | 2 | | 1 |
| *identification with the region brand* | 2 | 1 | |
| *international per capita consumption* | 2 | 1 | |
| *labor supply* | 2 | | 1 |
| *leasing of wine cellar* | 2 | | 1 |
| *liquidity* | 2 | 1 | |
| *natural conditions* | 2 | | 1 |
| *number of artisan vineyards* | 2 | 1 | |
| *production per hectare* | 2 | | 1 |
| *rural desertion* | 2 | | 1 |
| *taxes* | 2 | | 1 |
| *wine culture* | 2 | 1 | |

## 2.2 Selected for being individually characteristic

| Variables | Frequency | G1 | G2 |
|---|---|---|---|
| *recognizability of the wine* | 2 | | 1 |
| *desired shortage* | 1 | | 1 |
| *economic equilibrium* | 1 | | 1 |
| *efforts to find and develop distributors* | 1 | 1 | |
| *grape sales opportunity* | 1 | | 1 |
| *identity* | 1 | | 1 |
| *leadership among the vineyards* | 1 | | 1 |
| *pressure from associated producers* | 1 | 1 | |
| *profitability target* | 1 | | 1 |
| *proximity to the dealer* | 1 | 1 | |
| *research* | 1 | | 1 |
| *services provided to members of the cooperative* | 1 | | 1 |
| *wine cellaring service to other vineyards* | 1 | | 1 |

## 2.3 Selected for a loop

| Variables | Frequency | G1 | G2 |
|---|---|---|---|
| *purchase of grapes from other producers* | 2 | 1 | 1 |
| *debt with third parties* | 1 | 1 | |
| *grape producers related to each other* | 1 | | 1 |
| *growth rate og big vineyards* | 1 | 1 | |
| *growth target* | 1 | | 1 |
| *investment in marketing skills* | 1 | | 1 |
| *marketability* | 1 | | 1 |
| *marketing for the company* | 1 | | 1 |
| *mutual trust with producers* | 1 | | 1 |
| *opportunity to sell wine to other vineyards* | 1 | | 1 |
| *purchase of grapes from associated producers* | 1 | | 1 |
| *sales of wine to other vineyards* | 1 | | 1 |
| *shortage* | 1 | | 1 |
| *storage capacity* | 1 | | 1 |
| *total debt with producers* | 1 | 1 | |
| *vinification for own vineyard* | 1 | | 1 |

## 2.4 Selected for being input/output

| Variables | Frequency | G1 | G2 |
|---|---|---|---|
| *professionalization* | 2 | 1 | 1 |
| *sustainability* | 2 | | 1 |
| *time to market* | 2 | | 1 |
| *age of the vineyard* | 1 | 1 | |
| *appropriate varieties* | 1 | | 1 |
| *association of wine with getting drunk* | 1 | | 1 |
| *average boxes sold per vineyard* | 1 | | 1 |
| *awareness of the dangers of drinking* | 1 | | 1 |
| *bulk production capacity* | 1 | | 1 |
| *categorization on the market* | 1 | | 1 |
| *clarity of interests between the company and associated producers* | 1 | 1 | |
| *clarity of processes between the company and associated producers* | 1 | 1 | |
| *CLP exchange rate USD* | 1 | | 1 |
| *competitive advantages in other areas* | 1 | 1 | |
| *concentration of production and marketing* | 1 | 1 | |
| *consolidation* | 1 | | 1 |
| *consumer preference niches* | 1 | 1 | |
| *costs of adapting a yard to mechanized production* | 1 | | 1 |
| *costs of distributing to restaurants* | 1 | 1 | |
| *costs of selling in supermarkets* | 1 | 1 | |
| *degree of cultural adjustment with the distributor* | 1 | 1 | |
| *degree of difference of the recognized market opportunities* | 1 | | 1 |
| *demand for grape* | 1 | | 1 |
| *demand for identity* | 1 | | 1 |
| *designation of origin* | 1 | | 1 |

