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Toward a Project Learning Organization: a Multifaceted View

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Abstract: A huge number of Knowledge Management (KM) approaches and solutions have been developed in the last 20 years. Companies are usually dealing with those theories and practices to make corporate knowledge explicit, collected, and organized into large and homogeneous knowledge systems based on repositories, groupware, wikis, portals, etc. According to this milieu, some practitioners believe that the introduction of such solutions "mechanically" conduct innovation within the company, causing shortage of organizational integration in strategies and culture, business processes, and technological (or KM) solutions. In this article the authors take into account the Project Based Organizations. In fact those organizations might be considered an interesting case study for their characteristics of flexibility and complexity. These firms usually take advantages from the implementation of project management solutions aimed at conducting innovation, efficiency, and effectiveness. However these solutions cannot be considered valuable in all the situations, because they don't solve the lack of systematic learning and the overwhelming repetition of the same mistakes. To overcome these problems Project Based Organizations should introduce KM solutions and set up a new model (the Project Learning Organization) that integrate learning paradigms, organizational strategies and culture, business processes and KM solutions. In this paper, authors describe: (i) the concept of Project Learning Organizations, (ii) the model of projects life cycle with the memorizing and the corporate alignment phases and (iii) the model of knowledge coordination processes among projects, and their alignment with corporate knowledge.

Keywords: Project Management, Project Learning Organization, Knowledge Management Techniques, Integrated Knowledge Management, Knowledge Intensive Firms
Categories: A.0, A.1, C.2.1, C.2.4, H.4.3, H.1.0

1 Introduction

In today's dynamic markets (characterized by specialization of work, outsourcing processes, just in time and distributed productions, open virtual chain, etc.) firms have moved from hierarchical structures to networked models [Ekstedt et al, 99; Lei et al., 99]. In such organizations, the value chain is rolled across a constellation of units[1], that might grow and differentiate in an autonomous way, coordinating and coexisting

[1] From a KM perspective, the organizational units are called knowledge nodes. [Cuel, Bouquet, Bonifacio, 05; 02],

as in a bio-functional system [Maturana and Varela, 80]. This article focuses on a particular type of networked organization, based on projects: the Project Based Organization (PBO). PBOs are sustainable structures which enable economies of resource allocation, innovative and high quality outputs [Hobday, 00]. PBOs emphasize flexibility towards risk and uncertainty, involving various project management processes. According to the literature taken into account in this research, these processes are based on consolidated set of tools and techniques mainly described as project management [Jessen, 92, Kerzner, 82; Cleland, 90]. However the practice unveils that such organizations deal everyday with knowledge management, involving knowledge intensive work [Swart and Kinnie, 03], knowledge workers [Drucker, 93], time orientations and knowledge interventions [Zisuh and Manfredi, 06]. According to those insights, projects are considered important assets to widespread the use of knowledge [Jyrki et al., 03] and important vehicles to nurture and integrate different technologies and competences [Söderlund, 02]. Therefore, PBOs may be defined as both knowledge intensive firms [Quinn, 92; Alvesson, 01; Starbuck, 92] and learning organizations [Senge, 90]. The learning processes are mainly developed through intra and inter project loops [Kotnour, 99]:

- the intra-project learning loop is implemented into the team edges and it should be grounded on psychological safety of the environment, and on systematic and collective reflection [Ayas and Zeniuk, 01]. Common artefacts and practices are used to share knowledge within the knowledge nodes [Ruuska and Vartiainen, 05];
- the inter-project learning loop involves networking activities between groups and external contacts. This type of learning is based on three main kinds of knowing processes (why, who and whom) and it engages cultural, human and social capital [Arthur et al., 01]. However projects present everyday changes in the scheduling, which may cause tacit knowledge concentration in the leaders' head [Huzzard, 00], sensemaking disorientation and inefficiency in the systematic approach to the organizational learning loops.

Despite this scenario, some authors claim that PBOs do not implement processes of knowledge storage causing deleterious mistakes repetition (namely *reinvention the wheel)* [Järvinen, 99] and leaking of a multifaceted and systematic approach [Pinto, 99; Hobday, 00].

The purpose of this paper is to shed light on a new KM deployment technique that would transform Project Based Organizations into Project Learning Organizations.

In order to provide a more KM oriented vision, two models have been developed: (i) a more KM oriented model for the typical process of project life cycle, (ii) a model that allows knowledge workers to develop successful KM solutions, taking into account organizational strategies and culture, business processes, and technological solutions. In section 2, some traditional theories on projects and Project Based Organizations are analyzed; in section 3, a comparative analysis of knowledge management epistemologies is presented; in section 4, hypothesis of work and open problems are sketched out; in section 5, new models of Project Learning Organizations are deeply described; finally, conclusions and future works are outlined in section 6.

