



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

The Features and Categorization of Agribusiness Networks on the Example of the Polish Fruit and Vegetable Industry Enterprises

Joanna A. Wiśniewska-Paluszak*, Grzegorz T. Paluszak**

*University of Life Sciences in Poznan, Department of Economics

**University of Warsaw, Department of Banking, Finance and Accounting

wisniew@up.poznan.pl, gpaluszak@wne.uw.edu.pl

ABSTRACT

This paper contributes to the foregoing discussion on networks in agribusiness. It is grounded in business network approach. The aim of the paper is to recognise and evaluate distinguishing features of agribusiness networks. The eighteen Polish fruit and vegetable producers, processors and traders were investigated. Their network activities have been recognised as non-transactional exchange of knowledge and information, mutual adaptations, adjustments and standardizations. They are preceded by strong transactional relationships in the supply chain which are based on pricing conditions and terms of payments, cooperation as well as formal contracts. The network activities are reinforced by common aims, reciprocal trust and commitment, mutual benefits and stability. The main aim of networking is to increase profits and it is correlated with optimization of supplies and provisions, building of community and relationships and sustainable development. The study classifies five categories of agribusiness networks in the queried sample. They are: very strong operational, strong sustainable, moderate social, weak innovative and very weak shared resource. The paper concludes that the studied networks are characterized by strong actor and activity ties and weak resource bonds. Principally, non-appearance of shared resources may influence the weak innovative ability of networks in the fruit and vegetable industry.

Keywords: agribusiness network; business network approach; fruit and vegetable processing industry.

Acknowledgement

The project was supported by funds of the National Science Centre Poland based on the decision number DEC-2013/09/B/HS4/01494.

1. Introduction

Networks are commonly recognised in agribusiness as contract farming, cooperatives, producers' groups, supply and value chains, strategic alliances, and clusters. In this paper these typical structures of agribusiness should be classified as networks *sensu largo*. Today, the notion of network is being mostly known as an example of a proactive and voluntary settlement formed at least by two entities for new mutual benefits. It specifies which entity is going to undertake which activities and how the entities are going to work together to achieve their goals and the goals of the network. Networks consist of contractual and/or non-contractual long-lasting business relationships and/or formal and/or informal social relationships that influence the decisions on activities and resources of network actors. As L. Sauvée (2002) pointed out the essence of the network is the concept of "collective actor" and consequently the existence of collective actions. Discussing networks in this sense this paper identifies agribusiness networks *sensu stricto*.

This paper contributes to the foregoing discussion on networks in agribusiness. The study responds to the research question on types of networks in agribusiness. It is grounded in business network approach. The aim

of the paper is to recognise and evaluate distinguishing features of agribusiness networks. The main hypothesis of the research is that agribusiness networks have complex and highly interdependent aims. The main methods of the research are descriptive statistics in particular rank-order correlations of outcomes of the direct questionnaire proceeded on the sample of eighteen Polish fruit and vegetable producers, processors and traders.

This paper consists of four parts as follows. The first part is an introduction presenting aims and scopes of the paper. The second one explores theoretical and empirical findings on the nature of networks and its aims in agribusiness. In the third part the research sample and methods have been characterized. The fourth part describes the main results of the query. The fifth part discusses the main research hypothesis. The last part concludes the research results according to the main research problem, aim and hypothesis. It discusses strengths and limitations of the study as well as suggests the areas for future research.

2. The application of business network approach into agribusiness

For some time the network researches have been already conducted in agribusiness. Networks in agribusiness are recognized as wide variety of social, professional and exchange relationships of enterprises with their suppliers, customers, competitors, or other entities within or outside their domain of activity or country (Lefebvre *et al.*, 2012). Most of the researches concern with the problem of different roles of networks in agribusiness. They generally discuss network relationships in the context of following crucial topics for modern agribusiness:

- innovativeness (Perdomo *et al.*, 2017; Abdirahman *et al.*, 2014; Omta *et al.*, 2014; Kühne *et al.*, 2012; Gellynck *et al.*, 2007; Omta, 2002),
- supply chains (Forbes *et al.*, 2010; Malak-Rawlikowska and Milczarek-Andrzejewska, 201; Clemente *et al.*, 2016; Lie and Rich, 2016; Nasuelli *et al.*, 2015; Fisher and Hartmann, 2010),
- social capital and relationships (Lefebvre *et al.*, 2012; Wilson, 2007; Kühne *et al.*, 2013; Gërdoçi *et al.*, 2016),
- governance (Ménard, 2000; Ménard and Klein, 2004; Sauvée, 2002; Zylbersztajn, 2010),
- sustainable development (Abdirahman and Sauvée, 2014; Posch, 2010; Livesey *et al.*, 2009),
- bio-business (Nuhoff-Isakhanyam *et al.*, 2016; Nuhoff-Isakhanyam *et al.*, 2017).

Inter-firm networks as well as relational models of business have been already developed by various researches, among others: W.W. Powell (1990), A. Grandori and G. Soda (1995), J.H.Dyer and H.Singh (1998). Firstly, the presented ideas discussed on distinctive features of networks: complementary strengths, relational means of communication, conflicts resolutions within norm of reciprocity and reputational concerns, high commitment among the parties, climate of mutual benefits, interdependent actor preferences and choices (Powell, 1990). Secondly, current forms of network and organizational mechanisms supporting them have been recognised: industrial networks, uncertainty and frequency of transactions, measurability of performance and controlling, differentiation and complementarity, intensity of interdependence, number of units, complexity of interdependent activities, asymmetry in the resources controlled, communication, decision and negotiation mechanisms, social coordination (Grandori and Soda, 1995). Last but not least, these models discussed also sources of mutual benefits: investment in relation-specific assets, substantial knowledge exchange, including joint learning, combining of complementary, but scarce resources or capabilities, lowering transactional costs (Dyer and Singh, 1998).

Most of the authors recognize the immanent role of network in modern economy. It is reasonable then to further study the aims and specificity of networks in agribusiness. The concept of this paper is grounded in business network approach which has been initiated by Scandinavian researchers H. Håkansson and I. Snehota in 1989 in the paper titled “No business is an island: The network concept of business strategy”. In this article they presented the network model of business understood as an continuous interaction between entities in which context the business entity was endowed with its meaning and role. They based their concept on extensive empirical studies of industrial markets conducted in 70s and 80s. This studies indicated the existence of business relationships in these markets and interdependence among these relationships.

Further, seventeen years later H. Håkansson and I. Snehota (2006) elaborated on their earlier conclusions. First of all, they pointed out the importance of combining various types of resources across firm boundaries in order to create positive economic outcomes. Secondly, they underlined that business relationships have a very central role because they determine how individual resources are used and combined between business entities. Following, as they stated the effectiveness of a business is determined by systematic relating to others. Finally, they underlined the major role of the collective dimension of the networking processes as well as the role of interactive communication in business networks.