| | | | |
|---|:-:|:-:|:-:|
| *development of new wines* | 1 | | 1 |
| *difficulty of selling of differentiated vineyards* | 1 | | 1 |
| *disposition to buy from anyone* | 1 | | 1 |
| *distance from Santiago* | 1 | 1 | |
| *divergence of approaches* | 1 | 1 | |
| *divergence of interests* | 1 | 1 | |
| *diversification of varieties* | 1 | | 1 |
| *domestic demand for wine* | 1 | | 1 |
| *domestic price of grapes* | 1 | | 1 |
| *domestic price of wine* | 1 | 1 | |
| *domestic price of wine* | 1 | | 1 |
| *economic feasibility Asia* | 1 | 1 | |
| *efforts for the local community* | 1 | | 1 |
| *estate botteled* | 1 | | 1 |
| *estimated marketing capacity* | 1 | | 1 |
| *export potential* | 1 | | 1 |
| *external energy independence* | 1 | | 1 |
| *Fair Trade Association* | 1 | | 1 |
| *frost occurrences during the season* | 1 | 1 | |
| *government support* | 1 | | 1 |
| *grape available* | 1 | | 1 |
| *grape production unit cost* | 1 | | 1 |
| *grape production unit cost for bottled wine* | 1 | | 1 |
| *grape production unit cost for bulk wine* | 1 | | 1 |
| *grapes for bottled wine* | 1 | | 1 |
| *grapes for bulk wine* | 1 | | 1 |
| *growth of the vineyard* | 1 | | 1 |
| *growth prospects of the domestic market* | 1 | 1 | |
| *health* | 1 | | 1 |
| *impact on vineyard* | 1 | | 1 |
| *importance of fair trade for distributors* | 1 | 1 | |
| *importance of price in the business model* | 1 | | 1 |
| *importance of sustainability* | 1 | | 1 |
| *importance of the commercial side for finding a distributor* | 1 | 1 | |
| *improvement of genetic material* | 1 | | 1 |
| *increased efficiency expected from automation* | 1 | | 1 |
| *increased supply from other countries* | 1 | | 1 |
| *individualism of big vineyards* | 1 | | 1 |
| *infrastructure supporting identity* | 1 | 1 | |
| *innovation suppor infrastructure* | 1 | | 1 |
| *investment costs* | 1 | | 1 |
| *investment in delivery capacity* | 1 | | 1 |
| *investment needed to expand own grape production* | 1 | | 1 |
| *justice in deals* | 1 | | 1 |
| *knowledge of consumer tastes* | 1 | | 1 |
| *linkage to authentic stories* | 1 | | 1 |
| *loss of producers willing to sell grapes* | 1 | 1 | |
| *management complexity* | 1 | | 1 |
| *marketing efficiency* | 1 | | 1 |

