

# LEARNING SCENARIOS AND SERVICES FOR AN SME

## *Collaboration between an SME and a Research Team*

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**Keywords:** Learning organization, SME, Learning scenarios, Learning services, Collaborative learning.

**Abstract:** This paper proposes learning scenarios and learning services to support collaboration between Small or Medium Enterprises (SMEs) and research teams. Successful SMEs take special care about constant improvement of their business processes. To do this, they act as learning organizations – they acquire new knowledge, facilitate the learning of all their employees, learn collectively, and use various approaches and tools to support learning processes within an organization. However, competition on the market and deadline pressures often reduce the time the employees can use to learn in their organizations. To this end, collaboration with research teams can provide useful guidance to learning SMEs. The paper discusses such collaboration between a specific SME and a specific research team, but the scenarios proposed can be easily generalized to other cases of collaboration between SMEs and research teams.

## 1 INTRODUCTION

Intelligent Learning Extended Organization (IntelLEO) denotes a learning community emerging as a temporal integration of two or more different business and educational communities and organizational cultures (Stokić et al., 2008). The integration happens on the grounds of common interests of the organizations/institutions involved, in terms of knowledge transfer and harmonization of interests/objectives of the organizations/institutions and their members. For example, there may be one or two companies from industry, a university, and a training institution. They may want to collaborate and share business and educational efforts through performing various vertical and horizontal learning and knowledge-building (LKB) activities. Vertical LKB activities are performed within the organizations involved, whereas horizontal LKB activities can be performed within and between the organizations (Tuomi-Gröhn and Engeström, 2003).

The effectiveness of using the IntelLEO concept in practice is currently under study within an ongoing international research project (<http://www.intelleo.eu/>), being conducted within

the 7th Framework Programme (FP7) of the European Commission (European Commission, 2006). The project has officially started in February 2009.

Three application cases are designed to conduct the study, one of them being an IntelLEO involving an SME and a university research team.

The paper focuses on this specific IntelLEO and discusses its objectives, learning scenarios, LKB activities, harmonization between individual and organizational learning goals, and design issues related to learning services envisioned to support the learning scenarios and activities.

## 2 CASE DESCRIPTION

In this specific IntelLEO, the partner from industry is INI (<http://www.ini-int.com/home.aspx>), i.e. its branch from Belgrade, Serbia. INI is a successful SME doing its business in the area of e-Engineering and e-Manufacturing. INI's major product group is Key to Metals, the metal properties database and applications, fully operational on Web (<http://www.keytometals.com/>). The company has

clients around the world. In addition, its sites offer a knowledge base of 500+ related articles. INI's employees and experts include metallurgists and software developers.

The research partner is the GOOD OLD AI Lab (<http://goodoldai.org>) from the University of Belgrade, Serbia (GOOD OLD AI, for short). The lab members focus on research related to intelligent systems, semantic technologies, user modelling, Web engineering, software engineering, and technology-enhanced learning (TEL).

INI and GOOD OLD AI have already collaborated on other projects in the past. Figure 1 illustrates INI's typical communication with GOOD OLD AI and other parties (external communication), as well as internal communication between INI's employees. Here 'communication' denotes both business-related and LKB-related communication.

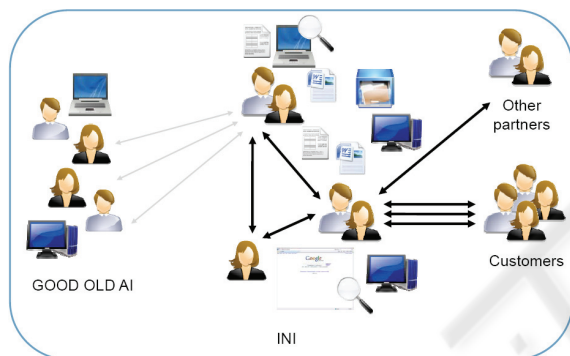


Figure 1: INI's collaboration with its customers, GOOD OLD AI, and other partners.

