

On knowledge transfer management as a learning process for ad hoc teams

D Iliescu

University POLITEHNICA Bucharest, Faculty of Engineering and Management of Technological Systems, 313 Splaiul Unirii, 060042, Bucharest, Romania
Independent researcher, IEEE Member

E-mail: dragos.iliescu@ieee.org

Abstract. Knowledge management represents an emerging domain becoming more and more important. Concepts like knowledge codification and personalisation, knowledge life-cycle, social and technological dimensions, knowledge transfer and learning management are integral parts. Focus goes here in the process of knowledge transfer for the case of ad hoc teams. The social dimension of knowledge transfer plays an important role. No single individual actors involved in the process, but a collective one, representing the organisation. It is critically important for knowledge to be managed from the life-cycle point of view. A complex communication network needs to be in place to supports the process of knowledge transfer. Two particular concepts, the bridge tie and transactive memory, would eventually enhance the communication. The paper focuses on an informational communication platform supporting the collaborative work on knowledge transfer. The platform facilitates the creation of a topic language to be used in knowledge modelling, storage and reuse, by the ad hoc teams.

1. Introduction

Experience is the teacher of all things. Julius Caesar's quote [1] expresses in a very short sentence the critical importance of experience. But, how someone can get experience? One possible answer is by knowledge transfer. Learning associates knowledge transfer [2], and tacit and explicit knowledge [2, 3] refers to this process.

Where the experiences come from? Multiple sources involved, and the entity named here as knowledge is supplied by a particular aggregation of those sources, resulting in a newly acquired knowledge and experience. The channels on where the objects of knowledge are under transfer should have an proper equilibrium according to the Experiential Learning Theory (ELT) [4]. Experience and observation can get the focus, or by the contrary, experiment and concept are those sources primarily involved in the transfer. Whatever the case, the knowledge state will evolve eventually. That means the transferred knowledge should repeat the transfer as the original was updated. The ELT explains this behaviour by the hypothesis of relearning being integral part of learning. The concept of knowledge life-cycle applies, and the model of learning developed based on ELT is illustrated in figure 1 [5]. It shows learning being a holistic process having as output the expected knowledge.

Knowledge transfer is also a process. It involves particular sub-processes, among them communication will play a significant role.



In a sense, learning should be similar to knowledge transfer, but there is no equality between them, and a more advanced relationship would explain how learning and knowledge transfer are tied together.

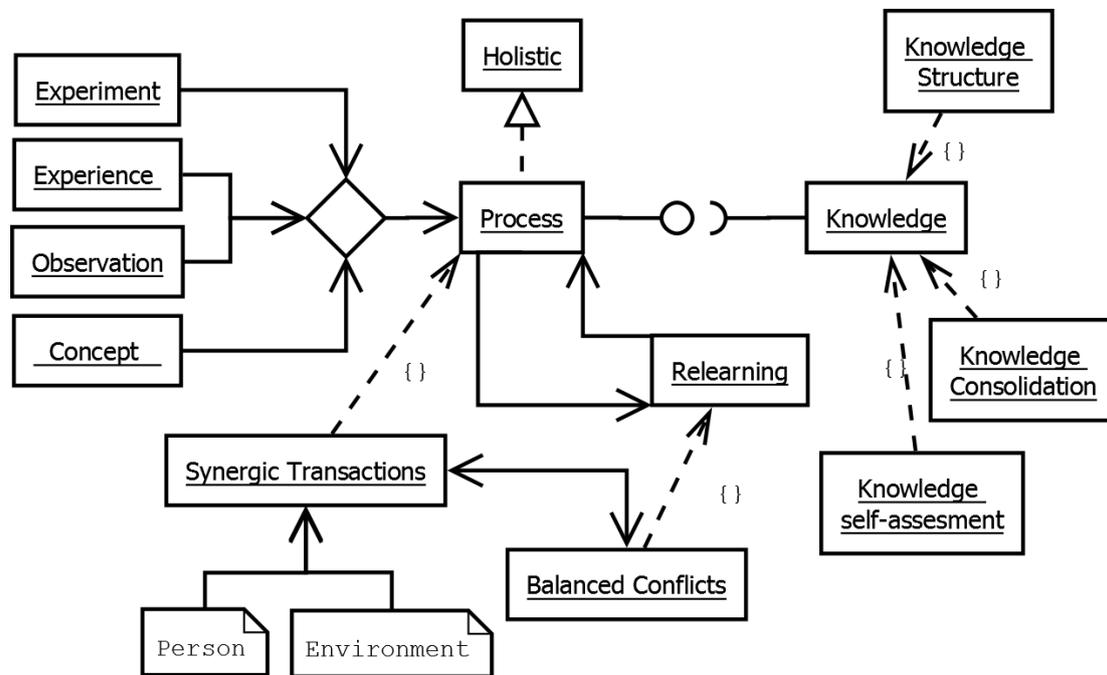


Figure 1. Learning model.