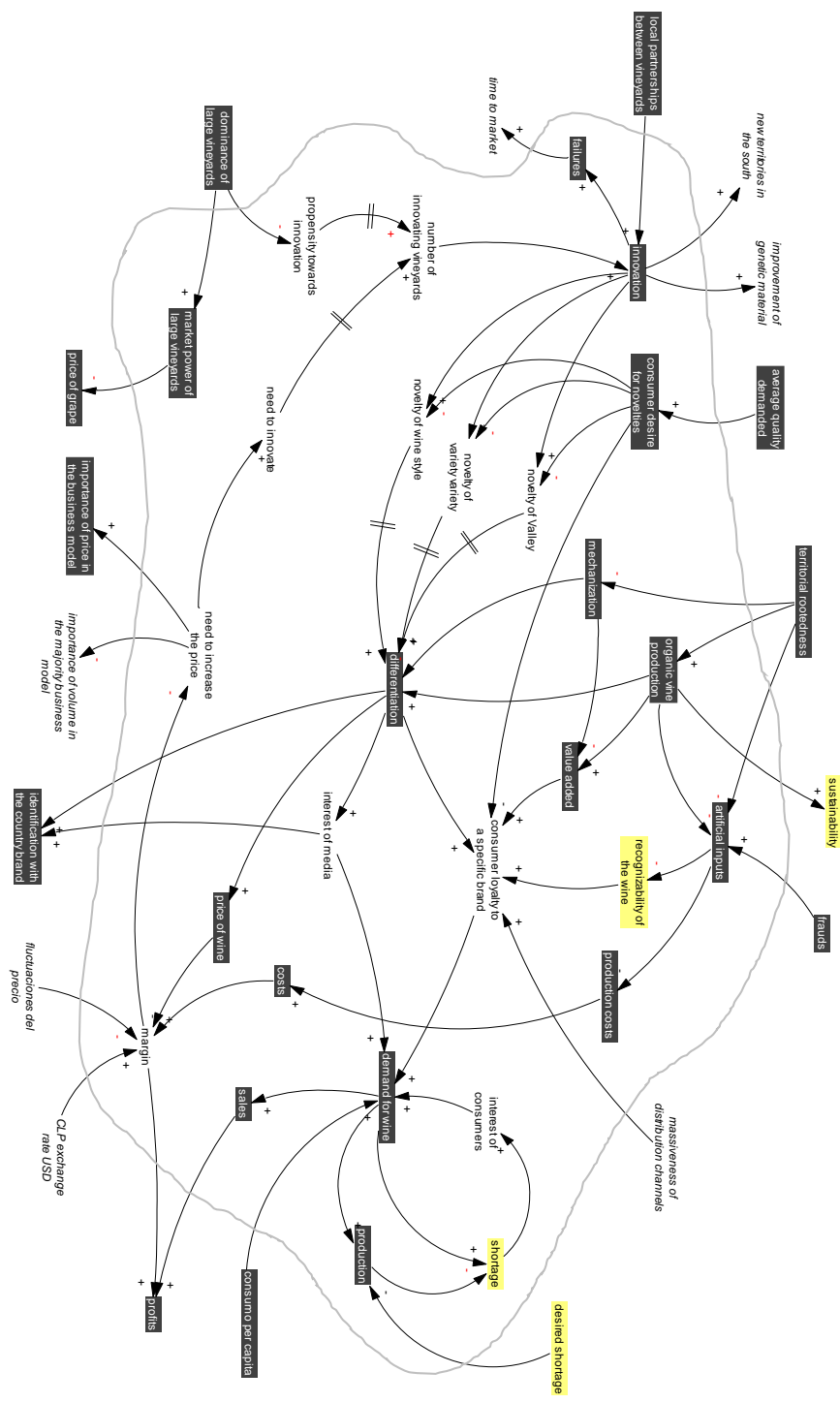| | | | |
|---|---|---|---|
| *marketing efforts abroad* | 1 | | 1 |
| *markup of domestic distributor* | 1 | | 1 |
| *massiveness of distribution channels* | 1 | | 1 |
| *mental propensity to innovate* | 1 | | 1 |
| *mergers of distributors* | 1 | 1 | |
| *need to establish sustainable profitability* | 1 | | 1 |
| *new export markets* | 1 | 1 | |
| *new territories in the south* | 1 | | 1 |
| *niches covered* | 1 | 1 | |
| *number of brands in supermarkets* | 1 | 1 | |
| *number of destination markets* | 1 | | 1 |
| *number of large vineyards* | 1 | 1 | |
| *number of vineyards in Chile* | 1 | | 1 |
| *opportunity to sell wine for other vineyards* | 1 | | 1 |
| *organic wines* | 1 | | 1 |
| *population* | 1 | | 1 |
| *pressure to sell in the short term* | 1 | 1 | |
| *price fluctuations* | 1 | | 1 |
| *price of bottled wine* | 1 | | 1 |
| *price of bulk wine in domestic market* | 1 | | 1 |
| *price of bulk wine in export markets* | 1 | | 1 |
| *price of wine in Asian market* | 1 | 1 | |
| *price of wine in European market* | 1 | 1 | |
