

# Using Wearable Computing for Knowledge Management

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**Abstract:** Wearable computers aim to support and improve KM abilities for the worker and the organization. However it is also expected that the wearable computers will present them with many challenges along the way. The following paper presents both the advantages and the challenges found in the research of four industrial pilots for which wearable computers are being developed.

**Keywords:** Wearable computing, knowledge management, application.

## 1. Knowledge Management at Work: “If we only knew what we know” [1]

In the 21<sup>st</sup> century, knowledge is a key resource that may differentiate a successfully growing organization from a failing company that does not keep up with reality's challenges. As technology rapidly evolves and progresses, relevant on-time knowledge and information becomes an essential component for building sustained organizational capability. Knowledge management (KM) is the name of a concept in which an organization consciously and comprehensively creates, gathers, organizes, shares, analyzes and re-uses its knowledge in terms of resources, documents, and people skills [2]. In practice, KM means identifying what you know and where it is, and then capturing, storing and sharing the knowledge and experiences of individual workers and groups within an organization so as to make it available to others in the organization and to create new knowledge and put it into action. The mission of KM is to support the organization and its people by enabling maximum accessibility to knowledge in order to better achieve their organizational goals [3]. As a concept, KM combines three aspects, which operate together and affect one another in order to achieve its objectives:

- Culture: creating an organizational climate that encourages, supports and rewards knowledge capturing and sharing.
- Processes: KM activities introduced into work processes.
- Technology: using IT to support knowledge sharing.

## 2. Wearable Computers for Knowledge Management

Wearable computers bring a new level of digitization into workplaces. Unlike a laptop or a PDA, a wearable computer follows workers around and merges into the working processes and the human interactions [4].

As such, wearable computers support and improve KM abilities for the workers and the organization. By enabling online access to written information, maps, diagrams, photos, and allowing consultation with experts and peers through audio, video and text, the wearable computer can provide workers with access to knowledge every where and in any situation. This, in turn, will affect all three aspects of KM as mentioned above. Wearable KM can enable

more effective and efficient work processes, which will lead to more autonomy and more collaboration for workers. Creating easier cultural change and processes and at the same time creating challenges to be faced.

## 2.1 Wearable-KM the four industrial pilots

Under the framework of the WearIT@work project, we examine the use of wearable computers in four different industrial contexts - among doctors and nurses (the clinical pathway), among production workers, among maintenance workers in aviation, and in emergency services, among fire fighters. Though we are in the midst of the research and development of the project, the results collected thus far from the four pilots are presented here, from a KM perspective.

**The Clinical Pathway.** Among the medical staff of the hospital, wearable computers should allow better functioning by enabling online access (on ward-round) to all patient information for more accurate and faster treatment. It shall decrease unnecessary paper and administrative work for nurses and doctors allowing them to focus on medical issues and better personal caretaking of patients, an issue that has been found to be of greater importance in a patients' recovery [5]. Enabling remote collaboration between doctor, nurse and other staff members, through wearable computers, should bring to faster, more efficient knowledge sharing and hence faster, more accurate, on-line higher standard performance.

**Production.** The main contribution of wearable computers in this industrial domain will be by allowing new forms of complex task training which include: learning, task tracking and on-line quality control through supervisor's support using audio and video.

**Maintenance.** Among maintenance workers, wearable computers are foreseen to be able to improve KM by several means. These included the ability to access more information as needed, creating more autonomous problem solving, enhancing workers capabilities, expertise and satisfaction. Moreover, better communication shall produce on-line and easily available expert or team member consultation; and enable remote reporting and validation resulting in shorter job process. The wearable computer aims at the generation of more accurate documentation of experiences by allowing the maintenance worker to store notes, ideas and lesson learned while on job and in an easy and accessible manner.

**Emergency Response.** Among fire fighters, wearable computers are anticipated to support interventions through remote assistance with local and central command, enabling asynchronous communication, consulting hazmat information, and through bio-sensing. These shall formulate faster, more efficient, more effective and life saving interventions. Moreover, pre- and post-intervention support will be more easily constructed and monitored in training, debriefing and expertise sharing.

## 3. Wearable-KM Challenges on the Way

Though it is foreseen that wearable computers will bring a great advantage to KM in the different workplaces, according to our fieldwork hitherto, it is also expected to present us with many challenges along the way, both in the development process and in the implementation of the device. The following are some of the findings found in the research conducted up to now. These give an apparent direction regarding the future steps that should

be examined and take into consideration in the development and implementation of the system.

### **3.1 Cultural Challenges**

The worker shall become more autonomous by using a wearable computer and having in the palm of his hands all the information he needs. Nonetheless, at the same time the challenge we face is to prevent this advantage from harming the cooperation between him, his colleagues and his superiors, and even more so, it should strengthen their collaboration.

Another challenge we face is finding a way to ensure that physical interactions and contact, being an important aspect of knowledge sharing, mutual learning and teamwork, will be retained. The physical interaction we forgo can also hurt the normative social clues (smiles, yelling and the like) we need for collaboration and teamwork. Thus a way to preserve these clues needs to be found. In addition, the knowledge flow that wearable computers will allow on the job might cause a redefinition of what an "expert" is and it could impact the organizational hierarchy and status.

### **3.2 Process Challenges**

A challenge that threatens the adoption of wearable computers is the concern of interacting with new technology. This concern is a result of computer illiteracy of many workers. Though the world has become more computer literate, integrating computers in most areas of our lives, some fields are only now slowly starting to adopt even the simple PC. In some cases even if computers have been used in the workers' field they personally, on their job, have had little or no need to use computers, e.g. doctors had the nurses do the administrative computer work and have not used PCs for other functions; fire fighters did not need computers for performing their job. Introducing computers, and even more so top of the line technological systems, is a change that creates a challenge.

Another question that pertains is who will use the wearable? Will all workers use it, or will it be used only in special tasks? Will there be one wearable per team or will each worker have his own personal wearable? These questions will also affect such issues as successful collaboration between non-users and users or between users and users.

Today, KM processes, though not always structured or official, do exist in these working places. Face to face meeting when wandering around the workplace, in café area, near the computer stand all create a knowledge sharing opportunity. The wearable should enhance knowledge sharing while trying to avoid hurting existing KM processes.

### **3.3 Technological Challenges**

The adoption of a change is based on the need that it fulfills and the opportunities that it creates. Thus, the design and development of the wearable must be according to the specific needs and constraints of the user (UCD approach). Moreover, the device should be ergonomically convenient, unobtrusive and yet robust so as not to make the workers' life more difficult and inconvenient.

Another challenge we face is finding the right way to introduce, train and technically support usage of the wearable computer. If the wearable scares the workers on sight, when first encountered, they will be reluctant to even try the system and their initial motivation to use it will be low. This will result in creating a burden on the whole process of adapting to the change.

All the factors mentioned will have an effect on the user and organizational recognition of the system. In conclusion the challenge is to design a system and find a way that will create optimal user and organizational need, interest, motivation, adoption and acceptance.

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