Journal of Innovation & Knowledge

www.elsevier.es/jik

Conceptual paper

Configuration and innovation related network topology

Ela Ozkan-Canbolat [a,*], *Aydin Beraha* [b]

[a] *Cankiri Karatekin University, Faculty of Economics and Administrative Sciences, Department of Business Administration, Uluyazi Campus, Cankiri, Turkey*
[b] *Cankiri Karatekin University, Faculty of Economics and Administrative Sciences, Department of International Trade, Uluyazi Campus, Cankiri, Turkey*

ARTICLE INFO

Article history:
Received 23 December 2015
Accepted 18 January 2016
Available online 23 March 2016

JEL classification:
M100
M150
M190

Keywords:
Network topology
Configurational theory
Product innovation
Process innovation

ABSTRACT

Network topologies attract much theoretical attention in recent studies. Researchers adopt network topology models and assert that specific type of network topology improves product and process innovation. This study attempts to explore how network topology relates to product and process innovation in configurational terms. While this paper exploits interrelatedness between network topology configurations, and product and process innovation, it refers the firms outside contingencies obviously. Focusing on product and process innovation, outside contingencies rather than inside ones also make this paper natural to examine and contribute towards configurational theory.

Topología de red relacionada con la innovación y la configuración

Códigos JEL:
M100
M150
M190

RESUMEN

Las topologías de red atraen mucha atención teorética en estudios recientes. Los investigadores adoptan nuevos modelos de topologías de red y afirman que el tipo específico de topología de red mejora la innovación del proceso y del producto. El estudio intenta explorar cómo la topología de red está relacionada con la innovación del proceso y del producto en términos de configuración. Aunque este ensayo explota la interrelación entre las

* *Corresponding author.*
E-mail address: elaozkan@karatekin.edu.tr (E. Ozkan-Canbolat).

http://dx.doi.org/10.1016/j.jik.2016.01.013

Palabras clave:
Topología de red
Teoría configuracional
Innovación de producto
Innovación de proceso

configuraciones de la topología de red y la innovación del proceso y del producto, obviamente se refiere a las contingencias exteriores de las firmas. Centrándose en la innovación del proceso y del producto, en las contingencias exteriores en lugar de las interiores, también hace que sea natural para este ensayo examinar y contribuir a la teoría configuracional.

Introduction

The social network is a theoretical construct useful in the social sciences to study relationships between individuals, groups, organizations, or even entire societies (social units, see differentiation). A social network is a social structure made up of individuals (or organizations) called *nodes*, which are tied (connected) by one or more specific types of interdependency, such as friendship, kinship, common interest, financial exchange, dislike, sexual relationships, or relationships of beliefs, knowledge or prestige. Most of the studies on network theory depend on network outputs; thus they are output-oriented studies. Why is network anatomy so important to characterize? Because structure always effects function. The topology of network affects the spread of activities. Recent theoretical research on macro networks focus on the properties of network topology (Fleming, King, & Juda, 2007; Watts & Strogatz, 1998; Watts, 1999; Watts, 2002; Yan & Assimakopoulos, 2009). Physicists and mathematicians expose three basic network topology models, *small-world*, *random networks* and *scale-free* networks (Barabasi & Albert, 1999; Newman, 2004; Watts & Strogatz, 1998), and they generate considerable interest from natural and social scientists alike. Many empirical research use these models and explore neuronal networks (Watts, 1999), biological networks (Koch & Laurent, 1999), scientific collaboration networks (Newman, 2004), e-mail networks (Ebel, Mielsch, & Bornholdt, 2002), telecommunications networks (Schintler, Gorman, Reggiani, Patuelli, & Nijkamp, 2003), airline transport networks (Guimerà, Mossa, Turtschi, & Amaral, 2005) and online communities (Adamic, Buyukokten, & Adar, 2003; Ravid & Rafaeli, 2004). For example in some kinds of networks information, innovation, and technology or vice versa can spread though society. This type of very famous network is known as “small-world networks” popularly known as “six-degrees of separation”.

The idea of a small-world network is that the world appears small considering the short distance of a path of friends that connects a person to almost anyone else. Small-world networks tend to contain cliques, and near-cliques, meaning sub-networks which have connections between almost any two nodes within them. This follows from the defining property of a high *clustering coefficient*. The clustering coefficient is a measure of an “all-my-friends-know-each-other” property. This is sometimes described as the friends of my friends are my friends. More precisely, the clustering coefficient of a node is the ratio of existing links connecting a node’s neighbors to each other to the maximum possible number of such links. Secondly, most pairs of nodes will be connected by at least one short path. This follows from the defining property that the *mean-shortest path length be small*. As underlying the structure of network can be complex and several other network properties often associate with small-world networks, it is still difficult to summarize the whole small-world network succinctly.

Because the definition of networks is flexible, developing a language for talking about typical structure features of small-world networks will be an important step in understanding them. Structure of the small-world network is only starting point of this phenomenon, so researchers should detail who is linked to whom.

A random network is a network whose connections between the actors happen at random. In random network, arranged links between individuals are random, so that each pair has an equal probability to become connected (Fleming et al., 2007; M’Chirgui, 2004). Random networks require two assumptions; first, the size of the network is unchanged as time elapses. That means the network does not grow over time. Second, the probability of connection between any two nodes is equal for all nodes. That is, a connection happens at random with no preference whatsoever for any network member. As a result, in a random network, the number of connections each node has follows a Poisson distribution (Newman, 2003).

In the study of graphs and networks, the degree of a node in a network is the number of connections it has to other nodes and the degree distribution is the probability distribution of these degrees over the whole network. In statistics, a power law is a functional relationship between two quantities, where a relative change in one quantity results in a proportional relative change in the other quantity, independent of the initial size of those quantities: one quantity varies as a power of another. A scale-free network is a network whose degree distribution follows a power law, at least asymptotically. The key assumptions of random networks simply do not fasten on real-world networks (Yan & Assimakopoulos, 2009). Jeong (2003) explains that the random network topology is a rather over simplistic model.

Although physicists and mathematicians are first developers of these topological models, these models gain increasing attention in social science (Granovetter, 2003) and management research (Schilling & Phelps, 2007). Yan and Assimakopoulos (2009) criticize that several commentators prove that a variety of networks are both small-world and scale-free networks, for example, the movie co-star networks (Watts & Strogatz, 1998), co-authorship networks (Newman, 2004), Internet discussion groups (Adamic et al., 2003; Ravid & Rafaeli, 2004) and airway transport networks (Guimerà et al., 2005).