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## Investigation of Institutional Clustering: Empirical Evidence<sup>1</sup>

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### ABSTRACT

Cluster development depends on provided technical support and on institutional environment either. The paper presents fundamental cluster`s institutions, examines key parameters and factors underlying the institutions. Correlations between a parameter and factors within each institution are given in hypotheses, which were tested at Ural Biopharmaceutical cluster`s enterprises. The results obtained as interrelations between parameters and factors enable to conclude what factors are the most crucial for cluster development. The practical significance of the current study consists in recommendations regarding development of interfirm relationships that may be allowed for decision making in cluster management.

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## 1. INTRODUCTION

Nowadays, the term "cluster" refers to a unit of competitiveness identified by the particular industrial and economical effects so generated. However, despite the great attention paid to the technical environment of clusters (techno-parks and business incubators), the establishment of the institutional environment that stimulates the creation of clusters has been less intensively studied. The relevant role of institutions has been noted by Michael Porter (2004), who defines a cluster as "a geographical proximate group of interconnected companies and associated institu-

tions in a particular field, linked by commonalities and externalities". In other words, he considers the institutional clustering environment as a set of specific institutions operating only within a cluster. We understand "set of specific institutions" to refer to the formal and informal rules ("rules of the game" in Douglas North's terms) that reduce transaction costs and provide so called "quasi-rents", i.e. the additional pure benefits of clustering the activities of firms.

The paper attempts to define and evaluate crucial factors that determine the evolution of institutions in the interfirm relationships characterised by clustering. The paper proceeds as follows: in the first part, we describe the main institutions governing interactions within and between clusters, highlighting important parameters and factors underlying each institution. In the second section, six hypotheses based on described factors and parameters are formulated. In the third part, we present results of survey carried out to test the hypotheses and discuss verified and falsified hypotheses from the previous part. Finally, the obtained results are summarised and recommendations for developing interfirm relationships within clusters presented.

## 2. CLUSTER`S INSTITUTIONS

Among institutions that form the institutional environment of clusters, we consider institutions of: (a) innovation; (b) "coopetition"; (c) knowledge generation; (d) communication; (e) trust; (f) protection against opportunistic behaviour.

Before discussing institutions of innovation, it seems reasonable to clarify the term "innovation": for the purposes of the present discussion, innovation is the result of innovative activity; the transformation into a new or upgraded implemented technology or launched product. In other words, perspectives of eventualities that are not applied in practice are not considered as innovations. However "*innovation is not an activity of a single firm; it increasingly requires an active search involving several firms to tap new sources of knowledge and technology and apply these in products and production processes*" (Guinet, 1999). Consequently, "*cooperation between actors from diverse organisations with distinct activities and backgrounds is seen as an important factor in stimulating innovation in its different expressions: product, process and organisational innovations*" (Alves, 2004).

Innovative gains come from geographical proximity between consumers and suppliers where interactions provide a quick feedback to proposed innovative decisions. "*Proximity to knowledge centres makes the interaction processes concerning design, testing and prototype development physically easier, especially where much of the necessary knowledge is partly or wholly tacit rather than codified*" (Cooke, 2001). Moreover, innovative gains derive from connecting with local or regional authorities that can place orders for innovative products or provide financial, organisational or other support for the generation of innovations.

The pooling of risk between firms stimulates the production process. The idea of connecting innovations with risk traces back to Schumpeter, who identified the crucial role played by entrepreneurs in creating new products. Moreover, the generation of new products is built upon prior experience and interests, including local contacts and business knowledge (Cortright, 2006). Thus, the institution of innovation is viewed as a mechanism of interaction within the cluster, based on knowledge transfer, risk taking, previous experience and the power of authorities, framed by geographical proximity.

Due to global economic transformation, competition and cooperation are no longer distinct processes. The interdependence of these two activities, their embeddedness, can be described as "coopetition". M. Porter, who first highlighted the important role of cooperation alongside competition, concentration, communication and competitiveness, expanded the concept of cooperation by distinguishing between horizontal and vertical aspects. While a horizontal cooperation is formed by shared activities and infrastructure, a vertical cooperation is aimed at expanding discrete transactions among firms within clusters. Such transactions support knowledge

spillover and strengthen the advantages of cooperation. In addition to horizontal and vertical cooperation, incentive cooperation is found (Lorenzen and Foss, 2003), where social capital is an underlying factor. Social capital is usually defined as a networks together with shared norms, values and understandings that facilitate co-operation within or among groups. Social capital is also associated with values such as tolerance, solidarity or trust (Harper, 2002). Because social capital is based on common norms and rules, it is reasonable to assume that it fosters learning processes within clusters and compliance in coordinated actions between clustering firms. Thus, the institution of co-competition is viewed as a mechanism of interacting within clusters, based on shared activities and infrastructure, knowledge transfer, learning process and social capital.

