

Analysis of effective motivational indicators among members on entry in agricultural cooperatives

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Abstract

This study presents an analysis of the personal *motivational factors* of the farmers to entry in *agricultural cooperatives*. The study is based on the survey carried out during the 2014-15 in Slavonija (Croatia).

The results presented here are obtained by *factor analysis* (FA) and *correspondence analysis* (CA).

We show that motivational factors are divided into two groups: *social* and *economic* factors, with the highest loadings of *safe product placement* and *production cost reduction*.

The survey summary (202 items)

1 – 5 economic, 6 – 10 social (reasons)	<i>Item scale</i>					\bar{X}	CV
	1	2	3	4	5		
	<i>n</i> ^o	<i>n</i> ^o	<i>n</i> ^o	<i>n</i> ^o	<i>n</i> ^o		
1. Decreasing risk production	13	20	69	66	34	3.44	0.314
2. Safe market placement and product sales	7	6	40	72	77	4.02	0.250
3. Reducing production costs	11	8	52	69	62	3.81	0.285
4. Easier obtain of state aid measurement	43	57	46	39	17	2.65	0.469
5. Increased avail. of state aid financial funds	19	31	59	59	34	3.29	0.362
6. Personal satisfact. and a sense of usefulness	14	48	68	51	21	3.08	0.352
7. Social backgr. and beliefs among members	10	29	67	73	23	3.35	0.305
8. Meeting new people	26	68	61	30	17	2.72	0.413
9. Devel. of prof. skills and exchanging exper.	10	24	71	66	31	3.42	0.305
10. Active contribution to local development	4	40	75	47	36	3.35	0.313

1=unimportant; 2=weak; 3=enough; 4=big; 5=very big (reason)

Motivational Likert scale quality (internal consistency)

<i>var</i>	correlation	mean	variance	Cronbach's α
<i>motiv</i> ₁	0.68	29.69	36.13	0.79
<i>motiv</i> ₂	0.60	29.10	37.77	0.80
<i>motiv</i> ₃	0.61	29.32	37.06	0.80
<i>motiv</i> ₄	0.67	30.47	35.13	0.79
<i>motiv</i> ₅	0.63	29.84	36.17	0.80
<i>motiv</i> ₆	0.57	30.04	37.64	0.80
<i>motiv</i> ₇	0.57	29.78	38.02	0.80
<i>motiv</i> ₈	0.60	30.40	36.96	0.80
<i>motiv</i> ₉	0.60	29.71	37.53	0.80
<i>motiv</i> ₁₀	0.57	29.77	37.83	0.80
			overall	0.812

Factor analysis

SS loadings	F1	F2	h^2	u^2
	Business	Social		
	2.38	2.25		
<i>motiv</i> ₁	0.711		0.57	0.43
<i>motiv</i> ₂	0.857		0.70	0.30
<i>motiv</i> ₃	0.821		0.66	0.34
<i>motiv</i> ₄	0.413		0.33	0.67
<i>motiv</i> ₅	0.423		0.29	0.71
<i>motiv</i> ₆		0.624	0.39	0.61
<i>motiv</i> ₇		0.458	0.28	0.72
<i>motiv</i> ₈		0.796	0.61	0.39
<i>motiv</i> ₉		0.658	0.45	0.55
<i>motiv</i> ₁₀		0.578	0.35	0.65
var (%)	24	22		
cum. var (%)	24	46		

Correspondence analysis

Correspondence analysis (CA) is proposed by Hirschfeld (1935) and later developed by Benzécri (1973), see also Greenacre (1984).

It is conceptually similar to principal component analysis, but applies to categorical rather than continuous data. In a similar manner to principal component analysis, it provides a means of displaying or summarising a set of data in two-dimensional graphical form (biplot).

All data should be nonnegative and on the same scale for CA to be applicable. The method treats rows and columns equivalently.

We shall use *classical* CA and *doubling ratings* variant as well.

