TRUST – NETWORKING – INNOVATION

József TÓTH[1]

ABSTRACT
From innovation point of view the agri-food industry is seen as matured branch of the economy, where revolutionary new products and processes are very rare. Especially the SMEs are in squeezing situation: they have to fit very sharp prerequisites and demands on one side and very much constrained resources to give them power in order to formulate appropriate answers on the other side. They are looking for partners beyond the boundaries of their organization, mainly with other firms, universities, research organisations and government agencies.
Adopting an effective innovation process to successfully introduce and develop new products to the market has become one of the most important strategies for food companies.
The innovation dimension of networking activity contributes to growing network complexity, which in turn also affects the nature of traditional governance structure. Trust and other relational factors are playing an increasing role in these structures.
Our research interest is whether the trust as coordination form of governance structure plays significant role in the Hungarian agri-food industry. Empirical data was drawn from a survey carried out in Central Hungary and aiming at the research of cooperation and knowledge management within the SMEs of the food economy.
Structural Equation Modelling (SEM) is applied in order to determine the relationship among the three (Trust, Networking, Innovation) latent factors.
We have found that trust plays significant positive role in increasing networking activity and innovation, but the extent of it is less than expected.

KEYWORDS *agri-food SME, innovation, networking, trust, SEM*

JEL CLASSIFICATION: *D03, D22, D23, C38*

1. INTRODUCTION

From innovation point of view the agri-food industry is seen as matured branch of the economy, where revolutionary new products and processes are very rare. At the same time the firms are increasingly exposed to global competition and food safety requirements. Especially the SMEs are in squeezing situation: they have to fit very sharp prerequisites and demands on one side and very much constrained resources to give them power in order to formulate appropriate answers on the other side (Fertő – Tóth, 2013).
Meanwhile there is an increasing trend in firms' practice that they carry out innovation with their network partners instead of in-house R&D. They are looking for partners beyond the boundaries of their organization, mainly with other firms, universities, research organisations and government agencies. Besides the market threatens and safety regulations there are several factors behind this process, including exploding R&D costs and risks, shifting public R&D funding incentives towards

[1]Corvinus University of Budapest, Department of Agricultural Economics and Rural Development, Hungary, e-mail: jozsef.toth@uni-corvinus.hu

multi-institutional research, the influence of new technologies (biotechnology and nanotechnology), which have dissolved boundaries between industries (Rampersad et al., 2010).
Adopting an effective innovation process to successfully introduce and develop new products to the market has become one of the most important strategies for food companies (Karantininis et al., 2010). However, whether it is more effective to speed up the innovation process by sharing ideas and resources with other companies, or to innovate in-house in a more closed system is still under debate in the academic domain (Sarkar & Costa, 2008).
Chesbrough (2003) has been the first to introduce the concept of 'open innovation'. The idea of open innovation indicates that a company is increasingly using inflows and outflows of knowledge to speed up the internal innovation process, and expand the markets for external use of innovation (Chesbrough - Crowther, 2006).
The innovation dimension of networking activity contributes to growing network complexity, which in turn also affects the nature of traditional governance structure (Ritter, 2007). Trust and other relational factors are playing an increasing role in these structures (Izquierdo & Cillan, 2004).
Our main research interest is whether the trust as coordination form of the governance structure plays significant role in the Hungarian agri-food industry. Empirical data was drawn from a survey carried out in Central Hungary and aiming at the research of cooperation and knowledge management within the SMEs of the food economy. However the literature of innovation and knowledge management is rapidly increasing in the recent years, we hardly can find predecessor ones around the Hungarian agricultural- and food sector. Especially the research in agri-food territory on the field of trust as governance tool in concatenation with networking and innovation is extremely scarce, even on global level. The uniqueness is getting more intense if we look at the methodological approach: Structural Equation Modelling (SEM) is applied in order to determine the relationship among these three latent factors.
This paper contributes to the existing literature by (i) creating appropriate constructs which – based on survey data – represent the "Trust – Networking – Innovation" triad in appropriate manner, (ii) demonstrate the direct and indirect effects of these structures – which represent latent factors – on each other and (iii) applies Structural Equation Modelling approach on the field of food chain SMEs in Hungary.
The paper is organized in the following way. After the introduction we summarize the theoretical considerations behind our investigation area and set up our hypotheses. In the next paragraph we introduce the applied methodology, pointing out why SEM is suitable for analysing the organizational behaviour of food SMEs with respect to their innovation capacities. In the following part we carry out our SEM analysis and in the final one we conclude.

