A learning-by-doing based framework for micro-knowledge management in project contexts

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Abstract.
BACKGROUND: There is a general acknowledgement of projects as sites of knowledge creation, but in multi-project contexts, we witness at times a lack of robust procedures that would ensure harvesting the lessons learned.
OBJECTIVE: This paper aims at providing an operational conceptual framework for micro-knowledge management, depicting knowledge as created by individuals performing project activities.
METHODS: Documentation on relevant literature and observation of current managerial practices and tools, in order to use the underpinnings of experiential education for managing learning-by-doing knowledge creation.
RESULTS: Developing the framework led to identifying the decision-making processes in micro-knowledge management and their correlation with human resources management Secondly - we have shown the need for a coherent integration of knowledge deliverables into the project management tools and practices, especially in the context of the COVID-19 pandemic.
CONCLUSIONS: Micro-knowledge management points to a recurrent assessment of the opportunity for micro-knowledge codification and/or staff retention based on tacit professional or biographical knowledge of the project team members. The framework offers a balance between the detachment of knowledge from the owners, in codification, and affirming the irreducible tacit and personal dimensions of learning-by-doing.

Keywords: Experiential education, knowledge deliverables, projects management, human resources management, COVID-19

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1. Introduction

There are various ways to look upon projects as sites of learning, such as - learning-by-doing contexts, contexts for storytelling of lessons learned or intrinsic knowledge management processes. The learning opportunity is an inherent part of the project management process [1]. Considering the ephemeral nature of projects as temporary settings, there are instances where knowledge created amidst the project environments is not captured, documented and shared (to the project team and at the organizational level) [2]. Even when there is some level of sharing, this is mostly done in informal ways and not through a robust ongoing process of harvesting project knowledge.

The aim of this paper is to present an operational conceptual framework for identifying, articulating and codifying micro-knowledge created by individuals in learning-by-doing processes, while performing project activities. Such a framework will lead to identifying: the role of individual reflection, the related decision-making processes in knowledge management and human resources management, the need for a coherent and explicit integration of knowledge deliverables into the project management tools and practices.

The methods chosen consists in: identifying and using the theoretical underpinnings of experiential education for revealing, through reflection, knowledge created in learning-by-doing settings; proposing a set of tools (as found in the relevant literature) for managing the micro-knowledge life-cycle; classifying the relevant decisions for knowledge management and human resources management.

In terms of knowledge scale, this paper aims at micro-knowledge at an individual level, form

focusing on the micro-knowledge life cycle there is a movement upwards at the intra-project and inter-project organizational levels. This movement is facilitated by managing individual micro-knowledge, using a procedure modelled by the proposed framework. The focus resides mainly on the individual and intra-project aspects of the knowledge constructed in the context of regular project tasks. This approach is chosen due mainly to the ontological difficulties of defining rigorously what one means by learning organizations, other than the evident fact that the members learn in social practices, happening in a certain organizational setting. As Scarborough and Carter have noted, there is a higher degree of precision in knowledge management, than in learning organization theories [3].

The current ongoing debate in knowledge management, between knowledge as codified commodity and knowledge as ineffably held by persons, gives a rather dim description of knowledge and learning in organizations [1, 4, 5] and, at times, neglects the learning-by-doing nature of experiential learning in project contexts. As shown by Buchan & Simpson, projects could be theorized as projects-as-practice and projects-as-practices [6]. In project management literature, there is shift from project management depicted as an engineering linear endeavour to project management being analysed through the lenses of pragmatic linguistics practices and postmodern social analysis [7]. Concentrating on practices might indicate a pragmatic move, but the concept of practice requires, in contemporary literature, a theoretical envelope grounded in a postmodern linguistic turn in social sciences, this being the hallmark of distrust in regular scientific formalism [8]. Not only, as Nonaka notices [5], the social practice organizational theory has a different research agenda than the theory of organizational knowledge creation, but it also neglects the pragmatic approach to learning which is currently expressed in the theories of experiential education [9, 10].

According to Kolb's definition [10] – 'Learning is the process whereby knowledge is created through the transformation of experience' [p.49]. Learning-by-doing occurs when one develops means of fulfilling tasks for which there is no predefined knowledge available; or at least there is a subjective lack of knowledge. The acquisition of subjective knowledge gain will be made "visible" for individuals, if a self-reflection tool mediates knowledge presence, hence leading to knowledge articulation. The process of revealing knowledge is compatible with a theory of

organizational knowledge creation along the continuum from tacit to explicit knowledge [5].