Low rank approximation (starting point for CA)

Theorem (Eckart and Young (1936), Mirsky (1960))

Let $D = U\Sigma V^T \in \mathbb{R}^{m \times n}$, $m \leq n$ be the *singular value decomposition* of matrix D and partitions of U , $\Sigma =: \text{diag}(\sigma_1, \dots, \sigma_m)$, and V as follows:

$$U =: \begin{bmatrix} U_1 & U_2 \end{bmatrix}, \quad \Sigma =: \begin{bmatrix} \Sigma_1 & 0 \\ 0 & \Sigma_2 \end{bmatrix}, \quad \text{and} \quad V =: \begin{bmatrix} V_1 & V_2 \end{bmatrix},$$

where Σ_1 is $r \times r$, U_1 is $m \times r$, and V_1 is $n \times r$.

Then, the rank- r matrix, obtained from the truncated singular value decomposition:

$$\hat{D}^* = U_1 \Sigma_1 V_1^T,$$

is such that:

$$\|D - \hat{D}^*\|_F = \min_{\text{rank}(\hat{D}) \leq r} \|D - \hat{D}\|_F = \sqrt{\sigma_{r+1}^2 + \dots + \sigma_m^2}.$$

Contingency table

Motives	1	2	3	4	5	Total	Rows masses
	f	f	f	f	f		
Decreasing risk production.	13	20	69	66	34	202	0.100
Motive 1	(0.0064)	(0.0099)	(0.0342)	(0.0327)	(0.0168)	(0.1000)	
Safe market placement and product sales.	7	6	40	72	77	202	0.100
Motive 2	(0.0035)	(0.0030)	(0.0198)	(0.0356)	(0.0381)	(0.1000)	
Reducing production costs.	11	8	52	69	62	202	0.100
Motive 3	(0.0054)	(0.0040)	(0.0257)	(0.0342)	(0.0307)	(0.1000)	
Easier obtain of state aid measurement.	43	57	46	39	17	202	0.100
Motive 4	(0.0213)	(0.0282)	(0.0228)	(0.0193)	(0.0084)	(0.1000)	
Increased avail. of state aid financial funds.	19	31	59	59	34	202	0.100
Motive 5	(0.0094)	(0.0153)	(0.0292)	(0.0292)	(0.0168)	(0.1000)	
Personal satisfact. and sense of usefulness.	14	48	68	51	21	202	0.100
Motive 6	(0.0069)	(0.0238)	(0.0337)	(0.0252)	(0.0104)	(0.1000)	
Social backgr. and beliefs among members.	10	29	67	73	23	202	0.100
Motive 7	(0.0050)	(0.0144)	(0.0332)	(0.0361)	(0.0114)	(0.1000)	
Meeting new people.	26	68	61	30	17	202	0.100
Motive 8	(0.0129)	(0.0337)	(0.0302)	(0.0149)	(0.0084)	(0.1000)	
Devel. of prof. skills and exchanging exper.	10	24	71	66	31	202	0.100
Motive 9	(0.0050)	(0.0119)	(0.0351)	(0.0327)	(0.0153)	(0.1000)	
Active contribution to local development.	4	40	75	47	36	202	0.100
Motive 10	(0.0020)	(0.0198)	(0.0371)	(0.0233)	(0.0178)	(0.1000)	
Total	157	331	608	572	352	2020	
Average row profiles	(0.0777)	(0.1639)	(0.3010)	(0.2832)	(0.1743)		

CA algorithm:

1. step – Calculate the matrix \mathbf{S} of standardised residuals:

$$\mathbf{S} = \mathbf{D}_r^{-\frac{1}{2}} \left(\mathbf{P} - \mathbf{r}\mathbf{c}^T \right) \mathbf{D}_c^{-\frac{1}{2}} \quad (1)$$

2. step – Calculate the SVD of \mathbf{S} :

$$\mathbf{S} = \mathbf{U}\mathbf{D}_\alpha\mathbf{V}^T \text{ where are } \mathbf{U}^T\mathbf{U} = \mathbf{V}^T\mathbf{V} = \mathbf{I} \quad (2)$$

