

## Challenges of the red meat supply chain in Slovenia: the case of pig breeders

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### Abstract

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The research comprises of an in-depth analysis of the models of vertical integration of Slovenian pig producers. The data were collected in a nation-wide survey (n = 152). Besides the structural characteristics of farms, the key focus was on vertical integration of the pig breeders and a set of questions related to beliefs and attitudes towards the contemporary food supply chains. The survey data were analysed with the latent class cluster analysis focused on researched constructs related to cooperation and pig meat supply chain. The results show that rather obsolete and informal organisation structures prevail in Slovenia, which is in contrasts with hypothesis and expectations. Furthermore, farmers significantly differ according to their attitude towards supply chain coordination and business engagement in actual activities of supply chains. The research concludes with various policy implications and business guidance.

*Keywords:* Slovenia; pig production; supply chain; management; latent class; cluster analysis

### Introduction

Effective collective action is the key approach to improve competitiveness in majority of business sectors and the positive implications from strategic collaboration are expected particularly in fragmented economies (Chandrasekaran & Raghuram, 2014). Supply chain management and integration in agro-food sector brings economic benefits to all chain participants (Swinnen & Maertens, 2007). Slovenian agriculture is characterized by dispersed farm structure, which is beside lack of efficient supply chain operation, an important factor for unfavourable economic performance. Among the sub-sectors of Slovenian agriculture, the red meat supply chain shows several symptoms of a sector in intensive transformation, yet many characteristics are annotating pre-transitional operation models (Kuhar et al., 2010).

A significant body of literature exists on supply chains and contracting in general economy, but also a notable amount of specific research is available for agro-food sector.

General conclusion is that existing arrangements in supply chain show varying complexity and sophistication and thus finding ways to increase their effectiveness is of a critical importance (Ondersteijn et al, 2006). Therefore, it is clear why majority of research focus on relationships management which is defined as supply chain management (SCM) and the widely accepted definition of SCM is the one by Christopher (2011) which states: “Supply chain management is the management of upstream and downstream relationships, with customers, suppliers, and key stakeholders in order to increase value and reduce cost for all members of the supply chain”. Furthermore, it is proposed that the benefits of SCM will only be achieved from very close collaborative relationships. Wilding and Humphries (2006) add in this perspective that collaboration in the supply chain means working together to bring resources into a required relationship to achieve effective operations in harmony with the strategies and objectives of the parties involved thus resulting in mutual benefits.

In reality various forms of buyer-supplier relationships might be established in supply chains and (at-least) two different schools of thought can be distinguished in literature on business relationship management (Cousins, 2002; Reynolds et al., 2009). The first stream in so called “behavioural” which compares relationships in the supply chain as relationships between people and concepts like trust, commitment, mutual understanding and cooperation are in focus. The second stream of theory is built on economical foundations and chain relationships are formulated in dependence of power differences, size of firms and underlying economic power.

Swinnen (2006) summarises that vertical coordination can take various forms, which can be thought of as institutional arrangements varying between the two extremes of spot market exchanges and full ownership integration. Between these two extremes several types of hybrid relationships have been distinguished (Van Plaggenhoef, 2007):

- 1) Spot market relationships (trading partners are interchangeable);
- 2) Short term focus (coordination activities and planning on a limited basis);
- 3) Long-term focus (progress beyond coordination to integration of activities);
- 4) No end of date (a significant level of operational integration);
- 5) Joint ventures (newly created and independent firms);
- 6) Vertical integration (activities from sourcing raw materials to delivering the products are coordinated).

Henchion and McIntyre (2008) propose a simplified definition of a business relationship which can be a single or a series of interactions and financial transactions between a seller and a buyer and can be distinguished by the type of governance involved. They single out four types of governance among partners; spot markets, repeated market transactions, formal contracts and financial participation. While the former two relationship types can be categorised as informal relationships, the latter two can be characterised as formal. In agro-food supply chains some relationships will be quite rare (e.g. joint venture and vertical integration) and Swinnen (2006) propose a distinction between marketing contracts and production contracts which are types of relation between Spot market and long-term focus, as described above. Marketing contracts are (verbal or written) agreements between a contractor and a grower that specify some form of a price (system) and outlet ex ante. Production contracts are more extensive forms of coordination and include detailed production practices, inputs supplied by the contractor and quality and quantity of a commodity and a price (system). Furthermore, key factors determining the use of various contract forms or other forms of vertical coordination

are the costs and uncertainties involved in the transactions, which themselves are affected by the economic and institutional environment, the need for asset- or transaction-specific investments, the frequency of interacting, commodity characteristics such as perishability, costs of measuring and monitoring product characteristics, uncertainty over product quality or reliability of supplies.

