The Network Potential of IT Firms

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Abstract – **In today's world, the key factor of competitive advantage consists in the ability of economic agents to integrate, exchange information and generate knowledge. In this paper, we set out to investigate networks formed between firms with the purpose of facilitating mutually beneficial collaboration between them. To this end, we develop a multi-factor model of the network potential of such structures, which can be applied in practice for maximizing the outcome of networking between firms. It is shown that the network potential of firms involved in such interactions can be represented by all the tangible and intangible resources of the agents consolidated with the purpose of increasing the mutual efficiency of their collaboration. The development of the model involved the analysis of networking collaborations in terms three conditions determining their efficiency. We refer to these conditions as assignment, coordination and affirmation. The condition of assignment characterizes the quality of resources contributed by all the parties; it is an 'existential' condition forming the basis for a further productive collaboration. The condition of coordination implies all management strategies and tactics aimed at optimizing the interaction processes and ensuring the synergistic effect. The affirmation condition represents the outcome of the functioning of a network organization in terms of the synergistic effects produced. Using the developed theoretical model, we empirically assessed the network potential of IT firms in Russia. It is shown that this sector of economy is characterized by the strategy of a collaborative implementation of innovations, which represents the affirmation condition. This becomes possible as a result of a high level of coordination, including measures aimed at intensifying integration, promoting adaptation and preventing opportunism**

Keywords – network potential, assessment of network potential, IT-sector firms

I. INTRODUCTION

The world economic system is gradually progressing from industrial to post-industrial manufacturing models. Such changes become an impetus for the formation of new economic entities, such as, e.g., high-technology enterprises. In this new reality, the capability of economic agents to work in collaboration is seen as a fundamental factor of competitiveness. Collaborative efforts can reduce the level of uncertainty and promote effective exchange of resources. Information then serves as a basis for the implementation of technological and organizational improvements. Under such conditions, the traditional forms of organization are being increasingly substituted by more effective and adaptive network forms.

The contemporary economic literature demonstrates a growing interest in the role and importance of interfirm networks as a source of competitiveness of individual firms. Thus, economic sociologists (Joscow P., 1987) draw attention to the importance of social networks and institutions for the establishment of efficient business relations. Within the framework of a resource-based approach (Bradach J.L., Eccles R.G., 1098), resources and competencies are seen as a fundamental value. Representatives of the relationship marketing concept (Hunt Sh., Morgan R., 1995) concentrate their attention on the characteristics of successful inter-firm relationships, while institutional theory (Williamson, O., 2008; Menard C.., 2004) refers to basic characteristics of inter-firm transactions. These approaches focus on certain aspects of sustainable inter-firm relations, in many ways complementing each other. The contribution of all the above-mentioned works consists not only in the analysis of synergistic effects achieved by means of collaborative work, but also in the development of methodological approaches to the analysis of network structures. However, there is a lack of research into the integration capacity of individual firms, which can greatly improve the performance of respective networking organisations. We believe that the development of a multi-factor model describing the network potential of individual firms can be useful for identification of those areas that demand close attention in the formation and development of network relations.

In this research, we aim to develop a multi-factor model that can be used for the assessment of the network potential of firms. To this end, we analyse the economic nature of network organisations and determine factors affecting the performance of individual participants within the network structure.

II. METHODOLOGY OF NETWORK ORGANISATIONS ANALYSIS

Seminal works published by E. Toffler and M. Castells in the second half of the 20th century were the first to draw attention to the analysis of network structures. There, networks were defined as the most effective and adaptive

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organisational forms under the new conditions of the information economy. R. Miles and C. Snow also viewed the network as the most effective form of organisation for company management in a globalised economy (Miles, Snow 1986).

In Castells' work (Castells, 2010), a networked enterprise is defined as a specific form of an enterprise, whose system of funds is made up of intersections of segments of autonomous target systems. H. Hakansson (1987) regards the network as a set of entities, institutionally independent of one another, but carrying out actions or controlling resources, which are to some degree interdependent.

The increasing popularity of the network approach is determined primarily by its empirical feasibility, which allows interdisciplinary theoretical generalisations to be made (Podolny and Page, 1998). Thus, social networks are seen as a foundation for the formation of knowledge economy (Nieves J., Osorio, 2013). The theory of graphs has a particular significance for empirical studies (Wang, Sharpe, Garry, Robins, 2009). Note should be made of a significant number of contemporary publications devoted to the problems of cooperability (Hofmeister, Borchert, 2004) and networkability (Ding, Ujang, Hamid, Wu, 2015; Fitter, Rohner, 2010).