In knowledge transfer, communication holds between two generic actors: the one representing the source – who pose the knowledge to be transferred, and the player representing the destination – who will get the transferred knowledge. If knowledge transfer is in progress, the two players should communicate one another. We will demonstrate the activation role associated with communication, within the process of knowledge transfer. As a corollary, a communication technique will be proposed by a particular communication platform to facilitate the embedded communication among ad hoc teams and management of the knowledge transfer.

The paper is structured as follows: Section two introduces the concepts and models engaged in proposed construction. Chapter three traits the communication process within the knowledge transfer and the communication platform in informational view. Chapter four present a case study of the proposed communication platform.

2. Model of knowledge transfer

The process of knowledge transfer considers the perspectives of inputs, constraints and process parameters. The design goal is to suggest an enhancing method for knowledge transfer across the ad hoc teams. A dynamic application should support those organisations in achieving the goals for what they started. This specificity places the paperwork goal in the domain of virtual teams' activity.

For the process of knowledge transfer analysis, the model should illustrate the process to study as a mechanism to transport the specified knowledge from source to the destination. Each of the distinct actors is enrolled either in the class of Social Object (SOB), or the class of Agentive Social Object (ASOB). The definitions of the two categories are those defined by Masolo et al. [6].

The process of knowledge transfer gets individual attributes as knowledge domain and explicit-tacit knowledge. Over the above attributes specified operations applies, such as ad hoc team creation, research objective and criteria, knowledge manipulation procedures.

The process of knowledge transfer implies the concept of knowledge life-cycle [3]. The proposed model accounts the cycles of knowledge acquisition and creation, knowledge distribution and application.

Communication, in this context, is enhanced by the implementation of the bridge tie concept [7]. It holds the effect the process of knowledge transfer may eventually have over the group members' relationships. From weak, or no interaction at all, to the communication state defined by bridge tie (considered as characteristic for innovative groups – primarily, non-redundant ties across the group). It is here to note that bridge tie concept enhances the proposed knowledge transfer model with a social dimension. Indeed, authors present the concepts of learning and knowledge transfer having a high social aspect [2, 4, 7-15], on another hand, these processes represent a method to become a member of a community of practice [4].

2.1. Knowledge life-cycle modelling

Knowledge transfer process scope should be expressed in terms depending with knowledge life-cycle. Intuitively, the transmission start and stop triggers need to be appointed. The process is a balance between the available quantity of knowledge on the source and the amount of acquired knowledge by destination. The transfer itself will pass several states until will be completed. By the knowledge life-cycle, the corresponding scope for knowledge transfer refers to [3]: (i) source identification, (ii) acquisition, (iii) conversion and retention, and (iv) protection.

The start trigger is tight with the determination of origin, but the evaluation of transfer completion resides on the ratio between the available knowledge on specified source, and the acquired knowledge lock and protected on destination. The flow above also considers the conversion tacit-to-explicit.

2.2. Source identification, acquisition and conversion

Knowledge transfer has certain states as mentioned. The identification of knowledge source depends on the knowledge domain we investigate. Confidence in a particular source plays a dominant role in source selection. The concept of trust is also present into the paper subject, and it would eventually enhance the model of knowledge transfer being proposed [12-15].

The nature of what is to be acquired should be noted here. In the beginning stage of knowledge transfer, the objects transitioned are in the form of information, as the objects received are not yet useful for the destination actor. Following receipt of the information, conversion comes as necessary to obtain knowledge. The information gained, and the later conversion to knowledge are both enrolled in the class of perdurants [6], having the following specialisation. The data transfer comes in the class of stative perdurants, but the conversion is part of the eventive.

This classification defines the information retrieval in a one-single-instance, it is similar to a one-way route. On another hand, the conversion to knowledge is more complex, and we can track the progress achieved in the transformation of information to knowledge. The two aspects noted here, the retrieval state and the conversion event are those classifying the life-cycle of knowledge acquisition and creation. In regard of knowledge life-cycle, acquisition deals with information, and creation deals with the transformation of information. The aggregation of acquiring and creation may apply for both explicit and tacit knowledge. Depending upon the knowledge, the particular source and information retrieval procedure should be accordingly selected. Once the information is acquired and the conversion completed, the experience just created should be accepted (the concept of justified true belief implementation [16, 17]) by the group where the destination actor resides.

