Don't Value the Valueless: Toward a Model of Evaluation of Knowledge within E-Communities of Practice.

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Abstract. The work presented in this paper aims to elaborate a model of knowledge evaluation within ICT solutions-supported Communities of Practice (e-CoPs). It is placed in the context of Knowledge Management (KM) services that are developed in the PALETTE project dedicated to enhance learning dynamics within e-CoPs. Building upon a study of participation and reification processes within e-CoPs, we distinguish between e-CoPs potential and realized value of knowledge. We then propose a model of knowledge evaluation dedicated to e-CoPs outlining the conditions of knowledge value creation able to support the different dimensions of knowledge creation, diffusion and storing.

Keywords: Community of practice, ICT solutions, Knowledge Management, Knowledge Value, Knowledge Measures.

Since its genesis in the precursory works of [1] and [2], the CoPs concept has been quickly identified as a powerful social vector for individual and collective learning enhancement.

The evolution of this social phenomenon has faced during the last decade an exponential need of communication tools sustained by the ICT development. However, despite the rapidly increasing potential offered by new technologies, recent research points out the lack of adequate KM tools and services to efficiently support this "progressive virtualization" of CoPs [3].

From this perspective, one of the main objectives of the PALETTE project[1] is to design effective ICT-based KM solutions fostering knowledge creation, exchanges and storing within CoPs. Thus, such KM solutions require a knowledge evaluation service, in order to estimate the usefulness of a given knowledge (or piece of knowledge) for the individual and the community.

[1] The PALETTE project (Pedagogically sustained Adaptive Learning Trough the exploitation of Tacit and Explicit knowledge) aims to design information, knowledge management and mediation services in order to facilitate and enhance individual and organizational learning within CoPs. For more details, please consult http://palette.ercim.org.

However, not knowledge but "good" knowledge is to be chiefly valued. Hence, the aim of this task is to develop a comprehensive PALETTE model for evaluating knowledge within e-CoPs. So, given the complex and multifaceted character of the notions of knowledge and value (and even e-CoPs…), we think it is necessary in this context to define and fix our comprehension of the concepts and the context in which we propose to develop this model.

About CoPs, Knowledge and Learning

Knowledge is a protean concept (tacit/explicit; individual/collective…) that has become prominent during these last years in the organizational learning literature [4; 5]. The realization of knowledge as embedded and created from and through social relationships and interactions [4; 5; 6] has led some KM researchers to focus on the importance of communal resource [7] and the notion of evolving communities within an without organizational boundaries. Resulting from a social and situated perspective of learning and cognition, the concept of CoP has been certainly one of the most developed and used ones. As noticed in [8], a large body of literature has developed concerning CoPs since Lave and Wenger's original use of the term in 1991. In May 2006 their search for the term 'Communities of Practice' in the EBSCO Business Source Premier database provided 425 references to papers. This shows that since 2001 there are more than 40 publications per year concerning CoPs, indicating its increasing popularity in Knowledge Management's academic discourse.

The importance of these practice- and person-based networks has been acknowledged in a number of seminal works on: sensemaking [9], CoP [1; 2], storytelling [10], knowing in practice [11], and communities of knowing [12].

However, this social conception of situated learning and cognition has its own set of assumptions and focus [13; 14; 15]. From this perspective, we put forward some premises about the underlying conception of knowledge, knowing and knowers in the CoP concept:

- Individuals are social beings, and even if this fact appears as being trivial, it represents a central aspect of learning [13];
- We must distinguish *knowledge* from *knowing* [11]. The noun "knowledge" draws a static concept that implies knowledge as a *thing* that can be located and manipulated as an independent object or stock; it seems possible to "capture" knowledge, to distribute, measure and manage it. The gerund "knowing" suggests instead a *process*, the action of knowers inseparable from them and from their context. If it may be possible to promote, motivate, nurture or guide knowing, the idea of capturing, distributing or even measuring it seems difficult, if not senseless… [16];
- The activity of learning must produce meaning, *i.e.* the (changing) ability of individuals to experience the world and their engagement [13].

Furthermore, from a socio-constructivist point of view, to learn means to participate to a process of co-construction of meaning [14]. In a CoP, knowledge and its articulation are social and contextualized. Cognitive productions resulting from interactions between members of a CoP are not only attributed to individuals but also to the group itself [17].

