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A knowledge management approach for ergonomics implementation within organizations

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Abstract

The current economic and social environment suffered major changes in the last years, mainly driven by technological and cultural innovations and trends. One of the most interesting changes is the development of knowledge management (KM) and its increasing diffusions in all economic sectors. There is no activity that can be performed without some type of knowledge transfer, irrespective of whether it is tacit or explicit. At the same time, every organization must implement health and safety objectives in order to achieve business effectiveness and efficiency. Through ergonomics working conditions and occupational health and safety (OHS) objectives can be achieved more efficient. Considering that ergonomics is an interdisciplinary science, KM appears as extremely necessary for superior knowledge transfer among expert groups in the organization. The paper aims to demonstrate the usefulness of KM science in the ergonomics approach by highlighting key focus areas to support efficient implementation within organizations. By analyzing the consulting services offer by six Unites States consulting companies in the filed of ergonomics, we shall underlined the trends and challenges of the KM implications in ergonomics approaches.

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1. Introduction

Today's economic and social context is characterized by rapidly changing technologies and larger amounts of information that became difficult to manage for those unable to keep the pace with all the novelties. These facts

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affect businesses and generate the necessity of creating management systems aimed at improving every aspect of their activity.

On the one hand, knowledge became the most important asset of an organization and knowledge management (KM) is of high importance to organizational profitability, efficiency and sustainability. All the top businesses developed KM systems that enable both effective use of knowledge and creation of new solutions to problems, as well as new knowledge (innovations).

On the other hand, people are also a very important asset of an organization. From this perspective, their workplace safety and well-being is a key factor to efficiency. Ergonomics is aimed at developing solutions to workplace issues and activity interruptions generated by accidents, and at optimizing machines and work equipment. Human stands at the heart of ergonomics, as no system can operate without the presence of a human being.

In order to achieve the best results of its activity, an organization should combine specific goals regarding knowledge, ergonomics, finance and economics, human resources and so on. The authors focus on the connection between KM and ergonomics, as these two domains have in common the human being and its capabilities. Without humans, knowledge is bare information stored on physical or virtual devices and ergonomics becomes a set of theories regarding design and engineering of machines and workplaces. Thus, the importance of KM in implementing ergonomics throughout organizational activity relies in the knowledge employees have and are able to use for performing efficient work and creating new knowledge to fructify across the organization.

2. General overview on knowledge management and ergonomics

2.1. Knowledge management

The concept of knowledge management (KM) appeared in the first decade of the 1990s as a necessity of dealing with larger amounts of data and the digitalization of information. According to KMWorld (a US-based magazine and KM- related content publisher) website, in 1994 Davenport defined KM as “the process of capturing, distributing, and effectively using knowledge” (KMWorld, 2012). Despite its simplicity, this definition encompasses the most important character of this concept: knowledge must be collated and put into a form that is comprehensible to all its users.

The most cited definition for KM was offered by The Gartner Group (a US-based consulting and IT research company founded in 1979): "Knowledge management is a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of an enterprise's information assets. These assets may include databases, documents, policies, procedures, and previously un-captured expertise and experience in individual workers" (KMWorld, 2012). This definition highlights organizational necessity to bring together all forms of knowledge in order to create a comprehensive database which can be available and user-friendly for all its current and future users. It is highly important when regarding KM in connection with other domains and activities.

In order to have a comprehensive overview of the concept, there are a few clarifications to be made. The success of KM implementation in an organization is dependent upon people, processes and technologies. In an integrated KM system, these are the entries that go through four basic steps: create/generate, represent/store, access/use/re-use, and disseminate/transfer. According to (Mathew et al., 2012), a successful KM initiative is based on consideration and interactions between all these elements and steps (see Figure 1).

KM is a multidisciplinary domain with various applications from industry to business administration and information systems (Ahram et al., 2012). Nowadays, its major utility stands in the management of data collated using information technology (IT) methods, as well as in the transmission of knowledge from an employee or a group of employees to the other (also known as knowledge transfer).

Many companies make serious efforts to develop KM systems that can last for long periods of time, aiming to meet sustainability objectives. The competitive landscape stimulates businesses to invest resources in the development of probably the most important of their assets: knowledge.

As a conclusion, the essence of KM is to improve organizational performance by successfully managing processes such as acquiring knowledge, transforming it into a comprehensible set of information, using it, storing and protecting it through internationally-recognized systems (such as copyright). At the same time, organizational

performance is directly linked to innovation based on already acquired knowledge creatively used for problem solving (Lee & Lee, 2007).

