Designing a Viable Scientific Communication Model: VSM Approach

Mahmood Khosrowjerdi¹,
Email: mkhosro@gmail.com
Website:

About the author
Mahmood Khosrowjerdi is a research fellow in the Regional Information Center for Science and Technology in Shiraz, Iran. He obtained his MA in Library and Information Science from Tehran University in 2007. He has undertaken many studies in the development of models and patterns for information and communication analysis and made their results published in Serials Review, Libri, and Electronic Library. Mahmood Khosrowjerdi can be contacted at: mkhosro@gmail.com

¹ Corresponding Author
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Structured Abstract:

Purpose: To design a Viable Model for scholarly communication system.

Approach: Stafford Beer's Viable System Model (VSM) is an exceptionally insightful analysis tool which has been applied in different fields. This article illustrates the usefulness of Beer's model as a tool for anticipating, planning for, and implementing large scale development in scientific communication domain. Following the Beer thinking of organizational structure and the usefulness of VSM in knowledge management stated by some researchers, we designed a Viable Scientific Communication Model (VSCM).

Findings: The authors have developed a viable scientific communication model which relates their knowledge about scientific communication system with Beer's viability thinking.

Originality/Value: Compared to the earlier models, our model is not dependent on context, time, and scale. This model can be used in every place because the functions and the operations of scholarly communication are unique. This model is a viable one which can update itself over years. New elements of scholarly communication and the Web 2.0 platforms have also been incorporated into the model.

Keywords: scientific/scholarly communication, Viable System Model (VSM), Stafford Beer, model design, Viable Scientific Communication Model (VSCM).

Article Type: Research Paper

1. Introduction

Communication plays an important role in the scientific endeavor, because a discovery or idea is of little value unless it is made known and critically evaluated by the interested communities (Ng, 1998). Scientific/scholarly communication means the study of how scholars in any field use and disseminate information through formal and informal channels (Borgman, 2000). The term scholarly communication has a broader meaning than publication, as it also includes the processes by which scholars communicate with one another as they create new knowledge and by which they measure its worth with colleagues prior to making a formal article available to the broader community (Thorin, 2003). In general, Scholarly communication can be defined as the process by which scholars and scientists conduct their research and make the results of their work known.

However, different models have been designed for mapping the scholarly communication system and the system has been observed of different points of view. In this study, we used the Viable System Model (VSM) to design a viable model for scientific communication. Our model is not context-, time-, process-, or scale-oriented. However, our study begins with reviewing the existing models in scholarly communication field, overviews workings of the
VSM, and then, describes proposed Viable Scientific Communication Model (VSCM). Finally, the entities of the proposed model is analyzed and explained.

2. Scientific Communication Models

Researchers have developed different models for scholarly communication phenomenon in order to satisfy their different approaches. It is referred to some of the well known models which have been designed in this field by now.

The UNISIST model (1971) is one of first scholarly communication models designed until now. It seeks to draw attention to information communication between knowledge producer and knowledge user, as a system consisting of diverse organizational and documentary units each contributing to the division of labor in scholarly communication. This model is a generalized model of the information structures and has a systemic approach.

Garvey and his colleagues (1972) presented a model in the early 1970’s. Their model is a good description of how the communication process functioned at time when IT-support was still lacking. In addition, the model is process-oriented, which begins with scholarly idea and leads to scientific publications such as periodicals, book, etc.

Hurd (2000) suggested a scholarly communication model which contains both modernized and transformed features and it could evolve out of contemporary developments through a process of incremental change. The Hurd model like the Garvey et al. (1972) model is a procedural one.

Shearer and Birdsall (2002) have designed a scholarly communication model in national context in Canada. They believe that 'scholarship in Canada has three main roles: (1) teaching; (2) making formal knowledge available to the public; (3) and spurring new research which in turn creates new knowledge.' Researchers, editors, publishers, distributors, librarians and consumers of scholarly information are all involved in this cycle. Their model is a national model which can be served in other countries.

