

# Relations between Information Literacy and Knowledge Generation in Innovation Teams *A Four Dimensional Perspective*

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**Keywords:** Knowledge Creation, Information Literacy, Technological Innovation, Project Teams, Cooperation Projects.

**Abstract:** The purpose of this study is to investigate how the skills related to Information Literacy (IL) influence the work of innovation project teams, while they create knowledge. As the main contribution, this research aims to propose a model of four dimensions concerning the resulting relationships between the knowledge created by the teams and the IL competences that influence its creation. These dimensions are intended to assist the process of team formation. Twelve project teams selected to comprise the study are part of the university-company Cooperation Research Partnership for Technological Innovation (PITE) from the Foundation for Research Support of the State of Sao Paulo (FAPESP) in Brazil. As a qualitative technique of data analysis, the categorical content analysis is used. To construct the dimensions, the potential relationships between the IL competences and the SECI model of knowledge generation are analyzed. The choice of this subject is justified by the lack of empirical research with particular treatment to each of the modes of knowledge conversion, as well as by the fact that the key to understanding the successes and failures in knowledge creation by innovative teams is to identify and evaluate preconditions, needed for the effort to flourish.

## 1 INTRODUCTION

The key to organizational success is increasingly based on individuals, their informational competences and collective involvement. Identifying and pursuing new ways to associating resources and opportunities is an essential responsibility of individuals in order to meet the demand of continuously aggregating more value to the institution and create knowledge that will result in innovation.

Recent literature has pointed out associations between Information Literacy (IL) and two core aspects of knowledge management (KM): the effective use of information systems (Effy, 2006) and the learning processes implied in knowledge creation (Davenport and Prusak, 2000; Nonaka and Takeuchi, 1995). The first aspect can be associated with the development of computer skills, while the second is related to a much more complex dimension involving social interaction and the application of information to the problems and tasks of the organization in situated practices (O’Farril,

2008). However, few explicit connections between IL and KM are to be found in the literature and little research has been done to explore IL in the workplace and in team formation (Lloyd, 2006).

To innovate, it is known that the formation of teams is a necessary, but not a sufficient condition to explore the individual and collective knowledge (Inkpen and Tsang, 2005). Investigations from Tsai (2001) showed that this effort requires the ability to recognize and assimilate knowledge offered by a given member, and this is in accordance with the development of individual and informational competences. Access to available knowledge depends primarily on the team’s informational skills, understood in this study as IL and other critical factors, such as communication.

Bearing this in mind, and also considering the complexity of the innovation process, this work’s syllabus is concerned with analyzing how the skills related to the information literacy influence the work of innovation project teams, while they create knowledge. Initially, Section 2 presents concepts on IL based on knowledge generation. Section 3 provides background on concepts already

established in the process of knowledge creation. Section 4 provides an overview about the aim of the research - to propose a model of four dimensions of the resulting relationships between the knowledge created by the teams and the IL competences that influence its creation. The last sections present the method and some final considerations on the presented approach, discussing new research directions emerging from this work.

## 2 INFORMATION LITERACY BASED ON KNOWLEDGE GENERATION

Literacy is about engaging with layers of meaning which we become able to generate (as much as discover) and to act upon progressively through our engagements with semiotic resources in situated social interaction. It is necessarily exercised as competences. These involve the progressive development of capability and the enactment of knowledge through experience and performance, as they do not consist of static knowledge about information, technology, language, etc (O'Farril, 2008).

The components that support the concept of information literacy according to Dudziak (2003) are: the investigative process, active learning, independent learning, critical thinking, learning to learn and lifelong learning. It is considered that IL includes certain knowledge, skills and attitudes essential for living in the information society, which are termed here as processes involving the informational universe.

Information Literacy should be seen in light of three concepts according to Dudziak (2003):

- The concept of information: with emphasis on information technology, prioritizing the approach from the point of view of systems. It is connected to processing and distributing information based on the development of skills when using tools and media.

- The concept of knowledge: it has an emphasis on cognitive processes in conducting information searches for knowledge construction, involving its use, interpretation and significance. Constructing mental models is emphasized, with the focus on the individual processes of understanding and using information in particular situations.

- The concept of intelligence: a focus on lifelong learning, linked to the knowledge of the informational universe and values related to social and situational dimension. It requires incorporating a

permanent state of change, the very essence of learning as a social phenomenon. From this view, we perceive the individual as a social actor.