The primary feature of inter-firm networks consists in the use of *the common assets of multiple firms* instead of concentrating all the resources of economic agents on a single integrated structure or an exclusive contract. In this case, while market incentives remain relevant, cooperation becomes more adaptive in comparison with cumbersome and unwieldy hierarchical structures. By pooling resources, companies strive to achieve an additional synergistic effect that is unobtainable when firms act alone without mutually coordinated action. The threshold is the moment at which the company concentrates on key resources and competencies in order to achieve a competitive advantage. In the context of network interactions, the key feature becomes the complementary resource partner compatibility inherent in any company resource, whether financial, material-and-technical, information or intellectual.

As a general rule, shared resources have specific characteristics. To ensure the sustainability of transactions that use specific resources, it is necessary to ensure the compliance of the parties with each other, involving the implementation of mutual investments and formation of mutual relations [Wilson, Jantrania, 1996], The common use of assets belonging to several companies involves the strategic management of joint activities in the absence of legal control over property. This means that, irrespective of what mechanisms are primarily employed by network organisations (market-based mechanisms or the management of administrative processes), individual aspects of planning must be implemented collaboratively. This process can relate to long-term goal-setting, e.g. prices, the number of products produced and resources used, quality standards of products, training of personnel etc.

The coordination parameter of inter-firm cooperation is structured around specific communication mechanisms, such as effective social ties and the organisation of

information exchange. Information resources play a special role in the formation and development of network relations. The essential features of this role are comprised firstly of the ability to develop an optimal strategy for the subject, and secondly, of the ability of the company to adapt in a rapidly changing external environment. The processes of generating knowledge and innovation become more effective if partners with different models of prior development share their knowledge and experience. Consequently, communication between partners with different competencies is an important factor in both organisational and production innovation.

The nature of the contract of interaction is the basis for cooperation in network organisations. Cooperation and coordination between independent economic entities that share resources takes place on the basis of incomplete formalised contracts. At the same time, however, many authors emphasise the importance of attitudinal contracting, reflecting the "spirit of the agreement", which is often more important for the interaction of participants than a formal agreement (Williamson, 2008; Menard, 2004; Baker, Gibbons, Murphy, 2002). However, long-term relations under conditions of incomplete formal contracts, involving the use of specific resources and investments aimed at ensuring the mutual compliance of parties, are necessarily realised under conditions of uncertainty. Consequently, here ex-post problems are possible, which can be the result of opportunism. A network organisation function is therefore necessary in order to avoid such eventualities and ensure the security of transactions, using mechanisms for the effective prevention of "extortion", "freeriding" and other forms of opportunism.

Furthermore, ex-post problems are generally the result either of circumstances beyond anyone's control or misunderstandings. For this reason, another important function of network organisations consists in their adaptability. For economic agents operating under conditions of uncertainty, modern networks are an adequate means of flexible integration. Accordingly, the functioning of network organisations involves specific, jointly developed mechanisms for adapting to unforeseen circumstances that may provoke a conflict of interest. Additionally, as Ian Gordon points out, enterprises that want to build long-term partnerships based on the complementarity of specific resources will have to develop flexible capabilities in their technologies, processes, personnel and knowledge; moreover, technologies should allow for any foreseen changes (Gordon, 1998).

Thus, network organisations require safety mechanisms for implemented transactions and the sustainable interaction of companies involved in cooperative activities on the basis of implied or incomplete formal contracts, thus allowing flexibility in adapting to unforeseen circumstances. Stability of interaction means partners coordinate their functions and mutual activities aimed at the optimal use of complementary resources continuously over the entire course of cooperation (Popov E., Simonova V., 2015). The disclosure of economic characteristics of network organisations makes it possible to create a model representing the network potential,

which in turn is used to conduct a multi-factor analysis of the effectiveness of inter-firm interactions.