Developing the framework entails the following steps: identifying the decision-making processes in micro-knowledge management and their correlation with human resources management (in section 2); describing the framework and the appropriate managerial tools used in its context (in section 3); pleading for a coherent and explicit integration of knowledge deliverables into the project management practices (in section 4); approaching the proposed framework against the background of the current COVID-19 threat (in section 5).

2. Specifics of micro-knowledge management related to human resources policies

Knowledge management is defined either as an enumeration of steps for the life cycle of knowledge or as focusing on knowledge in its entirety as held by individuals, groups or organizations [4]. According to Gasik's definition [4]: 'Micro-knowledge is a piece of knowledge needed to perform one task (or its part) or to solve a problem (or its part)' [p. 25].

The organizational learning processes are identified as being - experience accumulation, knowledge articulation and knowledge codification [11]. In terms of the micro-knowledge life cycle, the project management phases consist in [4]: identifying knowledge needs (in terms of human resources processes, this could be simultaneous with drafting an organizational role description), knowledge acquisition, knowledge creation, knowledge application, knowledge transfer (through conferences, discussions, socialization), knowledge identification, knowledge documentation (involving decisions upon knowledge usefulness, relevance and obsolescence) and knowledge sharing.

Knowledge creation and knowledge identification could happen as processes that are not simultaneous. Since many short-term projects have a meetings and reviews, related to the lessons learned, at the end of the project or at the completion of a project phase, usually there is a time-lapse between knowledge creation and knowledge identification. Postponing knowledge capturing leads to knowledge loss (through subjective memorization) and obsolescence. There is a difficulty in chronologically (and theoretically) positing identification after application, since it might be the case that a current unarticulated practice (based on knowledge which has not been previously identified) will actualize certain risks related to work safety or financial impact.

Applying reflection tools requires time allocation that would have to be scheduled alongside more pressing deadlines. This being among the reasons why the lessons learned are not identified in the case of projects where reflection is relegated to a closure phase alone [1]. Another effect of postponing knowledge capturing towards the end of the project life cycle consists in organizational amnesia [2]. The factors influencing organizational amnesia are: time pressure on tasks completion, lack of adequate debriefing tools etc. [2]. Schindler & Eppler [2] identify two factors for organizational amnesia that are highly relevant for the current paper: lacking enforcement of the procedures in the project manuals, missing integration of experience recording into project processes.

The problem of the flux of explicit knowledge between projects in multi-project organizations might be regarded as a subset pertaining to the issue of project integration. Vuorinen & Martinsuo [12] distinguish three interfaces in multi-project environments: between the parent organization and programs, between projects within a program, within the projects themselves. Integration is defined as unity of effort between the three interfaces, it overlaps with the managerial function of coordination and it is seen as different from in terms of scale [12]. The mechanisms of integration are divided into – impersonal, personal and group mechanisms [12]. These mechanisms subsume current managerial practices - meetings, reviews, procedures - aimed at achieving integration, knowledge discovery and articulation. The elements of project knowledge management at the organizational level are dependent upon the organizational strategic context, the program's knowledge management context, the operations and outcomes of knowledge management at the organizational level [13].

