The grounds for researching the business network efficiency

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Abstract

The aim of this article is to present the grounds for researching the business network efficiency. The efficiency assessment of business network needs a multi-level approach which reflects the complexity of economic relationships formed in them. In particular, the article shows: the network effects, efficiency of collaboration within networks and the theses of the proposed concept for researching the business network efficiency. This may constitute the foundation for the diagnostic and project works. The author has adopted the following assumptions: 1) the efficiency assessment of business network needs a multi-level approach, which reflects the complexity of economic relationships formed in them; and 2) a *business network efficiency evaluation should be based on efficiency measures/criteria relating to the achievement of goals in the organisation as a whole, within a coherent efficiency system.* The final part of the article presents a fragment of empirical research. The study aimed to carry out multi-criteria evaluation of efficiency of selected business networks.

1. Premises

Business networks consolidate their importance in the global economy. Currently they are considered amongst the most interesting solutions having many advantages, which extend the number of strategic options available for an enterprise, they may facilitate easier migration towards profit - to sectors offering better development opportunities. At the moment they represent one of the solutions, which help face growing competition. They boost the innovativeness of member enterprises as well as the sectors in which the network operates.

The topic of networks in literature is discussed by, e.g. Jarillo, Baker, Castells, Nohira, Ghoshal, Kay, Bartlett, Ebers, Grandori, Soda, Mattson, Miles, Snow, Czakon, Niemczyk. In general, two approaches may be distinguished: 1) institutional, focusing on the development and improvement of the existing coordination mechanisms and determination of qualities which differentiate this type of structures from other organisational forms and 2) functional, stressing the strategic function of network organisations and the role of communication and information technology in the process of continual changes and gaining competitive advantage. It should also be mentioned that the idea of network organisation was significantly influenced by economic theories, including the transaction cost theory (Williamson, 1994), and theories related to building network economy and information-based societies (Toffler, 1997; Drucker, 2009), and also new micro-economic theories based on the complexity and complex systems theory, theories of evolution and development of organisation and of organisation as a complex adaptive system.

One of the most important grounds for the development of organisational networks and an interesting research perspective is to take the process into consideration in terms of efficiency. Although the issue of networks is widely discussed in specialist literature, relatively little research has been devoted to mea-

suring its efficiency. The main reasons for this include:

- difficult access to hard financial data of firms,
- no uniform definition of collaborative networks,
- difficulties in determining synergy effects (in assessing the efficiency, indicators reflecting synergy effects produced within a network must be taken into consideration), and
- a question whether the analysis should cover the performance of individual member firms or the whole network.

The last reason seems to be particularly important, having regard to the fact that the analysis of the whole network can be difficult (or even impossible) because networks frequently do not form separate, (in legal terms), business entities. In this matter certain examples of research approaches can be discussed. For example, the approach of P. Ingram and T. Simons (Ingram&&Simos, 2002), who believe that the main measure of a network is profitability compared to other companies from outside the network. The above-mentioned comparison is very difficult to undertake and needs a lot of time because it requires data from the whole sector. Another difficulty is the question of how far the firm's performance results from the membership of the network and how far from independent operation. B. Kogut in turn emphasizes that individual networks can positively influence the performance of its members, proportionately to the scope and amount of information contributed to the group (Kogut, 2000, pp.406–407).

Afuah believes that the firm's – part of a network – performance will not always be good, especially when technology develops rapidly and the network fails to keep up with the developments (Afuah, 2000, pp.387–404). Given these findings, the aim of the article is to present the grounds for researching the business network efficiency. The author has adopted the following assumptions:

- the efficiency assessment of business network needs a multi-level approach which reflects the complexity of economic relationships formed in them,
- the business network efficiency evaluation should be based on efficiency measures/criteria relating to the achievement of goals in the organisation as a whole, within a coherent efficiency system.

2. Network efficiency assessment – selected approaches

The literature describes examples of studies on the efficiency of network structures. The following are the characteristics of selected the attitude research.

The concept Task Performance Benefits by Luis M. Camarinha-Matos

The concept of Task Performance Benefits, developed by professor Camarinha-Matos, can serve as an example of measuring benefits from collaborative networks (Camarinha-Matos, Abreu, 2007, p.599). It has been inspired by analyses of social networks and other concepts, including transaction costs and the theory of games. This concept has been based on the assumption that the notion of benefits is complex and extends not only to economic aspects but also to relationships. The author claims that the actual meaning of benefits depends on the basic system of values applied in any context.

This concept treats benefits as abstract and measurable values. The effects of actions taken can be:

- independent (task performance benefits – TB)
- dependable (dependable task benefits-DTB) on partners.