III. MULTI-FACTOR MODEL OF NETWORK POTENTIAL

In this paper, the network potential model is developed based on a factor analysis in terms of conditions ensuring the achievement of mutually beneficial synergistic effects by all the participants of a network organisation. We refer to these conditions as assignment, coordination and affirmation (Fig.1).
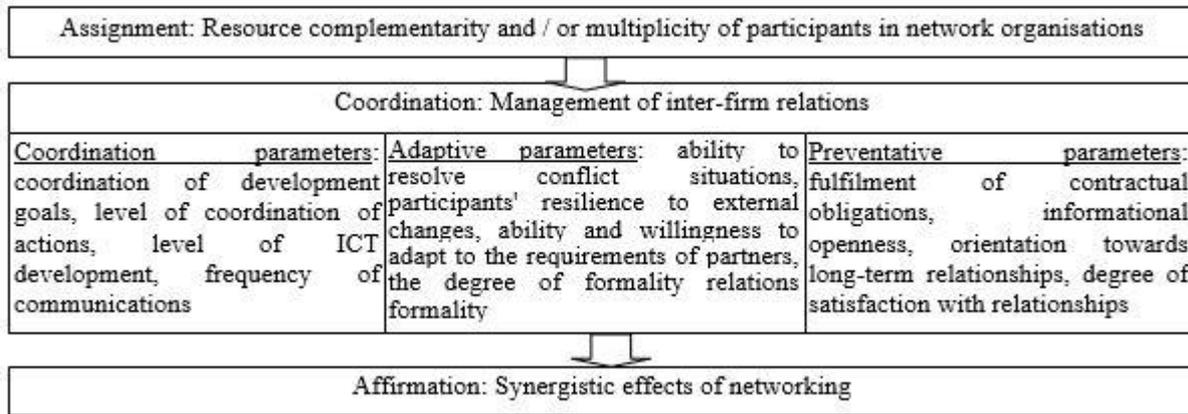
Assignment: Resource complementarity and / or multiplicity of participants in network organisations

Coordination: Management of inter-firm relations		
Coordination parameters: coordination of development goals, level of coordination of actions, level of ICT development, frequency of communications	Adaptive parameters: ability to resolve conflict situations, participants' resilience to external changes, ability and willingness to adapt to the requirements of partners, the degree of formality relations formality	Preventative parameters: fulfilment of contractual obligations, informational openness, orientation towards long-term relationships, degree of satisfaction with relationships

Affirmation: Synergistic effects of networking

Fig.1. Model of the network potential of a firm

Affirmation reflects the result of inter-firm networking in In terms of the synergistic effects of cooperation, which allow the reduction of interaction expenses and implementation of joint innovations. Assignment determines basic conditions and primary motivation for existing a networking organisation. This condition describes all the resource characteristics of the participants. Indeed, the magnitude of possible synergistic effects of the functioning of any network organisation is determined by the quality of resources contributed by the participants into this organisation.

However, the control over certain resources cannot be considered as the sufficient condition for this firm to perform well in a network structure. Here, the quality of *managing* network transactions is of great importance, which involves the development of effective norms and rules for inter-firm cooperation. Consequently, an appropriate coordination can provide for the efficacy of transforming the resource base into the results mutually beneficial to all the participants. According to the outlined network organisation theory, the quality of coordination is determined by the intensity of inter-firm interactions, including various adaptive and opportunism-preventive actions.

The assignment condition is assessed according to parameters such as (a) the security of resources in terms of their volume and quality in correspondence with the development objectives - SecRes, (b) the degree of the resource complementarity of the firm under study to its strategic partners - ComRes and (c) the degree of the resource specificity of the firm under study in terms of its potential alternative use - SpeRes. Respondents are asked to assess these parameters using a 5-point Likert scale. The performance estimates of the assignment condition (AE) are summarised and subsequently normalised. As a result, the normalised integral index value of the assignment condition should vary in the interval [0; 1], reflecting the quality of a firm's resources for use in networking.

The level of coordination is proposed to be assessed using the following parameters: (a) the level of agreement in terms of operational activities between the firm under study and its partners - AA, (b) the degree of democracy within its management - DM, (c) the frequency of inter-firm communications - CF, (d) the level of inter-firm communication regulation - CR, (e) the technological level of information infrastructure development - I. The ability of the management mechanism to prevent opportunism that can arise during joint efforts of innovation can be assessed by means of the following parameters: (a) willingness to trust a partner - T, (b) fulfilment of contractual obligations - CO, (c) information openness − IO, (d) the level of satisfaction with established relationships – RS, (e) strategic orientation towards long-term relationships – SO. For evaluating the adaptation aspect of the coordination condition, we have chosen the following parameters: (a) the ability of the company to constructively resolve conflict situations - CR, (b) the stability of the company in face of external changes - CS, (c) the willingness of the company to adapt to the requirements of its partner - AW, (e) the technological flexibility of the company in the introduction of new resources - TF. The methodology for estimating and grouping the indicators is identical to that used in the evaluation of the assignment condition.