For this study, it is considered that the concept of IL seen in light of the concept of knowledge is appropriate. Bruce (2003) supports the same view when addressing the concepts of information literacy for the concept based on the construction and extension of knowledge, namely:

- The concept based on the construction of knowledge: the notion of building a personal knowledge base in a new area of interest. The idea of the knowledge base goes beyond the information storage, as it implies adopting personal perspectives, achieved through critical analysis of what is read and its effective use.

- The concept based on the extent of knowledge: refers to using information involving the ability of intuition and creative insight, resulting in the development of new ideas or creative solutions. It is no longer centered on the construction of knowledge, but on its extent.

According to the Information Literacy Indicators by ACRL (2005), a person considered to be competent in information should be able to:

- Access the information needed effectively and efficiently, determine the extent of the information needed;

- Evaluate information and its sources critically, incorporate selected information to a knowledge base;

- Use information effectively to accomplish a specific purpose;

- Understand the problems and economic, legal and social issues that relate to the use of information and access, and use information ethically and legally.

IL can be understood as the progressive development of competences for becoming aware of accessing, critically interpreting and effectively using information in a variety of languages, codes, semiotic resources and technological affordances such as tools for learning, communication, and making sense in situated social practices (O'Farril, 2008).

Workplace information literacy is not simply an individual experience but rather it develops within a workplace context and is collectively experienced at both group and organizational levels. Ferguson and Lloyd (2007) recognize the role of social information in the development of IL practices relevant to gaining access to relevant and authentic workplace information. Particular attention should be given to social sources of information in the form of teams or experienced practitioners who generally

assist new members to access corporate knowledge which is not necessarily documented formally. Much of this knowledge is what the proponents of KM call tacit knowledge, which may not be articulated easily. Through practices such as narration and storytelling, such organizational information is disseminated in a way that facilitates the development of shared understanding about practice and profession, which introduces and eventually binds newcomers to the community of practice (Ferguson, 2009).

The main goal of information literacy is knowledge generation. The next section provides a background about the second component of the discussion.

### 3 KNOWLEDGE GENERATION AS A SYNTHESIZING PROCESS

Since 2008, the development of the theory of knowledge creation has shown the need for a paradigm shift in thinking about knowledge and the need to integrate new ideas, concepts and critical factors. In this current phase of the theory, the emphasis is on the subjective, the process-relational aspect and practices of knowledge creation (Nonaka et al., 2008).

The following challenges of the theory of knowledge creation were identified from the gaps in the literature:

- The understanding of how knowledge is created in the working groups and communities is not sufficient (Zboralski, 2009; Sun, 2010);
- There is a need to add critical dimensions and the evolutionary assumption about knowledge and its creation (Schultze and Stabell, 2004). Models of particular stages of understanding social processes of knowledge creation are needed (Nonaka et al., 2008).

One of the most influential theories of organizational knowledge creation is advocated by Nonaka and Takeuchi (1995). In their analysis, organization creates knowledge through interaction and conversion between tacit and explicit dimensions. Knowledge conversion occurs in four ways: from tacit to tacit knowledge – mode of socialization, from tacit to explicit knowledge – mode of externalization; from explicit to explicit knowledge – mode of combination, and from explicit to tacit knowledge – mode of internalization.

Figure 1 shows the four modes of conversion, as well as its main features. The model is used here as



Figure 1: SECI model of knowledge conversion. Adapted from Nonaka and Takeuchi (1995).

one of the topics of the discussion.

For a team to be able to analyze and diagnose needs and gaps of knowledge to create new knowledge and to formulate more clearly the issues necessary to resolve existing problems, it is necessary to acquire particular skills and competences related to the interaction and diagnosis, enabling the professional to become a kind of knowledge engineer (Popadiuk and Choo, 2006). The next section presents this problem from the perspective of four dimensions.

### 4 DIMENSIONS THAT INFLUENCE KNOWLEDGE GENERATION IN INNOVATION TEAMS

Based on the results that are being obtained, this study intends to confirm and build four dimensions that influence knowledge generation in innovation teams, from the understanding of the researchers as a result of the following relationships:

- 1) Individual Dimension: associated with externalization of knowledge and the IL competence - Access;
- 2) Informational Dimension: associated with the combination of knowledge and the IL competence - Evaluation;
- 3) Collective Dimension: associated with the socialization of knowledge and the IL competence - Use;

4) Cultural Dimension: associated with the internalization of knowledge and the IL competence - Feedback.