3. step – Standard coordinates Φ and Γ of rows and columns:

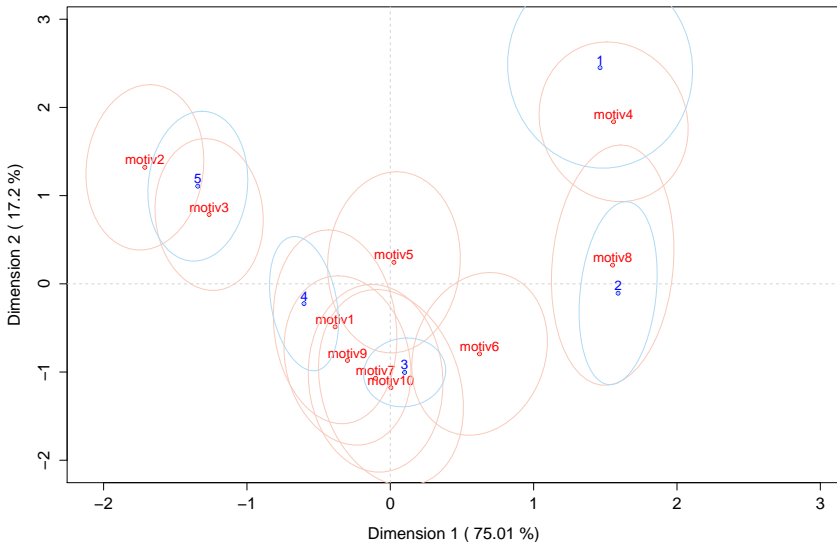
$$\Phi = \mathbf{D}_r^{-\frac{1}{2}} \mathbf{U} \text{ and } \Gamma = \mathbf{D}_c^{-\frac{1}{2}} \mathbf{V} \quad (3)$$

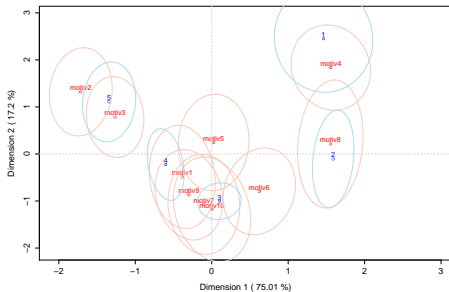
4. step – Principal coordinates \mathbf{F} and \mathbf{G} of rows and columns:

$$\mathbf{F} = \mathbf{D}_r^{-\frac{1}{2}} \mathbf{U}\mathbf{D}_\alpha = \Phi\mathbf{D}_\alpha \quad (4)$$

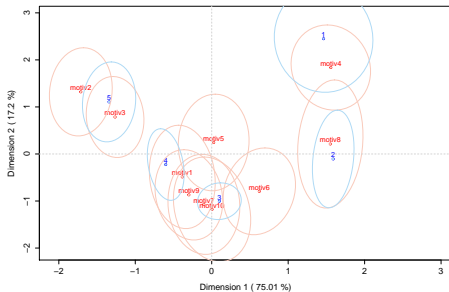
$$\mathbf{G} = \mathbf{D}_c^{-\frac{1}{2}} \mathbf{V}\mathbf{D}_\alpha = \Gamma\mathbf{D}_\alpha$$

Correspondence analysis of all motivational factors:



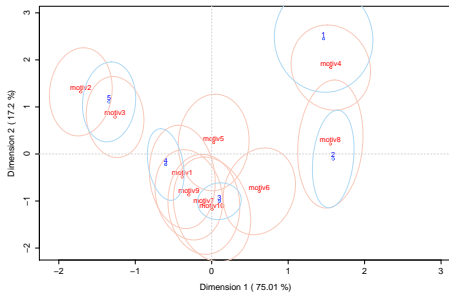


- Two economic motives *safe market product placement* (*motiv₂*) and *reducing production costs* (*motiv₃*) shows the **highest** correspondence with the *very big reason* for entering the cooperatives.
- The least correspondence is shown by *meeting new people* (*motiv₈*).



