Journal of Research on Trade, Management and Economic Development
VOLUME 1, ISSUE 1/2014

NETWORK AND PUBLIC GOODS IN NETWORK ECONOMICS, WEB MARKET PERSPECTIVE

Galina CARAGANCIU, Assoc. Prof., PhD,
Trade Co-Operative University Of Moldova
E-mail: g.caraganciu@gmail.com

Iulian CARAGANCIU, Lecturer, PhD,
"Lucian Blaga" University of Sibiu, Romania
E-mail: j.caraganciuy@gmail.com

Abstract

In this paper the authors aim to present the terms and basic notions of network economics. The aim of this presentation is to create an understanding of what is a network good. After presenting the terms of network goods we then will proceed to present the public goods, which have similar characteristics with network goods with some differences. Further, the web market will be presented supporting the idea why network goods and public goods characteristics should be presented within this example.

Keywords: *public goods, network economics, network goods, web market.*

JEL classification: A1, B5, D4

1. Introduction

The research to be presented is based on several concepts from network economics. This part has the goal to familiarize the reader with the concepts necessary for further understanding of the paper.

First, an introduction to networks economics is needed in order to better understand the web market as a whole. A network describes the relations between nodes, which could be countries, web pages, etc., and the connections between these nodes, which could represent a connection between two or more pages, companies, as well as access to a certain market.

The set of nodes in a network can be described as $N = \{1,2,3, \dots, n\}$ where n is a finite number. This network is denoted by $g_{ij} \in \{1,0\}$, where g_{ij} is 1 if there is a link between nodes I and j, otherwise g_{ij} takes the value of 0 (SanjeevGoyal 2007).

These links represent the connections that arise between nodes, which we have defined as companies, web pages or markets. They are very important because if we have no whatsoever link between two nodes then there is no economic connectivity between them.

Now we are going to try to cover distance in network relations. We can mention the distance between two distinct nodes, assuming these are I and j only if there is an existing link between the two. Therefore we have two possible cases when we can mention distance in a network. The first case is when we have $g_{ij}=1$. While the second case is when we have a set of distinct intermediate nodes such as j_1; j_2; … j_n, such that we get a relation $g_{ij1}=g_{ij2}=\dots=g_{ijn}$.

In a standard network we can have larger nodes often referred to as hubs. These nodes are, if to be analyzed in economic terms, the gravitation centers of a network with links coming out of them to nearby nodes.

Networks can be represented by formations of nodes knows as graphs, as it has been mentioned above, but there is another method for accurate presentation of a graph is displaying a matrix. Though a least convenient method for study it still presents a possibility to represent graphs. Networks presented as graphs are shown in the following figure.