2 Traditional theories about projects and Project Based Organization

Project Based Organizations (PBOs) are characterized by adhocratic and flexible structures, particularly suitable for resource delocalization and innovation [Mintzberg 79], which require high cost of coordination and integration processes (in terms of time and money). Thus PBOs are fundamentally based on projects [Cleland, 90; Kerzner, 86], which constitute the building blocks of a flat organizational model. That kind of model allows workers to easily exchange knowledge within and among projects [Dixon, 00]. Therefore traditional project management techniques tend to coordinate projects, exploiting time and resources rationalization processes, taking care of communication processes among workers and projects. In this scenario, a lot of tools and techniques have been exploited in PBOs such as: the Statement Of the Work (SOW), the Work Breakdown Structure (WBS), the Linear Responsibility Chart (LRC) and finally on the Gantt diagrams charter [Kerzner, 86]. Other important statistical techniques are PERT, CMP, GERT. Nevertheless, project management is based on some other major tools as detailed schedule, communication and control plan, and intensive communication processes with clients [Kloppenborg, 03]. Although all these techniques are nowadays used in the daily work, other KM methods and tools should be introduced in order to improve processes of knowledge sharing within and across team projects.

According to contingency theories, this research accept the "inside-out perspective". In other words, authors have focused on some critical variables inside the organization and will build a mix of tools and strategies aimed at challenging the external environment. First of all, it is necessary to focus on the main critical variables that influence the management of projects and the entire Project Based Organization. Therefore PBOs' environment can be studied according to the scope of the organization, as depicted in Figure 1. The "eye diagram of project management" divides organizational area into three main levels: the black space is the retina, the gray space is the iris and the white is the market and the society outside the firm's boundaries [Jiang and Heiser, 04].

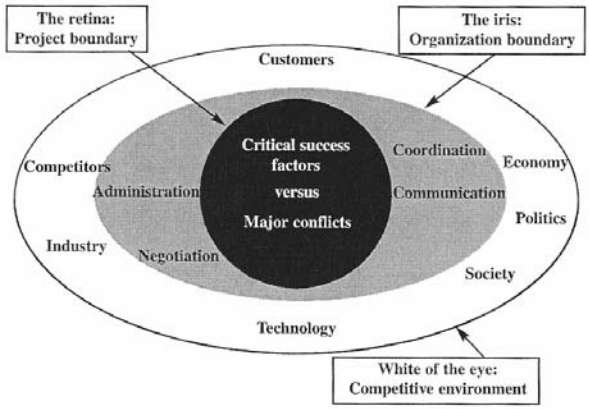

Figure 1: The eye diagram of project management [Jiang and Heiser, 04]

The white area is the external environment, basically it presents some critical variables which can influence the organization, for instance: competitors, customers, technology, subcontractors etc. [Jiang and Heiser, 04; Hyväri, 06]. The external area is not the focus of this study. The focus of this analysis is the grey and the black areas. The grey area -inside the organization- is affected by clear organization/job descriptions, top management support, project organization structure [Hyväri, 06]. Those situations should be managed through negotiation, communication and coordination of activities and tools [Jiang and Heiser, 04]. The "black retina" represents the project area, in which many activities run simultaneously. In depth analysis, each project presents some critical success factors versus other of major conflict. The project literature takes into account many critical variables which can lead to success or failure of the same – i.e. human resource allocation, coordination and integration, time orientation, clarity of the mission, scope, risks management, communication and control plan, adequate budget/resources, technology, troubleshooting and problem solving processes, identification of the customer needs, end-user commitment, etc. [Thamhain and Wilemon, 75; Jiang and Heiser, 04; Hyväri, 06]. In this study authors have focused only on three of these that will be deeply described in the next sections:

- clear project goal/mission [Pinto and Mantel, 90; Pinto and Slevin, 87];
- time management [Söderlund, 02; Zisuh and Manfredi, 06];
- resource allocation [Meredith and Mantel, 00].

3 Knowledge Management in the Project Based Organizations

From a KM point of view, the need of knowledge sharing among projects (and in general knowledge nodes) increases the importance of introducing new ICT technologies and effective KM systems. These systems and techniques should satisfy the twofold needs of developing highly specialized knowledge activities (within each project) and maintaining flexible inter-group (and inter-project) cooperation within and outside the organizational boundaries. This is revealed in the duality between the need of highly articulated local perspectives (within projects or knowledge nodes) and the need of sharing cultures and instruments (through communication processes across projects) [Mark et al., 02]. The following two sections depict some approaches and solutions based on KM.

3.1 Knowledge Management approaches

Current KM systems and solutions use different technologies, tools and methodologies that are based on various epistemologies and approaches[2].
The traditional and widely diffused approaches eventually lead to the creation of large and homogeneous knowledge repositories, in which corporate knowledge is collected, represented, measured, organized and finally made explicit [Davenport and Prusak, 97]. The underlie epistemology (called objective approach) is based on the assumption that raw forms of knowledge can be "cleaned up" from the contextual

[2] For in depth discussion see [Davenport and Prusak, 97], [Nonaka and Takeuchi, 95], [Stewart, 01], [Wenger, 98], [Cuel, Bouquet, and Bonifacio 05].

elements, and that the resulting "objective form" of knowledge can be explicitly represented in an abstract (independent from the original context) and general form. Then the stored knowledge can be used in any similar situation [Blackler, 95].