Social relationships between actors in clusters are considered to be a crucial feature of the performance of clusters. Such relationships seem to result from the local interdependence of all clustering partners – manufacturers, suppliers, intermediaries, consumers and infrastructure facilities – banking sector, research centres, universities etc.

The social relationships that are fostered by clusters are impacted by the culture that predominates therein. By culture, we understand the openness of clustering firms, their readiness to adaptation, knowledge, experience and experience sharing. Many studies have shown that both the manifold social interactions among economic actors and the culture of particular places play important roles in shaping economic behaviours such as risk-taking, cooperation and information sharing, all of which are also important to clustering (Cortright, 2006). In other words, effective communication within clusters is based on social capital.

In addition to the factors referred to above, the quality of communication within clusters is affected by technical support, i.e. particular soft- and hardware products that facilitate performance in clustering firms. Successful communication in clusters depends on conferences, meetings, seminars and mutual visits carried out within clusters; these require financing. Moreover, geographical proximity appears to comprise a key factor within the interaction of clusters. Thus institutions of communication comprise a mechanism of interaction within clusters, based on social capital, reputation, technical support and financing, and framed by geographical proximity.

Under the term “knowledge”, we understand structured and systematised information, applied for solving discrete tasks (Popov, 2012). Knowledge can be embodied in such intellectual products as manufactured samples, utility models, research papers, databases, trademarks etc. Consequently, institutions of knowledge generation firstly consist in the creation of new knowledge; secondly, in the rules and norms that regulate the consumption, distribution, planning, organisation and control of knowledge. Moreover, interactive learning between the main actors, including the developers and users of the knowledge, stimulates the generation of innovations.(Salami, 1997). Nevertheless, knowledge generation, transfer and distribution fail without financial support, so the financing of manufacturing and organisational performance is also an essential factor for institutions of knowledge generation (Nauwelaers, 2001)

Porter – in agreement with Scitovsky – argues that demanding local consumers can pressure firms to innovate, as well as to maintain and improve product quality, which in turn improves their competitiveness in other markets (Cortright, 2006). Thus, institutions of knowledge generation comprise mechanisms of interaction in clusters, based on the creation of new demanded products and services and the financing thereof.

Trust is expressed as belief that an exchange partner would not act in self-interest at another's expense (Uzzi, 1997) and considered as one of the most important factors for the management of interfirm relations. Nevertheless there is a lack of research studies that investigate fundamental factors that are crucial for establishing and maintaining institution of trust.

According to the carried research (Nguyen, 2006), cultural understanding, i.e. knowledge of the norms, beliefs, business ethos seems to be the main factors for establishing trust in inter-firm relations. Reputation is also identified as an important factor for gaining trust, which can be obtained via good references from previous partners. Another factor is the capabilities of firms in the following areas: management, technology and people. Effective and frequent communication at all stages of interfirm collaboration is a central unit in managing trustful relations in clusters (Harper, 2002). The main criterion for maintaining trust is the fulfilling of contractual commitments (Nguyen, 2006). Thus institutions of trust consist in a mechanism of interaction in clusters, based on cultural understanding, reputation, capabilities, communication and the fulfilling of contractual commitments.

Oliver Williamson defined opportunism as self-interested seeking with guile (...) involving “*self-disbelieved threats and promises*” in order to realise individual advantages (Williamson, 1975). These advantages can be due to “*selective and distorted information disclosure or self-disbelieved promises regarding future conduct*” (Williamson, 1975). Opportunism between partners in cluster is aimed at gaining individual benefits through breaking contractual agreements. Consequently, opportunism seems to be eliminated or reduced due to institutions of protection against opportunistic behaviour.