It is obvious from Figure 1 that all of INI's external communication goes only through *some* of the employees. It creates communication bottlenecks. Note that most of this communication is currently reduced to email and phone calls. Also, it increases the intensity of internal communication between INI's employees. Still, it further reduces the time needed for organizational learning.

LKB activities in INI are currently performed through:

- attending relevant seminars and conferences;
- in-house courses and knowledge building;
- collecting technical articles and publishing on the Key to Metals sites;
- communicating with academic institutions;
- exchanging ideas with users and partners;
- implementing innovative tools and methods.

Recently conducted interviews with INI employees revealed their common feeling that:

- formal external communication and exchange of information in terms of LKB are more effective than informal, ad-hoc internal communication;
- a centralized technical environment (a set of advanced software tools) for communication and exchange of information would produce better and more efficient LKB results;
- subscription to information feed coming from relevant Web sites is welcome (in addition to already existing subscription to electronic resources relevant for INI's work process);
- increase of awareness of available relevant information on the Internet other than the one the metallurgists from INI are already aware of, as well as of awareness of new trends in the area, is considered highly beneficial in terms of improving the work efficiency;
- knowledge building should be more formal and more structured, e.g. adapted seminars and training courses focused on specific topics (but not standard and expensive seminars);
- the ratio between guided learning and ad-hoc learning should change in favour of guided learning.

As a result, INI and GOOD OLD AI have decided to team up in an IntelLEO and implement an IntelLEO *platform* – a centralized technical environment encompassing a number of LKB services to support the above objectives, Figure 2. Examples of such services include learning resource provision/discovery, human resource discovery, learning group composition, collaboration tracing, and the like.

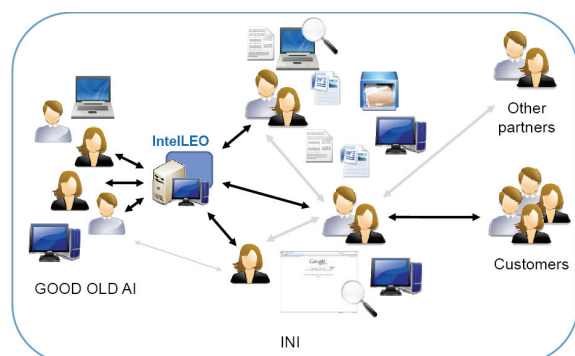


Figure 2: INI's collaboration with GOOD OLD AI through the IntelLEO platform.

In addition, the platform should also encompass some services to support harmonization of individual and organizational learning goals. Examples include learning path planning and generation, organization policy handling (e.g.,

displaying organizational rules when necessary), selecting and filtering learning content/context according to the organization policy, and the like.

The IntelLEO platform is supposed to reduce the communication bottlenecks featuring current business processes at INI (compare the directions and the intensity of communication in Figs. 1 and 2).

Note that both LKB services and harmonization services in this IntelLEO target not only INI employees, but also GOOD OLD AI members. The idea is that collaboration between INI and GOOD OLD AI in this IntelLEO is a two-way LKB process:

- INI obtains guidance from GOOD OLD AI in finding more easily content, tools, technologies and human resources relevant for the company's business (metrics, evaluations, best practices, and the like);
- GOOD OLD AI gets access to real-world business cases and situations where they can apply their research results and ICT tools and validate them in an industrial setting.

### 3 LEARNING SCENARIOS

In this specific IntelLEO, several learning scenarios are envisioned and the IntelLEO platform is designed to support them. Two such scenarios are described here.

Each learning scenario, in turn, is further analyzed by one or two more specific *usage* scenarios, and each usage scenario is illustrated by a UML use-case diagram (Fowler & Scott, 1999). In these diagrams, use cases roughly correspond to simple *learning services* that the entire IntelLEO concept is structured about. Hence usage scenarios actually represent specific and more complex *application services*, composed by orchestrating more atomic learning services. Application services are specific to this IntelLEO. However, many of their parts – the constituting learning services – are rather general and can be used as components of application services and learning scenarios in other SMEs that might want to collaborate with external research teams.