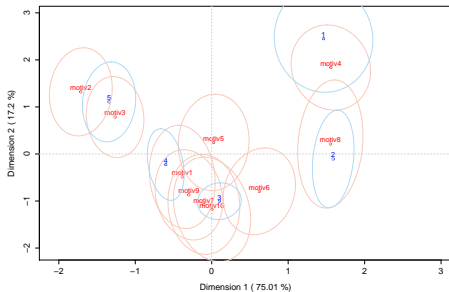
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– To the best of our knowledge, this is the best what the classical CA can give.



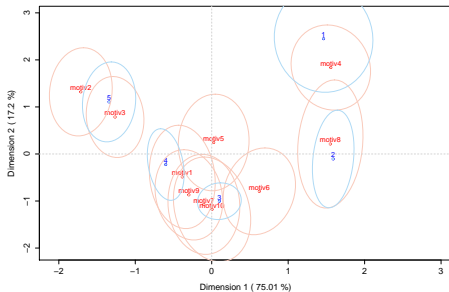
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- The additional Likert scales are created to support this direction: *confidence, autonomy, edu, cooperation*,... and 5 more.

Doubling of ratings

Table 1 : Example of *Doubling* on a scale 1-5

Questions				Extended (doubled) questions							
				Question A		Question B		Question C		Question D	
A	B	C	D	A-	A+	B-	B+	C-	C+	D-	D+
2	3	4	3	1	3	2	2	3	1	2	2
3	4	2	3	2	2	3	1	1	3	2	2
2	3	2	4	1	3	2	2	1	3	3	1
2	2	2	2	1	3	1	3	1	3	1	3
3	3	3	3	2	2	2	2	2	2	2	2

Polarization effect. The answer A2 is *1-step* from the *worst case*,

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				Question A		Question B		Question C		Question D	
A	B	C	D	A-	A+	B-	B+	C-	C+	D-	D+
2	3	4	3	1	3	2	2	3	1	2	2
3	4	2	3	2	2	3	1	1	3	2	2
2	3	2	4	1	3	2	2	1	3	3	1
2	2	2	2	1	3	1	3	1	3	1	3
3	3	3	3	2	2	2	2	2	2	2	2

Polarization effect. The answer A2 is *1-step* from the *worst case*, and *3-steps* from the *best case*.

Doubling of ratings

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Questions				Extended (doubled) questions							
				Question A		Question B		Question C		Question D	
A	B	C	D	A-	A+	B-	B+	C-	C+	D-	D+
2	3	4	3	1	3	2	2	3	1	2	2
3	4	2	3	2	2	3	1	1	3	2	2
2	3	2	4	1	3	2	2	1	3	3	1
2	2	2	2	1	3	1	3	1	3	1	3
3	3	3	3	2	2	2	2	2	2	2	2

Polarization effect. The answer A2 is *1-step* from the *worst case*, and *3-steps* from the *best case*. The sum equals 4 ($= 5 - 1$).

Doubling of ratings

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Questions				Extended (doubled) questions							
				Question A		Question B		Question C		Question D	
A	B	C	D	A-	A+	B-	B+	C-	C+	D-	D+
2	3	4	3	1	3	2	2	3	1	2	2
3	4	2	3	2	2	3	1	1	3	2	2
2	3	2	4	1	3	2	2	1	3	3	1
2	2	2	2	1	3	1	3	1	3	1	3
3	3	3	3	2	2	2	2	2	2	2	2

Polarization effect. The answer A2 is *1-step* from the *worst case*, and *3-steps* from the *best case*. The sum equals 4 ($= 5 - 1$).

– Apply CA with the extended column space.