The interest in networks is concerned with understanding content and shape of business relationships. The main phenomena observable in networks are: relationship, cooperation, interaction, exchange, association, relatedness, and competition as well. The main feature of business is interaction (Håkansson and Ford, 2002; Ford and Håkansson, 2006). As it was stated by H. Håkansson and I. Snehota, (1995) the interactions evolve into temporal relationships with specific features typical for business. Two types of characteristics for business relationships have been distinguished. The structural characteristics: continuity, complexity, symmetry and informality, and process characteristics: adaptations, cooperation, conflict, social interaction and routinization. Typical business relationships appear symmetrical in terms of resources and initiative of the parties involved. They often have a low degree of formalization. Mutual adaptations are the prerequisite of development and continued existence of relationships between two companies. Elements of cooperation and conflict coexist in business relationships. Despite business relationships being essentially about business – specific behaviours – subjective values – the personal bonds and convictions that are always present, play an important role in formation of business relationships.

And the last but not least, is the formal model developed by the Scandinavians which may serve as an adequate instrument of classification and recognition of networks. This model is called Activity-Resource-Actor (ARA) model. The model groups networks in the following three layers:

1. **Activity:** relating to the links between activities of two actors, like: production, logistics, administration, deliveries, information handling and so on.
2. **Resource:** relating to how actors' resources may become adapted and mutually tied together, like tangible (plant or equipment) and intangible (knowledge) important especially in the process of innovation.
3. **Actor:** interpersonal links developed between individuals in the involved entities. The degree to which individuals see, know and feel close to each other, how they trust, appreciate and influence each other and are or become mutually committed (Håkansson *et al.*, 2009).

This model provides a conceptual framework for systematic description of processes and outcomes of networks. It seems also suitable for application in agribusiness studies.

3. Selection of research sample and methods

Business networks are not easy to identify. Most of the current researchers used case or ground studies as a research methods (Bizzi and Langley, 2012). Most of the authors distinguished major challenges of case research for a network researcher: problem of network boundaries, complexity, time and case comparisons (Halien and Törnroos, 2005). But case and ground studies are capable of generating a robust, comprehensive array of knowledge about complex, highly interdependent and dynamic economic and social phenomena (Sterns *et al.*, 1998).

The data for this case study were gathered through direct questionnaire proceeded on the sample of eighteenth profiled entities of the fruit and vegetable industry. The questionnaires were conducted in October 2017 year. In the study the purposive sample selection has been used (Table 1). It aimed at the most representative sample for the structure of Polish fruit and vegetable processing industry. The size of the sample should not be considered as the representative for the general population. The studied sample consists of fruit and vegetable producers (3), processors (3), retailers (7) and wholesalers (5). Most of the researched entities are microenterprises (1-9 full-time employees), one is small enterprise (10-49 full-time employees) and one is medium size enterprise (50-249 full-time employees). All of the firms were based on private domestic capital. The sample consists of organizations of diverse age from 1 to 26 years of activity.

The entities in the sample participated in different formal forms of domestic and foreign integration. The results of the investigation show all together 36 indications of different integration forms. Among them 27 indications of participation in domestic and 9 indications of participation in foreign integration forms. Among domestic participation the most often is producer group: occasional cooperation (6) and status (3), second ranked concern supply chains (6) and the third one was contracting: contractor status (2), occasional contracting (2) and contracting party (1). Three of the enterprises indicated cooperative status and one occasional cooperation with cooperative. Two of the enterprises indicated strategic alliance status and one occasional cooperation with cluster. The sample enterprises participated also in foreign integration such as: producer group (1), cluster (1), strategic alliance (1), supply chain (1), occasional cooperation with supply chain (3), contractor (1), cooperative (1).

The main methods of the study are direct questionnaire and descriptive statistics. In the questionnaire the five-level Likert scale has been used. The research results were mostly presented in relational values. Firstly, numbers of ranks were related to the total numbers of answers for each question. Then, the main measure of the research is the percentage share of each rank in total ranks. This measure has been used to compare the significance of answers at each level for each question. Subsequently, the next measure has been introduced into the research. The share of positive answers (very important and important) in total answers has been compared with the share of negative answers (less important and unimportant) in the positive answers.

Table 1. The research sample (n=18)

No	Full-time employee	Activity	Legal status	Ownership	Set up	Status of integration	Share/membership/party	Occasional cooperation
1	10-49	Producer	Limited company	Private	1995	Producer group, cooperative	-	Contracting
2	1-9	Producer	Individual farm	Private	2003	-	-	Producer group
3	1-9	Producer	Individual farm	Private	2016	-	-	-
4	50-249	Processor	Limited company	Private	1994	Supply chain, contractor	-	Producer group, cluster
5	1-9	Processor	Natural person	Private	1994	Foreign strategic alliance, foreign supply chain, foreign contractor, foreign cooperative, foreign cluster	-	-
6	1-9	Processor	Natural person	Private	1999	-	-	Foreign supply chain
7	1-9	Wholesaler	Limited company	Private	2016	Strategic alliance, supply chain	-	Producer group, cooperative, foreign supply chain
8	1-9	Wholesaler	Natural person	Private	2016	Supply chain	-	Producer group, foreign supply chain
9	1-9	Wholesaler	Natural person	Private	1988			Producer group
10	1-9	Wholesaler	Commercial partnership	Private	2011	Producer group	-	
11	1-9	Wholesaler	Natural person	Private	2008			Producer group, contracting
12	1-9	Retailer	Natural person	Private	2002	-	-	-
13	1-9	Retailer	Natural person	Private	1991	-	-	-
14	1-9	Retailer	Natural person	Private	1999	-	-	-
15	1-9	Retailer	Natural person	Private	2016	-	-	-
16	1-9	Retailer	Natural person	Private	1991	-	-	-
17	1-9	Retailer	Natural person	Private	2016	Producer group, supply chain, cooperative	Contracting party	-
18	1-9	Retailer	Civil partnership	Private	2008	Supply chain	-	-

Source: Questionnaire conducted in October 2017.

Last but not least, the ρ -Spearman's ordinal correlation coefficient has been estimated for purposing network relationships in the fruit and vegetable processing industry in the sample entities (1). The calculation of rank correlation has been tested with the independence t -test of ρ -Spearman (2). To assess correlation of variables the following scale has been used: strong $|1.0 - 0.61|$, medium $|0.6 - 0.31|$, weak $|0.3 - 0.00|$ (Sobczyk, 2007, p. 118).

$$(1) \quad \rho = 1 - \frac{6 \sum_{i=1}^n d_i^2}{n(n^2 - 1)},$$

where, d_i – rank difference of converted values of variables x_i, y_i ($i = 1, 2, \dots, n$) (Kenkel, 1984, p. 754; Sobczyk, 2007, p. 117-118).

$$(2) \quad t = \rho \sqrt{\frac{n-2}{1-\rho^2}},$$

where, n – number of observations (Gajek and Kałuszka, 2000, p. 118; Kenkel, 1984, p. 754; Sobczyk, 2010, p. 284).