Challenging Knowledge Value Measurement Issues

Even if during these last years knowledge has been widely recognized as a vital (if not the vital) source of competitive advantage and of production, both academic and practitioners seems to fail in developing acknowledged efficient methods for measuring knowledge. According to Siesfeld [18]: "*Measuring knowledge is still a whole new area of development. It is clear that the traditional input/output approach to determining whether and to what extent a firm's assets are working do not work with knowledge*". Moreover, KM experiences show that good knowledge measures integrate qualitative and quantitative elements: "*Milestones and metrics define what you are trying to accomplish and whether you are succeeding, but 'crude and fuzzy' measures capture knowledge value more effectively than inappropriately precise ones*" [16].

The nature of our issue of knowledge measurement leads us to adopt a socio-organizational view instead of an economy-level view. Hence, we focus our analysis on specific aspects of knowledge value. In the e-CoPs framework, we can associate "knowledge value" to the proxy concept of utility, as used in economics. Indeed, knowledge generates value when it is used to satisfy a need; it represents here inputs for CoPs member's actions [19]. So the aim is not to determine the exact "objective" value of specific knowledge, but rather a "subjective", i.e. community-related value of knowledge within the CoP. For instance, in knowledge-intensive organizations such as CoPs, great importance is attached to the perceived value of knowledge by the community members (value of knowledge for individuals) as well as stored knowledge, as a collective good, element of the socially shared cognition (value of knowledge for the CoP). We consider then knowledge getting into the community (which implies clear representations of CoPs boundaries) that flows within the community and its benefits for the CoP and / or its members. As a consequence, we will focus our attention on a model able to provide indicators that provide information about a perception of the "value-added" by the knowledge of the CoP and its members (perceived outcome for members), instead of ex post or ex ante value indicators of knowledge.

Proposition 0: Given our highly contextualized, specific nature of knowledge and value, traditional input/output models of value measurement are not relevant. Both qualitative and quantitative indicators must be used.

Commitment, participation and exchanges are important concepts intervening in a CoP. They occur in face-to-face meetings, but are also supported by ICT solutions. Nowadays people exchange a lot of information by mails or via forums, using a lot of different means to communicate, and consequently participating in the CoP's life.

Considering our objective of giving elements for measuring CoPs knowledge value supported by ICT tools, we will use the term "knowledge" as an umbrella term gathering explicit knowledge and information. For e-CoPs, inputs of knowledge are

pieces of explicit knowledge and information (able to circulate via ICT solutions), brought by CoPs members from CoPs environment *via* different exchange objects as tools, rules, methodological support, demonstrations, references and vignettes or cases [20]. Then, the CoP will act as a system, i.e. as a method for collecting and processing knowledge inputs idiosyncratic to each CoP, and as a consequence, giving different results for different CoPs.

Hence, we consider CoPs as self-organized, autonomous systems, with strong identities, creating their own values and references system as well as their own sensemaking. In other terms, CoPs are autopoietic systems.

Proposition 1: CoPs are autopoietic, self-referencing systems. CoPs members provide inputs of knowledge to the community. These inputs are required to perform a task, to answer a need and to effect a change in members' daily activities.

The primary focus of the CoPs conception is on learning as social participation [13]. Participation represents in Wenger's conception of CoPs a core element since it is through participation that communities' characteristics and practice are developed: "*Participation here does not just refer to local events of engagement in certain activities with certain people, but to a more encompassing process of being active participants in the practices of social communities and constructing identities in relation to these communities*" [13]. Therefore participation can be linked to the commitment to the group [13]. This commitment is seen as an affective and psychological aptitude, thus reflecting the active participation of the CoPs members. It includes the fact of being part of the group. CoPs members have to know the individual roles of the members to appreciate the effort of the others and to measure the quality and quantity of the work performed by the group and to feel that commitment is mutual. Commitment also includes cohesion and productivity [21].

Moreover, thanks to ICT tools, some people feel more encouraged to give their opinion. Indeed, these tools allow people to communicate and to express their opinions, in an anonymous way. People feel more free and less observed or tracked. Tools can inhibit fears of people of expressing oneself in public. For instance, within the PALETTE project framework, some ICT solutions, such as CoPe-it!, facilitates collaborative work and helps CoPs' members to share their knowledge by structuring and handling an argumentative discussion and also by leveraging an evaluation of various opinions [22].