The basis of this concept is the assumption that the concept of benefits is a complex notion, encompassing not only economic, but also issues of mutual relations. Thus, the effects of measures taken may be independent (*the benefits of a completed task* - KzWZ) or dependent (*depending on the benefits of a completed task* - ZKzWZ) from the partners.

Table 1. Types of benefits from collaborative networks

Self-benefits ***(KW)*** – achieved by the pi enterprise as a result of performing the zi task, within the total number of independent L tasks and the total number of dependent M tasks	$(KWii)=\sum_{l=1}^{L} KzWZ_{ii}(z_{ii})+\sum_{m=1}^{M} ZKzWZ_{ii}(z_{im})$
Received Benefits ***(KO)*** – Achieved by the pi enterprise when the pi enterprise performs the zi task (perspective of the pi enterprise)	$(KO_{ij})=\sum_{l=1}^{L} KzWZ_{ij}(z_{ji})+\sum_{m=1}^{M} ZKzWZ_{ij}(z_{im})$
Contributed Benefits ***(KD)*** – benefits from the pj enterprise to the pi enterprise as a result of the performance of the zi task (perspective of the pj enterprise)	$(KD_{ij})=\sum_{l=1}^{L} KzWZ_{ij}(z_{ij})+\sum_{m=1}^{M} ZKzWZ_{ij}(z_{im})$

Source: own study based on (Camarinha-Matos, Abreu, 2007, p.600).

An enterprise of high reputation whose membership in the network results in winning a lucrative contract (otherwise impossible to win for other partners) can serve as an example of a dependent benefit. Therefore, benefits in networks can be divided as follows (table 1).

The description and the understanding of benefits from collaboration is the key condition that allows a paradigm of different forms of collaborative networks to be assumed. The understanding is also a starting point for establishing the relevant performance indicators to be used in the decision-making process on different levels: network management, determining network forms and membership.

Structural approach

In the structural approach the performance of a firm in a network depends on its structure understood as a degree of embeddedness in the network. The main author and advocate of this concept, M. Granovetter, claims that all forms of exchange contain elements of networks, markets and hierarchy (Granovetter, 1985).

Additionally, together with other authors (Rowley, Baum, Shipilov, Greve, Rao,2004) who elaborated on the perspective of embeddedness, he was sceptical about granting a special status to network relationships, regarding all economic transactions as embedded in social relationships and covering both collaboration and competition, formal and covert relationships. As a result of such making assumptions, it has been found that all economic transactions, except for superficial and negligent exchanges, consist in and create a certain degree of mutual association and obligation. The concept of embedding in a network describes the structure of the firm's relationships with other entities, including in particular the degree to which the firm is connected with other entities in a network and the interconnections between the firms. Two types of the firm's embeddedness in a network can be distinguished:

- high – where member firms are connected not only with the central firm but also with each other,
- low – where firms are connected only with the central firm and occasionally with individual entities.

A dense network of relationships between firms in the first case does not favour building trust, collaboration and getting to know other parties. In the second case, because of structural holes, it is more difficult because firms do not have access to resources which they could access if they built additional relationships with other entities. In such networks firms can collaborate with many other entities which may not be even aware of such interrelationships. As an example you can use the research (Rowley, Baum, Shipilov, Greve, Rao,2004) which analysed the influence of structural and relational features of embeddedness in a network on the performance of member firms. The research showed that the firms' performance depends on a business context. Based on the research carried out in a semi-conduc-

tor business, it has been found that weak relationships between firms, especially in the business where firms are strongly connected with each other, had an adverse effect on the performance of member firms while strong relationships had a positive effect. The analysis of the steel business produced different results, because strong relationships between firms had positive effects on the performance of firms in a network

An approach referring to resource diversity

The approach highlighting the role of resource diversity emphasises that the key attributes in a network that may influence the performance of member firms include similarities and differences between partners, and research shows that diversity of knowledge within a network has a favourable effect on the performance of firms (Kenny, 2009, pp.105-109). Yet, not always diversified networks bring benefits for individual member firms, because it may lead to a drop in profits of an organisation due to the need to maintain a more complex and expensive management structure. The reasons for that are as follows:

- partners of different capabilities and potential originate usually from outside the central firm, which results in high search costs. Additionally, the risk of adverse selection and engaging firm into ineffective partnerships rises and the costs of leaving the partnership can be relatively high with the process itself being time-consuming,
- establishing another relationship entails higher organisation costs than in the case of existing relationships,
- with growing diversity of a network, its management is prone to administer the network the same as it did previously, failing to take into account the fact that it is the lack of adequate knowledge and resources that increases the risk of wrong decisions.