The level of probability has been evaluated with the p -value. In this research it is the probability (assuming H_0) of a test statistical value equal to actually observed value. Very small p -values indicates strong conclusive evidence for rejecting the null hypothesis (H_0) and supports the research hypothesis (H_1). We assumed that:

$$(3) \quad H_0: \rho \leq 0$$

$$(4) \quad H_1: \rho > 0$$

The p -value is called the attained significance level of a statistical test. Statistical significance implies only that a null hypothesis can be rejected with a specified low risk of error (Hildebrand and Ott, 1996, p. 260-263). The 95% confidence interval has been assumed for the research population. Confidence intervals express that allowance for error (Hildebrand and Ott, 1996, p.226). All the statistical measures were computed on *Statistica ver. 13.1.* software.

4. Research results

The aim of the query was to identify networks and their features in the fruit and vegetable industry enterprises. The sample entities indicated that they have primary relationships with 1,566 contractors among them 1,124 suppliers and 442 buyers. On average it makes 62 suppliers and 25 buyers per entity. The relationships are developed in varying territorial scopes. The respondents have mostly regional (63%), domestic (35%) and European suppliers (2%). Among buyers the most often they have mostly domestic (71%), regional (18%), European (10%) and global buyers (1%).

The declared duration of the relationships is varying among suppliers and buyers. The most often duration of relationship with suppliers takes several months (81%). The same duration has been declared for over one third buyers (37%). The 1-5 years relationship has been declared only for 6% of suppliers. The same percentage is for the 6-10 years and over 10 years relationships (7%). For the buyers accordingly they are: 30%, 20% and 13%.

The declared relationships were at the varying stages. The respondents mostly operate based on mutual trust with suppliers (42%) and buyers (23%). They declared mutual dependence on suppliers (15%) and buyers (15%). They are checking out with suppliers (6%) and buyers (12%). They indicate also that they separately realize their aims with suppliers (18%) and buyers (27%). They pointed out that the current relationships run out with suppliers (15%) and buyers (17%), but they see possibility to tie out with new suppliers (4%) and buyers (6%).

The respondents declared also on secondary relationships with contractors of their contractors. They pointed out that they know them (77%). Half of them indicated that they are not in relationships with them, but 40% indicated that they have relationships with the contractors of their contractors. Among respondents 40% think that they will not lose secondary relationships if they lose their primary relationships. But some of them (10%) believe that they will lose secondary relationships in that case.

They also declared on secondary relationships with competitors of their contractors. They pointed out that they know them (85%). They indicated that they have (50%) or they do not have (30%) relationships with them. The 30% of them think that they will gain the secondary relationships if they lose their primary relationships and the same percentage of them believe that they will not gain.

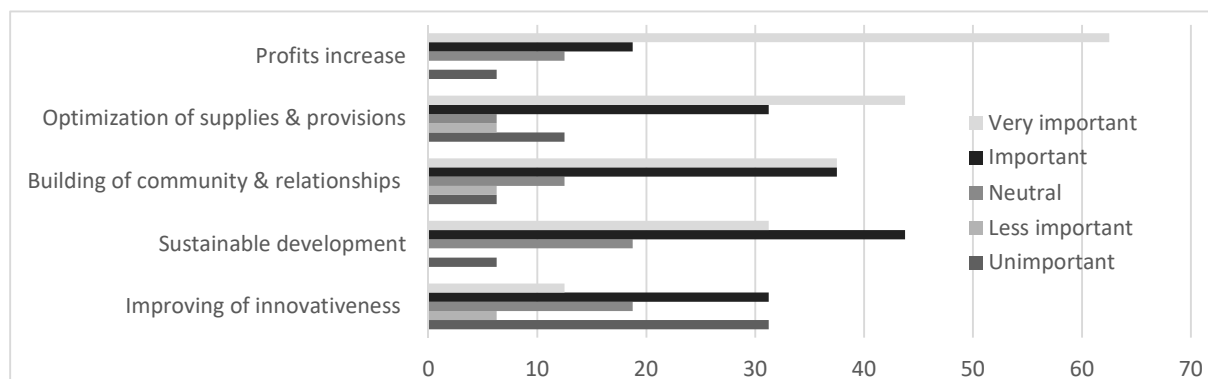


Fig.1. The networking aims of the Polish fruit and vegetable industry enterprises (n=18, in %)
 Source: own calculation based on data from questionnaire conducted in October 2017.

First of all this query tried to identify how important are different networking aims (Fig 1). Respondents indicated that the most important aim is to increase profits (63%). The second purpose ranked as a very important was optimization of supplies and provisions (44%) and the third one was building of community and relationships (38%). It is worth noticing that one third of the respondents indicated sustainable development as the very important purpose (31%), they indicated also this aim as an important one (44%). From the sum of positive answers it can be seen that the building of community and relationships as well as sustainable development are both equally important as the optimization of supplies and provisions (75%). However the profit increase was the first ranked for positive answers (81%). The least important purpose was improving of innovativeness. Only 44% of answers were positive and almost 38% of answers were negative as well as 19% was neutral.

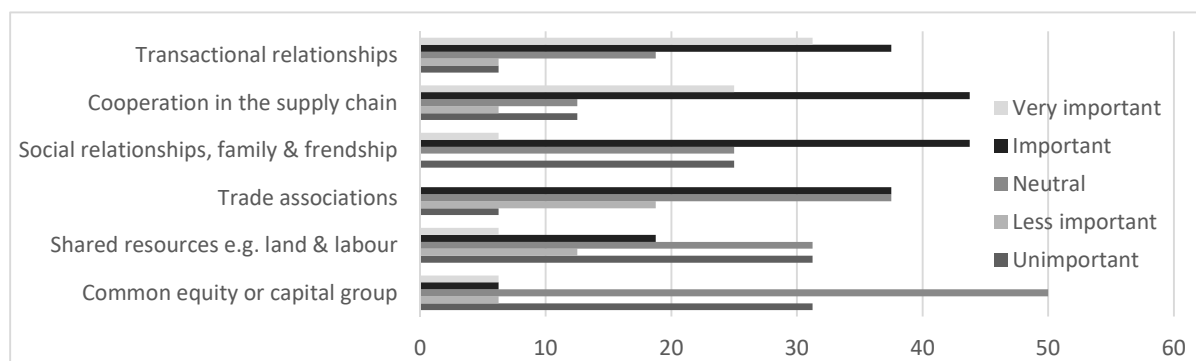


Fig.2. The network forms of the Polish fruit and vegetable industry enterprises (n=18, in %)
 Source: own calculation based on data from questionnaire conducted in October 2017.