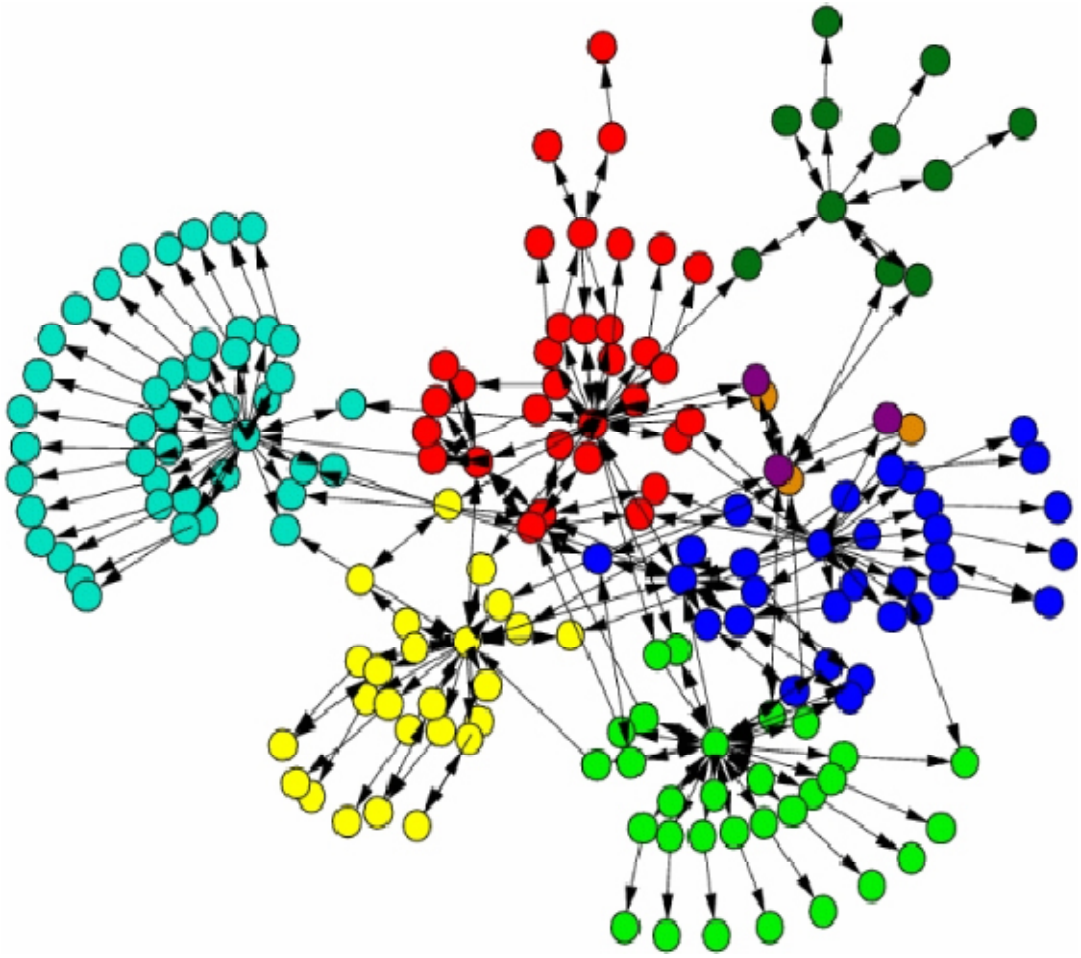

Figure 1: Standard network representation

Figure 1 presents a hyper network which consists of multiple networks. Different networks have different colors, being all connected they form a larger network known as the hyper network. Arrows in this presentation point the direction of links, if A has an arrow pointed to B then this means that A has a link with B, but B has no link with A. This network is also known as an imperfect network. However, when we talk about perfect networks, then there is no need for link directions since in a perfect network each node has a bivalent connection with nodes it is connected to.

Each economic mechanism, as long as it is not completely separated, can be depicted as a network. While the representation as a network of interconnected economic agents has large advantages

2. Network goods

When we mention networks we have to mention network goods. These goods cannot exist without the existence of a network. So network goods are goods that have to be distributed or require a network in order to function properly. Network goods are the goods that operate and are distributed via a network.

These goods are currently increasing in numbers due to fast development of the internet as well as to increase of the number of its users. These goods include software, applications, editing programs (the majority of technologies that appeared recently).

Network goods have a number of properties that are worth mentioning since they create the specifics for this type of goods. The most important of these properties are:

- **Low to no cost for production of scale** –this can be explained by the fact that this type of goods is composed more of the cost of researching a certain product, while its multiplication is done with low to no cost whatsoever. For example, if we take a computer software, the main part of its cost goes into the development of the product itself, while multiplication costs for making copies are either cheap in case of optical storage devices such as CDs/DVDs) or hasn't cost at all (in case the company makes the distribution of software via an e-commerce retailer).
- **Complementarity, Compatibility and Standardization** –this is an important principle due to the fact that it shows exactly the way network goods function. Complementarity refers to the fact that these goods are inter-connected and complementary with each other, which makes it difficult to start a different product without changing the whole package. A good example would be the Apple iPhone and the iOS system, which are inter-connected in a manner which doesn't allow one to function without the other. So if the customer would like to purchase apps for an iOS type of operating system then this would be possible only in case he already owns an iPhone. The previous example also shows the compatibility issue of the network goods which is strongly inter-connected with complementarity. Standardization, however, is more related to the fact that producers of network goods tend to create goods that set a standard, therefore forcing consumers to use their goods in order to achieve the desired result.