Some other approaches take into account the distributed nature of knowledge (subjective approach). In other words, meanings are not externally given; individuals give meaning to situations through subjective interpretation. Interpretation is subjective, since it occurs according to some "internal" interpretation schema, not directly accessible to other individuals. These schemas have been called, for example, mental spaces [Fauconnier, 85], contexts [McCarthy, 93; Ghidini, Giunchiglia, 01], or mental models [Johnson-Laird, 92]. Internal schemas can be made partially accessible to other individuals through language, since language is not just a means to communicate information, but also a way of manifesting an interpretation schema.

This vision pushes managers to enable networks of workers, communities of practices, knowledge café, adopting blogs and wiki systems, semantic based technologies that manage local knowledge conceptualization (e.g. domain ontologies, local classifications), etc.

Since we are talking about organizations, and thus about a collective level, it seems relevant to consider that without this inter-subjective agreement (or at least believed agreement) communication cannot take place, the coordination of actions is impossible, and meaning remains connected just at an individual level [Weick, 93]. Thus, these inter-subjective agreements constitute the "common parts" that can emerge by:

- actions of the management that are aimed to share a specific organizational culture and strategy (using communication channels);
- participation and reification processes of community's members, who share (or understand) the other's meanings through practices [Wenger, 98]. In other word we can assert that the intrinsically subjective schema can be shared, or at least coordinated, in the inter-subjective agreements of community's members.

All these inter-subjective agreements allow both the autonomous creation and management of knowledge within each group or unit (also called knowledge node), and the coordination among individuals' knowledge and autonomous units. Inter-subjective agreements can also be reified by stable rules and routines, which constitute community artefacts, namely the concrete elements that should be considered persistently present inside the community, the unit, or the firm. This approach is called distributed knowledge management approach [Cuel, Bouquet, Bonifacio, 05]

Summarizing what above said, every KM solution should be shaped according to processes, practices, strategies, and models of the organizations otherwise they are bound to failure. Therefore, these solutions should manage knowledge from all these epistemologies, enabling autonomous grow of each unit (namely a knowledge node) [Cuel, Bouquet, Bonifacio, 05], knowledge coordination among units, and knowledge alignment with the centralized one.

3.2 Traditional KM systems in the Project Based Organizations

Although in many cases, the top management focuses on the main strategy of knowledge memorizing [Hansen et al., 99] (stressing the objective approach), some

authors claim that the PBOs manage knowledge in a completely opposite way (according to the subjective approach). For instance, the classical conception of project lifecycle is based on four phases: introduction, planning, implementation and conclusion [Young 98, Cleland, 90; Turner, 93]. Moreover the traditional approach does not consider the memorizing phase focusing mainly on operative tasks. The KM approach suggests a deeper focus on the knowledge processes such as the definition of best practices, and the exploitation of these in other projects. Consequently, the new solutions, learned during the project (e.g. experience [Elkjaer 04], expertise [Starbuck, 92], best practices, and success stories), remain within each group, in the minds of the team members. In other words, the classical literature of projects and PBOs does not treat the argument of knowledge storing and memorizing. Instead this paper promote the exploitation of learned experiences inside and outside the project according to the KM field of study. KM systems are focused on personal knowledge sharing by face-to-face meeting, teams and communities of practices [Lave and Wenger, 91, Wenger, 98; Ruuska and Vartiainen, 05], and informal network [Krackhardt and Hanson, 93]. Only few authors (such as [Dixon, 00]) identify processes of inter and intra projects learning such as the distributed knowledge management approach. Starting from this approach, our research places the fundamentals of further analyses, which will investigate how to support effective KM processes into PBOs.

3.3 Tools and techniques

In this section some tools, processes and techniques will be described according to the distributed knowledge management approach.

- Practices, processes and tools: different teams tend to (autonomously) develop and adopt tools that suit their internal needs. The selection and utilization of these tools is a manifestation of their autonomy (personalized artefacts within each knowledge node). This may be for historical reasons (for example people use old KM systems that are still effective), but also because different tasks may require the use of different applications and formats data (i.e. text documents, audio/movies,) to work out effective procedures, and to adopt specific and often technical languages. Examples of applications are software systems, procedures and other artefacts, such as relational databases, groupware and content management tools. At the same time some common technologies, shared across the whole organization, are identified to support a common strategy of KM. These systems might be shared directories, wiki systems, web portals that allow people to accede and contribute to corporate knowledge.
- Culture, behaviours and informal networks: to achieve a learning culture, organizational knowledge should be perceived as really important and sharable for the sake of people [Dixon, 00]. This thesis is also supported by the The Economist Intelligence Unit's research [05], which highlights that having a corporate culture that encourages employees to volunteer ideas and share important information is ultimately more important than any single KM tool. Salary incentives and benefits can address people on this track.
- Strategy and mission sharing: the company must have a clear mission which considers knowledge, the system of thinking, and the learning structures