#### 3.1 IntelLEO Pedagogical Baseline

The pedagogical baseline of all learning scenarios presented here and of the IntelLEO concept as a whole is based on the *knowledge conversion modes* (Nonaka & Takeuchi, 1995), a handy framework for characterizing LKB processes in a learning

organization pedagogically. In this framework, one can speak of:

- *socialization of tacit knowledge* (knowledge accumulation by individuals in an apprenticeship manner);
- *externalization of tacit knowledge into explicit* (when individuals articulate tacit concepts or create new concepts);
- *combination of explicit knowledge* (primarily group-based learning activities);
- *internalization of explicit knowledge* (personal learning from activities the individuals have participated at).

#### 3.2 Scenario 1 – Supporting Guided Learning

At INI, in-house seminars on specific topics are organized for employees time after time. The IntelLEO platform can be used to support guided learning in this context. Occasionally, selected employees are sent to seminars organized outside the company. This kind of learning is welcome by INI employees, which is a good example of harmonization of the learners' individual interests with organization's needs.

In-house seminars at INI are given either by an expert from INI (i.e., a metallurgist giving a talk to selected other employees on a topic of interest for the learners' job responsibilities), or by an external presenter (socialization of tacit knowledge). The external presenter may be from any area the INI management decides is of interest for the employees and for the company (from various areas of technology to language learning).

The IntelLEO platform can be used to support this kind of learning in several ways. For example, when a seminar is organized, IntelLEO Wikis can be used to upload the learning resources and structure and workout assignments and practices (learning path creation/documentation), Figure 3. The assignments and practices can be conducted individually (personal learning management) or in groups (which requires support for team composition and collaboration, and can also benefit from enabling social networking activities through the IntelLEO platform). To do assignments and practices, the learners may want to use various tools, which makes a case for ePortfolio management.

The role of the GOOD OLD AI Lab in this learning scenario is to recommend and possibly provide tools to support learning activities through the IntelLEO platform, relevant ontologies and annotations, and support for seminar planning. For example, working collaboratively with INI

employees through the IntelLEO platform in other learning scenarios, researchers from the GOOD OLD AI Lab will learn enough about INI business needs and interests to provide relevant information feed through the platform. For instance, the researchers may recommend INI employees to attend a seminar on a topic of interest given by a distinguished researcher or practitioner at the University of Belgrade. Typically, there is a lot of posts on such events that researchers are aware of, and employees in industry are not. To some of the INI employees, this may easily turn into a human resource discovery case.

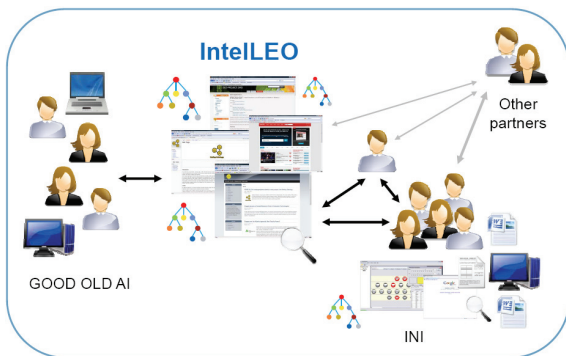


Figure 3: Supporting guided learning.

Examples of application services (usage scenarios) envisioned in this learning scenario include (but are not limited to):

- planning a seminar
- handling assignments
- specifying learning policies
- collecting and analyzing learners' feedback
- ...

The following subsections illustrate some of them in more details.

### 3.2.1 Application Service 1 – Planning a Seminar

When planning a seminar through the IntelLEO platform, the INI employee in charge (INI) can create a list of topics to be presented at the seminar (*Create topic list*), Figure 4. On the long run, such a topic list can be also a "wish list" of topics that INI employees may want to attend seminars about. A *Researcher* from the GOOD OLD AI Lab who knows enough about INI business needs and interests can post suggestion to include another topic in the list (the *Post topic* use case / learning service), or information she/he is aware of and related to an event of interest for INI employees to attend (a

conference, another seminar, a lecture, and the like) (*Post event*). Both *INI* and the *Researcher* can browse the posts and the list of topics (*View topic list*, *View post*). *INI* may decide to *Update topic list* with a topic from a post, and/or contact the seminar instructor about it (*Contact instructor*).