In a multi-project environment - having a team composed of members scattered across many projects, tacit knowledge gained in one project is translated to another project by the human resource allocation, if the allocation is based on criteria such as the experiences of team members correlated to the project deliverables. When tacit knowledge is acquired in a learning-by-doing process, where many team members are involved, then the team members are already aware of their colleagues' experiences, though they might not be able to express, represent or codify those peculiar experiences in terms of
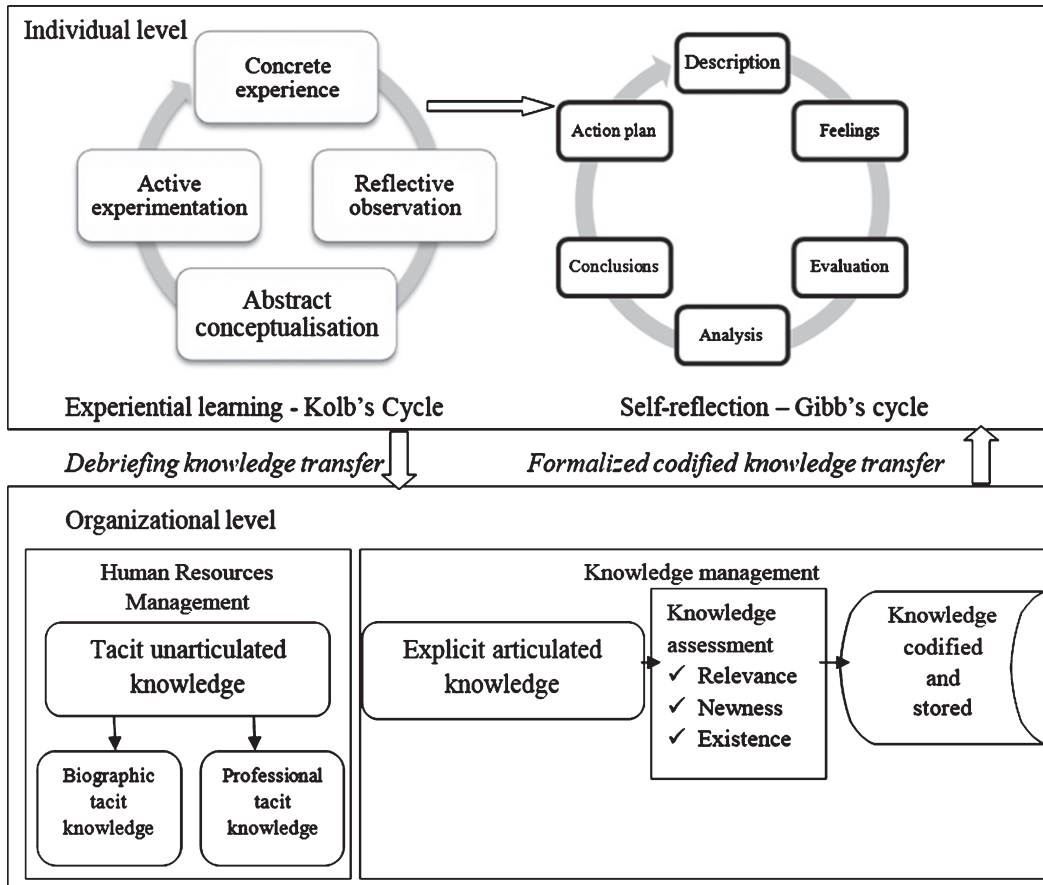
Fig. 1. Framework for operational micro-knowledge management in project contexts.

transferable knowledge. The more poignant problem of the necessity of capturing knowledge would consist in answering the question: If there is a discontinuity in team membership, how can the organization carry on the lessons learned during project execution? Hence, micro-knowledge management would affect the organizational process assets that are continuously enhanced, either by keeping skilled team members, whose tacit knowledge is very difficult to convert, or by codifying the knowledge acquired in learning-by-doing contexts.

The issue of replacing retired project members brings up the perennial knowledge management issue of whether knowledge might be entirely detached from persons and transferable henceforth [14]. Considering that experience is strictly personal, but that knowledge once articulated might be codified - our proposal maintains the personal knowledge dimension, through emphasizing the experiential base of the learning-by-doing contexts, while also recognizing the opportunity for knowledge codification,

where this is made possible, and decided upon, by personal reflection and procedural examination. A procedural mechanism for establishing, on the basis of the content and type of knowledge, the decision-making processes for choosing between personal development and knowledge codification might tone down the sharpness of the strategic option (between codifying or personalizing knowledge) [15] into an operational routine. This is a reversal of a strategic top-down approach to knowledge management, turning it into a learning-by-doing driven, bottom-up operational process.

In terms of professional relevance, even at a micro-level, there is a distinction between managerial knowledge (relevant for project management endeavours) and professional knowledge related to the specific set of skills of a certain occupational field (which are project scope oriented). Sharing individual micro-knowledge involves aspects that are not necessarily related to the relative importance of the professional field, but pertaining to the social

context into which the knowledge is shared. Knowledge sharing is being eased by: mutual trust [16], economic incentives [17], communities of practice attendance and the existence of affinity groups [18].

3. The operational managerial framework – From learning by doing to knowledge codification and team member appraisal

The framework we propose is theoretically grounded both in the pragmatics of experiential learning, as proposed by Kolb [10], and in the theory of organizational knowledge creation, as proposed by Nonaka, and Nonaka and Hitachi [5, 19]. This theoretical match is based on the assumption that tacit knowledge originates in the learning-by-doing interaction between the individual team members and their project contexts.