Quality approach

In accordance with this approach, the success of a given network depends on its fulfilment of set objectives. Apart from good performance the approach pays attention to failures of networks in the fulfilment of their objectives, except that in some cases the number of failures equals the number of successes. It also happens that some objectives have been fulfilled only partially. B. Gomes-Casseres deals with the issue of network efficiency, pointing to two main methods of measuring their performance (Gomes –Casseres, 2003):

- in technical and economic aspects,
- in aspects of interrelationship development.

The first method is similar to the measurement of classic international project effectiveness, e.g. meeting the deadline or project requirements, customer satisfaction. The other method regards the measurement of relationship development, i.e. communication quality, the ability of partners to understand each other, etc. In his opinion, it is important to separate these two areas because two parties frequently blame each other for their poor performance which may result from a specific technology or market. Additionally, it is easy to confuse the value of a relationship with a project deliverable even though they are two separate issues. Relationship monitoring involves the intention to avoid friction between partners, because successes and failures are unavoidable both in the area of technology and the market.

3. The network effects

The grounds for creating networks, ones related to efficiency, focus on the expected result of starting privileged interactions with a partner. The network effects were first introduced into economic literature by J. Rohlfs, who described them by analysing the telecommunication service markets (Rohlfs, 1974, pp. 16–37). The network effect should influence the cost level or bring increase in the value generated by the enterprise. The cost reduction pertains to the economies of scale and scope, as well as the pursuit of reducing the transaction costs of an enterprise. The increase in transaction

value, on the other hand, relates to the quasi-integration effect or the synergy effect which may occur between the parties to an inter-organisational network. A detailed analysis of network effects helped economists isolate the so-called indirect network effects which are related, among others, to reducing prices, increasing availability and diversity of services – a classic example of this is the computer hardware and software.

In the organisation theory, searching for efficiency of operation is related to synergy. Nowadays, the synergy effect is being sought for not only inside the enterprise, but also in the inter-organisational area. Synergy may come from phenomena such as specialisation, concentration, continuous work, technical progress, economies of scale (scale and scope), integration processes and autonomy, improvement and development processes, adaptation and pro-activeness.

Apart from the network effect, the network itself brings about many other benefits, often related with this issue, the systemisation of which is sometimes quite difficult. For instance, the following benefits related to enterprises operating in a network are stressed:

- gaining better financial results compared to traditional solutions which is an effect of eliminating the costs of organisational hierarchy, increased flexibility of operation, elimination of competition costs in relation to current partners, better allocation of investment capital, reduction of the costs of control and bureaucracy, costs of negotiation, specialisation of operation, better tying up of the customers to the network owing to the opportunity to offer comprehensive services, etc.,
- the complementarity of resources and competences within the network – the network of relations between the partners is beneficial to the exchange and joint use of scarce competences and resources,
- quick exchange of information through horizontal information and communication channels connecting the network contributes to boosting the speed and accuracy of decisions made, increasing the competitiveness and mutual learning,
- opportunity to acquire new knowledge and increase development potential,
- wide autonomy of individual partners which contributes to the innovativeness and learning, and joint coordination of operations and fulfilment of orders permits the flexible use of production capacity of participating enterprises,
- higher efficiency of operation results, among others, from the elimination of hierarchical relations (or their considerable weakening), multi-lateral information and communication connections, better application of the capacity to operate and competences, increased innovation level,

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4. Efficiency of collaboration within networks

Efficiency is defined as the result of actions taken described by means of a relationship between the effects achieved and efforts made. Efficiency is typically measured by means of the ratio analysis of the resources used, including labour, time, production or capital. In practice, efficiency is most often examined only in economic terms as a comparison of currency unit equivalent of effects of actions taken and the costs of said results fixed in the same units. This approach narrows down the substance of efficiency, thereby preventing the assessment and considering partial results which appear in an organisation and are essential for its de-

Table 2. Criteria used in assessing potential efficiency

Criterion	Description
Stability	Ability to maintain a current position in case of internal disturbances. The stability of networks is usually provided by proper relationship management. Business trust and compliance with the principles of responsible business are particularly important factors here. These two spheres facilitate the adjustment of social relationships in networks, mitigating economic risk and determining comparative stability of organisations operating in temporary and dispersed market structures. From the point of view of network and virtual organisations, economic indicators and indicators regarding relationships with business partners are particularly important, but other values may also provide significant information about anticipated stability of collaboration.
Adaptability	Ability to adapt an organisation to changes in the environment. Adaptability depends, most of all, on available resources and the ability to reconfigure the existing resources or to acquire new ones. One of the methods of assessing the efficiency of resource management is the Multi-Attribute Resource Management Model developed by ARC Advisory Group. The model covers such areas of enterprise resource management as: resources and interaction levels on which the enterprise is focused, scope of actions taken as part of resource management, selected approach and technologies employed to enhance efficiency, resources used by the managing team, anticipated collaboration level and integration with the enterprise information systems, results achieved as part of resource management.
Invention	Ability to change the operation of an organisation in pursuance of an intentional change of the environment. Actions in this regard are taken mainly as part of knowledge and intellectual capital management processes. In this context four types of development processes supporting the enhancement of efficiency in network environment can be distinguished.

