FUTURE IMAGES OF THE FINNISH PRIMARY PRODUCTION BY 2050

Perspective of resilience

Futures Studies Tackling Wicked Problems conference

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Resilience

Source: World Economic Forum, eds. Howell, 2013, 37

Specified and general resilience

Specified resilience: “resilience of what to what” (e.g. certain spatial area and certain phenomenon).

Resilience engineering defines resilience:

“The intrinsic ability of a system to adjust its functioning prior to, during, or following *changes and disturbances*, so that it can sustain required operations under both expected and *unexpected* conditions”

(Hollnagel, 2011, xxxvi)

General resilience

- Tightness of feedbacks; responsiveness
- Modularity; subsystems or components
- Diversity in a system

Connectedness

- The amount of change a system can withstand and maintain its main functions and structure (identity)
- The ability of a system to develop the capacity for learning and adaptation (e.g. trust, cultural capital)
- Capability of self-organizing behavior – resulting innovation and experimentation

(Walker and Salt, 2006, 121, 145-148; Cabell and Oelofse, 2012)

Methods

- Online Delphi, two rounds
  - First round: 63 experts (individual respondents).
  - Second round: 23 experts (individual respondents)
- The indicator framework for assessing resilience of agro-ecosystems (first round expert survey).
- 13 indicators (Cabell & Oelofse, 2012); present and future resilience.
- The survey had four sections to choose from: primary production, food industry, retail, and consumption. The respondent could answer more than one section.
- Options in the survey for primary production: small, medium or large farms; organic, plant or livestock production farms.
- The scale used was the Likert scale (1–5).
- Based on the first round results future images were constructed utilizing cluster analysis.

The first round expert survey, present status

Indicator	*Primary production, i.e. farms*						
	S	*MS*	*L*	*Org.*	*PP*	*LF*	*All*
1. Socially self-organised	3.33	3.44	3.41	3.59	3.3	3.11	3.36
2. Ecologically self-regulated	2.79	2.57	2.43	3.61	2.5	2.79	2.78
3. Appropriately connected	2.38	2.67	3.13	3.04	3.04	2.71	2.83
4. Functional and response diversity	3.08	2.85	2.5	3.65	2.5	2.46	2.84
5. Optimally redundant	2.88	2.80	2.76	2.96	2.88	2.72	2.83
6. Spatial and temporal heterogeneity	2.96	2.88	3.00	4.08	2.69	3.31	3.15
7. Exposed to disturbances	3.30	3.41	3.22	3.93	3.37	3.22	3.41
8. Coupled with local natural capital	2.2	2.27	2.23	2.76	2.23	2.15	2.31
9. Reflected and shared learning	3.23	3.48	4.12	4.00	3.80	3.96	3.77
10. Globally autonomous and locally interdependent	n/a	n/a	n/a	n/a	n/a	n/a	n/a
11. Honours legacy	3.52	3.37	3.00	3.85	3.26	3.30	3.38
12. Builds human capital	n/a	n/a	n/a	n/a	n/a	n/a	n/a
13. Reasonably profitable	n/a	n/a	n/a	n/a	n/a	n/a	n/a
In total	2.97	2.97	2.98	3.55	2.96	2.97	

Primary production is divided into small (S), medium (M), large (L), organic (Org.), plant production (PP) and livestock (LF) farms.
Degree of resilience is illustrated as follows: low (white, mean of responses 0–2.6),
medium (light grey, mean of responses 2.7–3.3) and high (dark grey, mean of responses 3.4–5).

(Tapiola & Paloviita, unpublished manuscript)

The first round expert survey, status by 2050

Indicator	*Primary production, i.e. farms*						
	S	*MS*	*L*	*Org.*	*PP*	*LF*	*All*
1. Socially self-organised	3.74	3.63	3.52	3.89	3.59	3.44	3.64
2. Ecologically self-regulated	3.59	3.67	3.7	4.00	3.63	3.96	3.76
3. Appropriately connected	3.56	3.79	3.88	3.96	3.92	3.72	3.81
4. Functional and response diversity	3.73	3.73	3.54	3.92	3.65	3.35	3.65
5. Optimally redundant	2.96	3.08	3.00	3.20	3.16	3.00	3.07
6. Spatial and temporal heterogeneity	3.50	3.69	3.96	4.24	3.68	3.88	3.83
7. Exposed to disturbances	3.38	3.35	3.31	3.58	3.38	3.38	3.40
8. Coupled with local natural capital	3.96	4.23	4.24	4.38	4.19	4.23	4.21
9. Reflected and shared learning	4.16	4.24	4.40	4.36	4.32	4.36	4.31
10. Globally autonomous and locally interdependent	3.42	3.35	3.31	3.54	3.31	3.58	3.42
11. Honours legacy	3.7	3.56	3.37	3.78	3.59	3.59	3.60
12. Builds human capital	n/a	n/a	n/a	n/a	n/a	n/a	n/a
13. Reasonably profitable	2.62	2.85	3.42	3.15	3.12	3.31	3.08
In total	3.53	3.6	3.64	3.83	3.63	3.65	