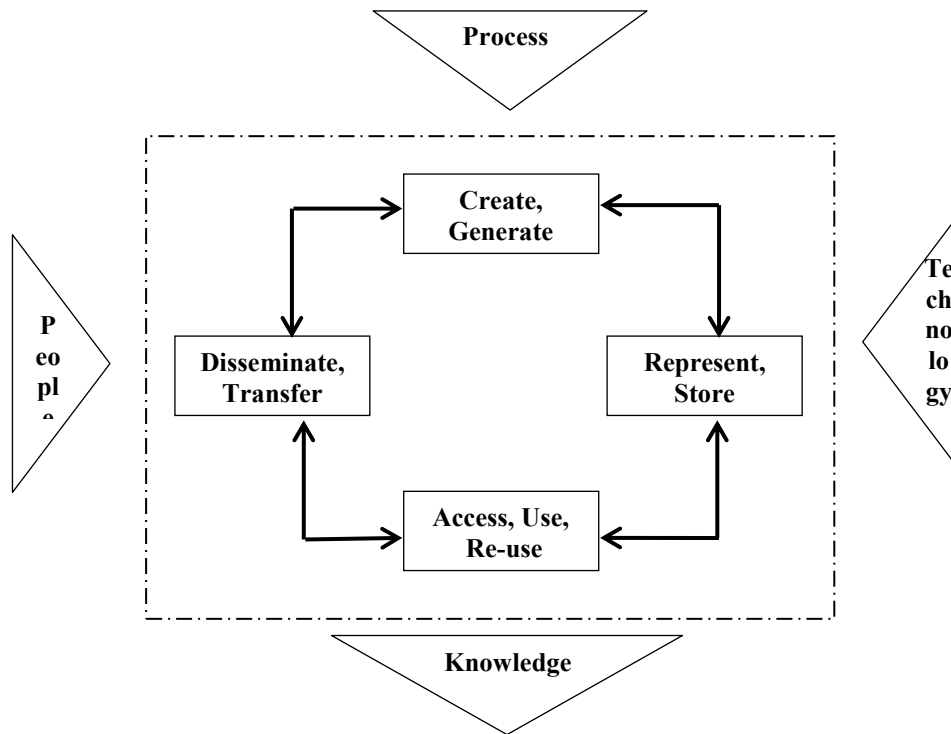


Fig. 1 KM Diamond - Adaptation after (Mathew, Rodrigues, & Vittaleswar, 2012)

Knowledge transfer is another term that is relevant to the attempt of understanding the relationship between KM and ergonomics. Basically, knowledge transfer can be understood as the process of information dissemination and learning from a human to the other. But most organizations are hierarchically managed and this brings to light a very common situation: on account of the management hierarchy and malfunctioning communication across management levels, organizational knowledge breaks into knowledge islands (Lupanava, 2017). When a certain problem occurs, workers who need to find the solution will, most likely, search into their own knowledge island and ignore the knowledge that other employees could share with them. However, there are solutions such as knowledge mapping and knowledge dissemination, which allow organizing, compacting, and efficiently transferring knowledge across the organization.

In theory, KM is extremely efficient and seems a revolutionary solution for the organizational concerns related to knowledge transfer. But it is quite difficult to efficiently manage knowledge if the concept is not properly and deeply understood. Simple principles such as enhanced communication across all hierarchical levels, trainings, and creating a meritocratic management system can open the path to a successful KM system implementation.

2.2. Ergonomics and ergonomics intervention

Similar to KM, ergonomics was studied from various perspectives and thus was defined in numerous manners, depending on the cultural and scientific context. At its core ergonomics is aimed at achieving a comprehensive connection between human resources, technical capital and the organization overall.

According to International Ergonomics Association (IEA), ergonomics (also known as human factors) is “the scientific discipline concerned with the understanding of interactions among humans and other elements of a system,

and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance”. The main purpose of ergonomics is to enhance compatibility between the needs, limitations and abilities of people, and tasks, workplaces, products, systems and environments (IEA website).