2. THEORETICAL CONSIDERATIONS

2.1. Trust

Trust is a key factor which formulates the performance in business transactions. Trust is driven by the individual's expectation of another's behaviour. In inter-organizational relationships, trust is considered as a valuable commercial asset (Morgan & Hunt, 1994; Svensson, 2005), essentially because a lack of trust can have severe cost consequences.
Trust is related to intentional behaviour, which is relevant in economic relationships. Distrust – and even the lack of trust – raises the transaction costs of cooperation, while trust can play a role in reducing these transaction costs (Levi, 2000), therefor trust may modify the terms of any economic calculus (Williamson, 1993).
Puranam and Vanneste (2009) examine the role of trust in the context of the choice of governance construct. They suggest that the governance structure supportively cops with unforeseen contingencies.

Changing institutional environment can influence the role of trust, although these changes can be managed by modified transaction-specific governance structure in a cost-effective way (Williamson, 1993).
Trust, from our point of view is seen as a certain way of coordination, which gives initiatives for acquiring and sharing new ideas-, knowledge and practices. Regarding that from innovation point of view the agri-food SMEs are operating in a low-tech industry and the product innovations are almost entirely incremental ones, the trust refers first of all to the reliability of new ideas and knowledge which are circulated among the networking partners. These new initiatives give impetus to the product- or process development which may result in new market solutions.

2.2. Networking

Network in our presentation means a set of actors connected by a set of repeated interaction of formal and/or informal ties. The actors are firms (competitors, suppliers, customers, auxiliary businesses etc.), individuals (boundary spanners etc.), knowledge centres (universities and research centres etc.) and other actors (network organizations, governments, special-interest groups, industry organizations etc.). The ties are the relationships between the actors. Ties may be formal (contractual, institutionalized etc.) or informal (social, trust-based etc.) (Kühne et. al. 2011).
SMEs are usually focusing in a specific area, and involvement in a network may be an effective way to successfully enter wider markets and acquire complementary resources. These complementary resources in our case are specific ones: these are mainly new ideas which can be developed into new products, processes, services or business practices and at the end they can help to close their productivity gap.
SMEs are engaged differently in networking depending on their networking abilities and existing relationships. The most common reason behind is that they would like to get access to new or complementary competencies, technologies and markets (Coles et al. 2003). The value of diverse networking partners in innovation stems from the fact that innovation occurs more effectively where there is exchange of knowledge between systems (for example, between different industries, between regions or between science and industry).
It is also empirically evident that the type of partner firms engaged in networking appears to be related to the type of innovation occurring: incremental innovation is more likely to happen in the presence of costumer partnership, while improved or new products more probably come together with suppliers' and/or consultants' networking (Pittaway et al. 2004).

2.3. Innovation

As for innovation we use the very broad definition of DTI (Department for Business Innovation & Skills of UK Government): "Innovation is the exploitation of new ideas" (DTI's Innovation Report 2003, p. 3) into new products, processes, services or business practices, and is a critical process for achieving the two complementary business goals of performance and growth, which in turn will help to close the productivity gap (Pittaway et al. 2004).
It is assumed widely in both the neoclassical and the evolutionary economic theory that market selection rewards the most innovative firms: ensures more markets and/or increase the market shares of innovators. However this approach is not unambiguously supported by empirical research: empirical evidence on whether innovative firms perform better than noninnovative firms remains inconclusive (Demirel & Mazzucato, 2009).
The empirical evidence on the impact of innovation on profits and firm growth is mostly mixed especially for the latter. Several studies find persistent differences in determinants of profitability for innovators and non-innovators (Freel, 2000, Leiponen, 2000, Stoneman & Kwon, 1996).
However the empirical results with regard to the effect of innovation on firm growth are more mixed. According to Adamou and Sasidharan (2007) firms with higher R&D intensity ratios (i.e. R&D/sales) grow faster. In contrary from Del Monte and Papagni (2003) we could learn that R&D has a positive impact on firm growth but this is more pronounced in traditional industries than in the