Influence of the agricultural activities duration on motivation

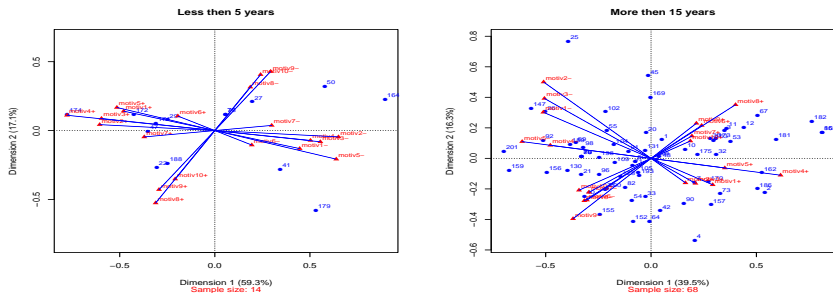


Figure 1 : Farmers with ≤ 5 (left) and ≥ 15 years (right) of agricultural activity.

Respondents with ≤ 5 years of agricultural activities prefer *motiv₂* and *motiv₅* more than others, while respondents with ≥ 15 years of agricultural activities prefer *motiv₂* and *motiv₃* more than others.

Influence of the income on motivation

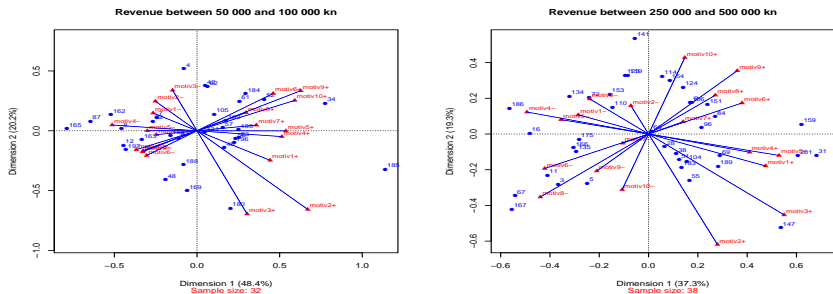


Figure 2 : Farmers with lower (left) and higher annual income (right).

Respondents with total income *less than* €13,333.33 *prefer to choose safe* product placement (*motiv₂*).

Respondents with annual income *more than* €33,333.33 or in cooperation with cooperative *prefer to reduce own production costs* (*motiv₃*).

Influence of the production on motivation

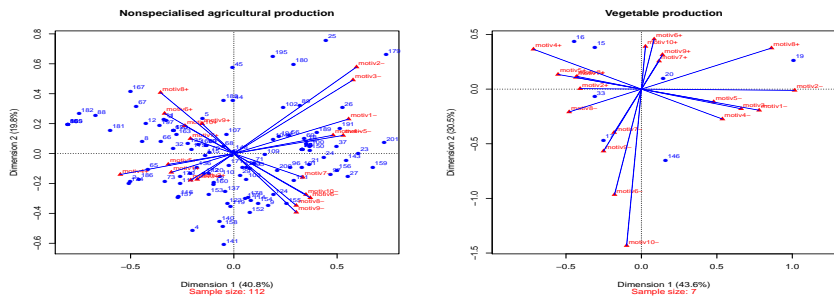


Figure 3 : Farmers with nonspecified (left) and vegetable production (right)

Respondents with *nonspecified production* prefer to *choose motiv₂ and motiv₃*. Respondents with *vegetable production* prefer to choose *motiv₁₀ and motiv₆*.

