TACIT KNOWLEDGE, LEARNING EXPERIENCES, SCAFFOLDINGS AND WIRELESS CONNECTIONS: HOW WORK CONTEXTS CAN INFLUENCE WORKERS' INFORMAL LEARNING AND SUITABLE TECHNOLOGIES CAN ENHANCE LEARNING ORGANISATIONS

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Abstract: The paper describes a project that aimed to develop a knowledge management system, which also became *a continuous learning experience* supporting workers and organisation growth over time.

The project was developed within the Leonardo da Vinci Programme 1 and addressed a very particular business context: work safety and occupational health within "shipyards".

The project was based on the fact that the best available organisational resource in this context is good practices of old and experienced workers and their way of carrying their tasks safely and healthy. In other words, old and experienced workers have a lot of valuable tacit knowledge, e.g., how to avoid casualties in a work place and/or how to manage daily work activities safely. The problem is that a vast amount of qualified workers in the field retire every year. Accordingly, there is a danger that tacit knowledge and good working practices disappear as well.

Both the subject, i.e. *making knowledge explicit and usable*, and the specific sector considered, i.e. *a large building yard*, enlightened how technologies (Information and Communication Technologies – ICT) become essential to support informal learning at the workplace, collaborative learning, and organisational learning, especially within complex and unstable contexts.

By collecting and adopting those good practices to on-the-job-training modules it was possible to considerably decrease work-related casualties and to improve work conditions and occupational health. Good working practices could be fixed, stored and later used in training, through the help of modern information technology.

Finally, the need for the development of safer work practices and occupational health has been acknowledged by employee organisations (trade unions at the local level) and their European counterparts.

Keywords: tacit knowledge, organisational learning environments, informal learning, mobile e-learning platforms

Objective

The aim of the project was to develop a method and a software tool in order to capitalize senior workers' knowledge 2 on safety in the workplace and to transfer it to juniors by means of non formal-informal and formal learning.

Motivation of workers, as well as their active participation to learning, were the two most important issues to be addressed.

Methodology

First of all, the project studied ways of *identifying, classifying,* and *formalizing* senior workers' knowledge and then making it really transparent and reachable.

The first issue was how to identify workers' knowledge experiences on safety in the workplace, because workers were not aware of their know-how. Hence, the first challenge was to make tacit knowledge explicit 4. The main methods used at this stage were:

- Video-clips and photos about work processes to be analysed together with workers in order to identify the risk level of their daily work, and ways of improving as well;
- Individual interviews with "wise" workers about *how* they learnt their job.

Different sets of questions about both "background" knowledge and daily work experiences were prepared, as well as specific grids to fix and formalize data to be stored into a well structured knowledge databank.

However, whereas those methods could be used to set the acquisition process of awareness and to update knowledge in the medium-long term, nonetheless, "live" discussion and meetings could not become a custom to fix experiences continuously and to learn on the job. In fact, the concept of "workplace" in shipyards environments is a little special, as it may refer to twenty-thirty metres high scaffoldings. The lay-out of building yards includes many stairs, gangways, long ways, and there are deafening, ear-splitting noises all over. It is really little friendly for *team work, learn shops, live communication, interviews, counselling*, etc., and for easy use of standard tools, such as paper or even traditional PCs. Consequently, the second issue was to identify what methods and devices could be ordinarily used to make know-how explicit and to create and maintain the required knowledge management system.

In these cases, small ICT-devices and wireless are the most suitable means for really fostering informal learning processes at the workplace and can become *key applications* for "e-learning organisations".

Technologies did play a very crucial role in this context because they could help workers fix their views and actions in very quick and simple ways during the job. For example, they allowed workers to record small notes, take photos or short movies by their Personal Digital Assistants, even on a thirty metres high scaffolding. Similarly, workers could also quickly consult online databanks, and connect to professional communities and experts for help, without being disturbed by sounds during their communication; their platforms allowed to save suggestions and solutions, store and maintain them for further consultations.