While the fulfilling of contractual commitments is primarily considered in terms of formal rules, trust, reputation and a readiness to share knowledge and experience (Siegler, 2014) also play an informal role in establishing institutions of protection against opportunistic behaviour. Informal rules seem to be more crucial than formal ones because following the former permits economies in terms of formal controls. It seems important to highlight that information concerning partners' capabilities can also protect opposite partners against unprofitable contracts. Thus institutions of protection against opportunistic behaviour comprise a mechanism of interaction in clusters, based on trust, reputation, capabilities and the fulfilling of contractual commitments.

### 3. METHOD

Based on interactions between determined parameters and factors, we proposed the following hypotheses:

- Hypothesis 1. The greater the knowledge transfer, previous experience and geographical proximity are, and the less the risk-taking is, the more numerous the implemented innovations as a consequence of clustering will be.
- Hypothesis 2. The more shared activities and infrastructure, greater learning process and higher social capital, the greater the knowledge transfer within a cluster.
- Hypothesis 3. The greater the geographical proximity, reputation, technical support and financing are, the greater the social capital will be.
- Hypothesis 4. The greater the financing and monitoring of consumer demand are, the greater the number of created R&D samples will be.
- Hypothesis 5. The greater the reputation, capabilities (production, human and management), communication and readiness to knowledge transfer are, the greater cultural understanding will be.
- Hypothesis 6. The greater the contractual conformance, reputation, capabilities (production, human and management) are, the greater the trust will be.

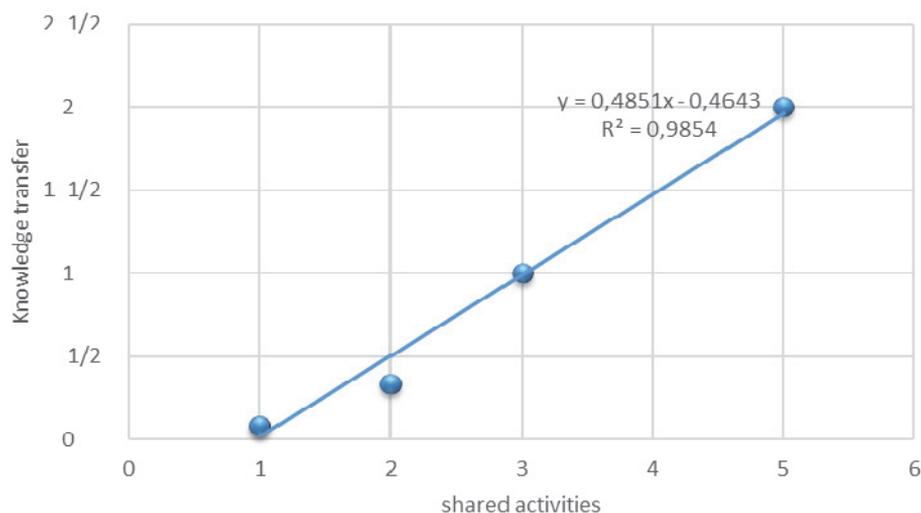
The testing of the above hypotheses via a questionnaire among top managers at the Ural Biomedical Cluster produced the following results:

### 3.1 Results

By investigating institutions of innovation, we examined a correlation between the parameter “implemented innovation” and the factors of “authority”, “knowledge transfer”, “previous experience”, “risk-taking” and “geographical proximity”. The low determination coefficient resulted in no correlations between the given parameter and factors being detected. As far as geographical proximity is concerned, the majority of respondents remarked on its irrelevance for innovations being implemented in a cluster.

By studying institutions of cooperation we found a correlation between the “knowledge transfer” parameter (measured as frequency of knowledge transfer within a year) and factors of “shared activities” (measured as a number of shared activities), “shared infrastructure” (measured as a number of shared infrastructure), “learning process” (measured as frequency of learning programs carried on for cluster employees) and “social capital” (measured as level of coordination). The high coefficient of determination showed the interrelation between the given parameter and factors.