most 'high-tech' ones. On a Swedish sample Heshmati and Lööf (2006) did not find significant impact of R&D expenditures on firm growth. Oliveira and Fortunato (2005) found that physical investments have a much higher impact compared to R&D investments, especially for 'high-tech' firms.
In our analysis – in line with Del Monte and Papagni (2003) – we assume that in case of the Hungarian food SMEs more innovation positively contributes to the firm performance.
Dynamic capabilities are the ones which promotes the performance of (open) innovation (Dahlander & Gann, 2010; Huizingh, 2011). The role of openness and connected capabilities is especially important in food business because they have even more intense interactions with both upstream and downstream partners than other types of companies (Enzing et al., 2011).

3. HYPOTHESES

Deriving from the theory and empirical evidence studied above we have established the following hypotheses.

H1: ***Trust, Networking*** *and* ***Innovation*** *are latent exogenous characters of the Hungarian food SMEs which can be explored via individual observed variables and their covariances.*
H2: ***Trust*** *and* ***Networking*** *positively influence each other*
H3: ***Networking*** *has got positive impact on* ***Innovation***
H4: ***Trust*** *has got positive inspire on* ***Innovation***

4. DATA AND METHODOLOGY

Data was drawn from a survey carried out in Central Hungary and aiming at the research of cooperation and knowledge management within the SMEs of the food economy in 2011. We have our sample from agricultural producers (64), food processors (59) and retailers (109). The sample probably underrepresents the innovation efforts in the Hungarian food chain because the conventional closed type (R&D) of innovation is more frequent in the bigger companies which are not examined here.
In order to test our hypotheses we employed Structural Equation Modelling (SEM). Structural equation modelling is a general term that has been used to describe a large number of statistical models used to evaluate the validity of substantive theories with empirical data. One of the primary advantages of SEM (vs. other applications) is that it can be used to study the relationships among latent constructs (like Trust, Networking and Innovation) that are indicated by multiple measures. SEM takes a confirmatory (hypothesis testing) approach to the multivariate analysis of a structural theory, one that stipulates causal relations among multiple variables (Lei, Pui-Wa and Wu, Qiong 2007).
SEM is a family of statistical techniques which builds upon multiple regression and incorporates and integrates path analysis and factor analysis.
SEM simultaneously:
(a) models causal processes represented by a series of regression equations, and
(b) provides the ability to include unobserved (latent) variables and takes into account measurement error.

In line with that, the structural equation modelling process focuses on two steps: (i) validating the measurement model – accomplished through confirmatory factor analysis and (ii) fitting the structural model – accomplished through path analysis with latent variables.
Usually the term SEM refers to hybrid models with both multiple indicators for each latent variable (sometimes called factor), and directional paths specified connecting these latent variables.
In our case SEM was used first for identifying factors which create appropriate constructs for Trust, Networking and Innovation, after then we have fit the structural model utilizing the latent variables.

5. RESULTS

Figures 1 – 3 show the Trust, Networking and Innovation measurement models (constructs), respectively. Table 1 – 3 explains the composition of the latent factors. On each figure we demonstrate standardized results. Double headed arrows mean covariance, while one headed arrow represents causal relationship between variables.

