Today’s world is the world of science, knowledge and information so that the development of societies is based on the increase of knowledge. Since the nature of higher education is defined by the production of information and exchange of knowledge, it’s reasonable to say that the advancement of information technology transformed colleges and universities. Besides, systematic information networks, knowledge and sciences provided the production, spread and exchange of knowledge based on ICT. The study is of review type. Information was collected using printed and electronic documents in the related field. The results of the study have shown that given the revolutions which have occurred in scientific field and consequently in social field, the developments over the last centuries have considerably affected the societies and accelerated the convergence of societies in joint extraction of science and the production of knowledge. In knowledge networks, members get closer together from distant geographical location with the help of communicative technologies and information enter networks from distant areas. Members are linked in networks in real and virtual ways and provide a suitable background for knowledge production.

**Keywords:** management of knowledge, electronic knowledge networks, the exchange of knowledge, educational organizations

**Introduction**

Awareness is the most important and effective human protection and the secret of human survival and civilization. Increasingly expanding borders of awareness have made higher education one of the most prominent institutions which has the responsibility to broaden knowledge borders (Safayi Fakhri and Behrangi, 2009). Every organization is, nowadays, concerned with fast mobility toward a knowledge-based society. The advent and emergence of information technology and communication and their effect on all aspects of human life have introduced new paradigms into human life and have subsequently transformed it (Fazlollahi and Karimiyan, 2012).

As digital resources and communicative devices emerged, a new approach to education evolved in information revolution. Information technology as a modern medium includes messages and concepts for the development of information society into a knowledge society. Based on Mc Lohan’s theory, media is the message itself. The development speeds up and continues in the fourth wave of human life. In this situation, it’s important that theories and patterns be highly valued. Connective knowledge is one of those theories which have received considerable attention recently. Based on connective knowledge, learning occurs as a process of networking in the digital world. In other words, knowledge and understanding are distributed in a network of people and technology; learning is, in fact, the process of relating, evolving and directing such networks (Downes, 2007). Or knowledge is a network and learning is the process of searching through the network (Ala et al 2015). Being inspired by communicative knowledge, Stephen Downes put forth the theory of connective knowledge. He argued that the traditional division of learning methods or knowledge acquisition in two qualitative and quantitative methods seems rather incorrect. Lately, because of internet, traditional approaches to learning have been questioned. According to Zimens and Dawnes, the third kind of knowledge, which doesn’t fit within dichotomy, occurs in the 21st century. This kind of knowledge is beyond the knowledge which is usually derived from senses or learned from logical calculations. Downes(2005) called it “communicative knowledge” and believed that it results from neither qualitative nor quantitative methods but from communications.

Communicative learning is based on association, group collaboration and relation with the activities of other people. Zimens (2006) developed the following principles for connective knowledge:

1. Learning and knowledge require different views so that one comprehensive view will be provided and the best approach will be chosen.
2. Learning is the process of networking by a set of specific and related knots or information sources.
3. Knowledge exists within networks
4. There might be some knowledge in manmade artifacts and technologies enable or facilitate learning
5. Bigger learning capacity is more important than what’s learned.
6. Knowledge and learning are permanent and continuous processes not temporary and ending processes and states.
7. The ability to see connections, to identify patterns and to understand the meanings of fields, ideas and concepts are the key skills people need in the modern age.
8. Every connective action is targeted at precise, updated and valid knowledge.
9. Decision making is a learning process in itself. The choice of what should be learned and how input information should be interpreted is seen through an ever-changing reality.
An answer might be considered accurate one day but inaccurate another day due to changes in information which affects on decision (Bell, 2011).

In his works, Skyrme refers to the architecture of knowledge collaboration in organizations and studies the role of information technology and communications. According to Skyrme, this architecture involves 4 layers or in other words 4 stages (Amin Moghaddam and Sotudeh Riyazi, 2005).

<table>
<thead>
<tr>
<th>Collaboration</th>
<th>Conversations</th>
<th>Communications</th>
<th>connections</th>
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</table>

architecture of knowledge collaboration

Level 1: connections
The lowest level of this model is concerned with connections among the elements of knowledge. At this level, each element of knowledge (knowledge producers) can access and relate with knowledge (and / or knowledge producers) in organizations anytime anywhere. Thus, informational and communications infrastructures play an important role. Internet, intranet and extranet are the most significant elements of informational and communication systems which are necessary at this stage.