Participation is an active process that conveys the possibility to mutual recognition and the ability to negotiate meanings, but does not necessarily entail equality or respect, or even collaboration [13]. If CoP's members have repeated exchanges about knowledge freely flowing within the community, we can consider that the most collective exchanges a piece of knowledge generates, the more potential value it has. If knowledge cannot be measured, its impact always can be**.** Indeed, knowledge lies here in the flows, and it is in these flows, i.e. in the mingling of community member's experiences and insights, that knowledge is created and applied [18].

Proposition 2: High levels of knowledge exchanges and interactions within the CoP strengthen the participation process and reveals knowledge with high potential value.

CoPs facilitate an environment of 'structured informality' supported by knowledge, knowers, and CoPs infrastructure. CoPs own a vast base of knowledge ranging from theoretical concepts to practical experiences; they are the engines of learning for its members. Socially, CoPs are the fabrics of knowing as members of CoPs acquire communal identity around a shared passion, relationships, roles and ways of intermingling common knowledge, practices and approaches [23]. From this perspective, and from a socio-constructivist point of view, if CoPs members have identified potentially useful knowledge during their interactions, they will integrate it, modify their "cognitive framework" and try to use it in their daily practice activities.

We can also note here some socio-psychological effects that affect the level and the number of interactions between CoP's members, such as, for instance, groupthink, which is a type of thought exhibited by group members who try to minimize conflict and reach consensus without critically testing, analyzing, and evaluating ideas [24]; as well as reputation effects about the knowledge provider, i.e. if this member is acknowledged as an expert, the knowledge provided will be estimated as high-potential value knowledge and as a consequence, will create a high level of exchange.

Within an e-CoP, it is easy to determine levels of interactions (number of mails exchanged around a subject, number of clicks on a link…); nevertheless, it is more complex to determine their interest. Indeed, people can interact around knowledge with low value, in order to demonstrate that this is not interesting or not proved. By contrast, high value knowledge that could be very interesting for CoP's members, can be overlooked due to the important number of information contained in such tools (lots of topics in forums, to many mails exchanged with not enough time to read them…). Anyway, thanks to these interactions, CoP's members may be able to anticipate the created value by the use of this knowledge, integrating and combining it [5] in order to mobilize it in a personal knowing process.

Proposition 3: The potential value of knowledge circulating within CoPs depends on both the quantitative and qualitative interaction levels and simultaneously on the members' ability to anticipate, integrate and deploy the created value. From this perspective, the potential value of knowledge may fluctuate, i.e. co-evolve with the Cop's interaction level.

After having appreciated the potential value of knowledge, it is now relevant to examine how this potential value can be realized. Knowledge is not separable from its context, especially within CoPs (which origins is rooted, let's not forget, to situated learning [1; 13]). Knowledge is here a lever for action, and its value is very context-dependant. In addition, CoP's members use CoP's knowledge in the framework of their practice. Therefore, this process of knowing is a human act.

From this perspective, using CoP's knowledge refers to the personal knowledge-creation abilities of the CoP's member (i.e. his abilities to detect, assimilate, combine and experiment this knowledge). As McDermott noticed: *"... professionals piece information together, reflect on their experience, generate insights, and use those insights to solve problems*" [25].

Proposition 4: The value of CoP's knowledge in practice relies on the "knowing" capabilities of CoP's members, i.e. their personal abilities to detect, assimilate and use knowledge in their daily practice.

But for all that, the (personal) use of knowledge circulating within CoPs would be valueless for the community if members do not share and exchange it. These outcomes of knowledge in motion have to be "crystallized" by CoPs members and re-injected in the community in order to be shared, evaluated and acknowledged by the whole CoP. This refers to the concept of "reification" defined by Wenger as: "*the process of giving form to our experience by producing objects that congeal this experience into 'thingness'*" [13]. According to this, applied knowledge generates value if e-CoPs members formalize their experiences, i.e. give a form to their own understanding of their practice by writing and exchanging e-mails and messages, or producing electronic documents and books.