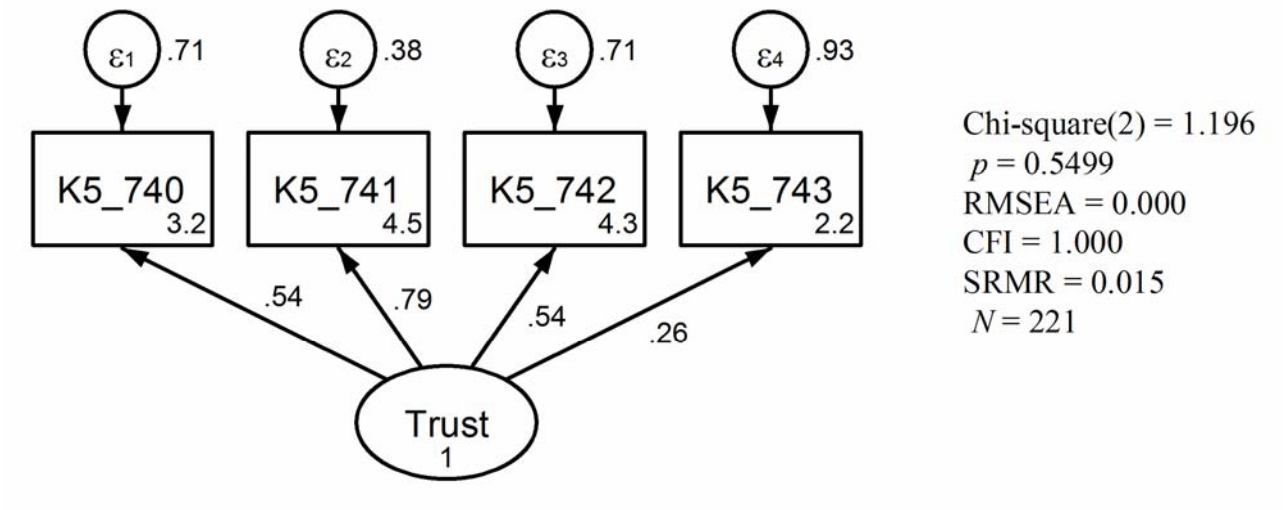

Figure 1. Trust as latent factor
Source: own calculation

Table 1. Individual variables composing Trust

	Item	Name
1	K5_740	How do you trust other people?
2	K5_741	How do you trust your suppliers?
3	K5_742	How do you trust your consumers?
4	K5_743	How do you trust your competitors?