The validation process materialises the social dimension embedded into both learning and knowledge transfer. There is no valid knowledge without acceptance from the social group where the destination actor resides. Important effects created on knowledge transfer from this point of view. The first observation is that the players involved in the process are in same time individuals (enrolled in SOB) and social group too, presenting specific interactions between group members – the destination actor and other members and therefore joined in ASOB.

Second observation refers to the group structure having specific members and interactions. It is then necessary for a language to be in place for the objective on which the ad hoc team initiated.

Knowledge can be explicit, tacit, or an aggregation of both forms [2, 4]. Depending upon the information come to the destination, the appropriate further state in knowledge transfer can differ too, but in both cases, the concept of formal language applies.

This particular form of language, first described by Frege [18], is here used to extract the truth from the information received and to connect it with some other knowledge that destination actor already had. The structure of a formal language [19, 20] consists of (i) building blocks (parentheses, connectives, quantifiers, variables, constants, functions, and predicates), (ii) atomic formula and (iii) compound formulas.

On the domain of group collective knowledge, the concept of transactive memory has been defined [21-24] and supply data on who knows what across the group.

2.3. Bridge tie and transactive memory concepts in knowledge management

Knowledge transfer is part of knowledge management domain. This concept deals with certain aspects of acquiring, storing and usage of those entities forming the knowledge. As already introduced, there is a high social dependence of knowledge management, as the validity of acquired knowledge should be verified and these aspects run in a social environment (§2). From the perspective above, the question of how the information/knowledge flows in the group, and how the group knowledge compares to the group members' sum of knowledge arise.

Communication inside the group, or with other groups, is a dynamic process [25] and several states of inter group relationships directly affecting the group communicating behaviour. The most innovative state of the group communication behaviour is described by the bridge tie concept (§2).

The state of innovation effectiveness induced by the bridge tie in a group will last as this status will last. A specific management needs to control the effectiveness of the communication channels to be redundant free [7]. From this perspective, an eventual conflict can occurs between the management of communication channels for redundancy free preservations, and the natural tendency of a social group to establish many-to-many relationships between the group members.

The concept of transactive memory considers the group knowledge is higher compared with the group members' sum of knowledge. This state is given by the fact that group experience also contains the category of "who knows what" knowledge [21-24]. This specific typology is constraint by the group existence, reflecting the presence of two group members and a specific relationship among them. One will pose the knowledge and second will just acknowledge who knows that.

3. Information conversion to knowledge and communication in ad hoc team

The process of knowledge transfer specifically for ad hoc groups pose a dynamicity that should concern. Both actor-to-actor and actor-to-team communication are enclosed. The process model for the study here is shown in figure 2.

The process is in the context described in §2, supplementary, a geographical distribution of the team members should account. The last constraint arises an interesting feature that should be here under study. A collaborative work style characterises the ad hoc team, and it should be in place also for the knowledge transfer too. The constraint above works into a functional requirement of communication as an enabler of collaborative work.

From the perspective of knowledge transfer, the communication process comes between the two actors, each as an individual entity. However, from the standpoint of collaboration, the connection holds between the destination agent and the ad hoc team members. In this respect, the information received by the target agent it should also shared it with the other team members. The transfer runs in two steps, actor to actor and actor to team with the constraints: (i) build and validate the confidence in the source, (ii) decide the procedure for transfer, (iii) receive information and proceed for validation and (iv) share with the team members the transferred information and newly knowledge acquired. A specific language is applied. A formal language, described in §2.2, should be adopted (figure 3).