[Senge, 90] as key elements for knowledge coordination. The mission of a PBO is to generate an innovative service through an ongoing learning process (based on practice and experience). This vision should be supported by a strategy that integrates social and practice networks [Wenger, 98; Ruuska and Vartiainen, 05], knowledge sharing processes [Nonaka and Takeuchi, 95] and a distributed knowledge deployment [Tsoukas, 96]. The strategy should results by the interplay of project management techniques [Kerzner, 82; Cleland, 90], internal and external networking [Dixon, 00], intra and inter project learning [Ayas and Zeniuk, 01; Juran, 88; Arthur et al., 01] and technology support [Davenport and Prusak, 98]. In PBOs, projects are simultaneously implemented, autonomously managed, and can exhibit different learning processes [Ayas, 99]. Thus, the top management should create connections among team members, facilitate the collection of knowledge inside and outside projects, and finally create the conditions to generate and nurture new knowledge and innovation.

All these aspects (strategy, mission and vision; culture, behaviours and informal networks; practices, processes and tools) should be part of a multifaceted system which allow people to autonomously create knowledge and coordinate it across the whole organization.

4 New Hypothesis and open problems

As we said in previous sections, project is considered a unique flow of activities in which team members work, learn, and create new solutions inside the project. Some authors assert that the autonomous management of project per se can causes the "reinvention of the wheel" [Järvinen, 99] because the know-how is yielded only in the project lifecycle [Hobday, 00], and the leaking of systematic learning causes the repetition of same mistakes among projects. Those treats might be overcame adopting the distributed knowledge management approach presented in this research, in which projects autonomously manage knowledge (because of different characteristics, needs, and social structures), and coordinate it with others in order to share and align knowledge. The distributed knowledge management approach allows the creation of a more effective and efficient learning organization. Also, it takes into account the traditional project management techniques, the distributed nature of knowledge and a new set of emerging tools. The final destination of those tools and techniques is a new project based organization edging its processes on learning. This new type of organization is called *Project Learning Organization (PLO)*. It is based on human and technical resources, in which the top management sets the mission and a mix of strategies, while workers share culture, practices, tools, and techniques. The management of PLOs is task oriented, knowledge intensive, and based on teamwork. It also implicates learning processes both inside each single project and among them, across organizational units.

In the following sections new models that aim at identifying and supporting the model of Project Learning Organizations are described.

5 New models for the Project Learning Organization

Previously, it has been asserted that the deficiency of KM solutions within Project Based Organizations may causes inefficiencies.
Taking into consideration the KM approaches (described in the section 3.1.), *the creation of specialized knowledge within each single project team (namely a knowledge node), the coordination processes among knowledge nodes, and the knowledge alignment with the corporate one, should be enabled as in a multifaceted system. In this way, PBOs become learning organizations, namely Project Learning Organizations (PLOs).*

For this reasons, we have analysed the knowledge characteristics of projects according to their complexity and their critical variables: time, amount of available resources, and clarity of project mission. For each type of variable combination we have identified a specific strategy [Pich et al, 04] that attempt to overcome treats and incentives/opportunities. Finally, we have developed two models for PLOs. The first one refers to the projects life cycle in which the memorizing and corporate alignment phases are added; the second one refers to knowledge coordination processes among projects, and their alignment with the corporate knowledge.

5.1 The project life cycle for the Project Learning Organization

According to our studies, the project lifecycle of a PLO should be structured in five phases (see Figure 2):

1. the analysis phase that is composed by:
    - the definition of the goal, namely the statement of work;
    - the generation of a shared understanding among the team members (such as the customer consultation);
    - the identification of technical and managerial resources (such as time, budget, etc.);
    - the definition of the typology of the project;
2. the planning phase that is based on:
    - the investigation on the availability of knowledge into and outside the organization;
    - the knowledge creation activities (such as brainstorming, brain writing team learning and team building activities);
    - the schedule of resources to manage;
3. the action – implementation phase that is constituted by:
    - the program execution;
    - the problem – solving interventions;
4. the measurement - results control phase:
    - if the result is satisfactory, the project will pass to the last phase;
    - if the result is rejected, the project will go back to the planning or to the action phases;
5. the memorizing and alignment phase: experts' knowledge should be spread over the firm through best practices (codification strategy), storytelling (personalization strategy), and formal/informal meeting.

In Figure 2, an integrated view of the project lifecycle is presented. The project lifecycle should not be intended as a step-by-step process. The Memorizing phase, for

instance, is used across the other 4 phases. It might occur at any time storing good practices of analysis, planning procedures, action-implementation techniques, or measurement ratios. Besides, in most of the cases and in particular organizations (such as small firms), some phases may be implemented in pairs (for instance memorizing into the measurement) or integrated simultaneously.