Secondly, the query attempted to recognize how important are diverse network forms (Fig. 2). The respondents pointed out that the most important are transactional relationships (31%). The second ranked as a very important was cooperation in the supply chain (25%). When positive answers are sum up it can be seen that they were ranked equally important for the respondents (69%). The same measure for social relationships, family and friendship equals to 50% what means that social network is also important for the studied entities. The relationships in forms of trade associations reached 38% of positive answers. The least important forms of network for the studied entities were shared resources e.g. land, labour and common equity or capital groups. It is worth noticing that the sum of negative and neutral indications for this forms of networks were high and reached accordingly 44%, 37% and 31%, 50%.

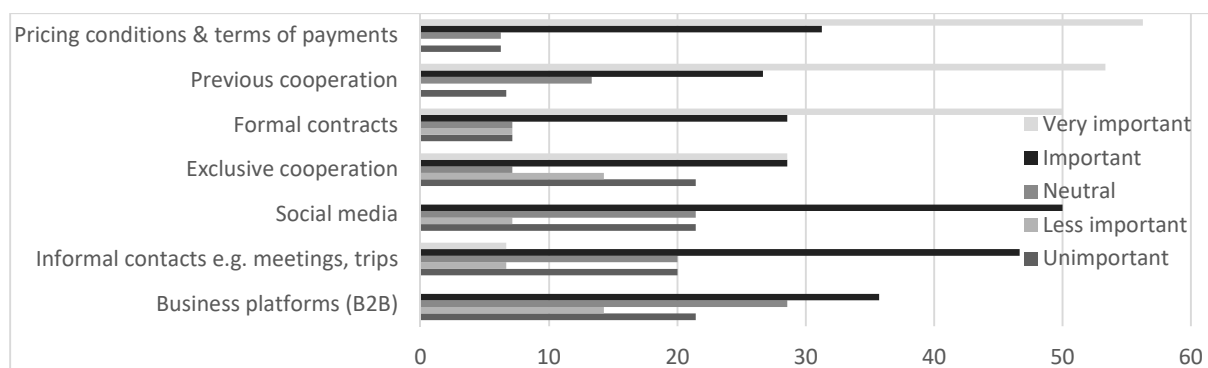


Fig.3. The network bases of the Polish fruit and vegetable industry enterprises (n=18, in %)
 Source: own calculation based on data from questionnaire conducted in October 2017.

Thirdly, the query challenged the importance of different network bases (Fig. 3). The respondents indicated that the most important bases were pricing conditions and terms of payments (56%). The second ranked as a very important was previous cooperation (53%) and the third one were formal contracts (50%). It can be seen from positive answers that those three bases were the highest ranked i.e. accordingly 88%, 80% and 79%. Exclusive cooperation, social media and informal contracts e.g. meetings, trips were pointed out by more than 50% of the respondents to be important and very important, i.e. 57%, 50% and 53% accordingly. Positive answers for business platforms (B2B) reached 36% and the same percentage of respondents pointed it out as being less important or not important. For almost the same percentage as less important or not important were indicated exclusive cooperation, informal contacts e.g. meetings, trips and social media – accordingly 36%, 29%, 27%.

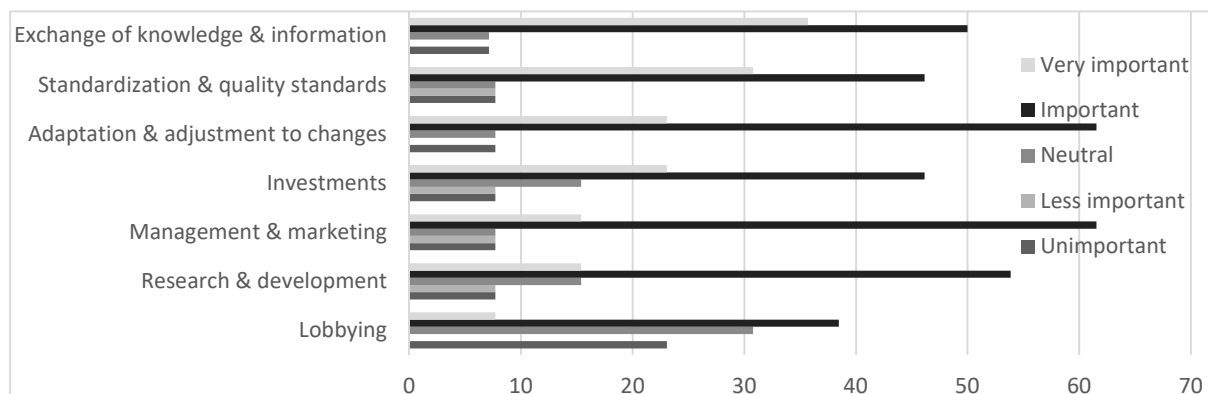


Fig.4. The network activities of the Polish fruit and vegetable industry enterprises (n=18, in %)
 Source: own calculation based on data from questionnaire conducted in October 2017.

The fourth step of the query was to recognize the importance of different network activities (Fig. 4). Over one third of the respondents pointed out that the most important activity was to exchange knowledge and information (36%). The second ranked was standardization and quality standards (31%). Adaptation and adjustment to changes as well as investments were ranked as very important interactions by 23% of respondents. Management and marketing as well as research and development were ranked as very important only by 15% of respondents. It can be seen from the sum of positive answers that exchange of knowledge and information was still ranked first (86%), but the second ranked were adaptations and adjustments to changes (85%) while standardization and quality standards were ranked third equally to management and marketing (77%). Also investments as well as research and development were ranked positively by most than 50% of respondents, i.e. accordingly 69%, 69% and 62%. Lobbying was of fewer importance for the queried business relationships (46%). It is worth noticing that for 23% of respondents it was unimportant.

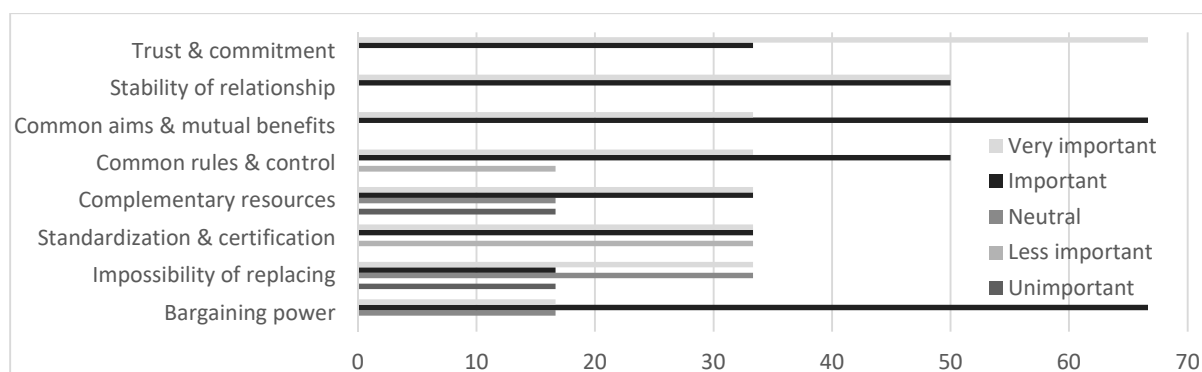


Fig.5. The reinforcing factors of the Polish fruit and vegetable industry enterprises networking (n=18, in %)
Source: own calculation based on data from questionnaire conducted in October 2017.