Source: Own study based on (Dzidowski, 2011, p.91).

velopment and operation. Efficiency is a complex category and needs analysing on different planes through diverse assessment aspects.

Efficiency in broader terms may be seen from two different perspectives, namely potential and actual efficiency.

In assessing the actual efficiency of collaboration between independent enterprises, the theory of games, theory of transaction costs and the issues of social networks should be referred to. What should be borne in mind is that, apart from measurable indicators, other non-measurable issues, especially in very dynamic networks, are equally important.

Potential efficiency reveals the sources of enhancing the actual efficiency of an organisation. The analysis of potential efficiency extends to the capabilities of an organisation that have not been fully used so far and their potential influence on future efficiency. Thus, the analysis of potential efficiency describes a quality of the organisational system performance and directions for its improvement. In assessing potential efficiency, the following criteria can be considered: stability, adaptability, innovation (Table 2).

The above criteria can be used in the assessment of different organisational structures. They acquire special significance in networks as what determines their occurrence is internal disturbances, changes in the environment and the need for constant innovation.

5. Assumptions of analysing the network structure efficiency

The grounds for researching the business network efficiency cover the theses of the proposed cognitive concept which may be the foundation for the diagnostic and project works. These grounds are presented below.

1. The network structure is considered from the internal (the relations between the parts of the organisation and its members) and external perspective (as an inter-organisational

network).

- internal perspective – increase in the importance of knowledge as the key resource building company value resulted in the fact that the organisation itself started to be perceived as a dynamic and network structure in which the internal social relations between the employees, oriented at building, flow and use of knowledge, play a key role. The principal assumption underlying the relations in the network is that both parties to the exchange rely on resources controlled by the other party and both parties gain benefits from these various sources.
- external perspective – network organisation, also referred to as the strategic (cooperation) network or strategic relationships network, inter-organisational network or inter-firm network, is defined as the system of inter-organisational relations permitting the organisations to carry out a joint strategy which boost their total efficiency.

2. Business networks are alliances between companies which jointly cooperate to achieve basis business objectives. They may be created by the Small and Medium Enterprises (SMEs) within clusters but they exist also outside clusters. The networks may be both horizontal and vertical.

- the horizontal networks are built between enterprises which compete on the same market, these are e.g. groups of manufacturers supplying the same retail stores in the region,
- vertical, which pertain in particular to the development of supply systems, alliances between the enterprises belonging to different stages of task implementation in the same value chain.

3. The main purpose of building networks, in particular technological, is the evolutionary cooperation between companies and other organisations concentrating their operation on technological modification or all-out changes in technology. The operation consists in the fact that the actors operate on various levels of the economy, use IT technology in their functions and thus drive technological innovation necessary to solve specific problems. If a problem is solved, the network created to that end often disappears and new work is started in the technological network, necessary to solve another, different business problem. However, in each such case, the existing expertise is put to use, which speeds up the building of new networks. One of the examples of such operation, in particular in the European Union structures, is the growing number of national or supranational research and development programmes which are aimed at the development of specific technologies (biotechnology, vaccines, and medicines) and which bring together the innovative potential of many institutions, organisations and countries. Another example is the building of numerous virtual structures. In these relations one may distinguish many and various operational levels of member organisations through relations which are decisive for innovation. These are usually the following relations:

- inter-institutional and inter-disciplinary relations inside the R&D works system,
- between scientists and engineers, usually within core technologies, such as biotechnology, electronics, new materials,
- between the existing and potential users of new products and technological processes,
- emerging in various company units, of considerable importance both for new product manufacturing and its marketing, i.e. between the design, R&D, manufacturing and marketing units,
- developing new knowledge and expertise for the company and its employees (own and competitors' knowledge) and using external expertise (of suppliers, customers, vendors, advisers, universities and institutes).