Network goods are the type of goods that have a stronger locking effect than their real market counterparts. This is explained by compatibility and complementarity of such goods, but also by the fact that these goods create a habit for the consumer to work with them, therefore forcing the consumer to remain with a certain good as not to support the cost of transfer to a counterpart of the latter (learning cost, inefficiency due to inexperience of work with the new product). This is the case of Microsoft Office suite which may not be the best product on the market but a rather costly one, and although there are free analogues on the market, consumers do not migrate to them due to the costs of learning involved as well as due to the incompatibility of formats.

Lock in as a phenomenon is the effect which a certain product might have in terms of inadmissibility of migrating to a similar product. Companies tend to use this effect to their advantage. An example of a strong lock in would be Microsoft Windows which is an indispensable

tool for almost every PC. While there are substitutes on the market, the learning path which needs to be taken in order to efficiently use the other systems is too long for the majority of consumers.

Another property of network goods which is worth mentioning is the "trap effect" which is present in relations between some companies. This effect means that companies create products which aren't useful without another product. Such an example would be companies that create specialized software for operating systems like Solaris, and their products would not be useful in any way if Solaris were to disappear from the market as an operating system. There could be also other examples of this type of "trap effect". Another example would be personal computers and Windows as an operating system, when the decrease in computers sale would lead to the decrease in Windows operating system sales as well.

"Trap effect" can have 5 main reasons, these reasons are as follows:

1. Contracts and agreements – if a company has a contract to work with a certain software or database, it makes the former dependent of the latter.
2. Teaching clients – if a company is taught to use a certain product for specific purposes, then due to the proficiency of the employees the company can considered dependent of the product that they use.
3. Information conversion – sometimes the information that is owned by a company needs to be converted in order to be used in other applications. This poses an additional cost which can get high in some cases.
4. Connection costs – this aspect is generally true when you need to change the infrastructure of your network in order to benefit from the network good to which the company would like to switch. In some cases connection costs can be rather high.
5. Loss from decrease of loyalty – sometimes companies get loyalty discounts for products and network goods are no exception. Sometimes to change to a different product could cost even more than it seems from the beginning due to the decrease of loyalty.

Network goods are goods that are heavily based on intellectual property. This is why the economy of scale for such goods has a number of differences compared to the real market. In case of normal goods, economies of scale are available only to larger companies, and require large investments to implement. However, for network goods the cost of scale economy is reduced allowing even smaller companies to benefit from such goods. Another distinction is that for normal goods the effects of scale economies manifest themselves in a linear manner while for network goods it manifests exponentially.

The effects of scale economies for network goods can be seen in the following figure.

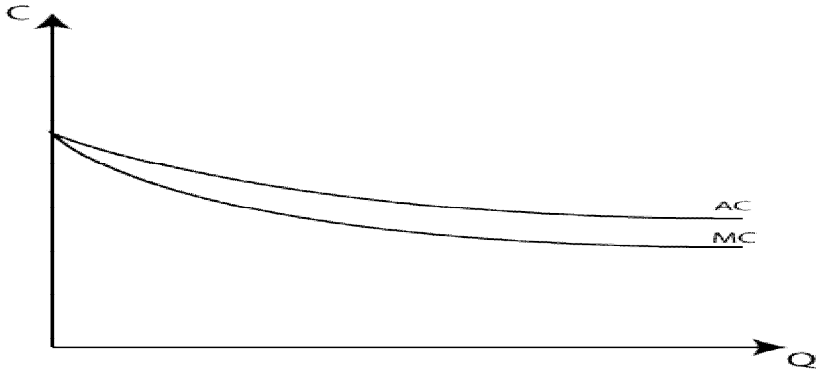

Figure 2: Distribution of costs in scale economies for network goods

Where: C is the cost,

Q is the quantity produced,

AC represents the Average Cost,

MC represents the Marginal Cost.