Bjork (2005) designed a model entitled 'Scientific Communication Life-Cycle (SCLC) Model'. This model acts as a roadmap for policy discussions and research concerning the scholarly communication process. In comparison to earlier models found in the literature this model is more detailed, hierarchical and includes more modeling constructs (activities, inputs, outputs, controls, mechanisms).

Zucca (2006) named her model as 'structurationally informed value-added model for the study of scientific organizations'. Her model is based on the behaviors which a user do in an Information Use Environment (IUE).
Khosrowjerdi and Alidousti (forthcoming) designed a conceptual model for scholarly communication in IranDoc. Following the Scott classification of organization level, their model has four levels: Person-to-Persons (P2P) scientific communication, Person-to-Organizations (P2O) scientific communication, Organization-to-Persons (O2P) scientific communication, and Organization-to-Organizations (O2O) scientific communication. Their model is a middle-out one. The noted model has an organizational perspective and can be modified in research organizations.

In general, the models noted above, have had different analysis level (National, Regional, and International) and have more focused on formal and informal aspects of scholarly communications. Additionally, their models have been dependent to context, process, or the scale which scholarly communication system does act in it. Our approach is based on the VSM approach which the viability and change are the main features of it.

3. Viable System Model (VSM)

The Viable System Model (VSM) was described by British Cybernetician Stafford Beer in his books Brain of the Firm (1981), The Heart of Enterprise (1979), and Diagnosing the System for Organizations (1985).

The VSM is a model of organizational structure that is based on the structure of the human nervous system (Brocklesby and Cummings, 1999). The VSM (Figure 1) draws on the science of cybernetics, applied to the management process of an organization.

![Viable System Model (VSM)](image)

Figure 1. Viable System Model (VSM) (Brocklesby and Cummings, 1999)
As Brocklesby and Cummings states: "In order to be viable, a system must incorporate five inter-connected functions:

- System 1 (operation) is those parts of the organization directly involved in implementation, with each of these parts autonomous.
- System 2 (co-ordination) provides co-ordination between the sometimes many systems 1, to prevent oscillations.
- System 3 (control) provides short term control of internal stability.
- System 5 (policy) is responsible for policy.
- System 4 (intelligence) acts as a switch between the lower levels and System 5, and is the point where internal and external information can be brought together, with consideration of future requirements. Direct control is minimized to that necessary to maintain overall cohesion by making use of indirect channels, one through system 2 and another termed system 3* (audit) that links system 1 to system 3 on a sporadic, auditing basis" (Brocklesby and Cummings, 1999).

There are some researchers concentrated on the theory behind the model (Beer, 1979; 1981; 1985; Jackson, 1989; Espejo and Harnden, 1989) and many papers relating applications in practice (Flood and Zambuni, 1990; Schuhmann, 1990; Brocklesby, Cummings, and Davies, 1995). But we are not aware of any research, written from the scholarly communication perspective.

Since the 'VSM is highly practical, and it offers an insightful framework for thinking differently about organizations' (Brocklesby and Cummings, 1999: 100), and it is a useful guide for knowledge management (Umpleby, 2006), thus, we link the theory and practice of scientific communication via applying it. Besides, 'by providing a single model of activities at all levels of the organization, the VSM increases awareness, and knowledge, among employees of how the (scholarly) organization functions' (Umpleby, 2006).

4. Viable Scientific Communication Model (VSCM): Description and Analysis

Following the Beer (1979, 1981, 1985) thinking of organizational structure and the usefulness of VSM in knowledge management stated by some researchers (Umpleby, 2006) we designed (Figure 2) a Viable Scientific Communication Model (VSCM). Each of the detailed elements of this model is described as following.
4-1. the Meta-Level of system

The Meta level of VSCM is shown in Figure 2.
As you observe, this Meta system is composed of four systems: identity (S5), intelligence (S4), control and audit (S3), and coordination (S2). Each system is explained as continued.