Although it is widely recognised that supply chain management can contribute substantial benefits for the participants, it is also apparent that there are potential disadvantages (Fischer et al, 2009). Among most often are reduced flexibility and competition options, the risk of increased dependence, the risk of losing intellectual property rights and, more complex, onerous organisation and management arrangements (Cooper et al., 1997). It is thus not surprising that supply chain management is often a source of challenges, frustrations and cost (Matopoulos et al., 2007). In addition to the lack of skills, tools and resources available to managers, a number of behavioural problems are evident. Agri-food partners very often take a short-term view when faced by high business complexity and uncertainty which often lead to limited extent of their collaborative focus (Van Plaggenhoef, 2007). Furthermore, adversarial practices such as power abuse, lack of transparency, poor and misleading communication and reluctance to adopt changes in attitude appear which reduce collaborative effectiveness (Kempainen & Vepsalainen, 2003). It is important to recognise that the development of relationships in agro-food supply chains is not always a sequential process (Claro, 2003). Empirically successful supply chain in agriculture is commodity specific, transition stage-specific, heterogeneous and often non-traditional. Swinnen (2006) point out some specific characteristics of agro-food supply chains in transition economies. In the early stages most of the emphasis in supply chain goes on basically securing supplies, in more advanced situations there will be more emphasis on product quality. For this, more sophisticated forms of engagement are needed.

The Slovenian pig meat supply chain is in constant downward trend which was a strong rationale for the research. One of the key deficiencies certainly lies in weak chain performance, particularly pig farmer-processor interface that represents a potential point of substantial improvements in terms of cost saving and productivity growth and better two-way communication on issues such as market conditions, production planning, quality requirements, performance benchmarking etc. Certainly, significant improvements are also possible at the farm level including production technology, farm management and organisation however this is not the focus of the research. Furthermore, the national policy makers are strongly emphasising the importance of the value

chain efficiency. The Slovenian Resolution on strategic development objectives of agriculture and food industry 2020 (MAFF, 2011) aims among other objectives also to reinforce the strategic links between agricultural production, the food processing industry and food distribution (retail and HORECA) as part of wider process of strengthening competitiveness and economic viability of the sector.

However, to develop such linkages one needs an understanding of the current situation and attitudes of the supply chain participants. The purpose of this paper is therefore to identify the modes of chain participation for Slovenian pig farmers i.e. marketing channels and the nature of their chain downstream relationships and in particular their attitudes towards collective activities and experiences. The research, therefore seeks to identify the challenges to the establishment of resilient supply chain and the strengthening of strategic links between farmers and other segments of the Slovenian pig meat supply chain. The conclusions of this research may be of value to pig farmers, their business associations and other chain participants, but also to policy makers as it tries to highlight key impediments that may hamper the development of strategically managed pig meat supply chains.

### The Slovenian pig breeding sector

Production of pig represented less than 4% of the Slovenian gross agricultural value (GVA) in 2016 and about 8% of animal production value. Both indicators have more than halved since 2000 which shows a serious diminishing of performance in comparison with other sectors of agriculture. Immediately after the breakup of the former regime, the hog herd accounted for more than 600 thousand animals, and has even increased to more than 655 thousand in 2002, however

since then, the size of the sector has constantly decreasing (Fig. 1). The recent herd size is approximately 50% smaller than two decades ago and the same goes for the live-weight production. In 1992 Slovenia produced about 83 thousand tons of live-weight pigs which increased with oscillations for almost 30% until 2003, but the production then followed the trend of herd size and sharply dropped to 37 thousand tons of live-weight pigs in 2016.

Almost 24 thousand farms reared pigs in 2013, which is about one third of all farms in Slovenia (Table 1). Expectedly, the prevalence of pig growing decreased significantly in the last decade, since in the year 2000 the number of farms with pigs was double and more than half of the farms than had pigs. On average, there is no evident trend of specialisation or radical structural change in the sector in the last years if measured by average number of animals per farm. The figure has decreased since 2007 structural survey, when on average a pig farm had slightly more than 17 pigs. The last available figure is 12.1 pigs per farm which is ten percent less, then in the year 2000. The average pig herd size is also around 30% smaller than in the year 2007 with the highest figure in the observed period.

Given the Slovenian farm structure, where small-scale farms predominate, it is not surprising that also in pig farming small farms prevail. In the year 2016 as much as 87% of pig farms had herd size smaller than 10 animals and only 2% of farms reared more than 100 pigs (Fig. 2). If we analyse the distribution of pigs according to the herd size, we can find that the largest farms (> 100 pigs) contribute more than half of the pig population, the midsize farms (> 10 < 100) adds 24% and the smallest category of pig breeders with less than ten animals on farm accounts for 21%. It is further obvious,