Level 2: communications
Sometimes there is, indeed, the best connective infrastructure in an organization but it might not be used for interpersonal communications. This level answers how knowledge producers communicate and interact with each other using the possibilities of information and communication technology.

Level 3: conversations and the exchange of ideas
Even the highest level of communications in an organization can’t guarantee the proper flow of knowledge. There are cases in which individuals exchange knowledge one way but more ideas are developed and new knowledge is created and externalized compared with those in interactive and conversational communications. Interactive communication systems and group support systems have the most important role at this level.

Level 4: knowledge collaboration
At this level, knowledge producers engage in knowledge sharing, exchange and production in a specific and common field by forming working groups. It is at this stage that a real network of knowledge producers produce, share and exchange knowledge as well as storing a knowledge database. Undoubtedly, every high level depends on the development of lower levels.

Electronic knowledge networks (EKNs):
Electronic knowledge networks are important and modern methods of organization which have not been extensively studied. Like any other new phenomena, several different definitions have been developed for EKNs. Our definition in this article is focused on common elements of other definitions on electronic interface of knowledge sharing and social network structure. It’s assumed that both people and networks are important for continuous exchange in electronic knowledge networks. Communication structure is effective on individual participation and network dynamics. The effect is so strong on the exchange of messages that it results in increasing network value and creating proper collaborative knowledge (Fernandes and Linds, translated electronic knowledge networks by Shafiiyan, 2012:285).

The present article aims to examine the role and the status of electronic knowledge networks in knowledge management. In this relation, it tries to answer the following question:
1- How is knowledge produced in electronic knowledge networks?
2- How is knowledge shared and exchanged in electronic knowledge networks?
3- How is knowledge organized in electronic knowledge networks?
4- How does interaction take place in electronic knowledge networks?

Research methodology:
The present research is theoretical and based on descriptive – analytical method with a qualitative approach. It’s necessary for qualitative researches that resources related to research topic be identified, texts be studied and interpreted, information be gathered from these resources, the relations between contents be established, described and analyzed and finally results be discussed. To gather information, we used field study method which includes the identification and study of available scientific resources such as articles and books related to research topic.

Theoretical bases and research background
Since the industrial revolution in Europe and the commencement of modern age, the status of science and knowledge has been changing along with various technologies. These changes have consequently led to changes in the status and nature of higher education institutions from traditional to modern institutions so that we’ve seen enormous changes in science production in the society in the age of communication and information technology due to increased access to database, computer systems, online and virtual learning, etc. (Fox, 1989). As communities entered post-industrial era and cultures entered post-modernism, the status of knowledge has greatly changed (Lewtar, translated by Norouzi, 2004:61). There are numerous definitions for knowledge management.

Nonaka and Takechi deigned knowledge management as a process by which organizations produce wealth from knowledge or intellectual capital. Knowledge management tries to create Values from intellectual knowledge – oriented assets in organizations (Nonaka and Takeuchi, 1995). Knowledge management is a process which created knowledge and identifies knowledge location and finally manages the exchange and use of knowledge organizations (Darouch, 2003). According to the above definition, knowledge management includes the process of knowledge creation, exchange, storage and use in organizations in order to achieve competitive advantage and
to survive in current knowledge–oriented economy. Peter Drucker (1993) believes that the most important source of wealth in mega capitalist communities is knowledge and information. He observes three big changes in knowledge revolution during 20th century: industrial revolution, productivity and management revolution. In the first revolution, knowledge is used for producing tools, processes and products. Productivity facilitates the use of knowledge for workforce, as authors like Taylor and Ford used knowledge for workers. In management revolution, knowledge is used for its own sake. This doesn’t mean that traditional factors of production have been eliminated but it means that their status has changed. Drucker states that other factors of production are easily accessible as long as knowledge is available. The fourth wave of human historical life is being formed as human is entering online world and new concepts like epistemological community, knowledge–oriented economy, knowledge management and so on are being created. Only access to suitable informational tools and communicative possibilities, appropriate with new conditions, guarantee human survival in this period (Rostami and Zomorrodian, 2010). In knowledge management texts, knowledge is divided into 2 tacit (implicit) and explicit knowledge (Sangsangs, 2012; Sepehri and Riyahi, 2010). According to Nonaka and Konno, tacit knowledge exists in mind, but it manifest in personal viewpoints, operations and habit. This kind of knowledge is of two types: cognitive knowledge (viewpoints and abstract models) and the knowledge which forms individual skills and technical knowledge (Nonaka and Kanno, 1998). However, there’s another kind of knowledge in organizations which is easily processed by computers, electronically transmitted and stored in databases. Explicit knowledge can be exchanged in the form of words, numbers, data, formula, characters, instructions and the like. It can be easily encoded and transferred among people in a formal and structured way (Rezaian et al. 2010). Explicit knowledge in organizations is referred to organized knowledge with stable content which can be encoded, organized and shared through information technology. This knowledge exists in upper and visible part of ice sheets of organizational knowledge resources. 2 notable examples of this knowledge are databases and manuals. Implicit knowledge is personal and textual. It exists in the mind, behavior and perceptions of individuals and forms the lower level of ice sheets of organizational knowledge resources. Individual’s values, beliefs, insights and intuition are examples of implicit knowledge in organizations (Daffi, 2000).