4. Business networks are systems which are established voluntarily by a group of business actors – enterprises operating in a similar business area, public and private institutions which support their operation, connected by mutual relations, interacting with the environment and established to achieve common

goals. In the model approach it is assumed that (Håkansson, Snehota, 1995):

- the elements of a business network may comprise companies, institutions in the business environment, R&D units and local governments,
- the relations may be formal (regulated by contracts or agreements) or informal (resulting from interpersonal contacts),
- the relations between the elements of the network are, primarily, cooperative – the mutual relations between the elements, in particular the division of activities and cooperation under a certain collective behaviour, not always formalised, secondly, the cooperation may be accompanied by competition between actors in the network (Easton 1992, s. 3-25):,
- the actors in the network share the feeling of identity separating them from entities outside the network,
- it is possible to identify similarities in the field of operation on which the network elements focus,
- the network elements have a defined and shared goal they want to achieve through the network.

5. Business networks may take on a form of clusters in line with the definition of M. E. Porter, or a cooperation network as defined by L. Palmen. They may be separate and formalised organisations, or operate without such separate and formal organisation. The cooperation networks and clusters correspond with the following organisational forms of business networks on the regional scale: cluster initiatives, local action or manufacturer groups.

6. When researching the efficiency of business networks, the relations between the members of organisation are stressed. In particular, horizontal relations are indicated as such, which permit to join competences and use the available resources in the best possible way. The inter-organisational relations cover such interactions between the enterprises, which include information, material or energy exchange and which the parties are mutually committed to. The network structure results from the application of an approach based on dynamic relations, and:

- the key precondition of business network operation is the use of its resources by the members. At the same time, the focus is on the initiative and autonomy,
- the application of such a solution results most of all from the excessive formalisation of actions in relation to the changeability of the environment, and it is also related to the chaos in the environment, and an information gap which prevents efficient management,
- they facilitate flexibility of operation, self-organisation and increased involvement of employees, they also drive innovation.

7. Network relations may be forced or agreed to by the parties and may be realised as:

- organisational relations – through companies holding ownership rights to other companies within the network, though, manning the management boards by the owners of the holding company etc.
- market relations – customer – supplier bond.
- regional relations – proximity of registered offices of companies, overlapping areas of operation.
- informal relations – family or political ties etc.
- When analysing the relations in networks, the following systems may be distinguished:
- systems of relations within the organisation,
- systems of relations between the enterprise, its suppliers and customers,
- systems between enterprises handling similar and complementary operations.

8. In the model approach it may be assumed that:

- the elements of a network of relations may comprise companies, institutions in the business environment, R&D units and local governments,
- the relations may be formal (regulated by contracts or agreements) or informal (re-

sulting from interpersonal contacts),
- the relations between the elements of the network are, primarily, cooperative – the mutual relations between the elements, in particular the division of activities and co-operation under a certain collective behaviour, not always formalised, secondly, the cooperation may be accompanied by competition between actors in the network,
- the actors in the network share the feeling of identity separating them from entities outside the network,
- it is possible to identify similarities in the field of operation on which the network elements focus,
- the network elements have a defined and shared goal they want to achieve through the network.

9. The business network efficiency evaluation should be based on efficiency measures/criteria relating to the achievement of goals in the organisation as a whole, within a coherent efficiency system. The guidelines for the business network efficiency system include an imperative to apply universal measures of organisational efficiency. This means that the same measures should be applied throughout and should pertain to the same elements as the universal measures may be summed bottom-up and factorised top-down and then efficiency may be compared within the organisation. The wide approach to efficiency requires it to be considered in various dimensions and at various levels of aggregation, using both quantitative and qualitative criteria.

10. At the level of the entire network it is important to evaluate the actual efficiency, which takes into consideration the mutual relations between business partners and synergy effects gained. On the other hand, at the level of individual enterprises contributing to the available resource base, it is important to determine the potential efficiency. The evaluation of potential efficiency should determine whether or not to accept an enterprise into the network, define its position in the mutual relations structure and initiate changes boosting the efficiency of the entire network structure.

11. The efficiency of management processes in business networks should be evaluated while taking into consideration the processes of building and capturing value, based on the business model concept, compatible with the value management concept.

6. Methodology for assessing the efficiency business networks

Description of research area

The forms of network cooperation may be very diverse, both due to the territorial scope and the scope and type of actions undertaken. Taking into consideration the spatial scope of the network, one can distinguish the local, regional and national ones, as well as networks dispersed on larger areas, e.g. supranational and global.

Many companies operate within international networks which function directly as strategic decision-making centres and serve as tools for coordination and often for the actual control of many companies or even entire industries. Apart from global and international networks, many entities operate within local networks which are established between enterprises operating in the area of a specific local unit or between enterprises and business environment (e.g. clusters). Examples of network solutions with social network properties include industrial districts (regional clusters, Marshallian districts).