The fifth step of the query was to recognize the importance of different reinforcing factors of networking (Fig. 5). Trust and commitment were ranked first among very important (67%). Stability of relationship was ranked second (50%). These both factors together with common aims and mutual benefits received 100% of positive answers each. Equally important for the respondents were also common rules and control as well as bargaining power which each received 83% of positive answers. The rest of the factors were also positively challenged by over 50% of responding entities as follows: complementary resources (67%), standardization and certification (67%) and impossibility of replacing (50%).

5. Discussion

This part of the paper intends to identify and evaluate interdependencies between aims of networking as well as categorize networks of inquired entities in accordance with the formal ARA model grounded in business network approach.

The interdependencies between different aims of the network relationships of the studied entities are being discussed. According to the literature five purposes of networks have been defined. Their importance for the studied entities has been recognised as follows:

- profits increase,
- optimization of supplies and provisions,
- building of community and relationships,
- sustainable development,
- improving of innovativeness.

To identify the independencies the correlation measures described in the methodological part of the paper have been used. The analysis of interdependencies shows that building of community and relationships is the most interdependent variable. It shows the highest degree of correlation with optimization of supplies and provisions (0.852). This is verified at a very high level of significance $p=0.00007$. It shows also strong interdependence with profits increase (0.789) and sustainable development (0.749). This interdependencies are also verified at a very high level of significance, accordingly: $p=0.0001$ and $p=0.00035$ (Table 2).

The community and relationships are built for optimization of supplies and provisions, sustainable business and increasing profits. Therefore, sustainable development is also highly correlated with optimization of supplies and provisions (0.721) as well as profits increase (0.707). Both verified at a very high level of significance, accordingly: $p=0.00073$ and $p=0.001042$. It is very interesting that these two purposes i.e. sustainable development and profits increase are recognized by the queried entities as not conflicting aims in networking.

Therefore we conclude the results indicate that specific nature of the fruit and vegetable industry requires coexisting aims in the sustainable network relationships, i.e. sustainable development and profits increase.

Secondary factor of profits increase in the studied entities is optimization of supplies and provisions. The correlation coefficient is high as well (0.680). Verified at $p=0.01913$. It also results from the industry specificity which is processing and distributing of fast-moving consumer goods.

Aiming at profits increase shows the lowest correlation with improving innovativeness (0.573). This is verified at the significance level $p=0.012982$. It confirms that the queried entities are moderately aware of the connection between those two aims. Probably innovations have been seen as requiring high inputs and are

Table 2. The interdependence of networking aims in the Polish fruit and vegetable industry enterprises (ρ - Spearman's ordinal correlation coefficient, n=18)

Variables	Improving of innovativeness	Optimization of supplies & provisions	Building of community & relationships	Sustainable development	Profits increase
Improving of innovativeness	1	0.376 <i>t</i> =1.624712 <i>p</i> =0.123757 <i>p</i> <0.13	0.477 <i>t</i> =2.168298 <i>p</i> =0.04557 <i>p</i> <0.05	0.324 <i>t</i> =1.368288 <i>p</i> =0.190131 <i>p</i> <0.2	0.573 <i>t</i> =2.794702 <i>p</i> =0.012982 <i>p</i> <0.05
Optimization of supplies & provisions	x	1	0.852 <i>t</i> =6.504859 <i>p</i> =0.00007 <i>p</i> <0.05	0.721 <i>t</i> =4.162485 <i>p</i> =0.00073 <i>p</i> <0.05	0.680 <i>t</i> =3.70723 <i>p</i> =0.01913 <i>p</i> <0.05
Building of community & relationships	x	x	1	0.749 <i>t</i> =4.524608 <i>p</i> =0.00035 <i>p</i> <0.05	0.789 <i>t</i> =5.129773 <i>p</i> =0.0001 <i>p</i> <0.05
Sustainable development	x	x	x	1	0.707 <i>t</i> =3.995628 <i>p</i> =0.001042 <i>p</i> <0.05
Profits increase	x	x	x	x	1

Source: own calculation based on data from questionnaire conducted in October 2017.

connected with deferred profits at least for some time. On the other hand the fruit and vegetable industry entities are too weak to improve innovativeness individually (Wiśniewska, 2012). Maybe they are aware that indirectly building of community and relationships leads to collective innovativeness in long run (0.477). Also optimization of supplies and provisions (0.376) is moderately perceived as connected with improving of innovativeness. First verified at the high and second at a fairly low level of significance as following: $p=0.04557$ and $p=0.123757$. Therefore, independence of tested hypothesis is not out of the question. The queried entities weakly recognize the connection between sustainable development (0.324) with improving innovativeness at a fairly low level of significance $p=0,190131$. Therefore, independence of tested hypothesis is not out of the question.

It could be seen from the correlation measures that for a 95% of confidence interval we can reject the null hypothesis (H_0) for almost all ρ - Spearman's coefficients. Eight out of ten calculated coefficients have been verified positively at $p<0.05$. For the other two the null hypothesis (H_0) have not been rejected at $p<0.05$. In these two cases the p -value should be greater than 0.05 to support the research hypothesis (H_1).

Among 25 observed variables of network aims, forms, bases and activities the primary and stable ones could be distinguished. In the query they received equal or over 80% of positive answers and the share of negative in positive answers is less than 10%. This is group of variables which could be categorized as a very strong network features. It consists of five variables among which the aim, the bases and the interactions undertaken within business network relationships could be found. They are accordingly: profits increase (the aim), exchange of knowledge and information as well as adaptation and adjustment to changes (the interactions) and pricing conditions and terms of payments as well as previous cooperation (the bases). This variables are very strongly accepted by the queried respondents in their business network relationships. It could be seen from the data that most of the studied entities undertake extra non-transactional interactions in their business network relationships in order to increase profits (Fig. 6).

In accordance with the ARA model the actors' layer could be described as previous cooperation as well as good pricing conditions and terms of payment. The activities' layer consist of exchange of knowledge and information as well as adaptation and adjustment to changes. In this group of very strong network features the resources' layer could be indirectly distinguished since some variables in this group concerns this area. They relate mostly to intangible resources which could be recognized as knowledge and information. This group of very strongly accepted network variables could be categorized as a very strong operational network.