The managerial process of micro-knowledge management consist in following the path (as in Fig. 1) starting with an individual learning-by-doing exercise - pointing to knowledge gaining (depicted by a Kolb cycle) that is revealed through self-reflection on the learning-by-doing cycle (depicted by a Gibb cycle). Once this individual process is debriefed, a distinction is drawn between knowledge that is adequately articulated for codification and knowledge that is still, to a high degree, tacit and insufficiently externalized.

The set of observations and decisions following this distinctions are: a) for the knowledge that it is still insufficiently articulated, the knowledge management function shall assess whether this knowledge is related to the professional field of the team member or is it strictly linked with one's personal experience and biography; b) for the knowledge that is sufficiently expressed, the knowledge function will assess the knowledge - in terms of existence, relevance, obsolescence; if the knowledge complies with these attributes it would be codified and shared. Closing the whole procedure, as it usually happens in experiential learning theory would entail that team members internalize the explicit knowledge, which, through formalized transfer of codified knowledge, has become part of the organizational process assets.

Some of the managerial means and techniques - that could be used in the knowledge creation, identification and codification steps mentioned above in the process – need to be spelled out. At an individual level, self-reflection on a learning-by-doing cycle is to be done using tools such as standardized forms [9] or debriefing meetings facilitated by external staff [2] – these means are mainly non-IT based and are highly influenced by the personal characteristics of team members and team contexts [20]. Schindler & Eppler [2] classify debrief methods into process-based methods (post-project appraisals, after action reviews) and documentation-based methods (micro articles, learning histories). How often is such a review useful or necessary? Usually lessons learned are best captured after the completion of a significant project phase that challenged the individual and organizational routines [2, 20]. The ontological content of these self-reflection processes might also be expressed in the term of the process of shifting between "focal" and "subsidiary" awareness [5] and of the actual intricacies of reflecting practitioners engaged in creative and surprising learning experiences [21].

As tools of knowledge capturing and codification, IT-based solutions will be personalized in terms of structuring and filling project knowledge files, that are to be ascribed access rules and sharing procedures [22, 23]. A restriction on choosing capturing solutions is given by their aptitude to capture knowledge in a timely manner [22]. Requirements related to knowledge capturing are related to [22]: cost, workload, legal issues (copyright, confidentiality), accuracy, and representation of knowledge. Representation of knowledge requirements are to be matched by the structure of knowledge capturing and knowledge mapping [22, 23].

The managerial process described above encompasses different strands of decision-making processes: a) human resources decisions on which are the team members using a great deal of tacit knowledge as part of their professional background or as a result of their organizational biography; b) human resources polices rewarding staff that complies with knowledge retention – through a mix of rewarding blueprints [24]; c) knowledge management decisions on choosing techniques and tools adequate for the organizational setting; d) procedural decision on formalizing organizational actions.

4. The relevance of the micro-knowledge management framework for project management practices and tools

The application of a structured process of self-reflection upon learning-by-doing gained knowledge, followed by a decision-making process on the

codification of knowledge, could represent a step towards a larger recognition of the importance of knowledge creation in projects. If knowledge creation (and knowledge transfer from one project to another) is to be treated as being of paramount importance for the organizational health and performance [20], our proposal consists in integrating knowledge deliverables amidst the array of deliverables required by the project scope. This would influence the three-fold restrictions of schedule, costs and quality, and would consequently apply those to the knowledge life cycle, i.e. the knowledge deliverables would have a schedule assigned, a specific budget line and a quality management toolkit – these aspects would be explicitly shown accordingly in the project baselines.

The *PMBOK® guide* systematizes knowledge across different areas of knowledge, but knowledge management itself is presented, in the latest edition [25], as a process under the umbrella of project management integration. The knowledge management processes could also be linked to the *PMBOK® guide's* five main types of processes groups - as in Gasik [4]. In contrast with the manner into which the aforementioned guide portrays knowledge management in relation to the other project management processes, knowledge management, *via* knowledge deliverables (as part of the project aim) should be integrated into most of the tools and techniques of project management.