4-1-1. Control and Audit (S3)

The most well known form of control in scientific communication system is Quality Control. As Borgman states:

"Quality-control processes affect the structure of scholarly communication in ways that are sometimes subtle and sometimes significant. Such processes can be divided into two general categories that often are conflated: quality of the scholarly content, and quality of the scholars. Scholarly content in the form of publications (e.g., journal articles, conference papers, and books) is assessed for correctness and whether the content is significant enough to warrant publication. Peer review, also known as “refereeing,” is the usual mechanism for assessing quality in these senses. Fields vary greatly in their criteria for correctness and significance and in the means by which they conduct peer review" (Borgman, 2007: 58).

4-1-2. Coordination

The coordination of the scholarly communication system is gained through special methods. A general type of this coordination is done via process standardization. The process standardization has some main measures. One of them is the design and application of Manual of Styles for publishing. Manual of Styles is used to make unique the formats and contents are published by main actors of scholarly communication system (writers, publishers, editors, etc).

The advisory systems, editorial boards, and more important, the peer review system are another tools for process standardization. Before publishing a work, one should approve the styles and frameworks designed by the governing bodies of journals. Besides, some publishers request the writers to do some modifications in order to publish and distribute their works.

The feudal agreement of publishing (Lyman, 1999), the copyright system, is another type of process standardization which occurs after publication. In this type, publishers suggest some options to authors that they cannot reject. The author gives his intellectual property to publisher. The publisher, in return, makes his work published.
4-1-3. Intelligence

Meta-System which is composed of system 2, system 3, system 4, and system 5 have a glance on future environment and the evolutions which is made in scholarly communication field. This leads to intelligence in the system. Besides, the connections among Meta-System and Operational Elements and generally the Environment, produce intelligence.

In addition, both Operation and Meta-System must be in contact with, and interacting with, their environment in order to create intelligence. The operational units themselves must be viable, and thus can be looked at as smaller viable systems embedded in the larger system (Walker, 2006).

4-1-4. Identity

Identity of scientific communication system is discussed from two perspectives. The first refers to the External Identity or systemic identity which looks at system as a whole. In this approach the identity of the system is gained through the outside-oriented missions and main purposes of the system as well as the one's of the surrounding contexts such as community, society, and generally the world which system does exist in. The second type of identity refers to the Internal Identity of system elements which is normally originated from the communication styles. In non–electronic or –digital formal scholarly communication only the identity of producer is clear and the information consumers' identity is not recognized. However, the target group or potential consumers' identity is nearly apparent.

In electronic or digital scholarly communication generally the identity of information producer and consumer is not clear, but can be cleared. For example, in a live chat (which both sides normally transfer their information with each other) the involved actors can be aware of their identity or not. If they introduce themselves the identity is converted to an unambiguous one.

In non-electronic or non–digital informal scholarly communication such as participation in conferences, meetings, sessions, etc the identity of both sides (message producer and consumer) is apparent, but the increase in the number of participants makes some problems in identifying them.

Another aspect of the internal identity is observed in peer review process. Today's, the different classifications which exist in peer review system is based on the categorization of internal identity. Thus the categorization of the producers or evaluators of the peer review system is an aspect of internal identity of scholarly communication.
The identity recognition is important in access to information sources especially in authentication systems of databases.

4-2. Operational Elements

We assume that scholarly communication process is done through five operational elements: content production, content legitimization, content publication, content distribution, and content preservation. These operations have been considered in some studies e.g. Borgman (2007) and Nentwich (2004).

4-2-1. content production

The first operation, content production, is occurred after critical thinking and generating ideas. When a researcher studies intensively in a field, he may make some ideas in that field. Then, he/she formulates the ideas and makes them visible through writing an article or a book, conducting a speech, etc.

4-2-2. content legitimization

After producing the content, the scholarly communities don't trust that content, unless the content validated by some actors, e.g. publishers, editors, reviewers, etc. This operation may be happened before or after publication (Nentwich, 2004). Peer review process in an outstanding example of content legitimization. In this process, the content is evaluated and improved, published, or denied.

4-2-3. content publication

Content publication is done in different types. From one point of view, this process can be classified into traditional, electronic, and digital. In traditional type, the content is published in hard format, and is observed physically. In electronic type, the content is published in electronic form which is used only by physical presence of a user to the place which it is kept. In the last form, the content is published in digital format, which can be accessed from everywhere.