**Fig. 1.** Correlation between knowledge transfer and shared activities



**Fig. 2.** Correlation between knowledge transfer and shared infrastructure

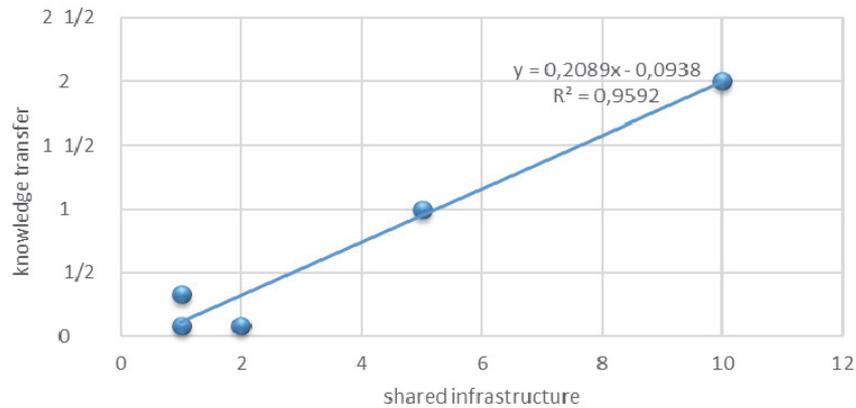


Fig. 3. Correlation between knowledge transfer and social capital

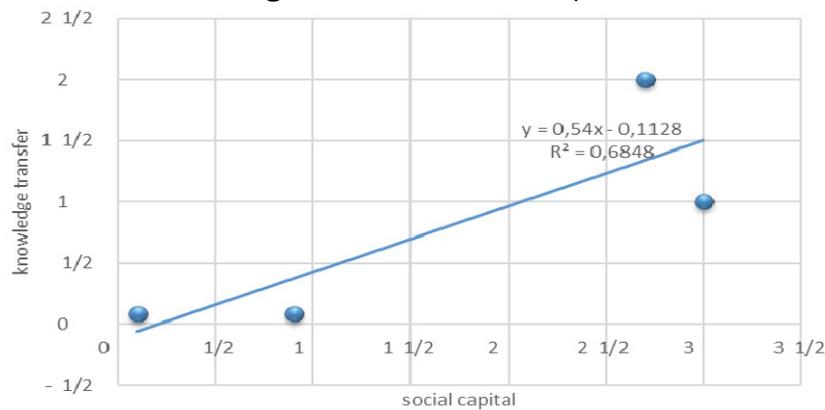
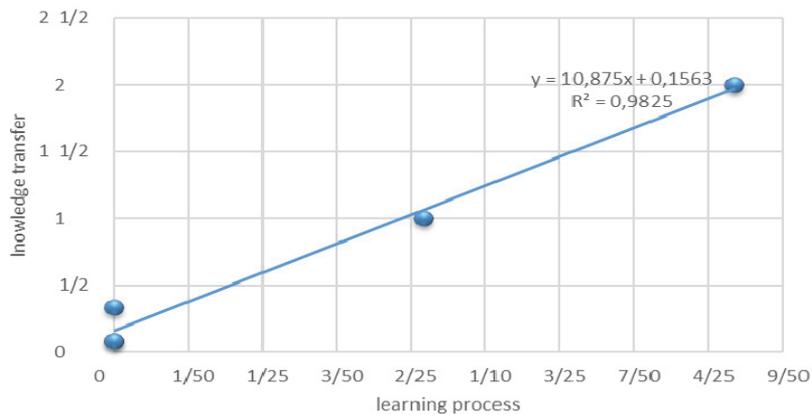


Fig. 4. Correlation between knowledge transfer and learning process



In investigating institutions of communication we tested the correlation between the “social capital” parameter and factors of “geographical proximity”, “reputation”, “financing” (measured as expenses for bargaining, exhibitions etc. of current total firm expenses) and “technical support” (measured as expenses for hardware provision of current total firm expenses). A high correlation between the “social capital” parameter and the factors of “reputation” and “financing” was detected.