Modern technologies and knowledge management

Modern technologies make it possible for organizations to implement knowledge management systems–a system which helps to store and transfer unstructured information. Two models have been proposed for knowledge management system so far (Alavi and Linder, 2001).

1- A network model in which communication technologies and manuals to link knowledge owners with knowledge users

2- Reservoir models in which information technology is used to obtain, organize, store and distribute organizational concrete knowledge.

Hansen and his colleagues (1999) believe that there are at least 2 strategies for knowledge management: encoding strategy and personalization strategy (Fadayi et al. 2011). The former is related to organizations whose competitive advantage results from the reaplication of encoded knowledge and is focused on storing and retrieving encoded knowledge (Hislope, translated by Monavvariyan and Asgari, 2014:109). While the latter tries to simulate learning and creating knowledge by group interaction with specialists and colleagues. This style is highly dependent on the abilities, interests and tendency of individuals towards interaction and the exchange of knowledge. Personalization involves various learning methods such as face-to-face conversations, informal talks and collaborative accumulated experiences. This strategy emphasizes on interpersonal discourses rather than knowledge records in data platform. Knowledge is exchanged in brainstorming sessions and one – to – one interaction. Accordingly, knowledge is formed not only through face-to face interactions but also through electronic communications like networks of individuals (Saralak et al. 2012).

Network knowledge management system supports the transmission of both kinds of knowledge (implicit and explicit). However, it seems that these models are more suitable for implicit knowledge. Network knowledge management system doesn’t try to collect knowledge obtained by elites of an organization, but it aims to provide some direction for such knowledge. Thus, organizational knowledge is achieved, knowledge holders are identified in each area other. Other elements of network knowledge management system include a rich set of communicative devices and collaborations for knowledge support, distribution and exchange in reservoir model, knowledge is regarded as an object which can be gathered, stored and transmitted. The knowledge management system based on this model is centered around concrete organizational knowledge so that knowledge is visibly obtained (Abbasi, 2007).

While assessing the importance of knowledge network, Siemens emphasized that today’s challenge is who’s there to obtain knowledge from not what you know. In other words, gaining knowledge capability is far more important than what we already know. Thus, he introduced a new learning method, connectivism, in which learning is considered as a process of networking / connection. Connective principles are based on the fact that learning and knowledge are complicated, multi-faceted and chaotic. Therefore, they require different points of views to be connected by knowledge networks (Simens, 2013). In connectivism theory, learning is referred to a process of networking. Connectivism assumes that knowledge and understanding are distributed within a network of people and technologies, and learning is a
process of relations/ growth and entering networks (Siemens and Wittenberg, 2009; Khatibi and Fouladchang, 2015). In simpler words, knots, related knots and a network of these knots and connections lead to learning. It should be noted that learning is not the result of communications by definition but it's not limited to communications. Accordingly, learning does not happen or facilitate only through a network but it is defined as networking. As a matter of fact, connectivism tries to develop our approach towards science and knowledge by introducing communicative knowledge in digital age (Zarei, 2014). In other words, a learning network means organizational groups who are in a mutual relationship for the purpose of learning from each other and their interactions. Therefore, it's mainly focused on group dynamics and individual learning rather than collaborative learning of a group of organizations. Authors consider the network as a learner identity not a learning background (Soltaniyeh and Abdollahi, 2013).