Source: own calculation

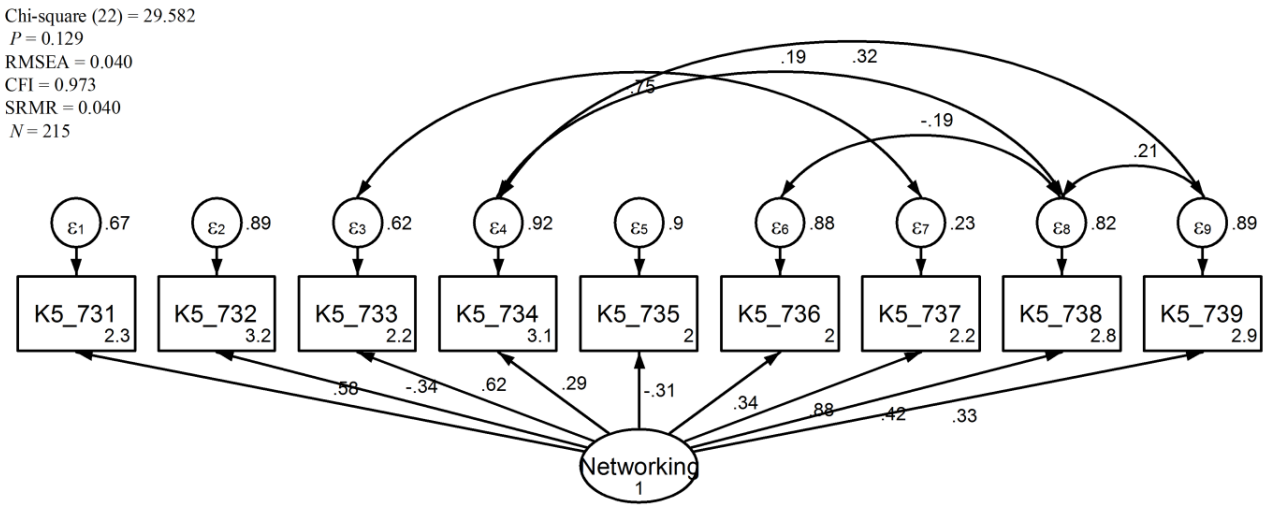

Figure 2. Networking as latent factor
Source: own calculation

Table 2. Individual variables composing Networking

	Item	Name
1	K5_731	Rival enterprises in the region would need tighter connections
2	K5_732	A new enterprise entering the local market harms the business environment
3	K5_733	Geographically close enterprises share more information
4	K5_734	Intense local competition increases innovation
5	K5_735	Cooperation causes more disadvantages than advantages
6	K5_736	Employees need to be encouraged to share non-confidential information with other enterprises' employees
7	K5_737	Cooperation and rivalry of enterprises are possible in the same time
8	K5_738	Cooperation of local enterprises contributes to the welfare of the region
9	K5_739	Intense local competition helps enterprises to increase their productivity

Source: own calculation

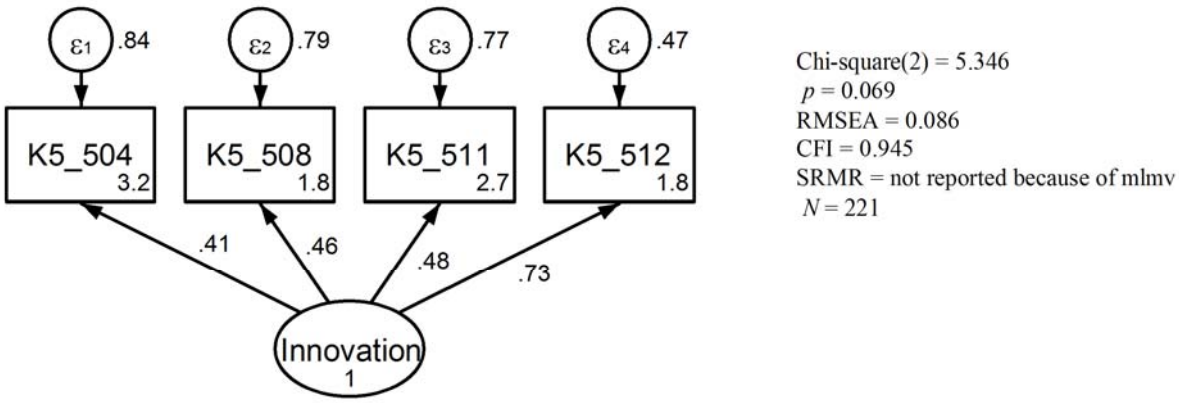

Figure 3. Innovation as latent factor

Source: own calculation

Table 3. Individual variables composing Innovation

	Item	Name
1	K5_504	Technological innovation: When did you start to use this technology?
2	K5_508	Product innovation: When did you start to produce this product?
3	K5_511	Organizational innovation: When did you change your organisational structure?
4	K5_512	Innovation in market activities and connections: When did you change your marketing channels last time?

Source: own calculation

Figure 4 demonstrates the very complex relationships between the latent and observed variables.