Fig. 5. Correlation between social capital and reputation

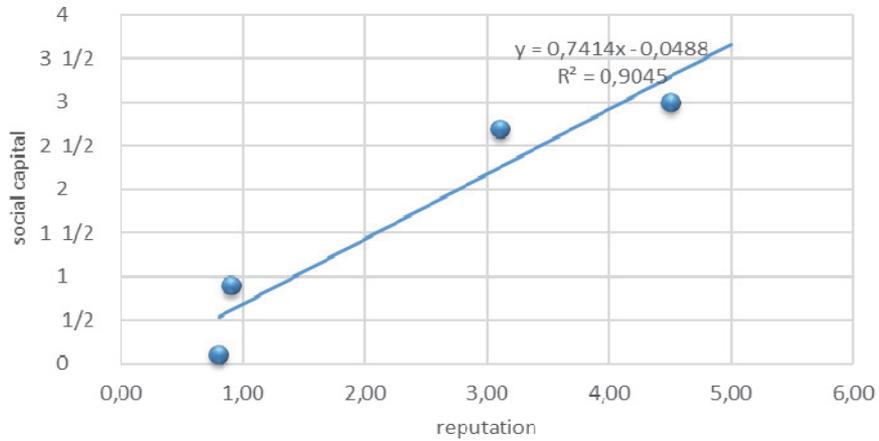
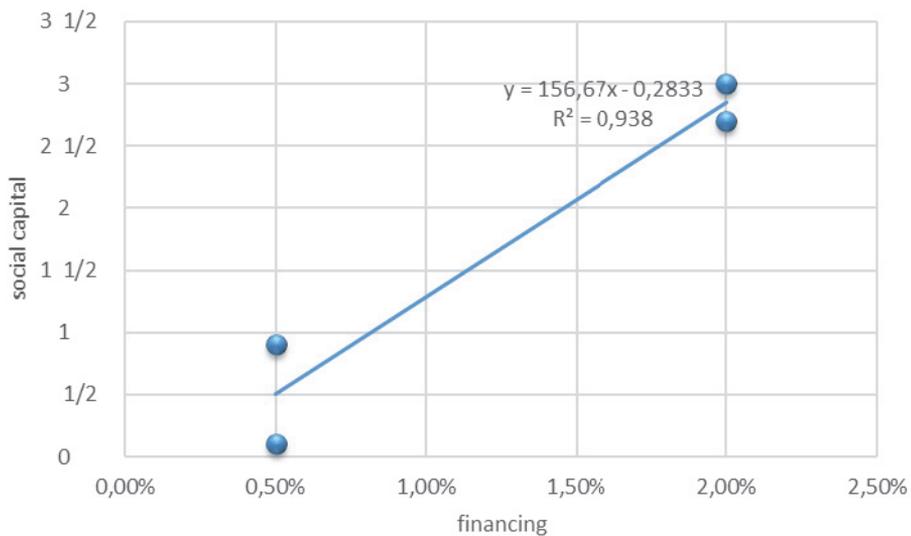


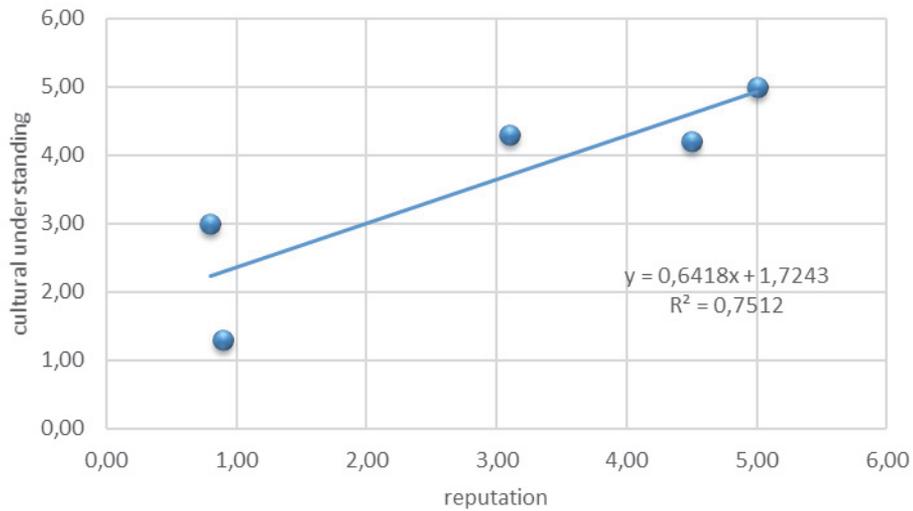
Fig. 6. - correlation between social capital and financing