Communicative knowledge results from combined technology and epistemology. On the one hand, connectivism is based on connective knowledge and distributed knowledge and on the other hand on modern technologies (networks). It tries to offer a new approach to epistemology and a new learning theory appropriate for the digital world. Garysen and Odel (1999) emphasized that learning and knowledge exchange are basically social activities. They held the belief that social interactions are centered around the interpersonal behaviors, the exchange and transmission of values, assumptions, insights and understanding and requires informal gatherings, discourses, social events, collaborative thoughts, networks and negotiations (Yung and Van, 2003). Nilson developed a basic conceptual model which explained the role of communications in the process of new knowledge creation. He believed that a kind of knowledge, which he called knowledge embeddedness, is embedded in network communications. This concept implies knowledge synergy in other words, the exchange of knowledge among different people results in the kind of knowledge which is bigger than the sum of knowledge each person possesses. Thus, interpersonal communication in a network facilitates the creation of knowledge. Since knowledge is embedded in network communications, the stronger communications lead to denser network and more knowledge (Sepehri and Riyahi, 2010). Communication technologies enable users to access necessary knowledge and to communicate with each other, particularly with specialists. Facilities such as electronic email, video chats, internet, organizational internal networks and other web-based devises, even telephones and fax machines provide such tools for group work. For example, users are able to work on the same document both simultaneously and different times. This is especially important for the members of interactive groups who have a big role in knowledge production. Another significant issue is that communicative knowledge is created only through the interaction of knots not their mere connection to each other. Communicative knowledge needs an interaction. Beyond that, communicative knowledge is interactive knowledge (Eskandari, 2009).

<table>
<thead>
<tr>
<th>Knowledge creation</th>
<th>Interpersonal relations within networks facilitates knowledge creation and synergy in knowledge production</th>
</tr>
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<tbody>
<tr>
<td>Knowledge transmission</td>
<td>Network knowledge management systems support the transmission of both implicit and explicit knowledge but it seems that these models are more appropriate for implicit knowledge.</td>
</tr>
<tr>
<td>Knowledge organization</td>
<td>In network structures, organizational departments are formed by the patterns of horizontal relations and the lines of mutual relations</td>
</tr>
<tr>
<td>Interaction</td>
<td>Unequal ranks and degrees are replaced by interactive and mutual interactions at different levels</td>
</tr>
<tr>
<td>Learning</td>
<td>Learning and knowledge require different beliefs which are connected by knowledge networks. Learning is the process of networking</td>
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</tbody>
</table>

**Discussion and conclusion**

In the present article, the electronic network was studied in knowledge management in higher education system. A literature review on knowledge management has shown that knowledge management networking emerged along with network structure theories and emphasizes on knowledge acquisition, exchange and transmission in the form of networks. In network structures, organizational departments are formed by the patterns of horizontal relations and the lines of mutual relations. Plus, interactive and mutual relations replace unequal ranks in equal levels. According to network theory, the growth of science happens in the networks of mutual and multi-faceted communications. When knowledgeable people interact and communicate with each other, instructions are shared and updated. Knowledge networks allow people from distant geographical locations get close together with the help of communicative technologies so that information enters network from everywhere. Networks link members together in both real and virtual world and create a suitable background for science development. Knowledge management is based on collaboration and participation
so it requires collaborative and group work skills. It is also grounded on equity, assimilation and avoidance from science dominance and preferences. Network interactions make knowledge socialization possible and concert implicit knowledge into explicit knowledge to such an extent that networks can link actors together and create scientific unions for knowledge production. Networks add social relations to scientific relations and establish a kind of unity and integrity which facilitate scientific transactions and interactions. Networking offers some advantages which are impossible to be obtained in case studies. When different departments from national or transnational universities combine with each other in networks of traditional or virtual relations, they become able to create knowledge at a high level. Networks allow scientific actors to achieve superior knowledge in different majors through synergy and avoid costly mistakes, repetition and unnecessary actions. Professional associations, non-public scientific centers and private organizations can help to establish networks. Besides, support centers and state organizations can support these efforts and contribute them as a sponsor or supervisor or even a decision maker.

According to what was mentioned above, the following suggestions are proposed for knowledge management in universities in order to increase knowledge level of academic staff:

1- Holding conferences and educational workshops and briefing sessions, the development of electronic relational networks, establishing networks for researchers, scientific actors and research centers with the aim of exchanging knowledge and experiences, upgrading organizational learning and interaction

2- A revision of laws, procedures and organizational processes in order to facilitate and accelerate the exchange of knowledge within groups, universities, trans-universities and faculties.

3- The improvement of hierarchical system and the development of network system in order to accelerate exchange procedures and the interaction of academic staff members with different responsibilities and specializations and finally accomplishing knowledge management goals in universities

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