Hence, e-CoP's members produce objects, shaped by their experiences. But, as Wenger emphasized: "*these objects… are only the tip of an iceberg, which indicates larger contexts of significance realized in human practices*" [13]. Once produced, these objects can be introduced to the e-CoP by different ways: either directly to some other e-CoPs members or put in the e-CoP electronic document memory, i.e. the e-CoP knowledge base. Nevertheless, these objects represent as many points of focus around which the negotiation of meaning becomes organized [13]. In most cases, less-formalized objects are directly submitted to other members, and then the negotiation of meaning process will be collective and often achieve the articulation of the object. But more formalized objects can be placed by e-CoP members directly in the e-CoP knowledge base. In this case, the collective negotiation process is rather focused about the pertinence of the existence of this document within the e-CoP's knowledge base instead of the collective achievement of its formalization. Once again, if this newly re-injected knowledge generates interesting interactions within the e-CoP, it will then generate value for the whole community itself. We propose to label it "realized value", i.e. value from knowledge experience feedback.

Proposition 5: The e-CoPs member's capabilities of reifying outcomes of knowledge in motion and of diffusing them within the community generate value for an e-CoP.

Anyway, the reification of "realized" knowledge leads e-CoPs members to use collective knowledge storing ICT solutions, such as a shared database, in order to make it available to other e-CoPs members. Afterwards, these objects of knowledge are submitted to the judgment of the other e-CoP members, which validate or not the considered object. Once validated, knowledge can be stored and being accessible to the e-CoP. In order to be an efficient ICT solution, the knowledge base must be organized and indexed so as to be convenient to usual requests as well as specific demands. In addition, the base must propose links between tasks and roles to pertinent documents or knowledge objects. This structured the presentation and storing of knowledge to e-CoPs members.

Moreover, the accumulation of the same knowledge yields no extra value [18]. Indeed, if there is value in reproducing knowledge, there is no value in acquiring the same knowledge again: "*More is not better, new is better*" [18]. When members adopt

a symmetric relation, minimizing their differences by simply adding new knowledge without trying to interact; then they will come to what Martin [26] calls "escalation of neutrality". Knowledge value may reside more in trying to discover relationships among distinctive ideas, via argumentation and negotiation of points of view, than in embracing sameness [16].

Proposition 6: The e-CoP knowledge base, as a knowledge repository, must structure and present knowledge efficiently, allow an easy access to e-CoPs members and avoid to propose accumulation of the same knowledge.

Once knowledge has been reified and proposed to the e-CoP, members exchange, share their experiences and debate about it. If knowledge is acknowledged as useful for the group, it is henceforth implemented in the e-CoP knowledge base. The process of negotiation of meaning will collectively evaluate, validate and attribute categories to the stored knowledge. This collective process will also update the e-CoP knowledge base.

However, utility is difficult to evaluate. Some documents, e.g. a basic process, may be very useful for a novice member and have less value for an expert. Moreover, for an e-CoP gathering of members from different organizations some knowledge may also be evaluated as very useful for one, and have less value for another. In this context, utility refers to the subjective value of knowledge. It depends on the potential use of the stored knowledge object [27]. From this perspective, great importance is dedicated to stored knowledge that generates high levels of interaction and experiences accumulation within the e-CoP.

Evaluating the utility could be done after having described the different groups of members composing the e-CoP: novice *versus* expert, intra-organization *versus* inter-organization, etc. Sometimes, e-CoP's identified sub-groups can evaluate the utility of an e-CoP's knowledge. As knowledge captured by a CoP is an element of the collective construction, linked to exactly defined social situations, it is normal that this knowledge and its utility evolve with the continuous collective interactions.

Furthermore, knowledge is a specific resource that has a specific life cycle and degree of obsolescence. Actually, knowledge can have a great value at a certain time, and can drop to zero if this stock of knowledge becomes obsolete. This means that, as the timing of obsolescence is highly uncertain, there are no schedules of depreciation. In this case, a maintenance service could be useful to sort knowledge contained in mails for instance, or to sort the old posts or documents contained in a forum.

Proposition 7: The e-CoP, through a collective process of negotiation of meaning, evaluates, validates and attributes categories to the stored knowledge. Hence, the knowledge base may be dynamic and updated in order to prevent the e-CoP from inertia.

Some people use ICT tools in their work, at home… They aren't aware of using these solutions in their daily activities, while others are. A risk exists for people without access to this kind of tool, because they could feel excluded.