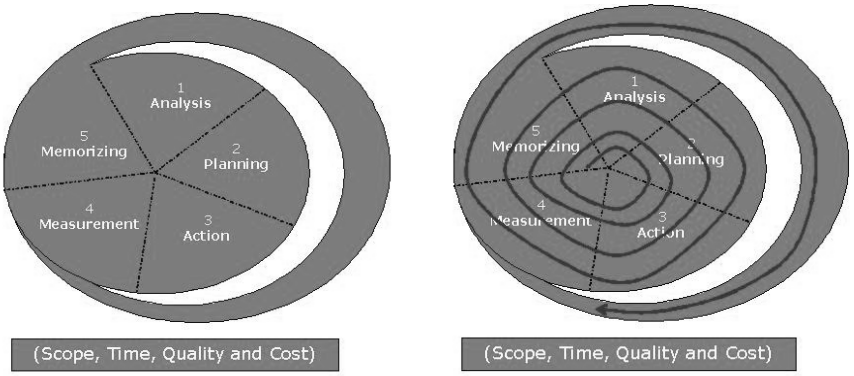

Figure 2: Project lifecycle for Project Learning Organizations

5.2 Table and project classification

Analyzing the knowledge characteristics of any project, their complexity and their critical variables can be unveiled. The work has been focused in particular on the variables of time, amount of available resources, and clarity of project mission. Finally, for each typology of project a specific strategy [Pich et al, 04] has been identified (Table 1.).

In the "known project" the project mission, the amount of resources, and the time are well known. The project team can easily manage the project focusing on the work efficiency. In this type of project, the memorizing phase is not very important, it refers only to the internal refinement of best practices.

In the "low critical projects" only one variable is missing. The project mission or the amount of money or the time is not defined. The difficulties in managing these project are not very relevant and the project team can exploit the experiences held by the organization and by the people through a process called serial transfer [Dixon, 00]. In this type of projects the memorizing phase is usually useful inside a single project and across projects within the PLO.

In the "critical projects" two variables among three (project mission, amount of money or time) are not identified. In this situation the learning process should be focused on the acquisition of knowledge from external networks (when it is needed), as processes of strategic transfer [Dixon, 00]. In this type of projects the memorizing phase could occur inside the project or/and across various projects, and with the contribution of external contacts or any other stakeholder.

Finally in the "very critical project" all the variables are not identified yet, there is no useful knowledge into the firm neither outside the organization. Therefore motivated and skilful human resources should be recruited through expert transfer processes [Dixon, 00]. In this type of projects the selectionist approach is the most used [Kohler, 94], pursuing multiple approaches in the hope that one will work.

TYPOLOGY OF PROJECTS	Critical variable: Project mission	Critical variable: Resources	Critical variable: Time
Known project: deterministic approach	known	known	known
Low critical project: instructionist approach	known	known	not identified
	not identified	known	known
	known	not identified	known
Critical project: learning approach	known	not identified	not identified
	not identified	not identified	known
	not identified	known	not identified
Very critical project: selectionist approach	not identified	not identified	not identified

Table 1: Project classification and strategy identification

5.3 The Project Learning Organization model

As depicted above, the PLO should always consider the ongoing process of learning. At the same time should nurture community of practice, informal networks among different projects, and motivate and conduct workers to share a common culture and strategy. According to the project typology (known project, low critical, critical, and very critical projects), PLO may identify an appropriate set of tools, practices, and strategies. This set of tools, practices, and strategies can derive from:

- traditional project management techniques,
- informal networks theories and methods,
- knowledge management tools and technologies, and
- project learning management techniques (see Figure 3).

All these components should be effectively integrated in order to support the PLO.

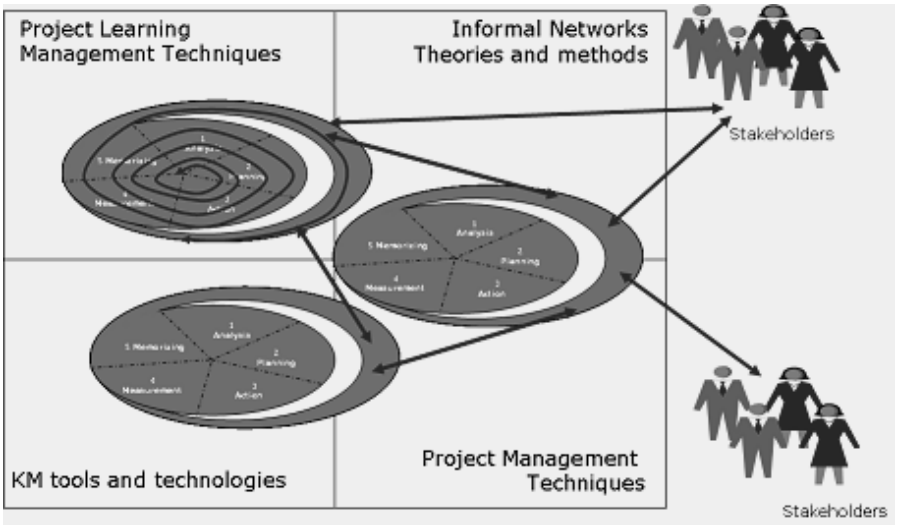

Figure 3: An example of multifaceted epistemology, for a PBO.