Influence of membership type on motivation

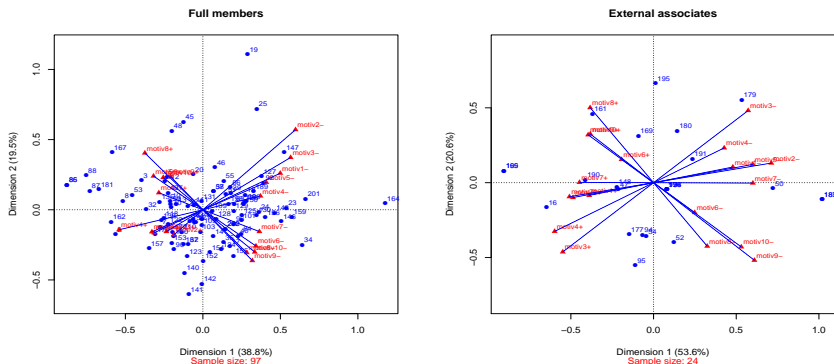


Figure 4 : Farmers with full membership (left) and external associates (right)

Respondents with *full membership* rights prefer to *choose motiv₂*, while non members (*external associates*) prefer to *choose motiv₃*.

Résumé

With a help of **factor analysis** we conclude that farmers recognize agricultural cooperatives exclusively as an economic organization, see also Drahiem (1955), Wilson (2000) and Bruynis et al. (2001).

Two groups of motivational factors were identified:

- Economic, represented by *safe product placement (motiv₂)* and *reducing production costs (motiv₃)* (loadings: 0.857 and 0.821).
- Social, represented by *meeting new people (motiv₈)* (loadings 0.796)

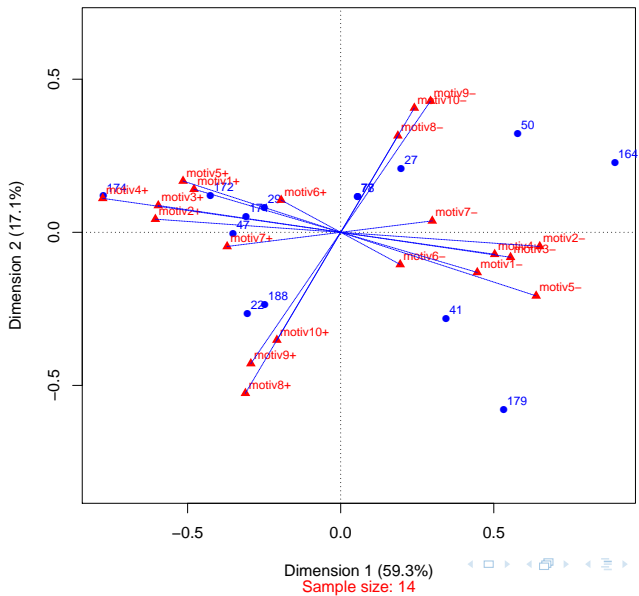
Correspondence analysis has many variants. We exploited here classical CA, and doubling (in column space) applied on the specified sub-groups of respondents.

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Thank you for your attention.
Hvala.