Accordingly, the second group has been distinguished as strong network features. It consists of ten variables which received from 79% to 69% of positive answers and the share of negative in positive answers was mostly around 10% to 20%. It comprises of three network aims: optimization of supplies and provisions, building of community and relationships as well as sustainable development. One network base variable could be distinguished, i.e. formal contracts and two variables representing forms of business relationships, i.e. transactional relationships and cooperation in the supply chain. In this group four different network activities are undertaken. They are: standardization and quality standards implementation, management and marketing, research and development as well as investments. The variables collected in this group are strongly accepted by the respondents in their networks. According to the variables studied entities undertake extra non-transactional interactions with their business partners in order to optimize supplies and provisions, build community and relationships as well as sustainable development.

In accordance with the formal ARA model in the actors' layer transactional relationships and formal contracts are distinguishing. In the activities' layer management and marketing, cooperation in the supply chain and standardization and implementation of quality standards are distinguishing. In this group we could distinguish the resources' layer which is connected with investments as well as research and development. This group of strongly accepted network variables could be categorized as a strong sustainable network.

The group of moderate network variables consists of 5 items for which the share of positive answers was from around 50% to 60% and the share of negative in positive answers was over 50%. It means that variables collected in this group were negatively recognized by quite important number of respondents. The moderate group consists of variables representing network bases: exclusive cooperation, informal contacts e.g. meetings, trips and social media. The form of relationship in this group is social relationships, family and friendship. The undertaken interaction is lobbying. The features collected in this group are moderately accepted by the respondents in their networks. In this moderate networks studied entities undertake extra non-transactional interactions with their business partners in order to develop social relationships.

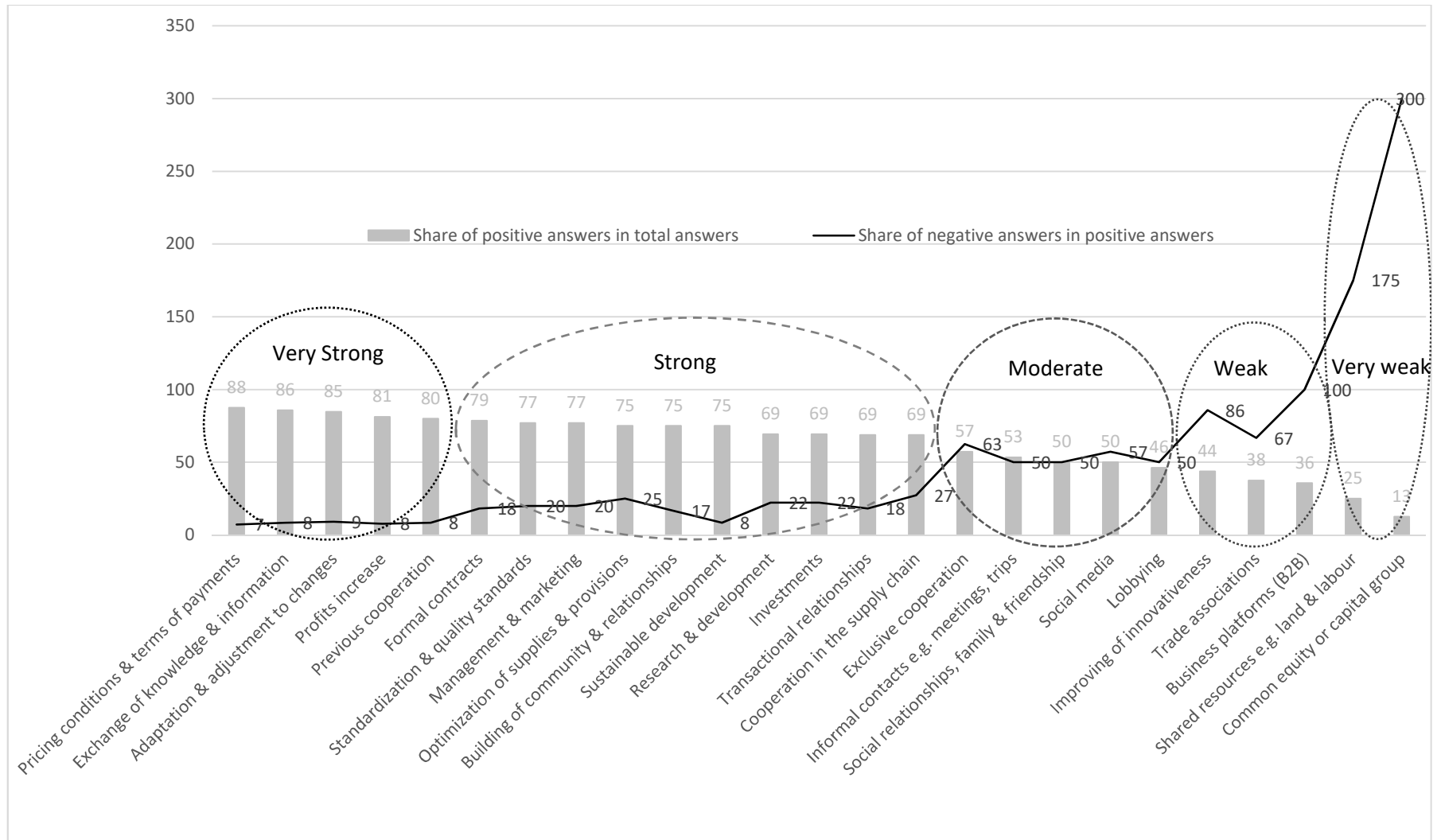


Fig. 6. The network variables and categories in the Polish fruit and vegetable industry enterprises (n=18, in %)
 Source: own calculation based on data from questionnaire conducted in October 2017.

In accordance with the formal ARA model in the actors' layer informal contacts, social relationships, family and friendships as well as social media can be distinguished. The activities' layer comprises of exclusive cooperation and lobbying. In this group we could also indirectly distinguish the resources' layer which is likewise in the previous group of intangible character. This time the intangible resources are social relationships. This group of moderate variables could be categorised as a moderate social network.

Consequently, the group of weak variables consists of 5 items for which the share of positive answers was quite low from around 30% to 40% and the share of negative in positive answers was also quite high from around 80% to 100%. It means that variables collected in this group were more often negatively recognized. The variables collected in this group are weakly accepted by the respondents in their network relationships. In this weak network a few studied entities undertake extra non-transactional interactions with their business partners in order to improve innovativeness. They network in trade associations and business platforms (B2B).

In accordance with the formal ARA model in the actors' layer trade associations and business platforms (B2B) can be seen. In the activities' layer improving innovativeness. In this group we could indirectly distinguish the resources' layer as innovative and trade relationships. Likewise they are of intangible character. Though, this group of weak variables could be categorised as a weak innovative network.