An optimized use and knowledge about ICT tools allow members to be at ease and not limited within the exchanges and interactions taking place within the e-CoPs. As we talk about e-CoPs, we can consider that the appropriation of ICT tools will play an important role in the assimilation and the access to knowledge circulating within the e-CoPs [27]. Members can be discouraged to transmit information or knowledge, if they are not in the habit of using such a tool. However people react differently face to new practices, fortunately behaviors faced to ICT tools change. Thus, whatever the technical problems and the complexity of use of the technology, the appropriation of a tool is facilitated by personal investment, the goal to reach and the utility perceived by the user [28].

ICT tools are becoming more and more sophisticated and are aiming to be as less intrusive as possible, but continuous efforts are made to improve their ergonomics.

Proposition 8: Good working knowledge and appropriation of the ICT solutions by e-CoPs members could be considered as levers for the circulation of knowledge within e-CoPs, and therefore for leveraging its value.

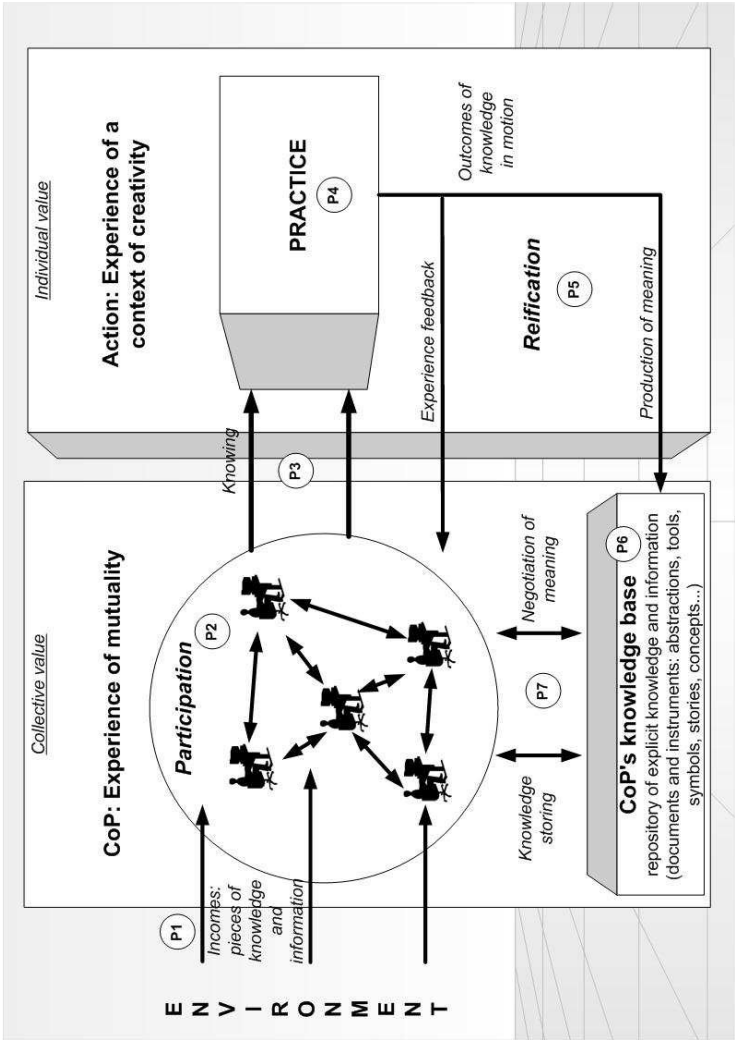

Fig. 1. The Knowledge Evaluation Model

The above Figure 1 synthesizes our theoretical construction through a model of knowledge evaluation within e-CoPs. This model reveals insights about knowledge evaluation within e-CoPs through the analysis of the participation / reification dialectic. The comprehension of the participation / reification duality appears as the key to analyzing knowledge value creation within CoPs. Moreover, participation and reification are self-feeding processes. Indeed, participation implies interactions, identifiable commitment in CoPs activities that leverage actions in CoPs' members practice. Then, reification gives form to theses actions, and generates interactions within CoPs through mainly the negotiation of meaning processes. Hence, reification strengthens commitment and participation within CoPs, with the negotiation of meaning as catalyst.

As the dual system participation / reification is relatively less explored in the literature, our research about reliable measures of knowledge value within e-CoPs must then identify and analyze knowledge value creation vectors within this system. If the previous model allows this identification, its analysis should reveal pertinent knowledge measurement indicators.