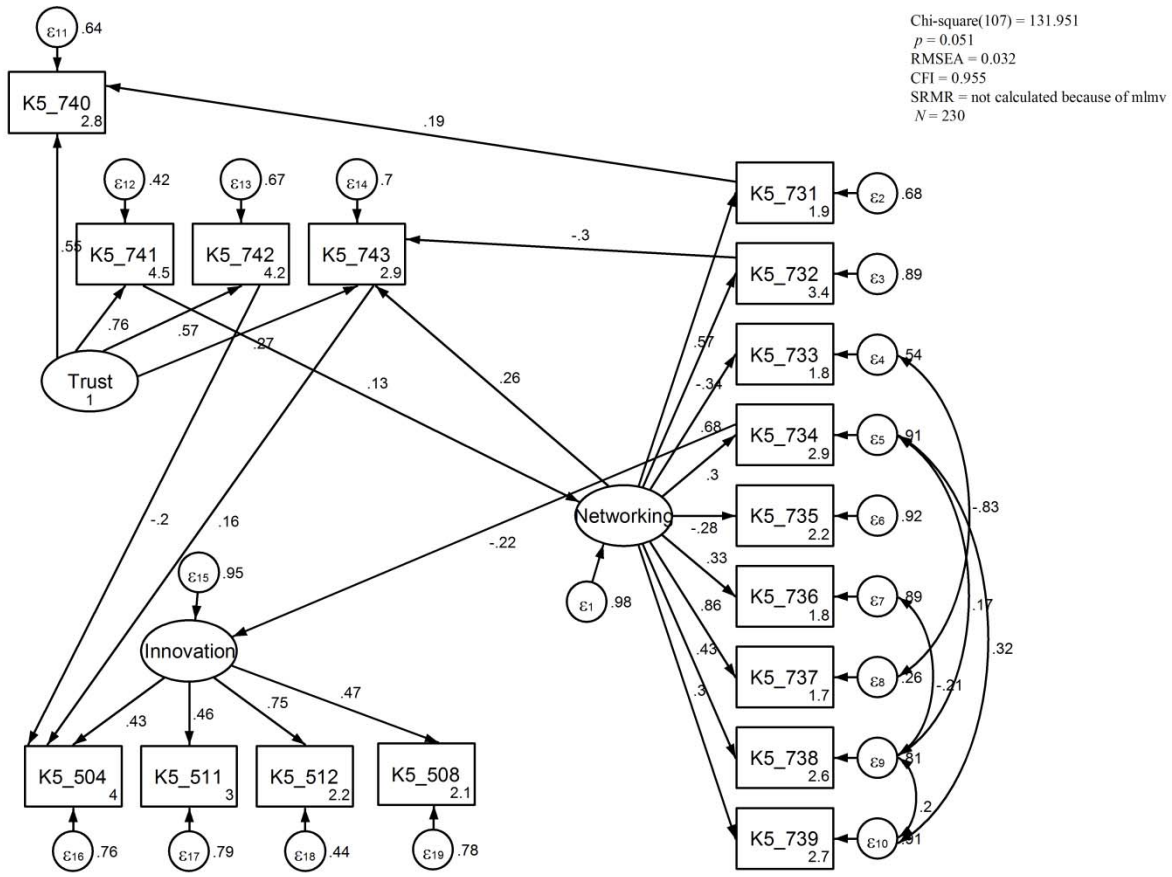

Figure 4. Trust – Networking – Innovation: structural relatioships
Source: own calculation

6. DISCUSSION AND CONCLUSIONS

In Figures 1 – 3 we demonstrated the existence of underlying factors behind the "Trust – Networking – Innovation" triad. In case of Trust and Innovation there is a rather clear structure with straight and unidirectional relations between the latent factor and the observed variables. The Networking factor shows up several covariancies between variables, however. The strongest and at the same time negative covariance between "Geographically close enterprises share more information – K5_733" and "Cooperation and rivalry of enterprises are possible in the same time – K5_737" suggest that geographical proximity negatively influence the information acquisition of food SMEs in Hungary. This finding is underpinned by the second largest covariance in this structure, which advises that more local competition increases the innovation and productivity. This statement shed light on the core nature of Central Hungarian food SMEs with respect to their innovation attitude: in the focus of their interest there is the behaviour of competitors and not others.