### Index 1992 = 100

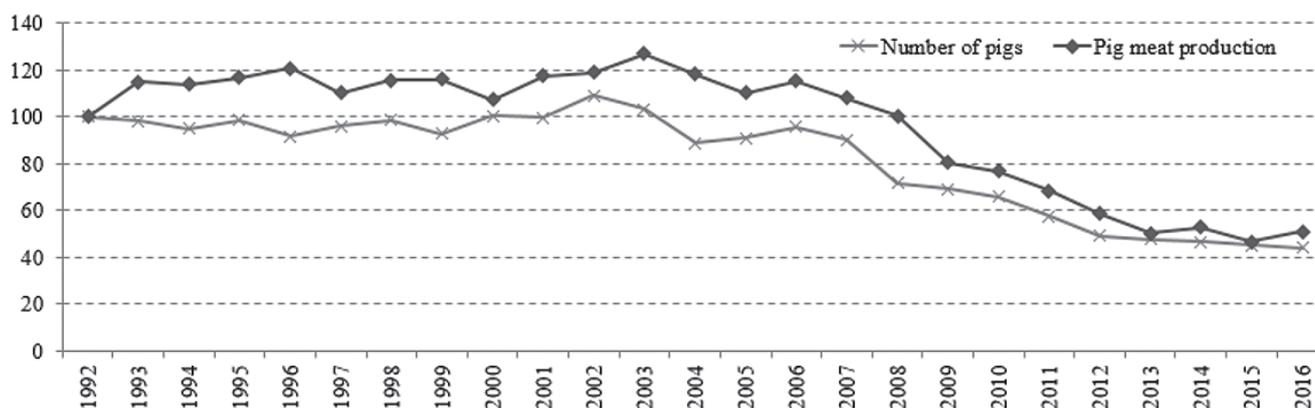


Fig. 1. Evolution of the Slovenian pig sector in the period 1992 – 2016; Index 1992 = 100 (Source SORS, 2018)

**Table 1. Key structural data on the Slovenian pig sector/ structural survey and census data**

	2000	2003	2005	2007	2010	2013	2016	Index 16/00
Number of farms with pigs (000)	44.6	39.5	34.0	31.7	26.4	23.7	22.7	50.9%
– share in all farms	51.6%	51.2%	44.0%	42.1%	35.4%	32.7%	32.4%	62.8%
Average no. of pigs/farm	13.5	15.4	14.9	17.2	14.4	12.1	12.1	89.4%

Source: SORS, 2018

that there have been some limited structural changes in the first half of the analysed period (Fig. 2). Between years 2000 and 2007 the proportion of animals kept at the largest pig holdings increased by 11 percentage points to 64%, however the trend reversed in the following ten years. Recent data show, that farms with more than 100 pigs, which represent only 2% of all pig farms, keep 55% of the pig population, which is two percentage point more, than in year 2000.

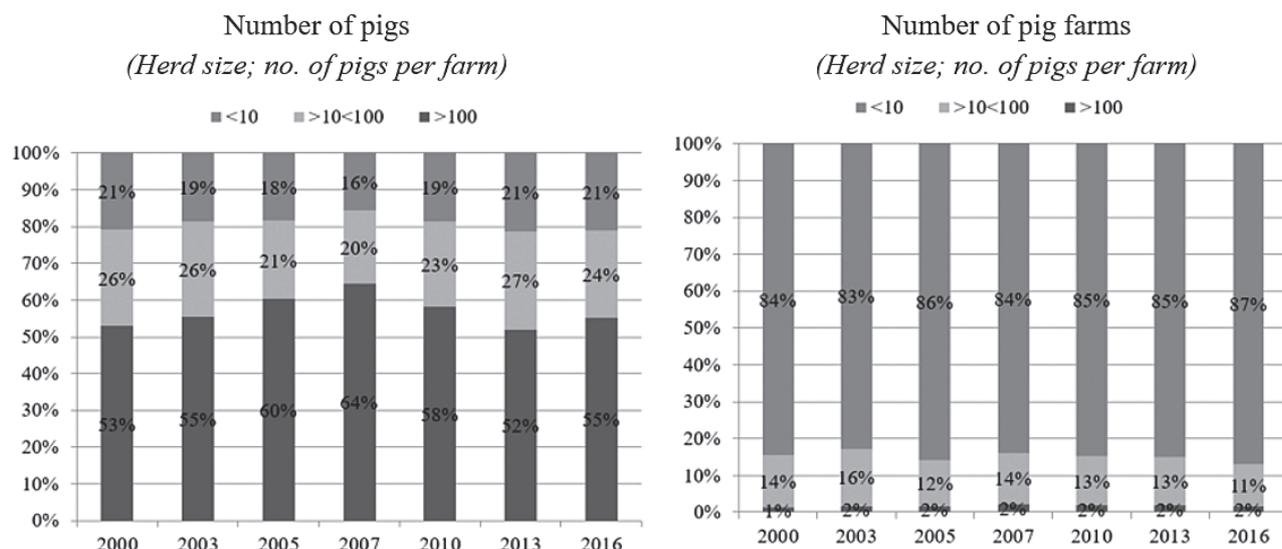
Obviously, the herd size reduction and live-weight production drops have effects on the structure of Slovenian pig meat market (Fig. 3). Total production in SWE (slaughter-weight equivalent) halved, as expected from the abovementioned live-weight trends. Consequently, the imports almost tripled in the period between 2001 and 2016 from around 25 thousand tons SWE to almost 69 thousand tons SWE. It is interesting to note the pig meat consumption changes on the Slovenian market. In the first five years of the analysis the figure increased by 10% up to 91 thousand tons SWE, in the following years until 2013, we can observe constant reduction, when again the quantities increased to reach 83 thousand tons of total consumption SWE in 2016.

However, despite the vast reduction of pig meat production in Slovenia, there is still a notable export activity which is even

showing a positive trend. In absolute terms there was around 16 thousand tons of pig meat exports SWE in 2016 which is roughly double the quantity from 2001. Consequently the share of exports in total pig meat production has increased almost threefold from 13% to 35% in the same period. A more detailed analysis of the international trade with pig meat reveals that Slovenia exports high value added processed pig meat, while the majority of imports are fresh pig carcasses for retail distribution.