As we can see in Figure 2 the average cost as well as the marginal cost drop with the increase in quantity of the network goods produced, since the production costs of the second and consecutive units are very low or null.

As we can see in the figure above the average cost of producing a network good decreases slower than its marginal cost. This would decrease the effect of cost in price formation of such goods, in turn decreasing the role of supply for such goods and take more into account the role of demand (which in this case would be the number of consumers interested in a certain good).

Another important property of network goods is called network externality. This property states that each consecutive connected consumer adds value to the existing network and to network goods as a whole. The affirmation is true until network value reaches a critical mass and afterwards starts to slowly decrease.

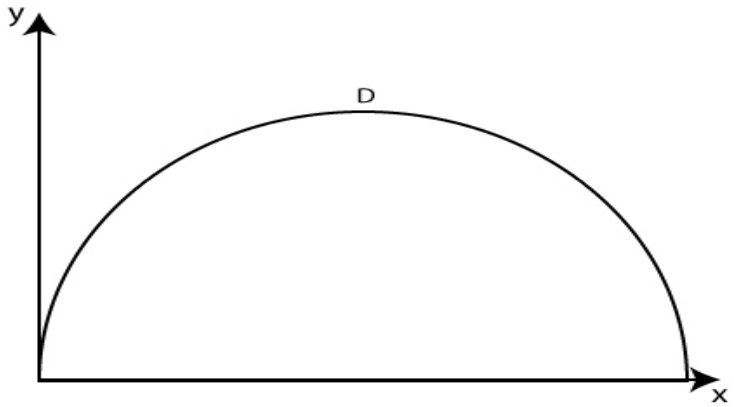

Figure 3: Network value – consumer number ratio

Source: Стрелец, И. А. 2003

In Figure 3, *x* is the amount of consumers in a network and *y* represents their readiness to pay for the network good, point D represents the top value point of the network. We can see that the value of a network increases in a nonlinear manner and after reaching a certain point it starts dropping. This can be explained by the fact that network goods are more useful when more consumers use them. To understand the concept better one must keep in mind that the majority of network goods use the network for any kind of improvement or communication between consumers (even if indirect). We also need to take into account the "trap effect" to understand that while more users use a certain network good the harder for them would be to switch to another product, e.g. Microsoft Office. The decrease in their readiness to pay can be explained by the fact that every consumer, which wanted to purchase the network good, has already done so.

A network good is not attractive for purchase by the consumer until the network of this good has reached a critical mass. This effect was explained by B. Metcalfe, the creator of Ethernet, in the 70s. Metcalfe established that the network, in order to have a value, needs to reach a critical mass,

and sometimes it can be created by engulfing smaller networks. The critical mass is a number of networks necessary to be connected in order to create value to the network. This effect is critical for the externality property of the networks to come into play.

3. Public goods

Now that we have made an introduction to network goods, we need to mention public goods. These two types of goods have some similarities, like being distributed mainly via networks or social networks. However, public goods and network goods have distinct properties – they are noted as exclusive in terms of consumption. This means that if you consume a public good this doesn't stop someone else from consuming the same good. The second property is that, public goods are consumed without competition.

Martin W. J. categorizes information as a public good because it cannot be consumed completely. If information is sold, it is given to the buyer but the seller doesn't lose the information, therefore it can be sold many times.

Gilder G. F. defines the price of information as decreasing after more consumers have already consumed it [2]. The graph below supports this idea.