The developed model has formed the basis for an empirical study of the network potential of IT sector enterprises. Using this theoretical foundation, we conducted a survey among the business leaders of firms either participating or potentially willing to participate in joint projects aimed at the creation of new products and/or technologies. The questionnaire included approximately 40 questions grouped into categories, e.g. aimed at revealing the resource potential of the firm, characteristics of its innovative activity, the level

of its management system with respect to coordination, protective and adaptive functions.

IV. ASSESSMENT OF THE NETWORK POTENTIAL OF RUSSIAN IT-SECTOR FIRMS

Our results show that the IT sector in Russia is characterised by the strategy of implementing innovations by means of consolidating efforts. Thus, 75% of the respondents noted that they frequently introduce innovations together with their partners. With the exception of those enterprises not participating or rarely participating in the joint production of innovative products or technologies, the analysis of the data obtained was primarily focused on the respondents regularly involved in networking collaborations. The research results are presented in a table (Table).

TABLE I. ASSESSMENT OF THE NETWORK POTENTIAL OF A FIRM

	Calculation formula *	Average value
Assignment condition	$RE = \dfrac{SecRes + Com\,Res + SpeRes}{5n}$	0.65
Coordination parameters of management	$AEcoord = \dfrac{AA + DM + CF + CR + II}{5n}$	0.74
Preventative parameters of management	$AEprevent = \dfrac{T + CO + IO + RS + SO}{5n}$	0.85
Adaptive parameters of management	$AE\,adapt = \dfrac{RCS + FS + AW + TF}{5n}$	0.69

The obtained data shows that the average RE (Assignment condition) for the surveyed enterprises is 0.65. The parameters under consideration – resource security, resource specificity and complementarity of partner resources were used equally to achieve this result (Fig.2). Nevertheless, it can be noted that, in general, the average RE value is quite high; therefore, the resource basis of inter-firm relations has the development potential to achieve a greater synergistic effect.
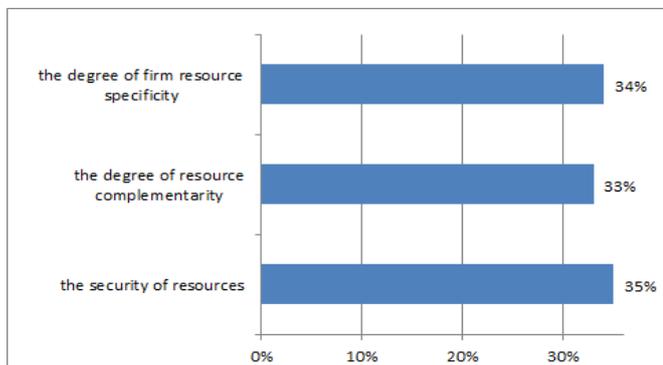

Fig. 2. Factor proportion in the integral index of the assignment condition

The assessment of the coordination condition among our respondents demonstrates its high level of development. The estimated average coordination component integral indicator of the management mechanism (AEcoord) is 0.74. This aspect is primarily characterised by a developed system of information exchange, including technical support. However, enterprises try to avoid strict regulation in

communicating with their partners, which emphasises the need for a certain flexibility in inter-firm relations. Senior managers largely adhere to a democratic management style, which forms the basis for an open culture and enables the consideration of partner interests. A sufficiently high level of coordination of the partner activities is presupposed, as in the case of the joint implementation of innovations, although full coordination of all actions is not required. The contribution of the factors to the integral value of the coordinating characteristic is shown in Figure 3.
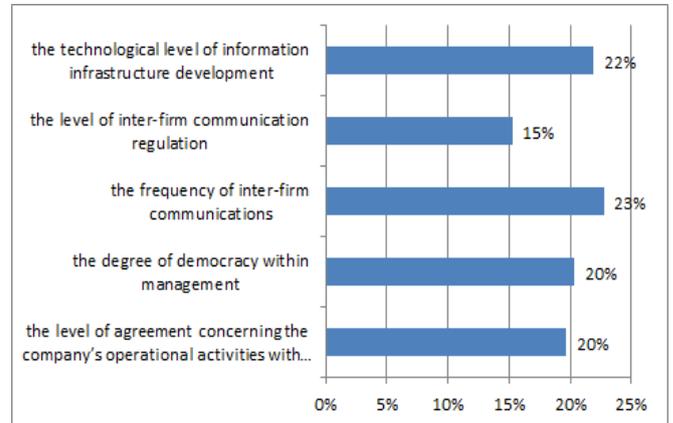