Undoubtedly, the Slovenian pig sector is changing rapidly with negative trends. It is evident that the largest professional farms are losing the share in the farm structure and the smallest probably semi-subsistence farms are remaining and the structural changes are reactionary. The Slovenian pig meat sector is de-professionalising and losing competitive potential. It is therefore necessary to gain a thorough understanding of the current status of the sectorial chain relations and their drivers.

This research, therefore seeks to identify the challenges to the establishment of resilient supply chain and the strengthening of strategic links between farmers and other segments of the Slovenian pig meat supply chain. Implementation of the findings can help members of the pig meat supply chains to successfully strengthen their competitiveness with improved relationships and commercial interactions.



**Fig. 2. Distribution of animals and pig farms by pig herd size (Source SORS, 2018)**

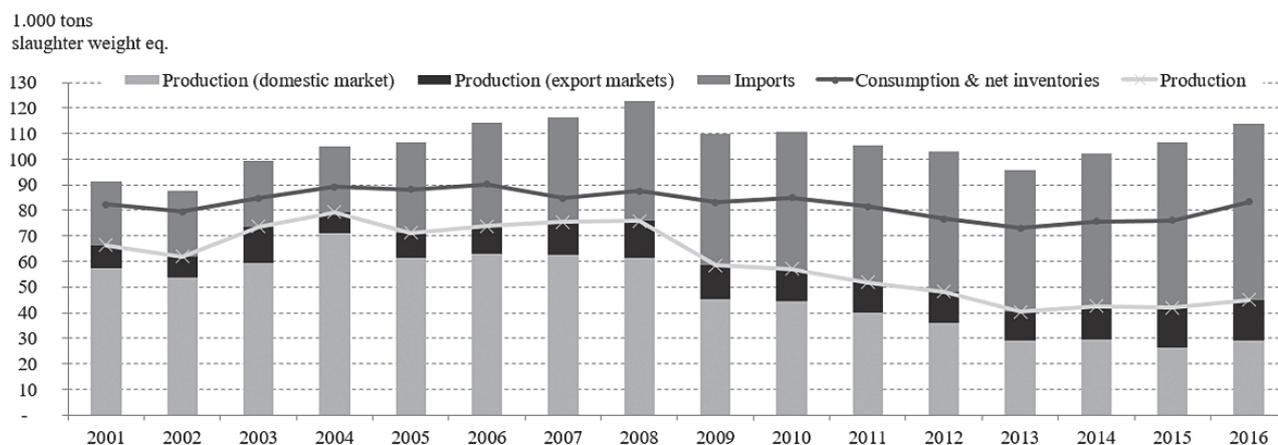


Fig. 3. Evolution of market balance for pig meat and products in the period 2001-2016; 1 000 t slaughter-weight equivalent (Source SORS, 2018)

## Materials and Methods

### The methodology and sample characteristics

This paper is based on a wider national study on red meat (beef and pig) supply chain management. The data were collected between November 2009 and March 2010 through a postal survey. This particular part of the analysis was targeted to 700 Slovenian pig farmers enrolled in a central register of breeders at the Ministry of Agriculture Forestry and Food as farms. The simple stratified random sampling was applied using by farm size and geographical region as a proportion condition. Despite its variability it should be noted that the sample is not random, since we deliberately targeted medium sized market oriented producers in the traditional pig producing regions of Slovenia which represent a dynamic part of the sector yet vulnerable and with no formal system of integration. Consequently, the smallest subsistent holdings with pigs were omitted, whereas the largest

segment of pig producers (*former large-scale state owned pig farms*) were excluded from this particular part of the survey and were analysed in a separate part of the overall national survey. In total 152 fully completed questionnaires were received e.g. the response rate was at around 21.7%.

The questionnaire was divided into five sections: 1) sales channels, 2) transaction characteristics, 3) relationship characteristics, 4) general attitudes towards cooperation in agro-food chain 5) farm characteristics and socio-demography.

The particular focus of the research was on the construct development describing pig farmers' attitude towards collective action (ACA) which was measured using six indicators on a five point Likert's scale. The variance explained by one factor using six indicators was 64.8% with a reliability of 0.712 measured by Cronbach's alpha indicator. The segmentation items and their means, the values for construct reliability, items' factor loadings and explained variance are presented in the Table 2.

Table 2. Measurement scales characteristics "Attitude towards collective action" (n = 152)

Construct and items	Overall mean	Cronbach's Alpha	Factor* loadings 1	Factor* loadings 2	Per cent of total variance explained
Attitude towards collective action:	2.91	0.712	/	/	64.83%
"Agricultural cooperative is the best intermediary between a farmer and food industry."	2.57	/	.617	-.728	/
"Agricultural cooperatives support a pig farmer towards better profitability."	2.53	/	.736	-.597	/
"Cooperation between pig farmers and meat processors improves meat quality."	2.85	/	.541	.337	/
"Contract with buyer reduces economic risk for farmer."	3.71	/	.700	.324	/
"Contract with buyer assures better price for pigs than spot market."	2.21	/	.566	.421	/
"Long term collaboration with buyer improves business performance of a pig farmer."	3.62	/	.674	.357	/