Primary production is divided into small (S), medium (M), large (L), organic (Org.), plant production (PP) and livestock (LF) farms.
Degree of resilience is illustrated as follows: low (white, mean of responses 0–2.6),
medium (light grey, mean of responses 2.7–3.3) and high (dark grey, mean of responses 3.4–5).

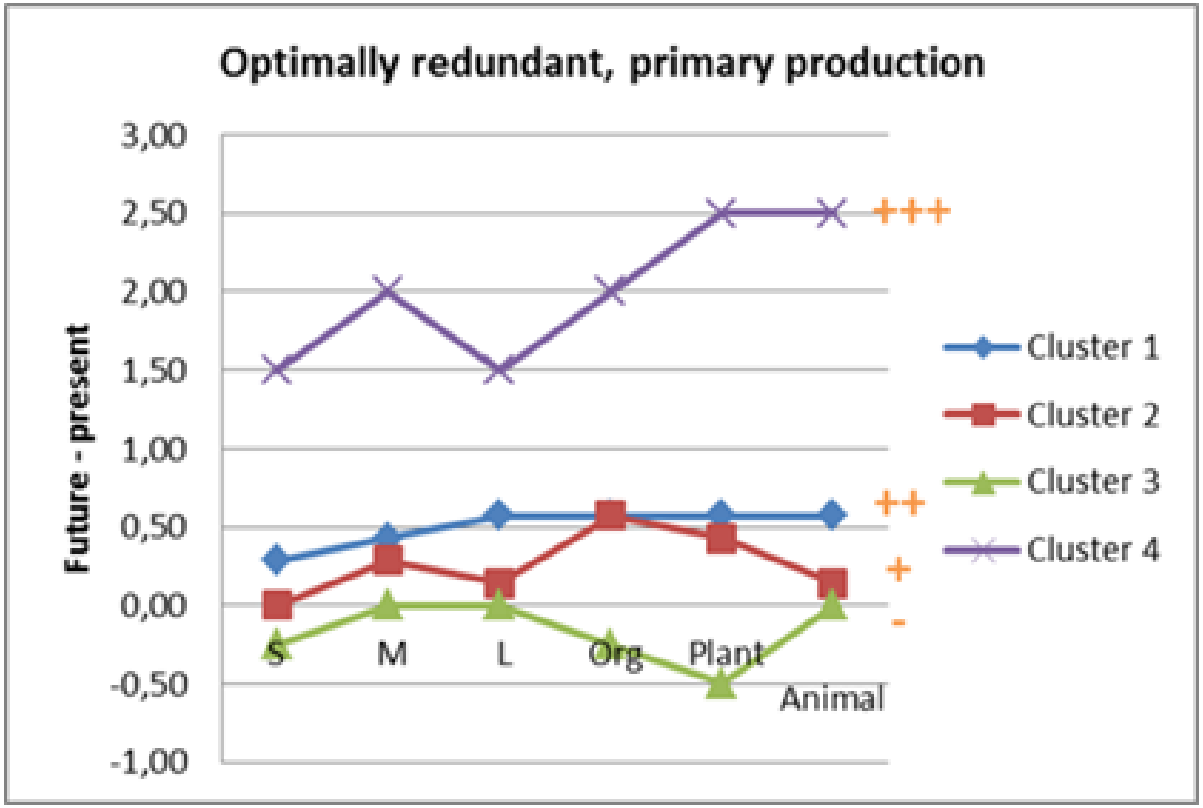
(Tapiola & Paloviita, unpublished manuscript)

Clusters visualized

Y-axis shows the relative change (future – present, average expert evaluation).

X-axis displays variables: small, medium, large farm size, organic, plant or livestock farms.

Plus and minus signs indicate clusters' relative position to each other.