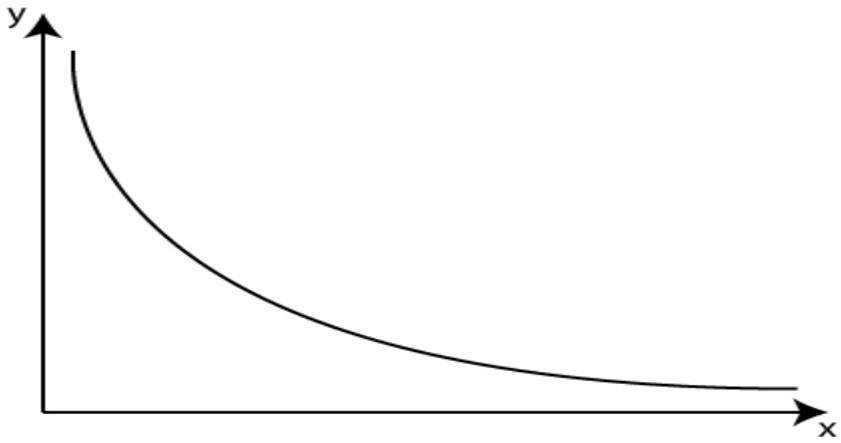

Figure 4: Price of information

Source: Gilder G.F., 2000

In Figure 4 y is the price axis, while x is the number of users holding information. As we can see the price is presented as a decreasing slope, meaning that the more users gain the information the less other users will be willing to pay for that information, due to the usefulness of the latter.

The majority of the properties possessed by network goods can be observed in case of the public goods as well. However there are some interesting aspects concerning the public goods as opposed to the network goods.

One of the main aspects of public goods is that the cost of reproduction in case of scale economies, not only tends to be 0, but is 0. This can be explained by the fact that public goods generate a cost only while being produced.

4. The web market

After presenting the basics of network economics as well as network and public goods we can proceed to the web market.

The web market is a growing market and although it is not fully developed yet we can already notice its distinct features. These distinct features make it necessary to introduce the definition of web market as something different than the real market.

The web market can be described as a market that cannot exist without the web and digital media. Companies from this market use digital means for different purposes but there is one thing in common which can be classified as a market characteristic - all of them are present on the web. Their presence on the web is achieved via websites, e-shops and social networks.

Companies on the web market can be of different types, e-commerce being just one of the types, although it is the type most frequently referred to. The amount of reference to e-commerce web market segment can be explained by the fact that it is somehow easier to be analyzed than other segments due to its resemblances to real market stores.

All companies on the web have an advantage over the companies on the real market, in terms of costs, which are lower on the web market. This allows companies to practice lower prices.

Software development sector has two important branches - the customizable software development and the mainstream software development. The mainstream software development is when clients buy a finished product, which may or may not be adaptable, but is available to every client in almost the same package. And the customized software development companies create software to specifically meet client's requirements and needs, making it unique client software.

We focused on the software development companies, since a large part of network goods are of software nature. This is where we can basically see what is said about the fact that costs tend to be 0 in case of network goods. Public goods, however, are true to have 0 cost, on the web since the main means of their transmission are the blogs, which are free in terms of creation and use.

5. Conclusion

In conclusion, we would like to mention the fact that due to network studies the economic modeling has changed from a more reflective type to an interconnected type.

Network goods and public goods behavior on the web, though not completely different, make their characteristics much more relevant. If on the real market we could talk about costs tending to 0 and it would be a less perceptive affirmation, on the web, however, we could talk about a more understood idea of costs tending to 0.

Another characteristic which defines network goods is the “trap effect”, which is more relevant on the web due to the fact that there are some services on which a lot of web businesses rely, and if these are to disappear then web companies, built around them, would also have a difficult period.

REFERENCES

1. ORDANINI, A., RUBERA, G. How does the application of an IT service innovation affect firm Performance? A theoretical framework and empirical analysis on e-commerce, *Information & Management.* 2011, **47**, pp. 60–67
2. GILDER, G.F. Telecosm: How Infinite Bandwidth Will Revolutionize our World / G.F. Gilder. - New York: Free Press, 2000.ess, 2000
3. SanjeevGoyal 2007 – Economics of Networks
4. TIM O'REILLY (2005-09-30). “What Is Web 2.0”. O'Reilly Network. Retrieved 2006-08-06
5. СТРЕЛЕЦ, И. А. Общество сетевых структур и информационный ресурс как сетевое благо. Вестник Московского университета. Сер. 6, Экономика 5 (2003): 3-18