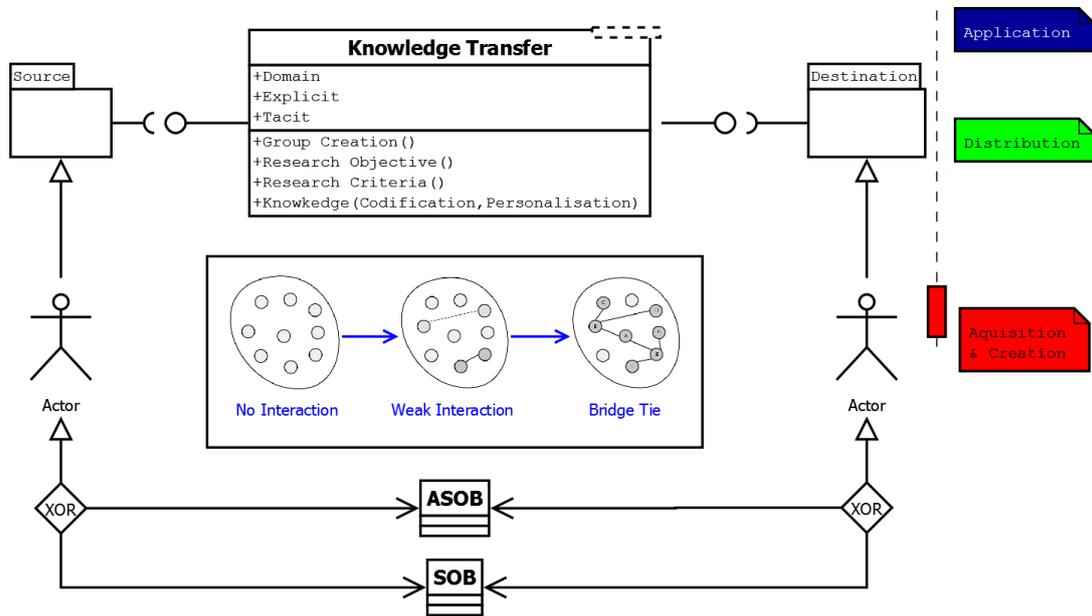


Figure 2. Knowledge transfer model.

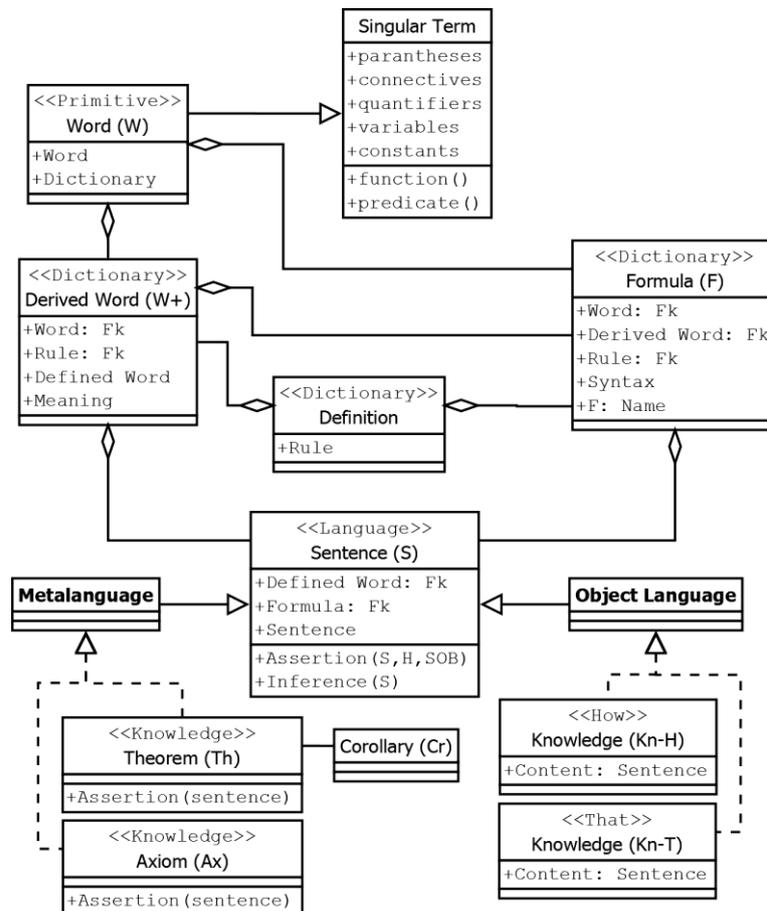


Figure 3. Formal language.

Table 1. Domain-ontology entities.

Dictionary	Derived Word	Dictionary	Derived Word	
Knowledge Space	Learning	Social Network	Team	
	Knowledge Management		Member (Actor)	
	Knowledge Transfer		Bridge tie	
	Knowledge		Transactive memory	
	Life-cycle		Interaction	
	Features & Qualities		Part-whole	Is_Part
	Connectivity			Involved_In
	Acquisition & creation			Has
	Distribution			Classify
	Application		Perdurant	Stative
Trust	Trust	Endurant	Event	
Operators	AND		Social Object	
	XOR		Agentive Social Object	

For practical implementation, it is recommended (see §2.3 for bridge tie and transactive memory concepts) to extract a domain ontology reflecting the field where the ad hoc team will get the transferred knowledge. The first step should establish the list of those entities in the desired field (Singular Term, figure 3).

For the subject here, terms in table 1 were settled, with graphical representation in figure 4. The dictionaries in table 1 were selected as follow. The Knowledge Space represents a generalisation of knowledge and knowledge transfer. Knowledge Space also relates to learning where knowledge transfer involves.