| *price of wine sold to other vineyards* | 1 | | 1 |
| *price wine in niches* | 1 | 1 | |
| *production capacity for bottled wine* | 1 | | 1 |
| *production time* | 1 | 1 | |
| *profit sharing* | 1 | | 1 |
| *prohibition* | 1 | | 1 |
| *public contribution to innovation* | 1 | | 1 |
| *public help* | 1 | | 1 |
| *quality standards* | 1 | | 1 |
| *regional identification with wine as part of society* | 1 | | 1 |
| *relative importance of grapes for wine* | 1 | | 1 |
| *restaurant* | 1 | | 1 |
| *risk aversion* | 1 | | 1 |
| *sales price stability* | 1 | | 1 |
| *share of bottled wine* | 1 | | 1 |
| *share of connoisseur consumers* | 1 | 1 | |
| *shared brand* | 1 | | 1 |
| *social importance of wine* | 1 | | 1 |
| *social value of wine as way of life* | 1 | | 1 |
| *stability of quality* | 1 | 1 | |
| *table wine* | 1 | | 1 |
| *term for payment to producer* | 1 | 1 | |
| *time to find land* | 1 | | 1 |
| *time to identify appropriate variety* | 1 | | 1 |
| *total integration of the process on the domain* | 1 | | 1 |
| *tourism* | 1 | | 1 |