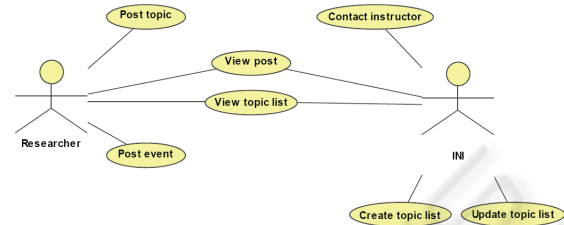


Figure 4: Usage scenario: *Planning a seminar*.

### 3.2.2 Application Service 2 – Collecting and Analyzing Learners' Feedback

After a seminar is over, the INI employees who attended it (*INI*) may be asked to provide some feedback about it through the IntelLEO platform (*Post feedback*), Figure 5. After a substantial feedback is collected that way, both *INI* and interested researchers from the GOOD OLD AI Lab (*Researcher*) can analyze the feedback collected in order to learn more about the attendees' evaluation of and feelings about the seminar they attended (*Analyze feedback*). Specifically, they may want to obtain and analyze statistics about the topics covered, the learning resources used, and the seminar instructor(s) (*View topic statistics*, *View resource statistics*, *View presenter statistics*). These can be useful indicators of the employees' individual motivation and learning needs and objectives, as well as indicators of the topics and instructors for other in-house seminars to possibly run in the future.

Note that in this application/usage scenario the *Researcher* is also a very active learner, since the feedback analysis can provide a number of useful indicators about the real-world acceptance of certain topic and resources.

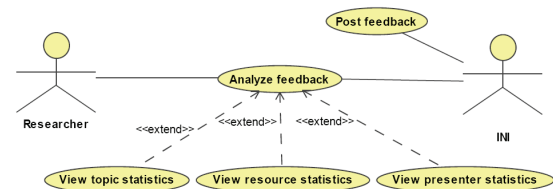


Figure 5: Usage scenario: *Collecting and analyzing learners' feedback*.



### 3.3 Scenario 2 – Specifying Customer Profiles

It is one of INI's most important business interests to characterize their customers precisely, in order to attract more site visitors and registered users to become subscribers. On the other hand, user modelling is a topic of high interest to GOOD OLD AI researchers. They can collaborate with INI to devise and apply suitable user modelling approaches to characterize INI's customers.

All registered users of INI's products have filled the registration form. This is how their basic profile is extracted. However, not all registered users are subscribers to INI's products. Attracting a registered user to become a subscriber (if this user is not a subscriber already) implies:

- studying business interests, behavior, and typical interactions with INI products of both subscribers and other registered users;
- discovering differences between the two groups of users;
- undertaking appropriate business decisions (such as marketing campaigns) related to registered users who did not subscribe to INI products yet.

Currently, an INI employee can extract very few relevant facts about INI customers from their basic profiles and log files that track the customers' interactions with INI products. Standard tools used for tracking visits to INI's Web-based products, such as Google Analytics ([www.google.com/analytics/](http://www.google.com/analytics/)), generate statistics about the site usage and can be relevant for site re-design. INI also uses a proprietary log file analysis tool, but it can discover only statistics about specific page visits and what data the visitors have searched for.

The IntelLEO platform enables INI employees to learn more about user modelling, user profiling tools, and how to apply them to their products. For example, an INI employee in charge of taking care of customers' profiles can consult the IntelLEO as a "hub" for learning about user modelling (available Web-based literature, tools, reviews, events, and the like), Figure 6. Continuous contacts with the GOOD OLD AI researchers will enable socialization of her tacit knowledge. Likewise, using the experience she acquires this way in her efforts to characterize INI customers better, she will externalize her tacit knowledge into explicit. It is up to the GOOD OLD AI researchers to take care of a continuous relevant information feed to the "hub" and structuring of this information, thus providing a kind of guided learning support. These researchers are especially interested in trying out the user modelling tools they

have developed (or other tools they are familiar with) at INI (harmonization with organization's needs). Note that through the use of the IntelLEO platform they can try out such tools in two ways:

- to profile (model) INI's customers, working collaboratively with selected INI employees (this may include selection of suitable profiling tools, extraction of customer profiles, more precise definition of stereotypical customers, and the like);
- to model the INI employees involved as the learners (of user modelling) in this BC instance.