General diagram of research procedure

Figure 1 presents the diagram of network structure efficiency evaluation. This is a proposal of a research procedure related to the identification, diagnosis (evaluation) and change design.

The research procedure cycle may be presented in the following stages:

I. Identification of network structures as subject of the research

1. Defining the objective of the research and research assumptions

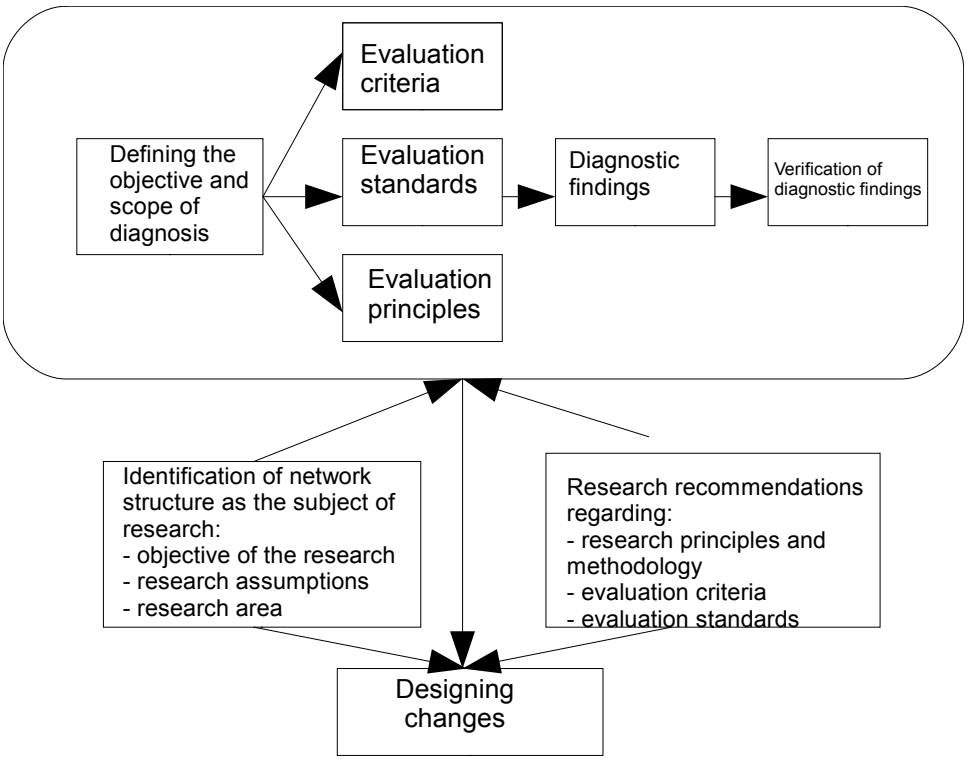

Fig. 1. A general diagram of network structure efficiency analysis
Source: own study.

2. Defining the research area
3. Registration and development of object and process description

II. Network structure efficiency diagnosis
1. Defining evaluation criteria,
2. Development of evaluation standards
3. Development of evaluation principles
4. Nominative and verification assessment
5. Diagnostic findings and causal analysis,
6. comparative, dynamic and spatial studies.

III. Designing changes
1. Defining grounds for changes;
2. Identification of the type and scope of changes;
3. Designing the system of objectives.

The network structure efficiency analysis should also take into consideration the grounds and indications resulting from the network analysis. The network analysis is widely used in many disciplines when analysing various types of phenomena: the development of attitudes, socio-economic mobility, diffusion of innovation and information, communication, communities, companies and organisation structure, interpersonal relations and political behaviours. Sometimes not only the actual networks and relations are analysed, but also how they are perceived by individual actors (*network perception*). The methods of analysing social networks help research:

- the position of individuals in the structure,
- the isolation of groups within networks,
- the global properties of the entire network's structure.

In addition, this method of researching organisation is distinguished by the quantitative character which permits the quantification of many phenomena typical of the knowledge.