This kind of approach is going to be reflected in the managerial techniques for project management: besides the lessons learn repositories (as already recommended by PMI [25]), the work breakdown structure will exhibit working packages related to knowledge deliverables assigned to responsible organizational units. There will be an ongoing interaction between the lessons learned and other project documents such as the change log, the issue log and the risks register. It is rather evident that knowledge creation and the lessons learned affect all the managerial process, and making this explicit should not be regarded as a radical move, as it might look *prima facie*. Ayas [26] has had a similar proposal when stating that learning 'has to be managed together with the project and must be integrated into project management as standard practice' [p.132], but we move on further and integrate knowledge management into the fibre of project management. This is legitimized in a stakeholder's perspective (listing employees and managers alongside the project stakeholders) having specific requirements expressed as knowledge deliverables.

5. Micro-knowledge management in the context of the COVID-19 pandemic

The recent COVID-19 pandemic has unfortunately shown the increasing need for self-assessment and self-reflection tools used in knowledge management and human resources management, especially in contexts where one-on-one interaction is no longer possible, and most of the informal sharing of knowledge and lessons learned could not occur.

During the current COVID-19 situation, the organizational capabilities to confront extremely novel contexts are put to the test. In projects where remote teams were already in place, switching some of the review meetings to an online framework might not have a significant impact on knowledge transfer and personal informal sharing (since those were restricted by the nature of the project scope or spatial distribution of teams). However, in organizations where multi-projects teams were highly interactive, the debriefing methods used and the witnessing of learning-by-doing contexts are altogether lost and there is a salient need to replace them with IT-based tools mimicking social interactions. This replacement is already happening in virtual communities through knowledge-sharing mechanisms [27].

The impossibility, during the pandemic, of applying non-IT based tools requiring face-to-face meetings, would proportionally increase the importance of self-assessment and self-reflection tools. If some of the team members are personally affected by the pandemic, and they were heavily relying on personal biographical knowledge, replacing them temporarily might put the project goals in jeopardy.

Reacting to the current COVID-19 pandemic in a project setting requires decisions that would be reflected by the standard project documents - such as the issue log, the change registry and the risks log. If, following our proposal, some of the knowledge deliverables where based on tasks requiring face-to-face collective work of team members, the postponing (or cancelling) of these tasks would necessarily entail the relegation of the knowledge deliverables embedded in the corresponding working packages. If the knowledge deliverables are going to be achieved individually, the project manager will assign new knowledge duties and schedules to project team members affected by the pandemic.

6. Conclusions

The relevance of this paper is three folded: it offers an operational balance between the detachment of knowledge from the owners in codification, on one hand, and affirming the irreducible tacit and personal dimensions of learning-by-doing, on the other hand; it takes into account the learning-by-doing nature of project knowledge creation - by using adequate experiential learning theoretical support and tools; it makes explicit the multiple decisions related to micro-knowledge management.

As a step further, we pleaded for integrating knowledge management into current project management practice and standards through recognizing the knowledge deliverables of projects.

One of the limits of our approach is that it does not give enough weight to the management processes that follow capturing, ensuring that the knowledge codified is not only stored, but also regularly used and updated once put into practice.

A second limitation, asking for further research, is the lack of a pattern matching [28] of the framework for a number of case studies, a track which is to be undertaken by the authors in future research. In terms of testing the descriptive accuracy and practical usefulness of the framework, we foresee three types of applicative pursuits. Firstly, enhancing an IT tool that would reflect the stored micro-knowledge through a series of tutorials, emulating the content and context of learning-by-doing. Secondly, the framework can be formalized into an organizational procedure for harvesting project knowledge creation. Thirdly, an appraisal tool for project management practices might be conceived aiming at the assessment of micro-knowledge deliverables.

An opportunity for further research consists in developing a tool for project comparison when it comes to knowledge needs, showing the knowledge inventory (adequately mapped) relevant for similar projects (having similar stakeholders, deliverables etc.).

The COVID-19 pandemic, as an event pointing to a radical uncertain environment for multi-project teams, asks not only for choosing different instruments form the managerial toolkit (in the areas of knowledge, human resources and project management), but also for an enhanced role of self-reflection tools for harvesting knowledge gained in learning-by-doing settings. The pandemic also puts a great deal of pressure on managers to deal with staffing for positions depending highly on biographical tacit knowledge, the organizations confronting COVID-19 being now tested on their capacity to work in chaotic contexts [29].

Author contributions

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