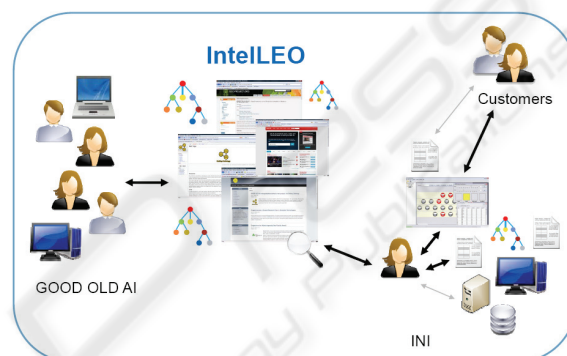


Figure 6: Specifying customer profiles.

Examples of application services (usage scenarios) envisioned in this learning scenario include (but are not limited to):

- selecting profiling tools
- learning to use a profiling tool
- extracting profiles
- defining stereotypical customers
- ...

The following subsections illustrate some of them in more details.

#### 3.3.1 Application Service 1 – Learning to Use a Profiling Tool

In this usage scenario, an employee from INI is supposed to learn how to use a profiling tool suggested by GOOD OLD AI Lab researchers, Figure 7. Typically, such a tool will enable INI to create a stereotype of a customer profile (*Create stereotype profile*) that characterizes a new customer. Such a tool may also support using data mining and Web mining techniques to extract more interesting, dynamic details about visitors of INI Web sites (INI customers). A *Researcher* from the GOOD OLD AI Lab and INI can collaboratively use such tools to *Extract customer profile*, i.e. to infer

about the customer's needs and intentions from her/his interactions with INI Web site and products. This requires a lot of collaborative effort; it is necessary to *View customer profile* often and for different customers, in order to *Extract customer profile* in a meaningful way. To characterize a customer better, *Researcher* and *INI* may need to learn more about the category (group) of a customer (a special case of *View group*) and about the subset of INI tools and products the customer typically interacts with (a special case of *View portfolio*). Note that these two characteristics are of dynamic nature and should be updated regularly.

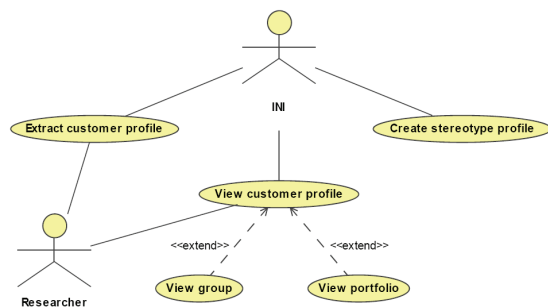


Figure 7: Usage scenario: *Learning to use a profiling tool*.

## 4 CONCLUSIONS

The specific application services presented in this paper are based on use cases that can be easily interpreted as not-so-specific learning services. When we rewrite these learning services in sequences, it is easy to notice that they can be easily applied to other learning scenarios and other learning application cases as well:

- *Create topic list, View topic list, Post topic, Post event, View post, Update topic list, Contact instructor;*
- *Post feedback, Analyze feedback, View topic statistics, View resource statistics, View presenter statistics;*
- *Create stereotype profile, Extract customer profile, View customer profile, View group, View portfolio.*

Moreover, even a quick overview of these learning services suggest means of implementing some of them (e.g., using Social Web, user modelling, and Web portal technologies).

## ACKNOWLEDGEMENTS

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This publication was completed with the support of the European Commission under the 7th Framework Programme. The contents of this publication do not necessarily reflect the Commission's own position.

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