**Individual Dimension:** in this first Dimension, it is assumed that knowledge is strongly associated with opinions, attitudes and experiences of the individual. Information ACCESS is considered critical in this process. In order to externalize knowledge, the team members should recognize the need for information and determine the nature and extent of the information needed. They should also maintain an internally coherent set of values informed by knowledge and experience.

**Informational Dimension:** The Informational Dimension aims to illustrate the knowledge shared in the explicit form, via structured information. The information EVALUATION is considered critical in this case, since the combination of knowledge is supported by IL when the team member evaluates information and its sources critically and incorporates selected information into their knowledge base and value system. The team member must have skills applicable to classify, store, manipulate and redraft information collected or generated, determining whether information satisfies the research or other information needed and whether the information contradicts or verifies information used from other sources.

**Collective Dimension:** knowledge is converted into parts of tacit knowledge of a team member to parts of the tacit knowledge of other members, residing in

collective actions of the group. Information USE is considered a critical factor in this process. IL is found in socialization of knowledge if the team communicates information and applies prior and new information to construct new concepts or create new understandings. Team members should incorporate principles of design and communication; communicate clearly and with a style that supports the purposes of the intended audience.

**Cultural Dimension:** Finally, in the Cultural Dimension, knowledge that was explicit in the organization becomes tacit of the individual, and is endowed with expectations and conventions that assign value and significance to new knowledge. The Information FEEDBACK is seen as critical in this step. While knowledge is internalized, the group is supposed to use information with understanding and acknowledge cultural, ethical, economic, legal, and social issues surrounding the use of information. Team members should identify and discuss issues related to privacy and security in both the print and electronic environments, as well as issues related to free vs. fee-based access to information.

## 5 METHOD

With an applied nature and in accordance with its objectives, this is an exploratory study. The qualitative approach uses data collection and data

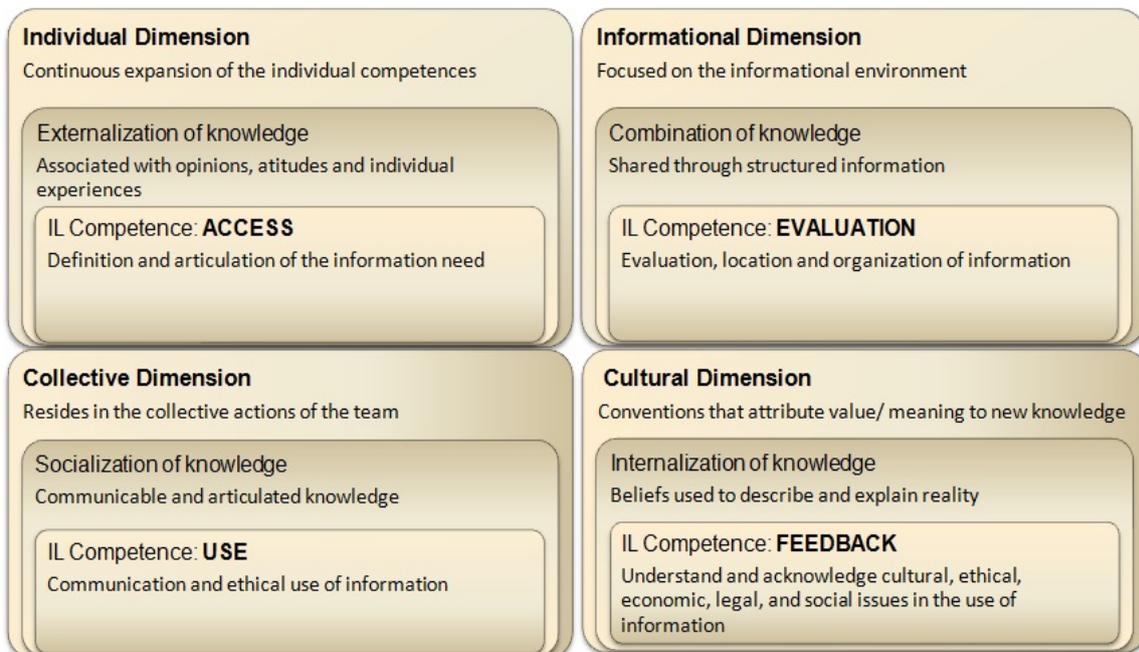


Figure 2: Dimensions that influence knowledge generation in innovation teams.

analysis to answer the research questions. According to its technical procedures, it is characterized as a multiple case study, as it investigates more than one project team in detail and presents comparisons between them.