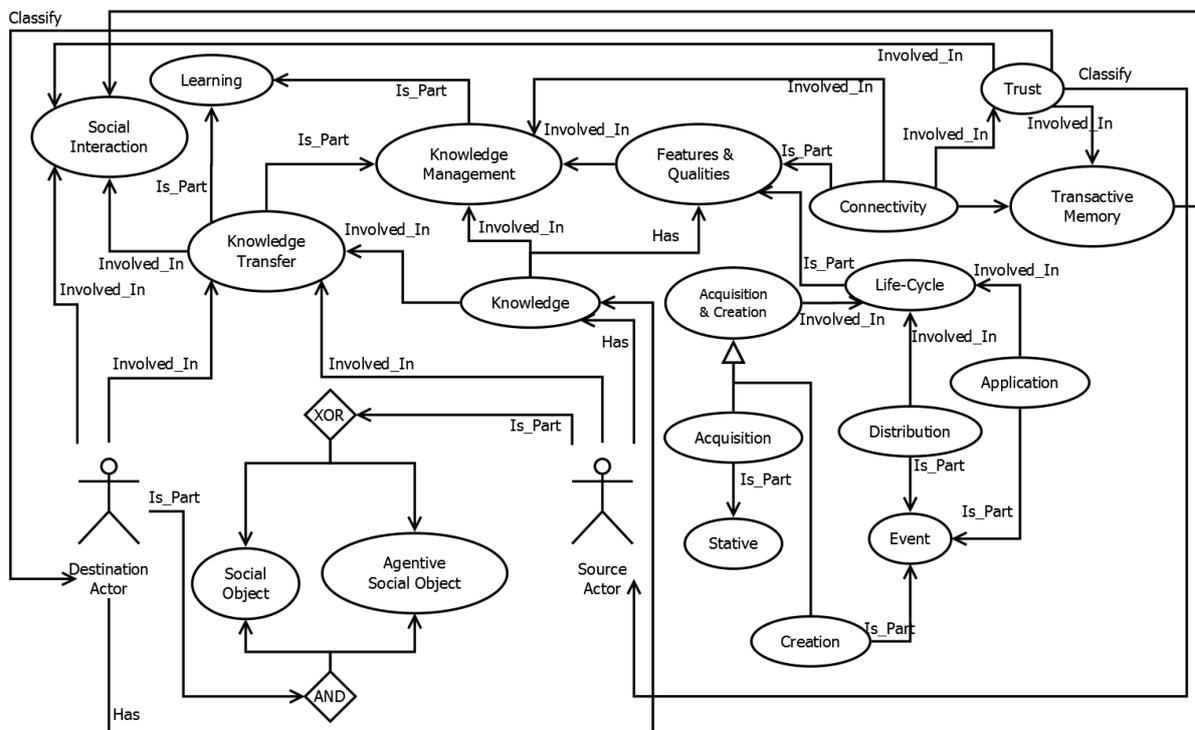


Figure 4. Knowledge transfer domain-ontology.

Dictionary of Trust is a generalisation of an important concept related to the social dimension of knowledge transfer. It comes in relation with both the source and the destination actors.

Dictionary of Social Networks represents an important part of the knowledge transfer process. It is a generalisation of the team, member, bridge tie and transactive memory entities.

4. Case study

The informational system (eXRF) case study is detailed here in short. The system administrates the specific knowledge for ad hoc teams having 2 to 6 team members. A repository stores the transferred information and assigns the saved files to an owner. The owner (DILIESCU) uses the available knowledge to named goal in which the ad hoc team initiates (figure 5, 6 and 7).

A second user identified as 'JDOE', by subscribing to the ModTech_2017 domain, he will be able to access the transferred knowledge owned by the user 'DILIESCU' (figure 8). In this manner, the awareness of each user is captured and stored. Moreover, the knowledge of "who knows what" is also present among the stored knowledge.

Figure 5. Case study system – the Welcome page (screen capture).

<u>Id Xrf Title</u>	<u>Author</u>	<u>Title</u>	<u>Binder</u>	<u>Publisher</u>	<u>Year</u>
373	Schreiber M., Engelmann T.	(articol) Knowledge And Information Awareness For Initiating Transactive Memory System Processes Of Computer-Supported Collaborating Ad Hoc Groups	Computers in Human Behavior, 2010, Vol. 26,	Elsevier Ltd.	2010
372	Melo F.S., Sardinha A.	(articol) Ad Hoc Teamwork By Learning Teammates' Task	Auton Agent Multi-Agent Syst, 2016, Vol. 30,	Springer	2016
371	Zhang Z., Wang K.	(articol) A Trust Model For Multimedia Social Networks	Social Network Analysis and Mining, 2013, Vol. 3,	Springer	2013
370	Tajeddine A., Kayssi A., Chehab A., Artail H.	(articol) Fuzzy Reputation-Based Trust Model	Applied Soft Computing, 2011, Vol. 11,	Elsevier	2011
369	Zhao L., Hua T., Lu C.T., Chen I.R.	(articol) A Topic-Focused Trust Model For Twitter	Computer Communications, 2016, Vol. 76,	Elsevier	2016
368	Huang C.C.	(articol) Knowledge Sharing And Group Cohesiveness On Performance: An Empirical Study Of Technology R&D Teams In Taiwan	Technovation, 2009, Vol. 29,	Elsevier	2009
367	Iliescu D.	(articol) Identity Criteria, Knowledge Formation And Conformity Concepts In Learning Space	-	in press	-