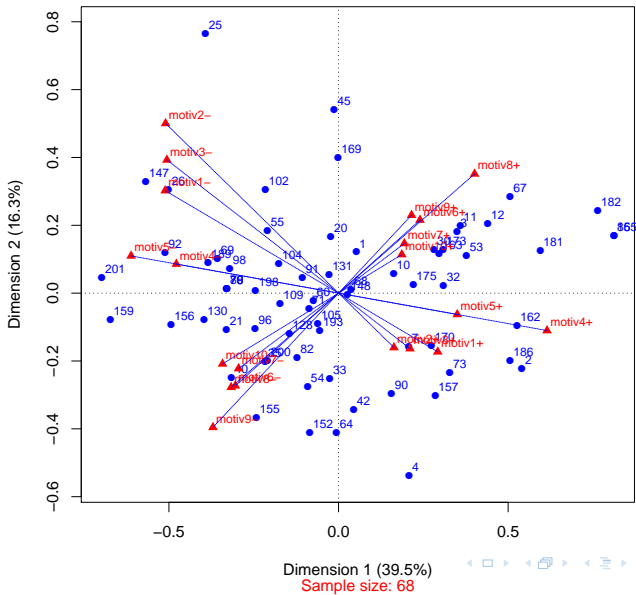
Less than 5 years



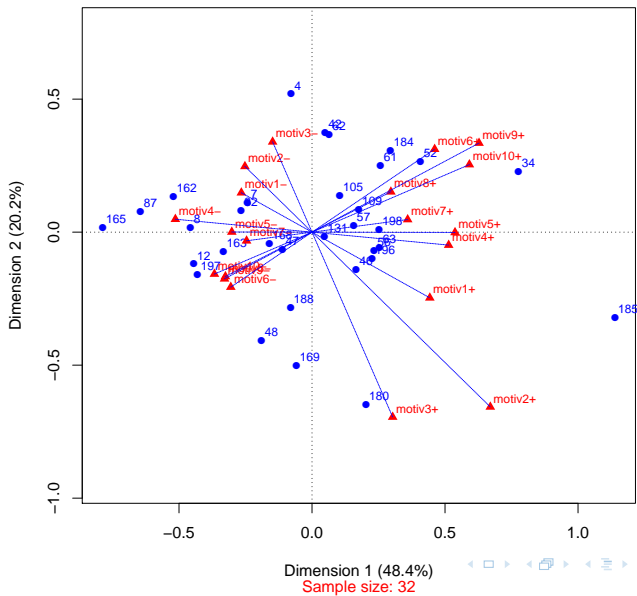
Dimension 1 (59.3%)

Sample size: 14

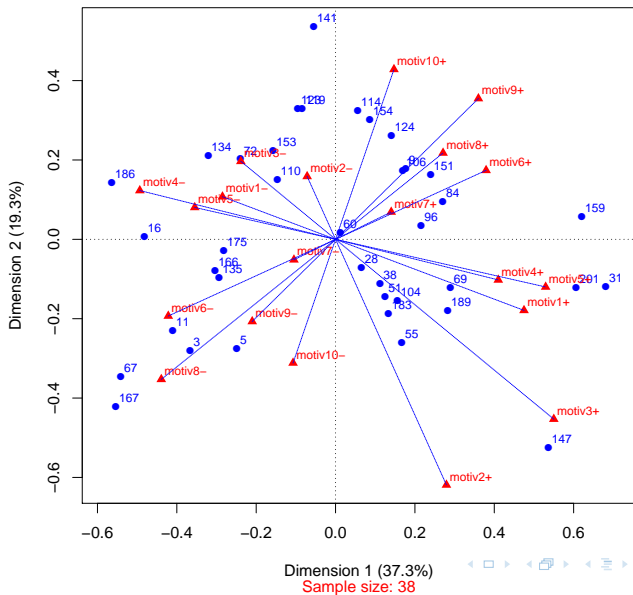
More than 15 years



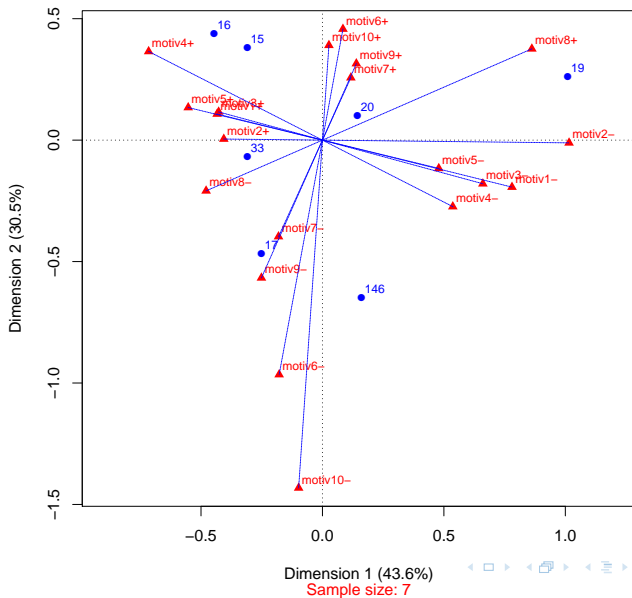
Revenue between 50 000 and 100 000 kn



Revenue between 250 000 and 500 000 kn



Vegetable production



External associates