The project management techniques in the PLO "is the planning, organizing, directing and controlling of company resources for a relatively short-term aim that has been established to complete specific goals and objectives" [Kerzner, 82]. Some techniques of project management have been cited in section 2. Taking into consideration the informal network theories and methods, some basic theories should constitute the building blocks of daily activities, such as advice network, trust network [Krackhardt e Hanson, 93], and communities of practice [Wenger, 98, Ruuska and Vartiainen, 05]. These might be transformed into tools and practices such as: relational databases, groupware and content management tools, shared directories, wiki systems, and more in general knowledge based portals (that allow people to accede and contribute to the corporate knowledge).

In the project learning management techniques, three main integration levels should be considered:

1. the intra-personal level (what is the best for the worker) that depends on mental and cognitive status/personality. Some critical factors are the perception of organizational strategies and values, and the lack of sharing a common organizational culture [Jones, 93];
2. the inter-personal level (among team members) that depends on shared understanding, quality of communication processes, team building. Some tools and techniques are the Johari window [Luft, 69], the left-hand column, the ladder of inference [Senge, 90], processes of group dynamics, free thinking (such as brainstorming, brainwriting, pool and card exchange technique, morphological tableau [Geschka, 93], brainsketching [Van der Lugt, 02]), etc.;
3. the inter-project level (among projects) that depends on the system of thinking and the organizational model of the firm. It can be improved by

storytelling, system archetypes definition [Senge, 90], best practice development, and delphi techniques.

Finally, the KM tools and techniques can be developed according to the three different approaches described in section 3.1:

1. objective approach: the most important strategy is the codification of large knowledge bases, the storage in homogeneous knowledge repositories, the consultancy of common best practices and case studies;
2. subjective approach: the most important strategy is the autonomous management of personal knowledge, using, for instance, personal networks of workers, communities of practices, knowledge café, blogs and wiki systems;
3. distributed knowledge management approach: the most important strategy is the coordination activity among autonomous units. Some useful techniques are local knowledge conceptualization (e.g. domain ontologies, local classifications), and semantic web technologies for concept negotiation.

6 Conclusions and future work

The multifaceted epistemology of KM shows how knowledge can effectively and efficiently be managed within each knowledge node, coordinated across a constellation of units, and aligned with the common and shared organizational knowledge. Depending on the type of knowledge, the environment, and the structure of the organization, it is beneficial to apply a more centralized (e.g., for secured and general knowledge) or a more decentralized KM approach (e.g., for ad-hoc and specific knowledge). In particular, Project Learning Organizations have to enforce their traditional management of local knowledge (inside each project, namely knowledge node) with centralized KM systems. Thus, the use of a multifaceted epistemology allows managers of Project Learning Organizations to systematically adopt the models depicted in the section 5. These might facilitate the creation of a stronger organizational culture and an attitude to share knowledge (using centralized repositories, wage incentives, group bonus, etc.) within and among knowledge nodes. This would allow people to identify themselves within the firm as part of a whole, share knowledge for a common real gain, and align their behaviours with the organizational strategy.

Concluding, this study constitutes only one thin end of the wedge, a sort of building block for normative rules inside the PLOs. In future works, authors will consider the analysis of concrete business case studies according to the multifaceted epistemology and the two models presented in this paper. Hopefully, new useful insights will be unveiled and analyzed.

References

[Alvesson, 01] Alvesson, M. Social identity and the problem of loyalty in knowledge-intensive companies. In F. Blackler, Courpasson D. and B. Elkjaer (eds.) *Knowledge work, organizations and expertise: European Perspectives.* London: Rutledge, 2001.

[Arthur et al., 01] Arthur, M. B., DeFillipo, R. J. and Jone, C. Project-based learning as the interplay of career and company and non-financial capital. In *Management Learning*. 32(1), 99-117, 2001.

[Ayas, 99] Ayas, K. Project Design for Learning and Innovation: Lessons Learned from Action Research in an Aircraft Manufacturing Company. In: Araujo L.M, Easterby-Smith M.P.V. and Snell R, (eds.*). Organizational Learning and the Learning Organization: Developments in Theory and Practice.* London: SAGE Publications, 1999.

[Ayas and Zeniuk, 01] Ayas, K. e Zeniuk, N. Project-based Learning: Building Communities of Reflective Practitioners. In *Management Learning*. 32(1), 61-76, 2001.

[Blackler, 95] Blackler, F. Knowledge, Knowledge Work and Organizations: An overview and Interpretation. In *Organization Studies*. 16(6), 1021-1046, 1995.

[Bonifacio, Bouquet, Cuel, 02] Bonifacio M. S., Bouquet P., Cuel R., "The role of classification(s) in distributed knowledge management". IOS press, 2002. In *Proceedings of "6th international conference on knowledge-based intelligent information engineering systems & allied technologies (KES 2002)"*, ISBN 1 58603 280 1. Italy, 16-18 September, 2002.

[Cleland, 90] Cleland, D.I. *Project management. Strategic Design and Implementation.* TAB Professional and Reference Books, 1990.

[Chandler, 62] Chandler, A.D. *Strategy and structure: chapters in the history of the industrial enterprise*. MIT Press (Cambridge), 1962.