Figure 6. Transferred knowledge owned by the user DILIESCU (screen capture).

An advanced searching method, based on the technique of text indexing [26], was also implemented in the eXRF system. It allows users to search across the stored knowledge for particular keywords and to find who across the registered users may pose the knowledge of interest. Also, the related papers are in the returned list for study.

Referinta

Q-

Id	Referinta
358	[1] Nowacki R., Bachnik K., <i>Innovations within knowledge management</i> , Journal of Business Research, 2016, Vol. 69, pp.1577-1581 © Elsevier Ltd., doi: 10.1016/j.jbusres.2015.10.020.
320	[10] Kolb Y. Alice, Kolb A. D., <i>Experiential Learning Theory: A Dynamic, Holistic Approach to Management Learning, Education and Development</i> , Academy of Management Learning & Education, 2005, Vol. 4, No. 2 pp.193-212 © SAGE.
367	[11] Iliescu D., <i>Identity Criteria, Knowledge Formation and Conformity Concepts in Learning Space</i> © in press.
304	[12] Alavi Maryam , Leidner E. Dorothy , <i>Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues</i> , Management Information Systems Quarterly Vol. 25, No. 1 pp.107-136, © (2001) Management Information Systems Research Center, University of Minnesota, http://www.ijstor.org/stable/3250961 .
129	[13] Masolo C., Borgo S., Gangemi A., Guarino N., Oltramari A., <i>WonderWeb Deliverable D18 Ontology Library (final)</i> , IST Project 2001-33052 WonderWeb: Ontology Infrastructure for the Semantic Web © Laboratory For Applied Ontology - ISTC-CNR, Trento.
216	[14] Borgatti P.S., Halgin S.D., <i>On Network Theory</i> , Organization Science, 2011, Vol. 22, Issue 5, pp.1168-1181 © INFORMS.

Figure 7. Defined ModTech_2017 knowledge reuse domain (screen capture).

Navigation

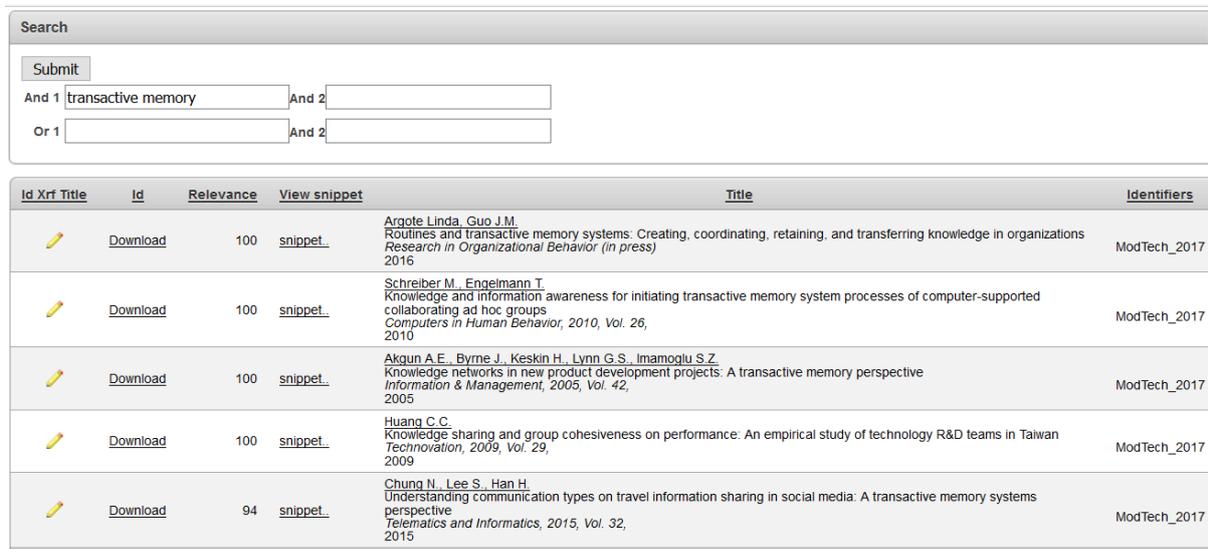
- > Key Words
- > Titles
- > Titles Report
- > Stored Files
- > Monthly Titles
- > Publishers
- > Text Indexing
- > Users

	Id User Fk	Identifier	Is Active	Create By	Create Date	Update By	Update Date
	1010	ModTech_2017	Y	JDOE	30-NOV-2016	-	-

Figure 8. User JDOE subscription to the ModTech_2017 domain (screen capture).