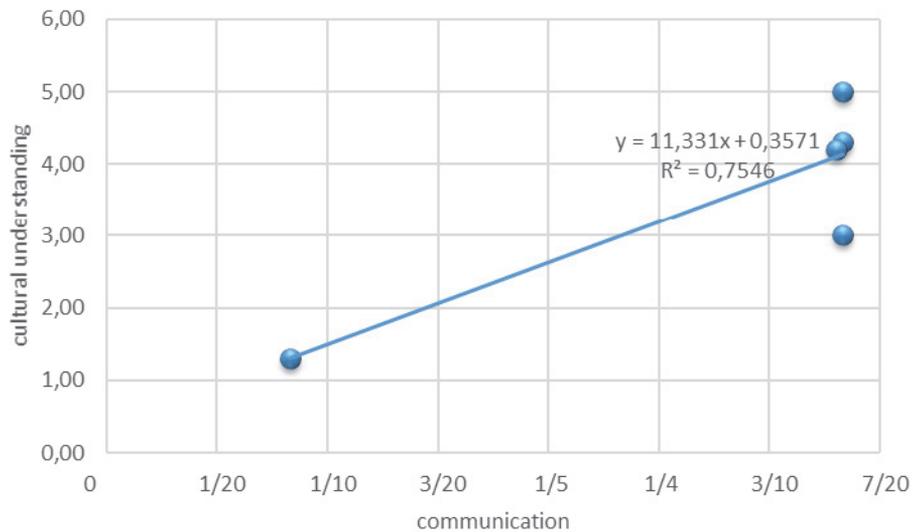
In examining institutions of knowledge, we predicted a correlation between the “R&D samples” parameter and factors of “R&D financing” and “consumer demand monitoring”. However, the results received from the questionnaire failed to establish any correlations between these quantities.

In investigating institutions of trust, we discovered a correlation between the “cultural understanding” parameter and factors of “reputation”, “management capability”, “people capability”, “technical capability”, “communication” (measured in meeting per year between cluster actors) and readiness to participate in knowledge transfer. By “management capability”, we understand firms’ influence on decision-making in clusters (measured in points); under “technical capability” – amortisation and covering manufacturing needs of cluster (measured in %), people capability was estimated in time period, required for qualification upgrading. Data analysing showed high correlation between a parameter “cultural understanding” and factors “reputation” and “communication”.

Fig. 7. Correlation between cultural understanding and reputation



**Fig. 8.** Correlation between cultural understanding and communication



By studying institution of protection against an opportunistic behaviour we determined a key parameter “trust” and factors “reputation”, “fulfilling contractual conformance”, “management capability”, “technical capability” and “people capability”. Like in case of institution of trust, examining factors “management capability”, “technical capability” and “people capability” failed in setting of any correlations between these factors and a parameter “trust”. However the high correlation was detected between the later and factors “reputation” and “fulfilling of contractual commitments”.

**Fig. 9.** Correlation between trust and fulfilling contractual commitments

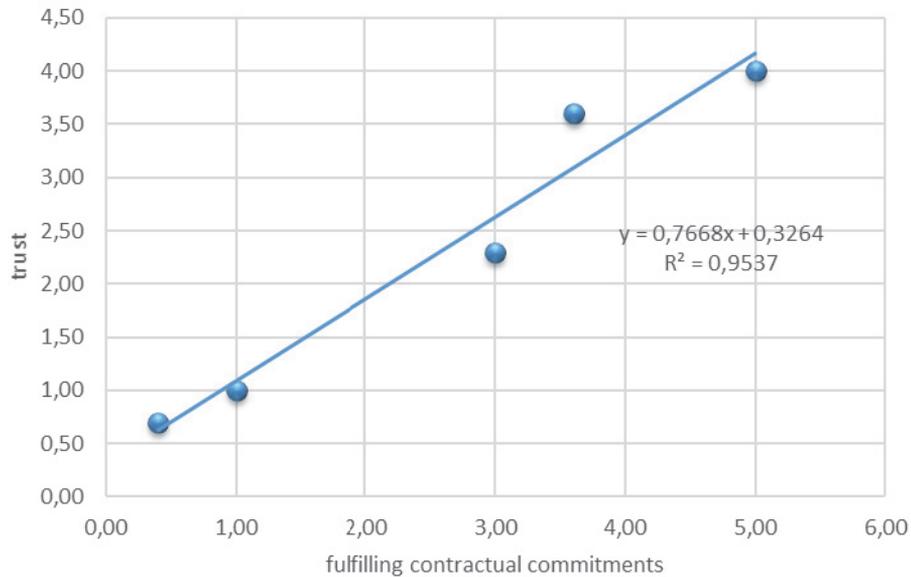
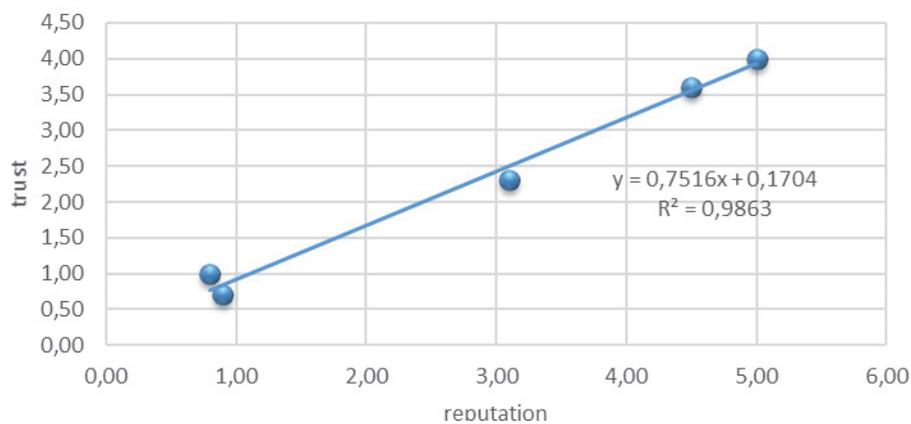