Fig. 3. Factor proportion in the integral index of the coordinating characteristic of the affirmation condition

The adaptive parameters of management are also estimated to be at a high level (the average value of the integral indicator is 0.7). Adaptability efficacy is determined, firstly, by the ability of the firm to constructively resolve conflict situations and the willingness of the firm to adapt to the requirements of its partners. The firms' resilience to external changes is also characterised by its technological flexibility, which reflect the amount of costs that arise when the need for new types of resources is unavoidable. The contribution of the factors to the integral value of the adaptation characteristic are shown in Figure 4.
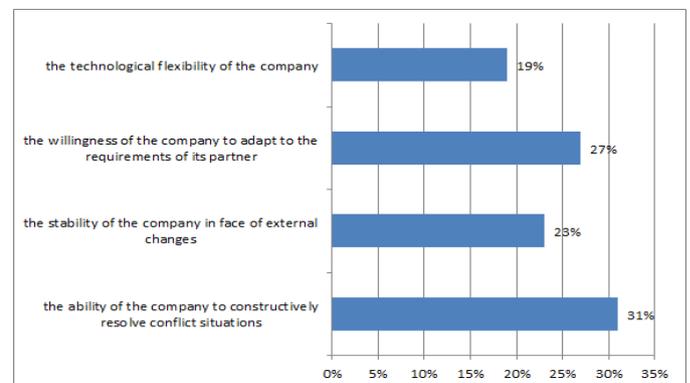

Fig. 4. Factor proportion in the integral index of the adaptation characteristic of the affirmation condition

As our study shows, existing inter-firm relations are characterised by a high level of the prevention parameter, with its average integral indicator score being 0.85. It makes it possible to conclude that the ability of firms to establish trust relationships, thereby effectively reducing the risks of

opportunism in the form of freeriding and extortion, becomes a key factor in implementing the strategy of joint innovation. The contribution of the factors to the integral value of the prevention characteristic are shown in Figure 5.

An important factor in preventing opportunism is the readiness of partners to trust each other. Our analysis has revealed a relationship between the individual factors of the prevention parameter. Thus, it is established that high levels of trust encourage participants to maintain long-term relationships, which, in the long run, will stimulate investments necessary for the technological, resource and managerial adaptation of the firm and facilitate the resolution of arising conflict situations. In turn, trust is more readily developed under the conditions of information openness and the conscientious fulfilment of contractual obligations.
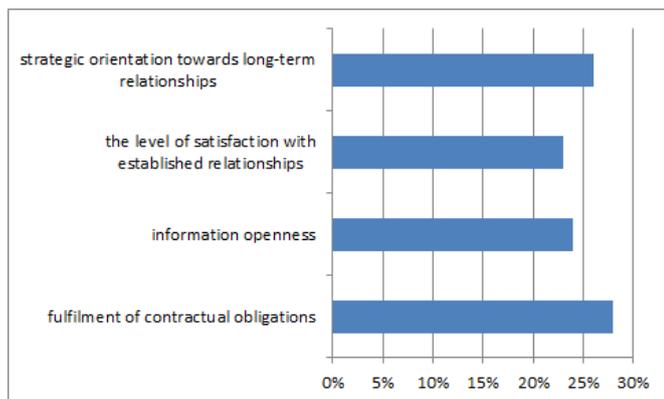

Fig.5. Factor proportion in the integral index of the prevention characteristic of the affirmation condition

V. CONCLUSION

Productive network interactions form on the basis of a shared use of resources contributed by all the participants. However, this facts creates a number of difficulties in terms of managing these shared assets, such as coordination of joint activities, solution of the free-rider problem or withdrawal of the shared revenue. Moreover, since all the decisions are frequently taken under the conditions of uncertainty inherent in long-term relationships, such management tactics should be adaptive to unforeseen circumstances.