For exemplification, user ‘JDOE’ searches the term of transactive memory. System returns five papers stored in the database, enlist them, and offer information where the related documents were associated with cited text. It also provides the information regarding the person who associates these papers, a possible person able to assist or to support (figure 9).

As introduced, the trust concept is imperative due to the social dimension the process of knowledge transfer has (§2.2). The eXRF platform implements individual elements of trust. In the first instance, the trust classifying the users (figure 4), both source and destination actors, plays the role of an enabler for the user validation.



The screenshot shows a search interface with a search bar containing the text 'transactive memory'. Below the search bar is a table of search results. The table has columns for 'Id', 'Xrf Title', 'Title', and 'Identifiers'. The results are as follows:

Id	Xrf Title	Title	Identifiers
100	Argote Linda, Guo J.M. Routines and transactive memory systems: Creating, coordinating, retaining, and transferring knowledge in organizations <i>Research in Organizational Behavior (in press)</i> 2015	ModTech_2017	
100	Schreiber M., Engelmann T. Knowledge and information awareness for initiating transactive memory system processes of computer-supported collaborating ad hoc groups <i>Computers in Human Behavior, 2010, Vol. 26,</i> 2010	ModTech_2017	
100	Akoun A.E., Byrne J., Keskin H., Lynn G.S., Imamoglu S.Z. Knowledge networks in new product development projects: A transactive memory perspective <i>Information & Management, 2005, Vol. 42,</i> 2005	ModTech_2017	
100	Huang C.C. Knowledge sharing and group cohesiveness on performance: An empirical study of technology R&D teams in Taiwan <i>Technovation, 2009, Vol. 29,</i> 2009	ModTech_2017	
94	Chung N., Lee S., Han H. Understanding communication types on travel information sharing in social media: A transactive memory systems perspective <i>Telematics and Informatics, 2015, Vol. 32,</i> 2015	ModTech_2017	

Figure 9. Knowledge retrieval through text indexing (screen capture).

The practical implementation of this case goes to an existing user who recommends a newly user to be granted. The newly user will be then supervised by the recommender.

Second, the trust in the platform knowledge content is made by selecting the right source information. As this application is a demonstrative for a doctoral school, the knowledge acquired should meet several particular conditions for validation.

Validation itself is a matter of social admittance, but for the application, it is to notes that only valid scientific papers, published in scientific journals, or international conferences (therefore admitted by community) are typically stored in the database. But, the group where the actual user is enrolled will decide upon the appropriateness of related papers. Upon the time, the users will deploy related knowledge and outcomes of their activity. Upon the time, the confidence of each user will be accounted by other users in the application as a social behaviour, enhanced by transactive memory and bridge tie concepts, both embedded in the the eXRF application.

5. Conclusions

The knowledge transfer process has been studied from the communication perspectives. This approach implies both technical and social aspects. The examinations revealed the concepts of bridge tie and transactive memory known to act with important effects on the knowledge transfer.

There is no sound knowledge without the group acceptance where the destination actor resides, moreover, gaining the consent for the acquired knowledge should be under a management account for the particular case of ad hoc teams.

An informational system implements the achieved results. A case study for the ad hoc teams, for scientific writing, describes a possible usage of the here concepts.

Two users are illustrated in the case study, one owning the acquired knowledge and another one which just intends to reuse the stored knowledge. There is a strong direct relationship between the two users, so the application just supports the entry user in finding relevant experience, or finding a person who just offers support. The users operating the application are expected to develop specific relationships within the ad hoc team. The concepts of bridge tie and transactive memory goes for implementation with the goal of support in ad hoc team forming and preserves the status of the non-redundant communication channel.

Trust, as a social factor, is also present in the case study. The trust should come out in relation to the stored knowledge, the owner, and the user who intend to reuse the acquired knowledge. A heuristic

method is present in the eXRF platform so that trust follows to be obtained in time by the right users. This approach is similar to natural processes in social extend for groups, but with the help of the eXRF there comes the expectation for a better non-redundant communication channel preservation.