Dealing with measures…

In management sciences, talking about measurement leads irremediably to consider performance measurement. If we have seen that developing an effective system for measuring and managing knowledge performance will require new ways of thinking, we cannot nevertheless ignore general properties of all measures. Meyer and Gupta [29] think that effective management requires multiple, uncorrelated and changing measures of performance. Applied to the e-CoPs, this means that simple and static measures loose information contents over time – the knowledge useful today will not be so tomorrow, and unless the e-CoPs change the measure, the value of knowledge is likely to decay. We note five general properties:

- **Reliability**: a reliable measure is one which returns the same value for the same performance, regardless the time of measurement, the form or nature of the observation (or observer), and the conditions under which these observations are made;

- **Validity:** a valid measure measures what the measurer intends it to measure. For a measure to be valid, we need to be clear on what the objective of the measure is and what the assumptions about the relationship between the phenomenon and the measure are.

- **Comparability**: a single measure conveys little information in and on itself. The information comes when the single measure is compared to some other standard, like a base line. Providing information for comparison (if necessary) allows knowing whether a measured value is good or bad.

- **Variability**: a lack of variation among measurements makes it impossible to tell whether something is good or bad.

- **Time**: performance measures tend to run down over time. Indeed, through learning (homogenization of human behavior and performance to maximize the measure), perverse learning (opportunistic appropriation of the measure in order to maximize it, but with diminishing performance) and selection (if over time individuals who perform well are retained and others are not, then the measure will no longer convey any new information as the pool grows in homogeneity).

Of course, measures should not be frozen. When a measure does run down, it has to be replaced by another; as well as the more the phenomena we study are complex, the more measures we need.

Within the framework of the PALETTE project and its multiplicity of ICT solutions for e-CoPs (please consult http://palette.ercim.org/content/view/13/30/[2]) it will be necessary to designate an e-CoP's member (with a profile of e-CoP's animator) in charge of the deployment of the evaluation service. This service must be adjustable and flexible considering the different e-CoPs objectives and the different ICT solutions used. The e-CoP's animator should decide on a series of e-CoP's KM objectives that will be declined in criteria able to define elements that contribute to reach these objectives. Then these criteria will be declined in parameters, i.e. quantitative and qualitative factors. Finally, these parameters will be combined in order to bring out indicators.

Once again we would like to insist on the fact that there is no consensus on what the right knowledge measurement is, and this is the reason why we propose to use the previous model about CoPs knowledge performance, according to the issues we have pointed out and to our own specific aims, in order to define appropriate indicators.

Implications for future research

Our model provides a starting point for future research on how to measure knowledge within e-CoPs. Through this articulation of theoretical propositions we have highlighted key processes of knowledge value creation within e-CoPs, i.e. participation as enhancing e-CoP's potential knowledge value and reification as enhancing e-CoP's realized knowledge value.

[2] PALETTE's ICT solutions gather mediation services (such as Cope-it! and e-Logbook…), KM services (such as SweetWiki, Generis and Bayfac…) and information services (such as Limsee3, Amaya and DocReuse…). Altogether a dozen of ICT Solutions dedicated for e-CoPs are developed in the framework of this project.

The next step to this work is the construction of a knowledge evaluation service dedicated to e-CoPs. Indeed, we advance in this paper testable theoretical propositions that enable the elaboration of key indicators. These indicators will then allow allotting a dynamic, quantitative and qualitative value to knowledge.

This service will allow to attribute a value of a knowledge circulating within an e-CoP, according to the context presented above. This value could be integrated in other services provided via PALETTE, for instance to help the maintenance (help in sorting archived mails for example), or to support classification or ranking in a research objective.

The criteria taken into account will be based on and related to the meta-models developed in the project, in order to reinforce and make them evolve. The inputs needed for the calculation of the value could be obtained via the other services proposed in PALETTE. This could be the meta-data or annotations of documents, based on PALETTE models.

The evaluation of these criteria will be based on declarative methods (feedbacks given by the users) and by automated calculations.

Acknowledgements

Research carried out in the context of this paper has been funded by the EU PALETTE (Pedagogically Sustained Adaptive Learning through the Exploitation of Tacit and Explicit Knowledge) Integrated Project within the 6th Framework Program (IST-2004-2.4.10).

The authors also want to thank two anonymous reviewers for their relevant comments, the whole PALETTE researchers and e-CoPs members, and last but not least Denise Lehste for her appreciated support.

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