Notes:\*Extraction method: Principal axis factoring

Source: The survey

### Latent class cluster analysis

Of the available analytical methods for respondent segmentation, the study applies latent class cluster analysis (LCA) in order to divide the pig farmers into the useful categories according to their individual-level scores on the construct “Attitude towards collective action”. Latent class cluster analysis provides a useful division of a population into a number of classes which best fit the data, assigning a probability of each variable to each class (Vermunt & Magidson, 2002) and a class membership prediction to each sample as well as calculating the predicted modal posterior membership probabilities. In order to determine the best underlying model, goodness-of-fit measures such as log-likelihood, likelihood-ratio chi-square (G<sup>2</sup>) and a corresponding p-value as well as parsimony statistics such as the Bayesian information criterion or BIC (Nylund et al., 2007) and the Akaike information criterion or AIC (Lin & Dayton, 1997) were used in this study. To perform the latent class analysis, the poLCA package for the R software environment (Linzer and Lewis, 2011), version 3.0.2, was used. Since the number of latent variables was unknown, the analysis was repeated for a number of classes, starting with 2 until the best values for the likelihood-ratio chi-square (G<sup>2</sup>) and the p-value were achieved. As recommended by Iglesias-Pradas et al. (2013), 10,000 iterations with 100 estimations were made for each model in order to find the global maximum of the log-likelihood function.

### Results and Discussion

#### Clustering based on attitude towards collective action

As it is observable from Table 3, the highest goodness-of-fit measures were obtained from the four-cluster solution when dividing the respondents according to their attitude towards collective action. Relevant measures were used to determine the optimal number of clusters, namely the BIC criteria (Nylund et al., 2007) and the chi-square statistics (Hardigan et al., 2013). The ‘p-value’ column provides the p value for each model under the assumption that the G<sup>2</sup> statistic follows a chi-square distribution. Generally, among the models for which the p-value is greater than 0.05 (i.e. the model provides an adequate fit), the one that is most parsimonious should be selected (Vermunt & Magidson, 2002). Following this criteria, the best score is given by using the four-cluster model (Table 3).

Mean scores for attitude towards collective action of the four identified clusters together with the cluster sizes are presented in Table 4. The segment loadings found on each cluster were strong with no cross-loadings, and all six indicators significantly differ between the clusters.

The first cluster is denoted “Traditional pig breeders” and represents 41% of the sample which is the largest group of farmers. Members of the cluster 1 are tepidly in favour of collaboration and have relatively positive attitude towards agricultural cooperatives. The cluster 2 represents 25% of the respondents and is named “Against everything”, since the members

**Table 3. Latent class cluster models’ goodness-of-fit measurements (n = 152)**

Model	LL	BIC(LL)	AIC(LL)	Npar	L	df	p-value
One-cluster model	-1202.208	2524.9888	2452.4157	24	1159.311	128	1.20E-165
Two-cluster model	-1140.371	2436.4827	2342.7425	31	1035.638	121	4.30E-145
Three-cluster model	-1109.452	2409.8104	2294.903	38	973.7986	114	1.70E-136
Four-cluster model	-1077.111	2380.2963	2244.2217	45	909.1174	107	2.50E-127
Five-cluster model	-1061.969	2385.1792	2227.9374	52	878.8331	100	8.50E-125

Source: The model

**Table 4. Cluster sizes and mean scores for attitude towards collective action (n = 152)**

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	p-value	R <sup>2</sup>
Cluster size (% of total sample; N = 152)	41.04	25.12	22.71	11.14	/	/
Attitude towards collective action:						
“Agricultural cooperative is the best agent between a farmer and food industry.”	3.26	1.51	1.38	4.93	0.000	0.71
“Agricultural cooperatives support pig farmers towards better profitability.”	3.20	1.25	1.74	4.82	0.000	0.72
“Cooperation between pig farmers and meat processors improves meat quality.”	3.05	1.72	3.74	2.92	0.000	0.24
“Contract with buyer reduces economic risk for farmer.”	3.81	2.44	4.68	4.43	0.000	0.40
“Contract with buyer assures better price for pigs than spot market.”	2.24	1.28	3.03	2.74	0.000	0.26
“Long term collaboration with buyer improves business performance of a pig farmer.”	3.66	2.58	4.36	4.36	0.000	0.33

Source: The survey

show very low scores towards the items regarding agricultural cooperatives as well as almost all items regarding benefits of collaboration in agricultural sector. The cluster 3 is named “For cooperation – against cooperatives” and represents 23% of participants. From the construct items mean scores it is obvious that members may express some kind of disappointment with agricultural cooperatives, but have positive attitude towards contracting as a tool to reduce risk and are in favour of long term collaboration with a buyer as a way to improve business performance of the farm. The cluster 4 is named “In favour of everything” which represents 11% of the sample. The members of the cluster strongly believe in positive role of agricultural cooperatives, effects of contracts on risk reduction and long term collaboration on better farm performance.

On average the participants of the survey were born in year 1959 (Table 5). This is substantially younger population than is the overall situation in the total population of Slovenian farmers. The data for year 2010 shows that 57% of the farmers were older than 55 years, whereas among the specialised pig farmers the same segment represents 39% (SORS, 2015). Seemingly, the pig farmers in the survey sample are older than national average, since 48% of the participants are older than 55 years.