7. An example of assessing the efficiency of business networks

This part of the paper discusses a fragment of empirical research, which is an effect of analyses carried out in 2013. The basic aim of these research was an assessment of efficiency

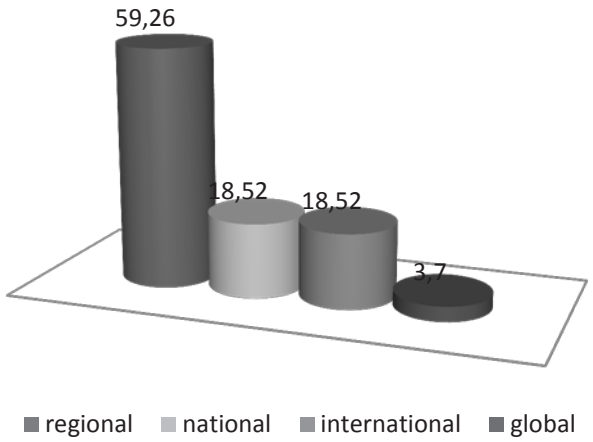

Fig. 2. Scope of working of surveyed clusters

Source: Author's own study.

of business networks by providing an aggregate assessment based on given criteria of assessment. Efficiency of business network indicate the following partial objectives:

- aggregate assessment of business networks
- assessment of a structural aspect of surveyed business networks,
- identification of a scope of applying the idea of knowledge management in business networks,
- assessment of degree of fulfilling the function of knowledge management in surveyed networks,
- assessment of the innovation capacity of surveyed networks
- assessment of social aspect of functioning of the surveyed networks.

The research was carried out with a sample of 56 clusters which work in different sectors located in different parts of Poland by using a questionnaire. This questionnaire was addressed to coordinators of 200 clusters and cluster initiatives defined on the basis of database of clusters, which is available on the Polish Innovation Portal – cluster [Polish Innovation Portal – cluster 2014]. Most of surveyed clusters (58%) are of regional scale, national and international scale have 18% of surveyed clusters. Only 3% of them are the clusters of global scale. The structure of surveyed clusters is presented in Figure 2.

The base for conducting the assessment of efficiency of surveyed clusters is a method of categorization, which is a research procedure. Its essence is:

- verifying assessment of condition and functioning of an object,
- qualification of an assessment.

The research procedure of categorisation included the following phases:

- determination of assessment criteria,
- qualification of assessment criteria,
- conducting verifying assessment.
- mark of category of a surveyed cluster.

Assessment criteria of efficiency[1] of surveyed cluster are presented in Table 1. A questionnaire was created on the basis of established criteria.

In second place the weights of assessment criteria were established (Table 4). Weights express the importance, relevance, materiality some factor (these are the measures used in a special way, because they are related to the evaluation criteria, which are the primary basis for evaluation). This step of the proce-

[1] The issue of criteria for assessing the efficiency of business networks widely article describes: Barczak B., *Kryteria oceny efektywności struktur sieciowych*, (in English: Evaluation Criteria of Network Structure Efficiency), in Ekonomika i Organizacja Przedsiębiorstwa, Orgmasz, Kraków, nr 2 (75, pp: 28-38, ISSN: 0860-6846, 2013.

Table 3. Assessment criteria of effectiveness of surveyed cluster

K1 - Calculation of productivity
K2 - Objectives and tasks
K3 - Stability (flexibility)
K4 - Coordination
K5 - Scale
K6 - Diversity of resources
K7 - Centralisation
K8 - Density
K9 - Formalization
K10 - Sharing of expertise with cooperants
K11 - Sharing of knowledge insider the middle of network
K12 - Barriers in the sharing of knowledge "
K13 - Using of IT systems
K14 - Corporate problem solving
K15 - Inner commucation
K16 - Investment business
K17- Research-and- Development
K18 - Involvement in society
K19 - Observing the rules of corporate responsibility
K20 - Development of worker's potential

Source: own study.

dure is an essential factor in the evaluation of weighted objects, since it can not be done otherwise than by determining the preferences of the individual evaluation criteria. Weights are allocated to the particular assessment criteria based on the three-point scale. 3 points – dominant criteria, 2 points- basic criteria (required), 1 point – useful criteria.

Then, the verifying assessment was conducted, where the normalized four-points assessment was provided. (Table 5) The verifying assessment is to indicate the extent to which the given subject respects established requirements. (given by the patterns of achievement assessment). Interpenetration of results and their tendency is the key issue in order to give an adequate verifying assessment, especially in the case of multicriteria model, in which individual criteria are of the stimulant, destimulant or nominant nature. The formula of verifying assessment is provided by the relation between actual fact and the master. The verifying assessment, which is defined in such manner, is a good appliance of normalization of assessment criteria., thanks to that the aggregate assessment is possible.

A value of effectiveness index *IE* was determined for each surveyed network service according to the table,

$$IE_i = \sum_{j=1}^{n} w_j \cdot q_{ij} \qquad (1)$$

where :
w_j – weight of the j assessment criterion,
q_{ij}– point verifying assessment,
$I = 1, \ldots, m$ – network service,
$J = 1, \ldots, n$ – assessment criteria.