Afterwards, the last group of very weak variables could be specified. It consists only with 2 items, but they are recognized in the literature as very important for business network. This are shared resources. However, they are negatively recognised by the queried entities. Around 10%-30% of the respondents indicated that they are very important or important in their business relationships. The negative recognition of this variables was very high. It amounts to around 200%-300% of positive answers. They are shared tangible and intangible resources e.g. land and labour (175% of negative share in positive) and common equity or capital group (300% of negative share in positive).

In accordance with the formal ARA model only the resources' layer could be recognised. It comprises shared tangible resources like land and capital and intangible labour. Though, this group of very weak variables could be classified as a very weak shared resources network.

To sum up, in the context of ARA model the example enterprises of the Polish fruit and vegetable industry could be perceived as the sustainable business entities. The actors are the most important sustainable network links. It is worth to state that the strong sustainable network relationships are not constituted simply by the sum of sustainable business entities. The strength of the network is also dependent on the joint actions and common resources. Collective actions are treated as the important network links. Unfortunately, just common resources are recognized as the unimportant network links. The strong sustainable network relationships require connection with very strong operational network and moderate social network relationships. However it would not develop in the future without strong shared resources network and innovative network relationships.

6. Conclusions

The aim of this paper was to recognize and evaluate distinguishing features of agribusiness networks. The study refers to the outcomes of the query proceeded in the Polish fruit and vegetable producers, processors and traders.

Primary, the paper introduces the business network approach into the study of agribusiness networks. It elaborates the present findings on agribusiness networks. It presents different views on business networks developed by different researches. It concludes that the formal ARA model is suitable for applications in agribusiness researches.

Secondary, the paper introduces the case study based on the direct questionnaire and descriptive statistics as the research method. The carried on investigation led to obtain a robust and comprehensive array of knowledge about complex and highly interdependent aims of agribusiness networks in the queried entities.

Next, the research results show that the queried entities have wide primary and secondary network relationships with quite a big number of contractors and competitors. They are mostly networking with regional suppliers and domestic buyers. They know their competitors and in many cases they have relationships with them as well. The average duration of networking with suppliers is much shorter (several

months) than with the buyers (several years). They mostly declared that their network relationships are on the stage of mutual trust and dependence.

Subsequently, the research results show the main features of the agribusiness networks in the queried entities, i.e. their aims, forms, bases, activities and reinforcing factors. The mostly declared aims of networking of the queried entities are: profit increase, optimization of supplies and provisions and building community and relationships. The agribusiness network relationships are mostly recognized in following forms: transactional relationships, cooperation in the supply chain and social relationships, family and friendship. They are mostly developed on the following bases: pricing conditions and terms of payments, previous cooperation and formal contracts. The most important activities undertaken in network relationships are: exchange of knowledge and information, standardization and quality standards implementation, adaptation and adjustment to changes. The most recognized reinforcing factors for network relationships are: trust and commitment, stability of relationship and common aims and mutual benefits.

Successively, the discussion led to identification of interdependencies between network aims as well as categorization of agribusiness network in accordance with the formal ARA model grounded in business network approach.

Very interesting results have been reached through the correlation measurement of interdependencies between different aims of agribusiness network relationships in the queried entities. In general it could be concluded that most of the aims were strongly correlated with each other. The only medium correlation has been noted for improving innovativeness with all the rest aims. The first conclusion is that the queried entities combine different aims in their agribusiness networks. Also, it is very interesting that two purposes i.e. sustainable development and profits increase are recognized by the queried entities as not conflicting aims in sustainable agribusiness network. Finally, the research results led to positive verification of the main hypothesis that agribusiness networks have complex and highly interdependent aims and five categories of networks have been recognized in the studied entities:

- very strong operational,
- strong sustainable,
- moderate social,
- weak innovative,
- very weak shared resource.

Consequently, it could be concluded from the research findings that the actors' and activities' layers are well developed in the investigated entities but the resource layer is only well developed in such intangible resources like knowledge and information or social relationships. It means that the studied agribusiness networks are not especially intending in sharing tangible resources like land or capital and intangible resources like labour. The weak shared innovative ability could also be indirectly supposed from the research results.

Afterwards, it could be stated that the weak and very weak features of the agribusiness networks in the queried entities are interconnected. The respondents could not see the interdependencies between networking in form of association trades and business platforms (B2B) as well as sharing resources and innovative ability. Indeed they indicated investments as well as research and development as quite important activity, but they really could not network in this areas without sharing resources in order to increase their profits.

This paper contributes to the present findings by operationalizing the formal ARA model in the agribusiness research. It identifies and evaluates main features and interdependencies in agribusiness networks in the example of fruit and vegetable industry enterprises.

This research limitations are mainly connected with the sample size which should not be regarded as the statistically representative. Therefore wider conclusions should not be extrapolated from this research results on the whole population. This study should be regarded as a qualitative examination. Consequently it lays out the directions of the future studies which might be extended into the wider population and different agribusiness industries.

References:

Abdirahman, Z.-Z., Cherni, M., Sauvée, L. (2014). Networked innovation: a concept for knowledge-based agrifood business. *Journal on Chain and Network Science*, 14(2), pp 83-93.