Among the four clusters, the representatives in the third one are significantly older than the rest of the groups therefore the opponent attitude towards agricultural cooperatives may be grounded on real experiences from the previous economic system. On the contrary, the youngest group of pig breeders is in cluster 1, where no explicit favouring neither resistant towards cooperative or business collaboration. The difference in mean year of birth is ten years among the two clusters. The other two clusters do not significantly differ in age, but relatively small age difference between the cluster 2 and 4 it is definitely puzzling, since the clusters are obvi-

ously distinct in terms of attitudes towards cooperation.

As far as the education is of concern, there is a slight pattern of relationship observable, since the highest share of pig farmers with only primary school or lower is in the cluster 4 (“In favour”), whereas the lowest share with this level is in the cluster 2 (“Against”). The latter has also the highest share of members with the university degree.

The employment status of a holding owner significantly determines farming model, including marketing channels, business conduct and development strategy. The Slovenian agriculture is determined with unfavourable demographic structure also from this perspective, since in 2010 part time farming represented 31% of the entire structure, full-time farmers 19%, while the majority (43%) of the farm holders in Slovenia had status of retiree (SORS, 2015). There is no recent national statistical data on employment status by farming activity to compare the survey sample and the national average, but our figures show very high rate of full-time farmers. Significantly highest share of professional farmers was observed in the third cluster “For cooperation-against cooperatives”, where more than 80% of farm-holders reports full time status. Less than one tenth of the cluster members are part time farmers and there are no retired representatives. The “Traditional” cluster (CL1) structure is closest to the overall Slovenian average with highest share of part-time farmer (22%) and retired status (16%), which corresponds with the cluster characteristics. The cluster 4 is dominated by full-time farmers or retired, whereas the cluster 2 has notably higher share of retired representatives.

As it is clear from the results in the Table 6, the pig farms included in the survey clearly falls within the category of “vital representatives”, since in the year 2010 they sold on average more than 300 hogs and have in cultivation 17.5 ha of agricultural land (i.e. own & rented fields and grass-

**Table 5. Socio-demographic characteristics of the sample and four clusters (N = 152)**

Variables	Whole sample	CL1 “Traditional”	CL2 “Against”	CL3 “For cooperation – against coops”	CL4 “In favour”
Age of farm holder:					
Mean year of birth	1959	1963	1962	1953	1960
Education:					
Primary or below	31.1%	32.4%	26.5%	28.1%	42.9%
Secondary	65.5%	63.3%	67.7%	71.9%	57.1%
Tertiary	3.4%	4.3%	5.8%	0.0%	0.0%
Employment status:					
Professional farmer	67.3%	59.4%	67.6%	81.3%	73.3%
Part time farmer	16.7%	21.7%	17.6%	9.4%	6.7%
Retired	10.0%	15.9%	5.9%	0.0%	13.3%
Other	6.0%	3.0%	8.9%	9.3%	6.7%

Source: The survey

land). Both figures are in concordance with the survey objective to focus on dynamic and market oriented pig farmers. The smallest farms, both in terms of fattened pigs sold and land in cultivation are grouped in the second cluster (CL2 “Against”). The cluster representatives are also notably less active in financial aspects of the farm management, since only 15% of them run a detailed farm accountancy system. Furthermore, they were also least investment active with only 6% of the cluster members underwent a major reconstruction in pig production.

Not surprisingly, the cluster 2 shows also the most unfavourable past trends in pig production with 36% of respondents claiming that they had notably reduce the activity in the last three years (Table 6). Moreover, also the stated perspectives are not encouraging for this segment with more than one third expects to reduce the pig farming in the next three years significantly. On the other side of the spectrum is the cluster CL3 with strong support towards collective activities but against engagement in agricultural cooperatives. The representatives in this cluster had largest average sales of hogs (351 per annum), and second largest land in cultivation (17 ha). Almost forty percent of them run detailed farm accountancy and 13% invested substantially in pig production. The cluster reports with the highest incidence (42%) a notable increase of their pig business in the past three years and majority of them (77%) expects no change in the future. The cluster 4, which includes pig farmers with strong positive attitude towards cooperatives and cooperation, differs significantly in high share of members with major pig farming investment in last decade (20%). Likely, these farmers, being members of agricultural cooperatives, consequently

perceives risk differently and were thus encouraged to invest in y farming activity. Moreover, one should not underestimate the services of efficient cooperatives in acquiring investment capital (e.g. special investment credit lines) and other support to active and engaged members.

The Table 7 reveals key differences in selling channels and typology of underlying transactions and shows quite a few challenging features of the Slovenian pig meat supply chain. On average, the most important sales channel is provision of slaughtering pigs to very small buyers for home consumption, since more than thirty percent of the total sample chose this category as a key buyer. The supply chain is rather country specific, probably more present in considerably less developed countries, but in Slovenian countryside a strong tradition of home meat processing still exists. This particular supply chain is by far not primarily stimulated by economic motives of the buyers; it is rather the perception of higher quality and uniqueness of sausage or died ham according to personal receipt. Another thing is particular too. Quite a substantial part of the transactions are interregional, where buyers from Southwest of Slovenia are coming to buy pigs in Northeast regions.