4-2-4. content distribution

The contents will not be used unless they are distributed and accessed. The distribution channels of contents have been revolutionized after the Web rising. Today, Amazon and eBay play an important role in the distribution system of the contents.

4-2-5. content preservation
The content preservation is the last stage of scholarly communication operations. In this stage, the produced and distributed content is preserved by archives, libraries, information centers, and scientific databases for the future demands. In recent years, the content preservation has been of concern of many international organizations, e.g. UNESCO and National Library of Australia which have done many works in this field and published some reports in the challenges of recorded heritage, especially, digital heritage.

4-3. Local and Future Environments

We face with two Environments in the designed system: Local Environments and Future Environments. The Local Environments of scholarly communication system are influenced by the context in which the system does exist. The strength of this kind of communication is based on the formal and informal networks which are shaped by the researcher. The formal systems lead to formal outputs such as joint works and co-authorships. The later one results in informal outputs such as invisible colleges' establishment.

The Future Environment is formed by date. In recent years, the technology advancement such as digitization has revolutionized the scholarly communication system. Some of these technology-oriented effects are: open access initiatives, blogs, social bookmarking, social
networking, podcasts, Wikis, and professional and academic hubs. These advancements are extraordinarily increasing in recent years and will be raised wildly in the future.

The other important effect of this phenomenon is Web 2.0 technology which offers tremendous potential to enhance scholarly communication. Web 2.0 is 'a social being, a concept rooted in interactivity and cooperation, and its emerging models of interaction are dynamic and real-time' (O’Reilly, 2005). Previously, blogs and wikis have been proving to be popular and influential ways of communication among scholars (O’Reilly, 2005).

![Figure 5. Local and Future Environments of Scientific Communication](image-url)

'It is increasingly the norm for scientists to start and even end their literature searches on Google, even when they have free (at the point of use) access to superior dedicated tools like Web of Knowledge, Scopus or SciFinder' (Ware, 2009). It is expected to see these and other technologies on the increase over the next few years.
5. Conclusion

Following the Beer (1979, 1981, 1985) thinking about the viability, we incorporated the five systemic functions of an organism necessary for viability in the framework of Viable Scientific Communication Model (VSCM). The Beer's Model builds upon the idea that an organization (e.g. scholarly communication) may be conceptualized as an organism that has an advanced brain capacity. The advanced brain of the VSCM is the audit and quality control, copyright system, peer review, evaluation, etc.

Besides, we should take a more complementary approach when dealing with organisms. The designed Model (VSCM) promotes a more pragmatic and measured approach to the change fact and enables the user to highlight the system strengths to be maintained (aspects of the organization similar to the template) and weaknesses (the differences from the theoretically perfect model), to be worked on.

The VSM enables an organization's vision and strategy and their fit with its operating procedures, to be investigated. In scientific communication system, the strategies and visions are changing during the more and more developments is occurred. Thus the internal and external glance at the future helps the system to be intelligent and alive. The intelligence which is injected into the VSCM via the Meta-Level of the system makes this model as an organism and thus flexible with the changes occurs in local and future environments.

The previous designed scientific communication models are not independent to the time or scale. The UNISIST model (1971) has a systemic approach which the communication occurs between producer and consumer, and via different channels. Garvey et al. model (1972) is a process-oriented model which begins with scholarly idea and leads to scientific publications such as periodicals, book, etc. Hurd (2000) model like the Garvey et al. (1972) model is a procedural one. Shearer and Birdsall (2002) model is a context-oriented model and in national scale. Zuccala's model is allocated to special type of scholarly communication which is invisible colleges. But, our model is viable and in large scale, besides, it is not dependent to time, contexts, and so on. Additionally, it has a general point-of-view and observes the scholarly communication system as a whole.

The environmental changes which affect every system are included in VSCM. The external eye of Meta Level of VSCM acts as a catalyst for updating the model with environmental change and future developments.
References