In order to evaluate the goodness of fit of our models we need to apply different indicators. Trust is seen as very good fitting model on empirics, because each of the fit statistics proves this statement. First, we have a Chi-squared of 1.196 wit 2 degrees of freedom and p = 0.55 (in case of Trust). The Chi-squared compares the fitted model to saturated one which has no degree of freedom. SEM tries to reproduce the covariance matrix for the variables in question (in case of Trust this is four). It selects the combination of parameter estimates which approaches closer the covariance matrix. It means that if we arrive at a model where the difference between the reproduced and original

covariance matrix is significant (Chi-squared < 0.05), we did not make good job; our model should be improved.
The second indicator is Root mean squared error of approximation (RMSEA). It is recommended that this be not more than 0.05 for a good fit and less than 0.08 for a reasonable close fit. Almost each of our results suits this requirement (except Innovation, however it is rather close to it).
The next one is the comparative fit index (CFI). The CFI is a widely used measure, which compares the model with the baseline one that assumes no relationship among the variables. The advised cutoff value for CFI is minimum 0.9, however the 0.95 can be regarded as generally accepted one. We can state that our results can be regarded as good ones from this point of view as well.
The last ratio is the standardized root mean squared residual (SRMR). This measures how close we are in reproducing each correlation, on average. The recommended value is less than 0.08. In two cases we are far below this value. In the other two cases we were not able to calculate this index, because we employed maximum likelihood with missing values (mlmv) method for estimating the parameters. This method utilises the information in observations containing missing values, observations that are omitted by the other methods. We needed to do this because otherwise we could not achieve convergence in the estimation.
All in all we dare state that our models fit rather good and can serve as good base for testing our hypotheses.

7. VALIDITY OF HYPOTHESES

H1: Models in Figure 1 – 3 are fully supportive. As discussed above, the latent factors behind the individual observed variables are valid constructs and explain them in appropriate way.

H2 – H4:

The interrelationship between the latent variables can be followed based on Figure 4. First we can state that the supportive relationship between them is partly supported. Especially, a part of Networking (namely "Intense local competition increases innovation – K5_734") is promoting the Innovation (the sign of the loading is negative, but the „Innovation" variables are expressing the performance in reverse order). Besides that direct effect we can also see, that there are many ties from certain variables of Networking to Trust and vice versa, as well as from Trust to Innovation. Taking everything into account we can declare that our a priori knowledge expressed in various, but related hypotheses has been proved partly, but mainly truth.

ACKNOWLEDGMENT

The research was supported by TÁMOP-4.2.1/B-09/1/KMR-2010-0005 and Hungarian Scientific Research Fund (OTKA), K 84327 "Integration of small farms into modern food chain"

REFERENCES

Adamou, A., & Sasidharan, S. (2007). *The impact of R&D and FDI on firm growth in emerging-developing countries: evidence from Indian manufacturing industries*. Madras School of Economic Policy, Working Paper 37.

Chesbrough, H. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Harvard Business School Press: Boston, MA.

Chesbrough, H., & Crowther, A. K. (2006). *Beyond high tech: early adopters of open innovation in other industries*. R&D Management, 36(3), 229-236.

Coles, A., Harris, L., & Dickson, K. (2003). Testing goodwill: conflict and cooperation in new product development networks. *International Journal of Technology Management 25*, 51–64.

Dahlander, L., & Gann, D.M. (2010). How open is innovation? *Research Policy 39*, 699–709.

Demirel, P., & Mazzucato, M. (2009). *Survey of the literature on innovation and economic performance*. FINNOV.

Del Monte, A., & Papagni, E. (2003). R&D and the Growth of Firms: Empirical Analysis of a Panel of Italian Firms. *Research Policy 32*, 1003-1014.

DTI. (2003). *Innovation Report – 'Competing in the Global Economy: the Innovation Challenge'* http://www.insme.org/files/617/view, donloaded: 02 july 2013

Enzing, C.M., Pascucci, S., Janszen, F.H.A. & Omta, O.S.W.F. (2011). Role of open innovation in the short- and long-term market success of new products: evidence from the Dutch food and beverages industry. *Journal on Chain and Network Science* 11(3), 235-250.