The largest share of transactions with very small buyers is found for the cluster 2 (“Against”) which is within expectations (Table 7). These pig farmers explicitly oppose to any form of collaboration or strategic interaction which is evident also from the type of transactions. More than 60% of transactions are spot sale, and likely they literally wait customers to come to buy their hogs. The most important type of grading and pricing is by weight classes (43%) or even without grading (33%). However, also the small part of the cluster 2 members sells primarily to large or small meat processors, and even to cooperatives. Also

**Table 6. Characteristics of the farm holding for the sample and four clusters (N = 152)**

Variables	Whole sample	CL1 “Traditional”	CL2 “Against”	CL3 “For cooperation – against coops”	CL4 “In favour”
Farm size and characteristics:					
No. of hogs sold in 2010	301.2	295.2	254.8	350.7	324.0
Land in cultivation (ha)	17.5	18.4	14.0	16.9	22.2
Detailed farm accountancy	27.2%	27.9%	14.7%	38.7%	28.6%
Major investment in pig farming in the last 10 years	10.1%	8.8%	6.1%	12.5%	20.0%
Change of farm’s pig business in the last three years:					
Reduced notably	21.1%	20.6%	36.4%	6.5%	20.0%
No changes	49.7%	55.9%	36.4%	51.6%	46.7%
Increased notably	29.3%	23.5%	27.3%	41.9%	33.3%
Prospects for farm’s pig business in the next three years:					
Notable reduction	20.9%	17.4%	35.3%	10.0%	26.7%
No changes	60.8%	63.8%	44.1%	76.7%	53.3%
Notable expansion	18.2%	18.8%	20.6%	13.3%	20.0%

Source: The survey

**Table 7. Pig selling channels and typology of transactions for the sample and four clusters (N = 152)**

Variables	Whole sample	CL1 "Traditional"	CL2 "Against"	CL3 "For cooperation – against coops"	CL4 "In favour"
Type of the main sales channel:					
Agricultural cooperative	26.3%	34.7%	7.4%	14.8%	63.6%
Large meat processor	26.3%	32.7%	14.8%	29.6%	18.2%
Small meat processor	6.1%	4.1%	14.8%	3.7%	0.0%
Very small buyers for own consumption	31.6%	18.4%	51.9%	40.7%	18.2%
Other buyers (trader, farm tourism, restaurant)	9.7%	10.1%	11.1%	11.2%	0.0%
Type of transaction for the main sales channel:					
Written contract	46.2%	56.9%	17.9%	41.9%	69.2%
Oral agreement	18.5%	20.7%	21.4%	19.4%	0.0%
No agreement-spot sale	35.3%	22.4%	60.7%	38.7%	30.8%
Type of grading & pricing for the main sales channel:					
EUROP system	53.4%	64.4%	23.3%	44.8%	86.7%
Weight classes	32.3%	25.4%	43.3%	44.8%	13.3%
No grading	14.3%	10.2%	33.4%	10.4%	0.0%

Source: The survey

about 15% of the third cluster states an agricultural cooperative as their most important buyer; however they again sell the majority of their production to households. The difference is, however in the type of transaction, since 42% of the farmers in this cluster operate via written contract (42%) or oral agreement (19%). Clearly, the most vertically integrated farmers are members of the fourth cluster. They sell majority of their pigs through agricultural cooperatives (64%) based on written contracts (69%) and pricing is done using EUROP classification of conformation of carcasses of slaughtered pigs (87%).

## Conclusions

Reinforcement of the strategic links between agricultural producers, food processors and food distribution is one of the key objectives of the Slovenian Resolution on strategic development of agro-food sector until 2020 (MAFF, 2011). The research presented in this paper has examined attitudes and experiences of Slovenian mid-sized pig farmers towards cooperation and agricultural cooperatives as intermediators in supply chain. Based on these criteria clustering was performed in order to form four distinct groups, namely "CL1 Traditional", "CL2 Against", "CL3 For cooperation, against cooperatives" and "CL4 In favour".

As the research results show there is inevitable need for supply chain modernisation in Slovenian pig sector, since the largest share of the targeted farmers use an informal channels, selling their pigs to very small buyers for individual consumption. The business environment within which these farmers are operating is dynamic with considerable economic and techno-

logical uncertainties, however, on average more than one third of them do not have any kind of agreement with the agents in their key selling channels and transactions are done on the spot frequently to coincidental buyers. The cluster with the most explicit contrariety opinion against vertical collaboration ("CL2 Against") has as much as 60% of respondents which perform transactions with main buyers without any kind of agreement. Seemingly, the farmers in this group do not see potential benefits of forming a contractual arrangement, including price risk reduction and improved production results with enabled intensity planning. Although, there was no explicit question about the profitability of pig farms, however, implicitly we can assume that the cluster 2 performance was inferior in comparison to other. The "Against" cluster had a) the lowest share of farmers that underwent a major investment on farm in last ten years, b) the highest proportion of respondents that reduced production considerably in last three years and c) the highest share of farmers with negative prospects of considerable size reduction in the following three years. On the contrary the cluster three (CL3 "For cooperation, against cooperatives") has the highest share of farmers stating considerable growth in pig farming in the last three years, the lowest share of farmers expecting notable reduction in the future three years. Further, it is interesting to point out the sales channels of this cluster of progressive pig breeders which show positive attitude towards collective actions, however, the key buyers are households which purchase slaughtering pigs for own consumption, following by large meat processor and agricultural cooperatives. Furthermore, to make things even more complex, the largest share of transactions is under a written contract with buyer (from the second and third