The maximum weight value of effectiveness index amounts to 168. This amount would be reached by an company if it became a 4 grade for each of assessment criteria. In surveyed population of 56 network services the biggest phatic index value.

Table 4. Importance of the evaluation criteria

Criterion	Weight
K1 - Calculation of productivity	3
K2 - Objectives and tasks	3
K3 - Stability (flexibility)	2
K4 - Coordination	3
K5 - Scale	1
K6 - Diversity of resources	2
K7 - Centralisation	2
K8 - Density	2
K9 - Formalization	2
K10 - Sharing of expertise with cooperants	2
K11 - Sharing of knowledge insider the middle of network	3
K12 - Barriers in the sharing of knowledge ”	3
K13 - Using of IT systems	3
K14 - Corporate problem solving	2
K15 - Inner commucation	2
K16 - Investment business	3
K17- Research-and- Development	1
K18 - Involvement in society	2
K19 - Observing the rules of corporate responsibility	2
K20 - Development of worker’s potential	2

Source: own study

After calculating of the index , the clusters were qualified to the given categories. (table 7)

Among the surveyed clusters, three of them got E category. This is the cluster of a high index value. In this group can be found the IT companies . The biggest amount of clusters are found in EA(17) and EB(27) categories.

The studies are an example of the use of multi-criteria approach in assessing the efficiency of business networks. This approach reflects the complexity of economic relationships formed in them. In the presented study the business network efficiency evaluation is based on efficiency measures/criteria relating to the achievement of goals in the organisation as a whole, within a coherent efficiency system.

8. Conclusion

It should be stated that the efficiency assessment of network organisations needs a multi-level approach which reflects the complexity of economic relationships formed in them. The considerations discussed can lead to the following conclusions:

- at the level of the whole network it is important to assess its actual efficiency, considering mutual relationships between business partners and synergy effects produced; when it comes to the level of individual enterprises forming available resources it is important to determine potential efficiency,
- the potential efficiency assessment should decide whether a given enterprise is accepted into a network, determine its position in mutual relationships and initiate changes aiming at enhancing efficiency of the whole network,
- the efficiency of managerial processes of network organisations should be assessed through the processes of value creation and value capturing based on the business mod-

Table 5. Conversion table for the scoring of the examination

Assessment criteria	Scoring				
	Insufficient condition **0**	Admissible condition **1**	Average condition **2**	Good condition **3**	Distinguishing condition **4**
K1	0	0-1	1	<1	<1
K2	0	1	2	3	4
K3	0	1	2	3	4
K4	0	2-3	2-3	2-3	1,4
K5	0	2-3	2-3	2-3	1,4
K6	0	2-3	2-3	2-3	1,4
K7	0	0-1	0-1	0-1	1
K8	0	0-1	0-1	0-1	0,203
K9	0	1	2	3	4
K10	0	1	2	3	4
K11	0	1	2	3	4
K12	9-7	6-4	4-2	1	0
K13	0	1-2	3-4	5-6	7-8
K14	0	1	2	3	4
K15	0	1	2	3	4
K16	0	1	2	3	4
K17	0	1	2	3	4
K18	0		1	2	3
K19	0	1-2	3-4	4-5	6
K20	0	1-2	3-5	5-6	7

Source: own study.

Table 6. Hierarchical index ranges IE

Category	Scoring
E – network service of a high effectiveness index index value: *IWI above* 80% maximal value	168-128
EA - network service of a satisfactory effectiveness of index index value *IWI* 61% - 80% of maximal value	127 - 87
EB - network service of a average effectiveness of index index value *IWI* 40% - 60% maximal value	86 - 46
EC - network service of a low effectiveness of index index value *IWI from* 40% maximal value	0 - 45

Source: own study.

el concept, compatible with the concept of management through value,

- the efficiency assessment of network organisations should be referred to basic goals of network creation,
- the efficiency of network business models should be analysed on the basis of an approach which focuses on dynamic relationships in which, as the theory of games presumes, total gains and losses, owing to

Table 7. Amount of distinguished clusters

Category	Index value	Amount of clusters
E	168-128	3
EA	127-87	17
EB	86-46	27
EC	0-45	9

Source: own study.

coopetition strategies applied by network members, exceeds zero,

- the aspects emphasised by the network-based approach include mutual trust and fulfilment of promises by partners, whereby they achieve long-term symbiotic benefits,
- empirical studies conducted by the author show, that the majority of respondents network presents the mean, or average level of efficiency. Among the clusters with the highest level of efficiency can be found in most networks active in the field of high technologies, mainly in the telecommunications industry.

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