Relative + change

Relative - change

Analysis of clusters for primary production

		Primary production			
Indicators below	Future images on the right	Technological agriculture (clusters 1 and 2)		Externally controlled agriculture (cluster 3)	Resilient agriculture (cluster 4)
1. Socially self-organized		+	+	-	+
2. Ecologically self-regulated		++	+	+	+++
3. Appropriately connected		+	+	+	++
4. Functional and response diversity		+	+	+	++
5. Optimally redundant		+	++	-	+++
6. Spatial and temporal heterogeneity		+	+	+	+++
7. Exposed to low level disturbances		++	+	-	+++
8. Coupled with local natural capital		++	+	-	+++
9. Reflected and shared learning		+	+	+	++
10. Globally autonomous and locally interdependent		++	+	++	+++
11. Honors legacy		- -	+	+	++
12. Builds local human capital		-	- -	+	++
13. Reasonably profitable		+++	+	+	+++
Total		**14**	**11**	**6**	**32**

Future images of primary production

“Resilient agriculture” is a future image foreseeing all the indicators having positive values.

- Farmers make use of ecosystem services, local conditions and natural resources enabling **ecological regulation**.
- Need of external inputs has decreased (fertilizers, water, pesticides and energy).
- Farms have redundancy or "flexibility" including strong networks.
- National agriculture is almost **self-sufficient** in terms of e.g. inputs and energy.
- Agriculture is **profitable** and national agriculture is highly appreciated.

Future images of primary production

“Technological agriculture” is a future image foreseeing the primary production developing towards resiliency.

- Appreciation for natural resources (because of natural catastrophes and legislative changes.)
- **New technologies** have advanced sustainable use of natural resources.
- Farmers have only **few connections** to their stakeholders (main motivation financial benefits).
- New technologies rapidly gain ground (risks not fully evaluated).
- Primary production is **reasonably profitable** .

Future images of primary production

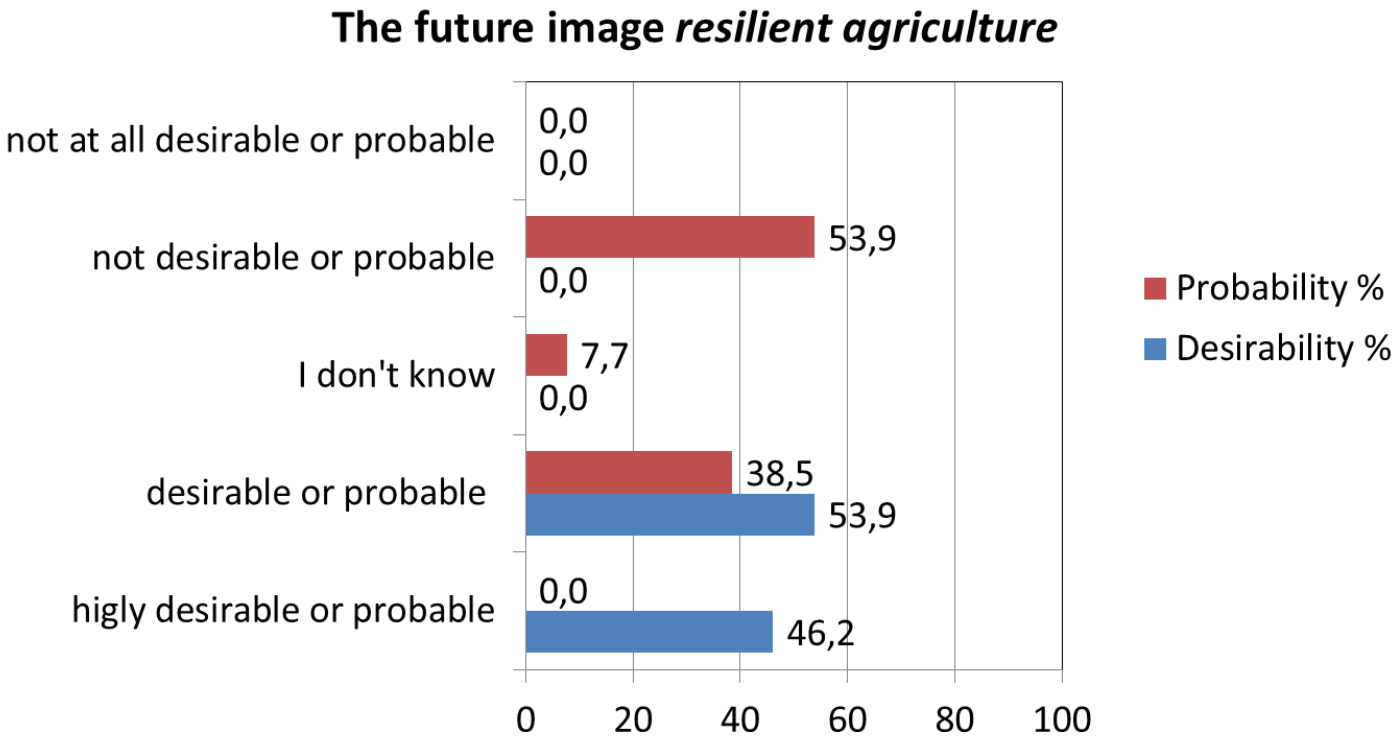
“Externally controlled agriculture” is a future image foreseeing that primary production has not developed towards resiliency .