[Cuel, Bouquet, Bonifacio, 05] Cuel R., Bouquet P., Bonifacio M. S., "A distributed approach to knowledge management, the concept of knowledge nodes, and their implications". Chapter 16: In: Schwartz D. (Editor of), *Encyclopedia of knowledge management*, Hershey, Pa: Idea group, 2005.

[Davenport and Prusak, 97] Davenport, TH., Prusak, L. *Working Knowledge: How Organizations Manage What They Know*. Harvard Business School Pr, Boston, 1997.

[Dixon, 00] Dixon, N.M. *Common Knowledge: How companies Thrive by Sharing What They Know*. Harvard Business School Press, 2000.

[Drucker, 93] Drucker, P.F. *The post capitalist society.* Oxford: Butterworth-Heinemann, 1993.

[Ekstedt et al., 99], Ekstedt, E., Lundin, R. A., Söderholm, A. e Wirdenius, H. *Neo-industrial organizing: Renwal by action and knowledge formation in a project-intensive economy*. Reutledge: London, 1999.

[Elkjaer, 04] Elkjaer, B. Organizational Learning: The 'Third Way. *Management Learning*. 35, 419-434, 2004.

[Fauconnier, 85]. Fauconnier, G. *Mental Spaces: Aspects of Meaning Construction in Natural Language.* Bradford Books, MIT Press, 1985.

[Geschka, 93] Geschka. The Development and Assessment of Creative Thinking Tecniques: A German Perspective. In: Isaksen, S. G, Murdock, M.C, Firestien, R.L e Treffinger, D.J (eds). *Nurturing and Developing Creativity: The emergence of a Discipline.* Ablex Publishing Corporation, 1993.

[Ghidini, Giunchiglia, 01]. Ghidini, C., Giunchiglia, F.Local Models Semantics, or Contextual Reasoning = Locality + Compatibility, *Artificial Intelligence*, 127(2), 221–259, 2001.

[Hansen et al., 99] Hansen, M.T, Nohria, N. e Tierney, T. What's your strategy for managing knowledge? *Harvard Business Review*. 106-116, 1999.

[Hobday, 00] Hobday, M. The project-based organization: An ideal form for managing complex products and systems? *Research Policy*. 29, 871–893, 2000.

[Huzzard, 00] Huzzard, T. From Partnership to Resistance: Unions and Organizational Learning at Ericsson Infocom. *Management Learning*. 31(3), 353-373, 2000.

[Hyväri, 06] Hyväri, I. Success of Projects in Different Organziational Conditions. *Project Management Journal.* 37(4), 31-41, 2006.

[Jessen, 92] Jessen, S. A. The nature of project leadership. Scandinavian University Press, Oslo, Norway, 1992.

[Jiang and Heiser, 04] Jiang, Bin and Heiser, Daniel, R. The Eye Diagram: A New Perspective on the Project Life Cycle. *Journal of Education for Business*. Sept/Oct. 10-16, 2004.

[Johnson-Laird, 92]. Johnson-Laird, P. *Mental Models*. Cambridge University Press, Cambridge, 1992.

[Jones, 93] Jones, L. Barriers to Creativity and Their Relationship to Individual, Group, and Organizational Behaviour In: Isaksen, S. G, Murdock, M.C, Firestien, R.L e Treffinger, D.J (eds), "*Nurturing and Developing Creativity: The emergence of a Discipline*". Ablex Publishing Corporation, 1993.

[Juran, 88] Juran, J. M. *Juran on planning for quality*. The free press. New York, 1988.

[Jyrki et al., 03] Jyrki J., Kasvi, J., Vartiainen, M., e Hailikari, M. Managing knowledge and knowledge competences in projects and project organizations. *International Journal of Project Management*. 21(8), 571-582, 2003.

[Järvinen, 99] Järvinen, P.J. The Significant Quality Makers of One-of-a-kind Product Projects. In: Artto, K., Kähkönen, K. and Koskinen, K. (Eds.) *Managing Business by Projects.* 2. 699 – 724. Helsinki: Project Management Association Finland and NORDNET, 1999.

[Kerzner, 82] Kerzner, H. *Project management for executives*. VNR, 1982.

[Kloppenborg, 03] Kloppenborg, T. J. *Problem-based Learning: teaching project management while solving real organizational problems.* Academy of Management Best Conference Paper, 2003.

[Kohler, 94] Kohler, R., *Lords of the Fly.* Chicago University Press, 1994.

[Krackhardt and Hanson, 93]. Krackhardt, D. e Hanson, J.R. Informal networks: the company behind the chart. *Harvard business review.* 104-111, 1993.

[Kotnour, 99] Kotnour, T. A learning framework for knowledge management. *Journal of Project Management.* 3(2), 32-38, 1999.

[Lave and Wenger, 91] Lave, J. e Wenger, E. *Situated learning. Legitimate peripheral participation*. Cambridge: Cambridge University Press, 1991.

[Lei et al., 99] Lei, D. Slocum, J.W. e Pitts, R.A. Designing organization for competitive advantage: the power of learning and unlearning. *Organizational Dynamics*. 24-38, 1999.