In this paper, we have developed a model describing the network potential of a firm, which can be used in the practice of managing network organisations. The network potential is shown to be a sum of the tangible and intangible assets consolidated by the participants of network organisations with the purpose of increasing the efficiency of their economic activity. The model has been developed on the basis of a multi-factor analysis of conditions determining the efficiency of networking. Among them, we have distinguished the conditions referred to as assignment, coordination and affirmation.

The assignment condition describes the resource characteristics of network organisation participants from the standpoint of their complementarity and specificity, which can be considered to be a prerequisite for a sustainable system of inter-firm cooperation. The affirmation condition reflects the effects of synergistic cooperation, which serve to reduce interaction expenses and implement joint innovations. The coordination condition is aimed at optimising the process of transforming the contributed resources into a mutually beneficial outcome, through adaptive, coordinating and opportunism-preventing actions. The coordination condition is realised by means of communication and democratic management mechanisms. Opportunism is prevented by the conscientious fulfilment of contractual obligations, information openness and orientation towards long-term cooperation. The adaptability level is determined by the participants' ability to constructively resolve conflict situations, their willingness to adapt to the requirements of the partners, their resilience and technological flexibility in the face of external changes.

Referents

[1] Almodovar J. & Teixeira A.A.C. (2014) *Assessing the Importance of Local Supporting Organizations in the Automotive Industry: a Hybrid Dynamic Framework of Innovation Networks*, European Planning Studies, Vol. 22, No 4, pp. 841-865.

[2] Baker K.M. (2013) *Decision Making in a Hybrid Organization; a Case Study of a Southwestern Drug Court Treatment Program,* Law & Social Inquiry, Vol. 38. No 1, pp. 27-54.

[3] Barney J. (2001) *Is the resource-based view a useful perspective for strategic management? Yes*, Academic of management review, Vol. 26, No. 1, pp. 41-56.

[4] Bradach J.L., Eccles R.G. (1989) *Price, authority and trust: From ideal types to plural forms*, Annual Review of Sociology.

[5] Castells M.l. (2010). *The Rise of the Network Society: The Information Age: Economy*, Society and Culture Vol. I. Wiley-Blackwell.

[6] Menard C. (2004) *The Economics of Hybrid Organizations*, Journal of Institutional and Theoretical Economics, Vol. 160, No. 3, pp. 345–376.

[7] Felzenszein C. and Gimmon E. (2009) *Social network and marketing cooperation in entrepreneurial clusters: an international comparative study*, Journal of international entrepreneurship, Vol. 7, pp. 281-291.

[8] Gordon I. (1998) *Relationship Marketing : New Strategies, Techniques and Technologies to Win the Customers You Want and Keep Them Forever*, John Wiley & Sons, Toronto.

[9] Hakansson H. (1987) *Industrial Technological Development: A Network Approach*, Croom Helm, London.

[10] Hunt Sh., Morgan R. (1995). *The comparative advantage theory of competition //Journal of Marketing*, Vol. 59. No. 2, pp. 1-15

[11] Joscow P. (1987) *Contract Duration and Relationship-Specific Investments: Empirical Evidence from Coal Markets* American Economic Review, Vol. 77, No. 1, p. 168–

[12] MacLean L.M. and Brass J.N.(2015) "Foreign Aid, NGOs and the Private Sector: New Forms of Hybridity in Renewable Energy Provision in Kenya and Uganda", Africa Today, Vol. 62, No 1, pp. 57-82.

[13] Miles R. and Snow C. (1986) *Network organization : New concepts for the new firms*, California Management Review, Vol. 28, No. 2, pp. 62-73.

[14] Popov E., Simonova V. *The impact of culture on inter-firm relations in corporations*, Montenegrin journal of economics, Vol. 11, No. 1, pp. 39-52

[15] Podolny J.M. and Page K.L. (1998) *Network Forms of Organization"*, Annual Review of Sociology, Vol. 24, No 1, pp. 57-76.

[16] Rhodes M.L., G.Donnelly-Cox (2014) *Hybridity and Social Entrepreneurship in Social Housing in Ireland*, Voluntas, Vol. 25, pp. 1630-1647.

[17] Williamson O. (1991) *Comparative Economic Organization: The Analysis of Discrete Structural Alternatives,* Administrative Science Quarterly, Vol. 36, No. 2, pp. 269-296.

[18] Williamson O. (2008) *Outsourcing: Transaction cost economics and supply chain management* Journal of Supply Chain Management, Vol.44, No. 2, p.