- Short-term **efficiency and economy** are the main drivers.
- Farmers have limited opportunities to build networks (dependencies) and develop their competencies.
- This may be one reason for **low profitability**.
- Farms rarely act ecologically or exploit sustainably ecosystem services or natural resources.
- Long-term sustainability is sacrificed in the name of profits.
- Farms have **no redundancy (flexibility)**.

Second round expert survey

- Online survey asking experts' opinion about probability and desirability of the future images
- Likert scale 1-5 (probability and desirability).

Resilient agriculture



Either highly desirable or desirable (100%) on the other hand probability divided the opinions.

Technological agriculture

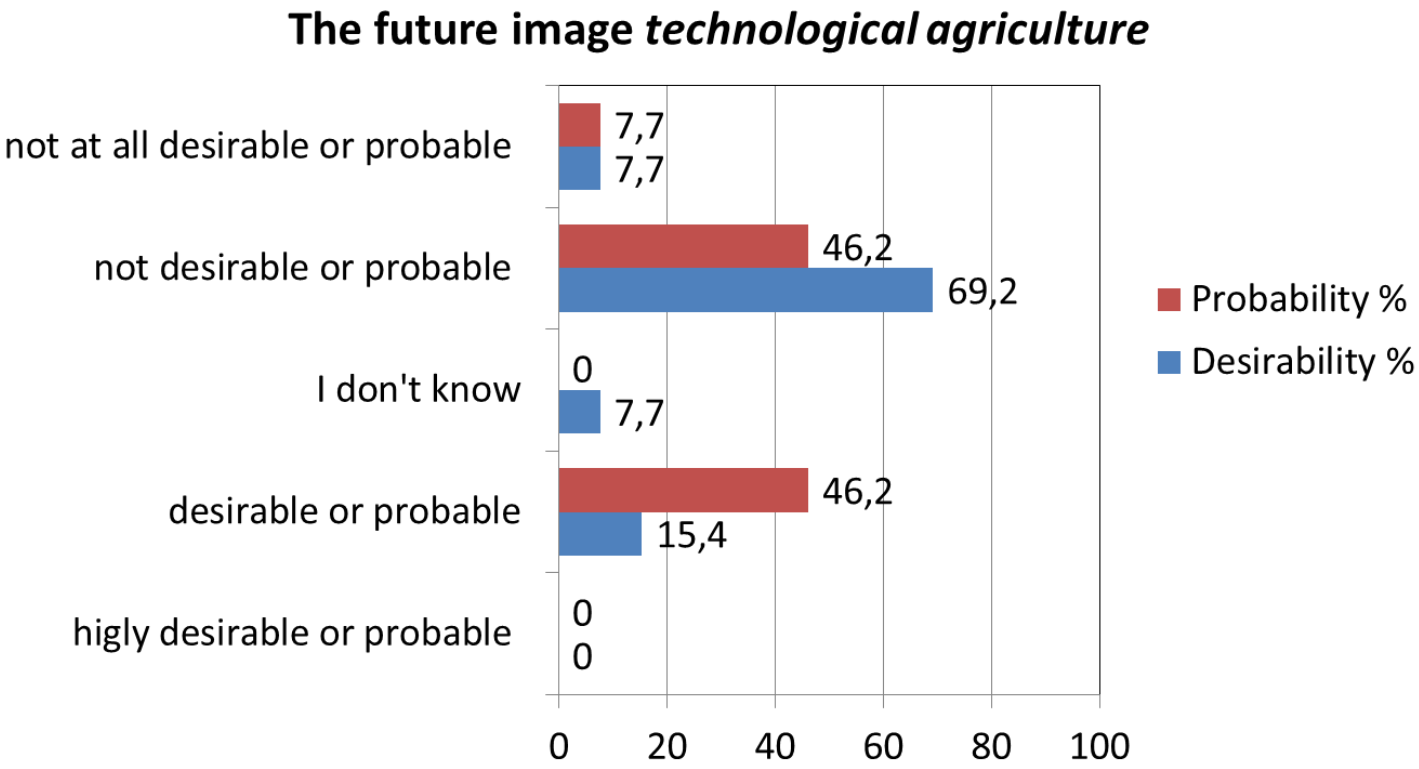
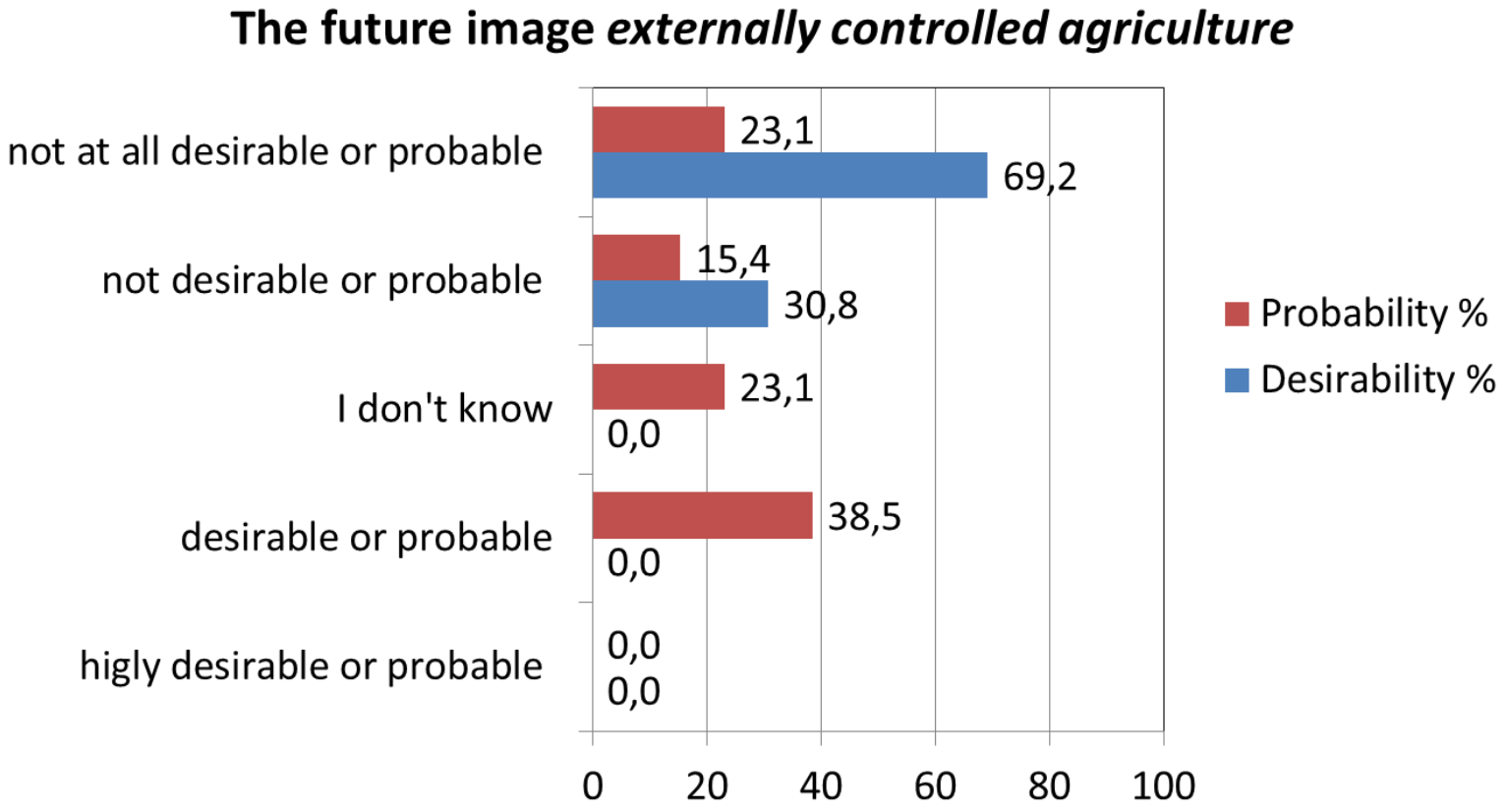


Image was not seen very desirable by most of the respondents. Minority regarded it as desirable. Probability divided opinions.

Externally controlled agriculture



Future image was seen as not desirable and many respondents considered this as a probable future image, however, opinions were divided.

Conclusions

- It appears that even though most of the experts have positive images of the future resilience, the probability divides the opinions.
- The question remains: how to facilitate the materialization of the desirable future despite of possible conflicts of interests between different sections of the food system (or society)?
- The futures research has a key role for example by facilitating the communication (e.g. participatory methods) between different groups of food system (or society).
- Maybe it would be possible to agree upon the desirable futures (resilient and sustainable) and build the common way towards that.