[Luft, 69] Luft, J. Of *Human Interaction*, Palo Alto, CA:National Pres, 1969.

[Mark et. al., 02] Mark, G., Gonzalez, V., Sarini, M., and Simone, C. *Reconciling Different Perspectives: An Experiment on Technology Support*, Proc. COOP02, IOS Press, 2002.

[Maturana and Varela, 80] Maturana H.R. and Varela F.J. *Autopoiesis and Cognition: The Realization of the Living* Dordrecht: D. Reidel. 1980.

[McCarthy, 93]. McCarthy, J. Notes on Formalizing Context. In *Proceedings of the 13th International Joint Conference in Artificial Intelligence*. 1993.

[Meredith and Mantel, 00] Meredith, J.R. e Mantel, S.J. *Project Management. A managerial approach*. John Wiley and Sons, 2000.

[Mintzberg, 79] Mintzberg, H. *The structuring of organizations*. London: Pretice-Hall, Inc. 1979.

[Nonaka and Takuechi, 95] Nonaka, I. , Takuechi, H. *The Knowledge Creating Company*. Oxford University Press, 1995.

[Pinto e Mantel, 90] Pinto, J.K. e Mantel, S.J., The causes of Project Failure, *IEEE Transactions on engineering Management*. 37(4), 269-276, 1990.

[Pinto e Slevin, 87] Pinto, J.K. e Slevin, D.P. Critical Success Factors across the project life cycle. *Project Management Journal*. 19(3), 67-75, 1987.

[Orlikowski, 91] Orlikowski, W.J. Integrated information environment or matrix of control? The contradictory implications of information technology. *Accounting, Management, and Information Technology*, 1(1), 9-42, 1991.

[Pich et al, 04] Pich, M.Y, Loch, C.H. e De Meyer, A. On Uncertainty, Ambiguity, and Complexity in Project Management. Management Science. 48(8), 1008-1023, 2004.

[Pinto, 99] Pinto, J.K. Managing information systems projects: Regaining control of a runaway train. In: Artto, K. A., Kähkönen, K. and Koskinen, K. (Eds.) *Managing Business by Projects*. 1,31 – 43. Helsinki: Project Management Association Finland and NORDNET, 1999.

[Ruuska and Vartiainen, 05] Ruuska, I. e Vartiainen, M. Charactristics of knowledge sharing communities in project organizations. *International Journal of Project Management.* 23, 374-379, 2005.

[Quinn, 92] Quinn, J. B. *Intelligent Enterprise*. New York: The Free Press, 1992.

[Senge, 90] Senge, P. M. *The Fifth Discipline: The Age and Practice of the Learning Organization*. London: Century Business, 1990.

[Starbuck, 92] Starbuck, W. "Learning by knowledge-intensive firms". *Journal of Management Studies*. 29(6), 713-740, 1992.

[Stewart, 01] Stewart, T. A. *The Wealth of Knowledge: Intellectual Capital and the Twenty-first Century Organization*, Doubleday, New York, 2001.

[Swart and Kinnie, 03] Swart, J., Kinnie, N. Sharing knowledge in knowledge-intensive firms. *Human Resource Management Journal.* 13(2), 60-75, 2003.

[Söderlund, 02] Söderlund, J. *Managing complex development project: arenas, knowledge processes and time.* R&D Management Blackwell Publishers Ltd. 32(5), 419-439, 2002.

[Thamhain and Wilemon, 75] Thamhain, H.J. e Wilemon, D.L, Conflict management in Project-life cycles. *Sloan Management Review*. 75, 31-50, 1975.

[The Economist Intelligence Unit, 05] The Economist Intelligence Unit. Know how Managing knowledge for competitive advantage. Internet source accessed the 20/11/2005: http://www.eiu.com/site_info.asp?info_name=eiu_TCS_know_how.

[Turner, 93] Turner, J. R. *The handbook of project-based management.* Londra: McGraw-Hill, 1993.

[Tsoukas, 96] Tsoukas, H. The firm as a distribute knowledge system: a constructionist approach. *Strategic Management Journal*. 17, 11-25, 1996.

[Van der Lugt, 02] Van der Lugt, R. Brainsketching and How it Differs from Brainstorming. *Creativity and Innovation Management*. 11(1), 43-54, 2002.

[Weick, 93]. Weick, E. K. Collective Mind in Organizations: Headful Interrelating on Flight Decks, *Administrative Science Quarterly*, 38, 1993.

[Wenger, 98] Wenger, E. *Communities of Practice. Learning, Meaning, and Identity.* Cambridge University Press, 1998.

[Young, 98] Young, T. L. *The handbook of project management: A practical guide to effective policies and procedures.* London, UK: Kogan Page, 1998.

[Ziush and Manfredi, 06] Ziush, N. M. and Manfredi, F. Knowledge Management in Project-Based Organizations: The interplay of time orientations and knowledge interventions. In Proceeding: *Science and Technology in Society: An Interdisciplinary Graduate Student Conference.* Washington D.C. (www.stglobal.org), 2006.