| | | | |
|---|---|---|---|
| *unit cost bottled wine* | 1 | | 1 |
| *unit cost of marketing bottled wine* | 1 | | 1 |
| *value of tradition* | 1 | | 1 |
| *visitor center* | 1 | | 1 |
| *volume of emerging markets* | 1 | | 1 |
| *wine adaptation to market preferences* | 1 | 1 | |
| *wine maturation time* | 1 | | 1 |
| *work infrastructure* | 1 | 1 | |

# 3 Example models in the original and aggregated version

This section contains the causal diagrams of MMDSs 2 and 7 in the original and the aggregated version. Input and output variables are printed in italics and separated from the rest of the variables by a grey border. Variables selected for their frequency have a black rectangular background and are printed in white. A yellow rectangle has been used for variables which are 'distinctive' for the vineyard or needed to conserve a feedback loop. Solid arrows represent causal links, and dotted arrows are aggregated links representing one or several paths in the original MMDS.

# 3.1 MMDS 2

## 3.1.1 Original

# 3.2 MMDS 7

## 3.2.1 Original

demand for wine with sustainable production

investment needed to expand own grape production

relative importance of grape for wine

growth of the vineyard

Fair Trade Association

leadership among the vineyards

importance of sustainability

impact on vineyard

time to identify appropriate variety

CO2 footprint

research

fair trade

efforts to incorporate new related producers

organic wine production

time to market

time to find land

degree of difference of the recognized market opportunities

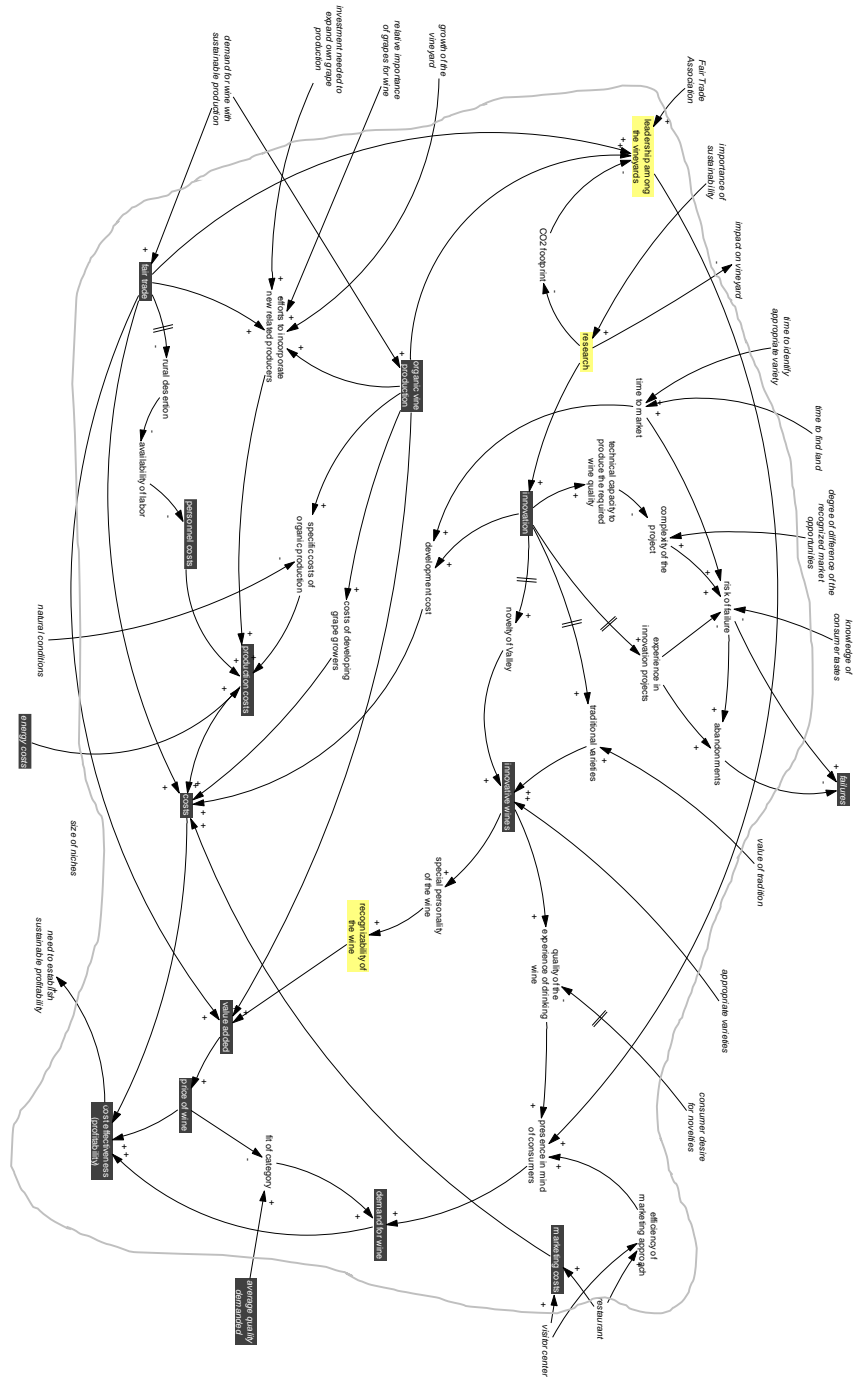knowledge of consumer tastes

rural desertion

availability of labor

technical capacity to produce the required wine quality

complexity of the project

risk of failure

personnel costs

specific costs of organic production

innovation

development cost

novelty of Valley

experience in innovation projects

abandonments

costs of developing grape growers

natural conditions

production costs

traditional varieties

failures

value of tradition

energy costs

costs

innovative wines

size of niches

special personality of the wine

recognizability of the wine

quality of the experience of drinking wine

appropriate varieties

need to establish sustainable profitability

value added

consumer desire for novelties

price of wine

costs of economically less profitability

fit of category

presence in mind of consumers

demand for wine

marketing costs

efficiency of marketing approach

restaurant

average quality demanded

visitor center

## 3.2.2 Aggregated