Fig. 10. Correlation between trust and reputation



## 4. DISCUSSION

As a result of the research, we found that some hypotheses were not confirmed.

Hypothesis 1. “The greater the knowledge transfer, previous experience and geographical proximity are, and the less the risk-taking is, the more numerous the implemented innovations as a consequence of clustering will be” was not confirmed. In spite of the tendency to openness and interfirm collaboration, every firm in the cluster represents a closed system with optimised technological and organisational processes, specified production cycle that is independent of factors like knowledge transfer, previous experience and risk-taking. Regarding geographical proximity, it reduces transport costs that are probably absent or negligible low due to lack of logistics between firms within clusters.

Hypothesis 2. “The more shared activities and infrastructure, greater learning process and higher social capital, the greater the knowledge transfer within a cluster” was confirmed. The internal cluster environment, formed by shared infrastructure (buildings, warehouses, banks,

financial and consulting groups, etc.), coordination of shared activities, learning programmes incline firms in clusters towards openness and readiness to cooperate. All of these factors support knowledge transfer.

Hypothesis 3. "The greater the geographical proximity, reputation, technical support and financing are, the greater the social capital will be" was confirmed regarding reputation and financing. Geographical proximity hardly improves social capital, probably because of alternative means of regulating strategic and current tasks; authority is an external resource that has no effect on internal coordination processes. As for technical support, it is necessary to highlight that costs for its maintenance are negligible and fixed independent of coordination in clusters.

Hypothesis 4. "The greater the financing and monitoring of consumer demand are, the greater the number of created R&D samples will be" was not confirmed. Although these factors are relevant for generating R&D, innovative processes seem to be caused by tacit, complex factors, which were not found in current research.

Hypothesis 5. "The greater the reputation, capabilities (production, human and management), communication and readiness to knowledge transfer are, the greater cultural understanding will be" was confirmed regarding reputation and communication. However, the estimation of capabilities detected its internal resources that don't affect cultural understanding between firms in clusters. Readiness to participate in knowledge transfer can be found without congruence in values, beliefs and norms.

Hypothesis 6. "The greater the contractual conformance, reputation, capabilities (production, human and management) are, the greater the trust will be" is confirmed regarding the fulfilment of contractual commitments and reputation. Capability was seen as irrelevant concerning cultural understanding and trust in interfirm relations.

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The investigation of some governing factors that determine interfirm relationships within clustering structures showed the following theoretical and practical outcomes:

In institutions of coopetition, a high correlation was identified between the "knowledge transfer" parameter and factors of "shared infrastructure", "shared activities", "social capital" and "learning process". In institutions of communication, a high correlation was detected between the "social capital" parameter and factors of "reputation" and "financing". In institutions of trust, we discovered a significant correlation between the "cultural understanding" parameter and factors of "reputation" and "communication". In institutions of protection against opportunistic behaviour, a significant correlation was ascertained between the "trust" parameter and factors of "fulfilling contractual commitments" and "reputation". In institutions of innovation and knowledge generation, no significant correlations between parameters and factors were revealed. Such factors as "authority", "geographical proximity" and "capacity" seem to be irrelevant to interfirm relations within clusters. Thus the empirical evaluation of factors affecting interfirm relations in clusters revealed their correspondence to real economic activity.

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