Twelve innovation project teams were selected to develop the research. The choice of university-company cooperation projects is due to the magnitude of information and knowledge embedded in these teams.

Questions arising from the research problem represent what the researchers aim to clarify to achieve their goals. Given the development of the literature review, the following research questions were defined:

- How do the skills related to information literacy (IL) influence the work of innovation project teams, while they create knowledge?

To answer the first research question, and in order to prove the existence of the proposed relationships, each IL competence and their categories are confronted with each mode of knowledge conversion. Thus, if the competence **evaluation** is identified with the highest number of occurrences within the **combination** of knowledge, the proposed relationship is confirmed, for example. This analysis is based on the information literacy indicators by ACRL (2005).

- What characteristics are found in the relationship between information literacy and conversions of knowledge during the process of technological innovation?

The second research question will be answered from specific parts of the interviews, which will be extracted meaning units, which after its condensation, the codes will be obtained from the characteristics sought. These characteristics will be used for the resulting four-dimensional model of the relationships presented.

### 5.1 Case Studies

FAPESP, considered one of the main funders of scientific and technological research in Brazil, has been an important organisation in the endeavour to articulate the academic base through cooperative projects, Research and Development (R&D) in the business world. Just over ten years ago, the Foundation's programs focusing on innovation started to produce a revolution in the way to finance scientific and technological research in Brazil, as well as obtain high-impact results in competitive areas.

The Cooperation Program for Technology Innovation (PITE) aims to strengthen the relationship between universities / research institutes and companies, by conducting cooperative research projects and co-financed, ranked by knowledge area, as shown in Table 1:

Table 1: Areas of PITE innovation projects.

Innovation fields	Projects
Agricultural Sciences	32
Biological Sciences	34
Exact and Earth Sciences	33
Humanities	1
Applied Social Sciences	1
Health Sciences	11
Engineering	75
Interdisciplinary	3

For this research, the 12 projects selected are innovation teams from universities in the State of Sao Paulo in cooperation with companies or group of companies in Brazil or abroad, whose aim is to develop technological innovation associated with high risk of technology commercialization. The projects have a revolutionary character and the resulting innovation can cause substantial changes in an entire sector of activities. Interviews are being conducted with team members from the universities and enterprises in cooperation.

## 6 FINAL CONSIDERATIONS

This study argues for the importance to develop new constructions suited to IL research within a workplace setting, particularly since many existing definitions and frameworks for IL have emerged largely from educational contexts.

Even though some of the literature in management explicitly relates information use to more complex tasks such as decision making and planning, it is not easy to find a coherent approach linking skills of the individual, information awareness, interpretation, and application of

information to tasks and organizational aims as part of a learning and innovation process.

The research questions address a topic related to the interests of analysing contemporary scholars in this field, as:

1) Each addressed IL competence is related to each specific step of knowledge generation, thus seeking results in specific processes of conversion and transformation of knowledge into innovation;

2) IL, extracted from the concept of the area of Information Science and suitable for the purposes of this study, is discussed as an under explored way to analyze the skills of project team members, and how these competences can improve the process of knowledge creation.

3) Teams from the cooperation program PITE FAPESP are studied for the first time, in an exploratory way.

When trying to apply the concept of IL to team level in workplace environments, one of the most important difficulties that we found was that the information needs, the information sources commonly used, the practices which involve their use and the social interaction are varied and complex. To sum up, this means that the limitations found in the mainstream concepts of information literacy (educational context) are magnified as we try to apply the concept to workplace situations. Due to this reason, the second research question was created in order to find characteristics that will define and illustrate the most important IL competences during the innovation process.

Thus, it is expected that the results obtained will be sufficient to provide their extrapolation, so that they can be applied to other innovation teams. Future research could focus on analyzing the new cultural context of teams linked to the increase in information technology and new media for knowledge transfer.

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