Fertő, I., & Tóth, J. (2013). *Innováció a magyar élelmiszer-gazdaságban.* (Innovation in the Hungarian Food Industry), X. Annual International Conference on Economics and Business, 10 -12 May 2013, SAPIENTIA University, Csíkszereda (Miercurea Ciuc), Romania

Fischer, C. (2013). Trust and communication in European agri-food chains. *Supply Chain Management: An International Journal 18*(2), 208 – 218

Freel, M. (2000). Strategy and Structure in Innovative Manufacturing SMEs: The Case of an English Region. *Small Business Economics, 15*(1), 27-45.

Heshmati, A., & Lööf. H. (2006). *Investment and Performance of Firms: Correlation or Causality?* Working Paper Series in Economics and Institutions of Innovation 72, Royal Institute of Technology, CESIS - Centre of Excellence for Science and Innovation Studies

Huizingh, E.K.R.E. (2011). Open innovation: State of the art and future perspectives. *Technovation 31*, 2-9.

Izquierdo, C.C., & Cillan, J.G. (2004). The interaction of dependence and trust in long-term industrial relationships. *European Journal of Marketing 38*(8), 974-94.

Karantininis, K., Sauer, J., & Furtan, W.H. (2010). Innovation and integration in the agri-food industry. *Food Policy 35*(2), 112-120.

Kühne, B., Lambrecht, E., & Gellynck, X. (2011). *Network types and their importance for knowledge exchange and innovation in the agri- and horticultural sector*. Proceedings. Presented at the 21st Annual world symposium of the International Food and Agribusiness Management Association, International Food and Agribusiness Management Association (IFAMA).

Lei, Pui-Wa, & Wu, Qiong. (2007). *An NCME Instructional Module on Introduction to Structural Equation Modeling: Issues and Practical Considerations*. http://ncme.org/linkservid/47EFEB5A-1320-5CAE-6EC90BFDF09AA39E/showMeta/0/, downloaded: 18 April 2013.

Leiponen, A. (2000). Competencies, Innovation and Profitability of Firms. *Economics of Innovation and New Technology 9*(1), 1–24.

Levi, M. (2000). *When good defenses make good neighbours: A transaction cost approach on trust, the absence of trust and distrust*. In: Ménard C (ed) Institutions, Contracts and Organizations: Perspective from New Institutional Economics, Chichester, UK: Edward Elgar, chap 12, 137–157

Morgan, R., & Hunt, S. (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing, 58*(3), 20-38.

Oliveira, B., & Fortunato, A. (2005). *Firm Growth and Persistence of Chance: Evidence from Portuguese Microdata* http://gemf.fe.uc.pt/workingpapers/pdf/2005/gemf05_10.pdf downloaded: 26 January 2012

Pittaway, L., Robertson, M., Munir, K., Denyer, D., & Neely, A. (2004). Networking and innovation: a systematic review of the evidence. *International Journal of Management Reviews 5/6*(3&4), 137–168

Puranam, P., Vanneste, B. S. (2009). Trust and Governance: Untangling a Tangled Web. *Academy of Management Review 34*(1), 11–31.

Rampersad, G., Quester, P., & Troshani, I. (2010). Examining network factors: commitment, trust, coordination and harmony. *Journal of Business & Industrial Marketing, 25*(7), 487–500.

Ritter, T. (2007). A framework for analyzing relationship governance. *Journal of Business & Industrial Marketing 22*(3), 196-201.

Sarkar, S., & Costa, A.I.A. (2008). Dynamic of open innovation in the food industry. *Trends in Food Science & Technology 19*, 574-580.

Stonemann, P., & Kwon, M. J. (1996). *Technology Adaption and Firm_Profitability*. The Economic Journal, 106 (July), 952-962.

Svensson, G. (2005). Mutual and interactive trust in business dyads: condition and process. *European Business Review, 17*(5), 411 – 427.

Williamson, O. E. (1993). Calculativeness, Trust, and Economic Organization. *Journal of Law and Economics 36, 453-486*