most important category of buyers). Seemingly, the members of the cluster 3 are aware of principles and benefits of collective action in agro-food supply chain and do prefer collaboration but in reality they sell most of their output under spot market conditions. Obviously, these farmers either behave opportunistically with optimising short-term perspective or the conditions at the downstream supply chain participants are not assuring attractive enough conditions for formation of contemporary business relations. Most probably the combination of both factors prevents the development of supply chain. Complexity of large meat processors business conditions (i.e. long lasting post-socialist transformation process and ownership restructuring), their exposure to intensive international competitive pressures and vertical domination of retailers most probably drive back chain participants at both stages from developing contemporary business relationship based on intensive vertical integration. Seemingly, the notable share of pig farmers in Slovenia including those with positive attitude towards the collaboration does engage in spot markets and sell to very small random buyers. In doing so they balance and/or omit potential vulnerability of transactions with bigger buyer on long term basis, however all the benefits of collaborative approach are lost including improved production results, specialisation, exploiting potentials for further growth and also price risk reduction.

Understanding of vertical coordination and awareness of vertical chain benefits are of great importance for improvement of Slovenian pig sector conditions. Furthermore, the key question in risk management within a pig supply chain is the extent to which a capability to cope with risk is developed and how the costs and benefits of that risk management are shared. As our research showed a significant proportion of pig breeders do not see a lack of chain integration as adversely impacting on their performance. This is partly an expression of lack of understanding the principles of collective acting and lack of awareness of vertical chain benefits among chain participants. Further, this research revealed surprising significance of the marketing channels which do not poses the characteristics of contemporary supply chains. Therefore, additional insight would seem appropriate to understand better the conditions which are necessary for Slovenian pig supply chain to be developed into a modern economically efficient and competitive sector and the approaches by which this can be achieved.

## References

- Chandrasekaran, N., & Raghuram, G. (2014). *Agribusiness supply chain management*. CRC Press.
- Claro, D. P. (2003). Managing business networks and buyer-supplier relationships. How information obtained from the business network affects trusts, transactions specific investments, collaboration and performance in the Dutch potted plant and flower industry. Dissertation, Wageningen University, Wageningen, Netherlands.
- Cooper, M. C., Ellram, L. M., Gardner, J. T., & Hanks, A. M. (1997). Meshing multiple alliances. *Journal of Business Logistics*, 18(1), 67-89.
- Cousins, P. D. A. (2002). Conceptual model for managing long-term inter-organisational relationships. *European Journal of Purchasing & Supply Management*, 8(2), 71-82.
- Fischer, C., Hartmann, M., Reynolds, N., Leat, P., Revoredo-Giha, C., Henchion, M., Albusu, L. M., & Gracia, A. (2009). Factors influencing contractual choice and sustainable relationships in European agri-food supply chains. *European Review of Agricultural Economics*, 36(4), 541-569.
- Henchion, M., & McIntyre, B. (2008). Key factors influencing economic relationships and communication in European agri-food chains. Ashtown Food Research Centre, Teagasc.
- Kemppainen, K., & Vepsäläinen, A. P. (2003). Trends in industrial supply chains and networks. *International Journal of Physical Distribution & Logistics Management*, 33(8), 701-719.
- Kuhar, A., Volk, T., Žnidaršič, A., Cerk, U., Iličič, I., & Travnikar, T. (2010). *Oskrbne verige rdečega mesa v Sloveniji-analiza stanja in oblikovanje razvojnih modelov za doseganje konkurenčnosti: zaključno poročilo*. Biotehniška fakulteta, Katedra za agrarno ekonomiko, politko in parvo.
- MAFF (Ministry of Republic of Slovenia of Agriculture Forestry and Food). (2011). Predlog Operativnega programa za izvedbo Resolucije o strateških usmeritvah slovenskega kmetijstva in živilstva do leta 2020. Zagotovimo si Hrano za Jutri.
- Matopoulos, A., Vlachopoulou, M., Manthou, V., & Manos, B. (2007). A conceptual framework for supply chain collaboration: empirical evidence from the agri-food industry. *Supply Chain Management*, 12(3), 177-186.
- Ondersteijn, C. J. M., Wijnands, J. H. M., Huirne, R. B. M., & Van Kooten, O. (2006). *Quantifying the agri-food supply chain*. Springer.
- Reynolds, N., Fischer, C., & Hartmann, M. (2009). Determinants of sustainable business relationships in selected German agrifood chains. *British Food Journal*, 111(8), 776-793.
- SORS (Statistical Office of Republic of Slovenia). (2018). Various databases found on [www.stat.si](http://www.stat.si), June 2018.
- Swinnen, J. F. (2006). The dynamics of vertical coordination in agri-food supply chains in transition countries. In: Swinnen J. (Ed.), *Global Supply Chains, Standards and the Poor*. CABI, Oxon, UK, 42-58.
- Swinnen, J. F., & Maertens, M. (2007). Globalization, privatization, and vertical coordination in food value chains in developing and transition countries. *Agricultural Economics*, 37(S1), 89-102.
- Van Plaggenhoef, W. (2007). *Integration and self-regulation of quality management in Dutch agri-food supply chains: a cross-chain analysis of the poultry meat, the fruit and vegetable and the flower and potted plant chains* (Vol. 4). Wageningen Academic Pub.