The project relied on a simple hardware infrastructure: a central server, wi-fi access points located all over the shipyards to implement a LAN, and handheld Personal Digital Assistants given to each workers. A special software was developed to support and manage the learning project. In particular, the PDAs used an ad-hoc interface, specifically developed for use within a shipyard. Workers in a shipyard usually wear gloves, and very often they have only one hand free, as they need to carry a tool or to hold to a rail. Consequently, the interface had very large buttons, which could be tapped with a finger, even with the thumb, and did not need the use of a stylus. Menus were very simple and navigation made easy by defining several binary questions for the user instead than more complicated commands (e.g, "Do you want to change this menu? Yes/ No", "Which level do you want to go? Upper/ Lower"). How to guide workers searching and storing information, and how to design and build databanks, define search criteria, build search engines, provide check lists and questionnaires, was crucial. Correct use and application of new web languages was critical as were the different levels of interaction, i.e. how workers could interact with their tools, how far they could actively upload and download information and connect altogether. In addition to that, the application used high contrast colours to improve the vision in sunny environment, as a shipyard may be, even in Finland.

Initially, the system included bluetooth video cameras as well to be mounted on the helmets of workers. These camera were to be connected to the PDAs and should register most of the actions performed during the work. The idea was to assemble all these videos at then end of each day on the server and to use them as base of discussion in learning workshops and similar initiatives. However, video cameras were not included in the implemented systems because they were regarded as too intrusive and because of privacy regulations. The actual system allowed the workers to take pictures directly by means of the handhelds, but this process was performed in specific instants and driven by the will of the worker, instead of being continuous and uncontrolled by the worker.

However, behind suitable technologies and *learning resources* made available, *organisational* and *individual cultures* have to be managed as well and encouraged towards *common aims*; workers *involvement and participation* in building these technology-based learning environments are also crucial in order to achieve. In fact, a phase of the project was devoted to "sharing" with workers *models, concepts, ways of working* and *of exploiting technologies for learning and for exchanging experiences* .

Main outputs

The project developed a knowledge and learning management system that was implemented in one of the shipyards involved and populated by workers during the job.

At that time, software technologies were not based on ontology-based development, which could actually have been a real key success factor for further improvements. These improvements could also involve other business sectors whose complexity and instability require advanced ICT to support informal learning processes inside.

Conclusions and future works

From a broader point of view, *informal learning* and *learning organisations* can require e-books, databanks, websites, but also community blogs, chats and even games; they can also require simple hardware tools such as fixed PC or sophisticated mobile multimedia devices. It will depend on specific *learning objectives* and on specific *work contexts* and also on *how workers can learn according to the reference objectives and contexts*. In a word, technological choices should depend on *individuals' learning processes* 3 that do depend on the *environments where they work* . Hence, existing technologies should be mapped and then linked to the main learning process categories, e-learning methods and learning targets (learners, environments-settings, objectives-outcomes), to provide guidelines for creating learning organizations without forgetting that workers are the main actors, that they play a crucial role and that culture, attitudes and motivations do determine success 5.

This project highlighted how some contexts would benefit from specific hardware: hardware should be thought and developed ad-hoc around the user, and not the contrary. Although the project was successful, thanks to the methodology adopted and to the deep involvement of workers, technology actually was a problem. Workers had to use last-generation PDAs, with high resolution colour screens and advanced tapping interfaces. These devices are perfect in the pocket of a business man in his office, but not on the gangway of a sunny shipyard, while wearing gloves and carrying a drill in the other hand. A stouter device, with a black and white high contrast screen and with ten large dust and water proof traditional buttons instead of a sophisticated touch screen would have probably proved much better than a PDA. Of course, designing and developing hardware is very expensive, especially if the target user group is small and scale economies are not possible. However, a specific highly usable software interface was affordable and could be developed, and this was one of the key enablers for the success of the project.

To sum up, two were the critical success factors for the project: i) the highly usable interface, and ii) the deep involvement of workers from the very beginning of the project. Both factors required a deep understanding of work context and of relevant workers' learning processes.

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