6. References

- [1] <https://www.brainyquote.com/quotes/quotes/j/juliuscaes398606.html> (25.11.2016)
- [2] Alavi M and Leidner ED 2001 Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues *Management Information Systems* **25** 107-36
- [3] Andriani M, Samadhi TA, Suryadi K and Siswanto J 2014 *Proc 2nd Int Conf Tech, Info, Manage, Engn & Environ (Bandung, Indonesia)* (IEEE) pp.351-56
- [4] Kolb YA and Kolb AD 2005 Experiential Learning Theory: A Dynamic, Holistic Approach to Management Learning, Education and Development *Acad Manag Learn Educ* **4** 193-212
- [5] Iliescu D, Banciu Felicia 2017 Application of some ideas from the axiomatic design principles for construction of a learning management system in Romanian higher engineering education *21th IManEE Int Conf (Iasi, May 2017)* in press
- [6] Masolo C, Borgo S, Gangemi A, Guarino N and Oltramari A 2003 *IST Project 2001-33052 WonderWeb: Ontology Infrastructure for the Semantic Web* (Trento: Laboratory For Applied Ontology - ISTC-CNR)
- [7] Borgatti PS and Halgin SD 2011 On Network Theory *Org Sci* **22** 1168-81
- [8] Nowacki R and Bachnik K 2016 Innovations within knowledge management *J Bus Res* **69** 1577-81
- [9] López-Nicolás C and Merono-Cerdán A L 2011 Strategic knowledge management, innovation and performance *Int J Info Manag* **31** 502-9
- [10] Almeida MV and Soares AL 2014 Knowledge sharing in project-based organizations: Overcoming the informational limbo *Int J Info Manag* **34** 770-79
- [11] Chu MT, Kumar P, Kumar K and Khosla R 2014 Mapping knowledge sharing traits to business strategy in knowledge based organisation *J Intell Manu* **25** 55-65
- [12] Huang CC 2009 Knowledge sharing and group cohesiveness on performance: An empirical study of technology R&D teams in Taiwan *Technovation* **29** 786-97
- [13] Zhao L, Hua T, Lu CT and Chen IR 2016 A topic-focused trust model for Twitter *Comp Com* **76** 1
- [14] Tajeddine A, Kayssi A, Chehab A and Artail H 2011 Fuzzy reputation-based trust model *Appl Soft Comput* **11** 345-55
- [15] Zhang Z and Wang KA trust model for multimedia social networks *Soc Net An Min* **3** 969-79
- [16] Ichikawa JJ and Steup M 2014 The Analysis of Knowledge *Stanford Enc Phil (Spring 2014 Edition)* ed EN Zalta Available from: <http://plato.stanford.edu/archives/spr2014/entries/knowledge-analysis>, Accessed: 18/11/2015
- [17] Gettier E 1970 Is Justified True Belief Knowledge? *Analysis* **23** 121
- [18] Frege G 1948 Sense and Reference *The Phil Rev* **57** 209-30
- [19] Shapiro S 2013 Classical Logic *Stanford Enc Phil* Available from: <http://plato.stanford.edu/archives/win2013/entries/logic-classical>, Accessed: 10/02/2016
- [20] Keet M 2008 *A Formal Theory of Granularity - Toward enhancing biological and applied life sciences information systems with granularity* (Bolzano: Free University of Bozen-Bolzano, Faculty of Computer Science)
- [21] Schreiber M and Engelmann T 2010 Knowledge and information awareness for initiating transactive memory system processes of computer-supported collaborating ad hoc groups *Comput Hum Behav* **26** 1701-09
- [22] Akgun AE, Byrne J, Keskin H, Lynn GS and Imamoglu SZ 2005 Knowledge networks in newly product development projects: A transactive memory perspective *Inform Manage* **42** 1105-20
- [23] Argote L and Guo JM 2016 Routines and transactive memory systems: Creating, coordinating, retaining, and transferring knowledge in organizations *Res Organ Behav* in press

- [24] Chung N, Lee S and Han H 2015 Understanding communication types on travel information sharing in social media: A transactive memory systems perspective *Telematics and Informatics* **32** 564-75
- [25] Werner E 1988 *Proceedings of the Second Conference on Theoretical Aspects of Reasoning about Knowledge* ed YV Moshe (*Pacific Grove, California*) (Los Altos: Morgan Kaufmann Publishers) 129-43
- [26] Shea C et al. 2008 Text indexing with Oracle Text *Text Application Developer's Guide* Available from: https://docs.oracle.com/cd/B28359_01/text.111/b28303/toc.htm, Accessed: 18/09/2013