- Abdirahman, Z.-Z., Sauvée, L. (2014). Analyzing network effects of Corporate Social Responsibility implementation in food small and medium enterprises. *Journal on Chain and Network Science*, 14(2), pp 103-115.
- Bizzi, L., Langley, A. (2012). Studying processes in and around networks. *Industrial Marketing Management*, 41, pp 224-234.
- Clemente, F., Nasuelli, P., Baggio, R. (2016). Modelling the Pig Supply Chain: a Network Analysis Applied to the Italian Case. In Deiters, J., Rickert, U., Schiefer, G. (Eds.), *System Dynamics and Innovation in Food Networks*, Kiel, CentMa, pp 470-481.
- Dyer, J.H., Singh, H. (1998). The relational view: cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23(4), pp 660-679.
- Fischer, C., Hartmann, M. (Eds.) (2010). *Agri-food Chain Relationships*. Oxford, CAB International.
- Forbes, S.L., Cohen, D.A., Clements, M.D. (2010). The dissemination of information amongst supply chain partners: A New Zealand wine industry perspective. *Supply Chain Forum: An International Journal*, 11(1), pp 123-134.
- Ford, D., Håkansson, H. (2006). The idea of Business Interaction. *The IMP Journal*, 1(1), pp 4-20.
- Gajek, L., Kałużska, M. (2000). *Wnioskowanie statystyczne. Modele i metody*. Warsaw, WNT.
- Gellynck, X., Vermeire, B., Viaene, J. (2007). Innovation in food firms: contribution of regional networks within the international business context, *Entrepreneurship and Regional Development*, 5(19), pp 209-227.
- Gërdoçi, B., Skreli, E., Imami, D. (2016). Determinants of Sustainable Relationships in the Albanian Apple Production Sector. *International Journal on Food System Dynamics*, 7(1), pp 50-56.
- Grandori, A., Soda, G. (1995). Inter-firm Networks: Antecedents, Mechanisms and Forms. *Organization Studies*, 16(2), pp 183-214.
- Håkansson, H., Ford, D. (2002). Should companies interact in business networks? *Journal of Business Research*, 55, pp 133-139.
- Håkansson, H., Ford, D., Gadde, L-E, Snehota, I., Waluszewski, A. (2009). *Business in Networks*. West Sussex, Wiley.
- Håkansson, H., Snehota, I. (1989). No business in an island: The network concept of business strategy. *Scandinavian Journal of Management*, 5(3), pp 187-200.
- Håkansson, H., Snehota, I. (1995). *Developing Relationships in Business Networks*. London, Routledge.
- Håkansson, H., Snehota, I. (2006). No business in an island 17 years later. *Scandinavian Journal of Management*, 22(3), pp 271-274.
- Halien, A., Törnroos, J.Å. (2005). Using case methods in the study of contemporary business networks. *Journal of Business Research*, 58, pp 1285-1297.
- Hildebrand, D.K., Ott, R.L. (1996). *Basic Statistical Ideas for Managers*. Belmont, Wadsworth Publishing Company.
- Kenkel, J.L. (1984). *Introductory Statistics for Management and Economics*. Boston, PWS Publishers.
- Kühne, B., Lambrecht, E., Vanhonacker, F., Pieniak, Z., Gellynck, X. (2013). Factors Underlying Farmers' Decisions to Participate in Networks. *International Journal on Food System Dynamics*, 4(3), pp 198-213.
- Kühne, B., Lefebvre, V., Gellynck, X. (2012). Knowledge Exchange in Innovation Networks: How Networks Support Open Innovation in Food SMEs. In Rickert, U., Schiefer, G. (Eds.), *System Dynamics and Innovation in Food Networks*, Kiel, CentMa, pp 181-196.
- Lefebvre, V.M., Molnár, A., Gellynck, X. (2012). The Role of Network Administrative Organizations in the Development of Social Capital in Inter-Organizational Food Networks. *International Journal On Food System Dynamics*, 3(3), pp 228-242.
- Lie, H., Rich, K.M. (2016). Improving Value Chains for Dairy Farmers in Matiguás, Nicaragua: a System Dynamics Approach. In Deiters, J., Rickert, U., Schiefer, G. (Eds.) *System Dynamics and Innovation in Food Networks*, Kiel, CentMa, pp 229-244.
- Livesey, S.M., Hartman, C.L., Stafford, E.R., Shearer, M. (2009). Performing sustainable development through eco-collaboration. The Riceland's Habitat Partnership. *Journal of Business Communication*, 4(46), pp 423-454.
- Malak-Rawlikowska, A., Milczarek-Andrzejewska, D. (2016). How do Farmers interact with Input Suppliers: Some Evidence from Dairy Sector in Poland. In Deiters, J., Rickert, U., Schiefer, G. (Eds.), *System Dynamics and Innovation in Food Networks*, Kiel, CentMa, pp 420-426.
- Ménard, C., Klein, P. G. (2004). Organizational Issues in the Agrifood Sector: Toward a Comparative Approach. *American Journal of Agricultural Economics*, 86(3), pp 750-755.
- Ménard, C. (2000). *New approach to the agro-food sector: new institutional economics*, Proceedings of Chain Management in Agribusiness and the Food Industry. Wageningen: Wageningen Press.

- Nasuelli, P., Clemente, F., Baggio, R., Berruto, R., Busato, P. (2015). Supply Chains of Products of Animal Origin: A Complex Network Model for Strategic Management. *International Journal on Food System Dynamics*, 6(4), pp 248-258.
- Nuhoff-Isakhanyan, G., Wubben, E.F.M., Omta, O.S.W.F. (2017). Network structure in sustainable agro-industrial parks. *Journal of Cleaner Production*, 141, pp 1209-1220.
- Nuhoff-Isakhanyan, G., Wubben, E.F.M., Omta, O.S.W.F. (2016). Sustainability Benefits and Challenges of Inter-Organizational Collaboration in Bio-Based Business: A Systematic Literature Review. *Sustainability*, 8(307), pp 1-17.
- Omta, O.S.W.F., Fortuin, F.T.J.M., Dijkman, N.C. (2014). *Open Innovation in the Food Industry: An Evidence Based Guide*. The Netherlands. Food Valley NL.
- Omta, S.W.F. (2002). Innovation in chains and networks. *Journal on Chain and Network Science* 2(2), pp 73-80.
- Perdomo, S.A.P., Farrow, A., Trienekens, J.H., Omta, O.S.W.F., van der Velde, G. (2017). Testing the Effectiveness of Network Governance Mechanisms to Foster Ambidexterity of Agricultural Innovation Networks in East and Central Africa. *International Journal on Food System Dynamics* 8(2), pp 81-95.
- Posch, A. (2010). Industrial Recycling Networks as Starting Points for Broader Sustainability-Oriented Cooperation? *Journal of Industrial Ecology*, 2(14), pp 242-257.
- Powell, W.W. (1990). Neither market nor hierarchy: Network forms of organization. *Research in Organizational Behaviour*, 12, pp 295-336.
- Sauvé, L. (2002). *Efficiency, Effectiveness and the Design of Network Governance. Paradoxes in Food Chains and Networks: proceedings of the fifth International Conference on Chain and Network Management in Agribusiness and the Food Industry*, Wageningen, Wageningen Academic Publishers.
- Sobczyk, M. (2007). *Statystyka opisowa*. Warsaw, PWN.
- Sobczyk, M. (2010). *Statystyka*. Warsaw, C.H.Beck.
- Statistica ver. 13.1. (2018), Stat Soft Polska.
- Sterns, J.A., Schweikhardt, D.B., Peterson, H.CH. (1998). Using Case Studies as an Approach for Conducting Agribusiness Research. *International Food and Agribusiness Management Review*, 1(3), pp 311-327.
- Wilson, P.N. (2007). The Economic Nature of Network Capital in B2B Transactions. *Agribusiness*, 23(3), pp 435-448.
- Wiśniewska, J.A. (2012). The Competitive Potential of Polish Fruit and Vegetable Producers on the Domestic and International Markets. *Journal of Transnational Management*, 17(4), pp 277-293.
- Zylbersztajn, D. (2010). From Contracts to Networks: New Directions in the Study of Governance of Agro-Food-Energy Networks. In Fritz, M., Rickert, U., Schiefer, G. (Eds.), *System Dynamics and Innovation in Food Networks*, Bonn, University of Bonn/ILB Press, pp 333-351.