Ergonomics is a comprehensive science, involving knowledge and experience of numerous experts in domains ranging from occupational health and safety (OHS), medicine and psychology to engineering and design. Therefore, definitions for ergonomics may have different perspectives but they also have a set of common aspects that stand at the heart of this concept. Among these, the most important are the following (Coelho, 2011):

- Use of human-related scientific data;
- These data have a multidisciplinary character: ergonomics is a science that encompasses knowledge from domains such as psychology, sociology, anthropology, anatomy, biomechanics and engineering;
- Ergonomics is characterized by interdisciplinary;
- This science is destined for technical devices, organizations (both daily activity and trainings). It has specific parameters and proposes improvement solutions;
- There is a strong relationship between the equipment, machines, and workplaces and the knowledge and technical resources required for their optimization;
- Considering that there are no perfect humans to use technical devices, ergonomics is focused on developing solutions optimized for normal workers;
- Human is the center of any activity. Therefore, machines and environments should meet human body and mind particularities;
- Occupational health, safety and well-being stands at the heart of ergonomics.

Moreover, ergonomics is a science that requires a large amount of data and knowledge that needs to be processed and collated together in order to obtain optimized workplaces and working equipment. Optimization may refer to design, utility, technical performance or user-friendly features, but it must be always centered on its users (humans) and their ability to adapt to the proposed changes. For example, it is possible to create a perfectly safe machine that requires an elevated level of knowledge to be efficiently used, making it less preferred among workers as compared to an older model with higher risks for the user but with easy-to-use features.

Ergonomics intervention is understood as a process of organizational activity improvement in all its features and particularities. A successful ergonomics intervention should cover as many operational issues as possible, including technological innovations and organizational and environmental changes. (Boatca & Cirjaliu, 2015) proposed a model for an efficient ergonomics intervention based on four pillars: management support, knowledge support, HR participation, and motivation through evaluation, recognition and rewards. This means that an ergonomic intervention should be made with the participation of both staff and the management team. The latter should enhance communication and cooperation between workers and provide adequate support for the execution of every step of the intervention.

Feedback is essential for the success of the ergonomics intervention. It is the only source of information about the effects and perceptions regarding the intervention. Communication between the management team and the staff enhances constructive feedback that can be used for further improvements (Boatca & Cirjaliu, 2015).

Training is at the heart of the ergonomics intervention, as it enables knowledge transfer among the organization. Trainings allow organizational knowledge transfer and help workers understand and learn how to apply a certain intervention in different working groups.

The management team must pay special attention to the fact that an ergonomics intervention is a long-term process which requires continuous support and involvement for solving any unpredicted challenges that might appear. Further, for the success of the ergonomics intervention, periodically it should be evaluated by a certified group of experts to verify the quality of the intervention and its compliance to the initial plan (Boatca & Cirjaliu, 2015).

3. The role of KM for supporting ergonomics approaches implementation in organizations

As the authors highlighted in the previous section, human is the center of both knowledge management (KM) and ergonomics. Firstly, KM is based on human cognition and the social context of knowledge transfer (Thomas et al., 2001). This means that knowledge is directly linked to human cognitive capacities, including memory, intelligence

and individual capacity of information understanding. At the same time, the social environment where knowledge is created or shared may stimulate or negatively affect the complex process of KM.

Secondly, ergonomics is focused on optimizing and designing products, workplaces, working equipment, machines and working environments keeping in the loop human necessities, particularities and limitations. Any organization that aims to achieve efficiency and efficacy has to invest time and resources to implement ergonomic solutions for all the issues faced in its activity. When the focus moves from profitability to workers, the organization is able to identify all the drawbacks and workflow interruptions that prevent it from meeting its long-term objectives. Identifying these aspects is not sufficient if the organization does not implement the proper solutions, which can only be found with the help of ergonomic-related knowledge. This leads to the idea that an ergonomic intervention is made by humans and for humans.

3.1. Aspects of KM that influence ergonomics implementation in organizations

Organizations need to identify and ensure transmission of “the right information to the right people at the right time” (Thomas et al., 2001). “The right information” refers to knowledge and intelligence, understood as the most relevant knowledge for a specific problem. Studies (Thomas et al., 2001) have shown that knowledge and intelligence are subjective, as their measurement and interpretation are dependent on the social and cultural context. Generally, humans underestimate the importance of external influences on knowledge transfer. Therefore, organizations must ensure the proper context for KM to obtain the best results of their efforts for implementing an ergonomic solution.

“The right time” is in connection with communication of knowledge and the learning process (Thomas et al., 2001). Workers should be regarded from a constructionist perspective: knowledge must be put in an appropriate form, easy to receive and understand by the listener, as the worker needs to process the information and learn it in order to be able to use it further on (Thomas et al., 2001). Workers must be actively involved in the process of learning. Here appears one of the main problems faced by organizations when trying to implement KM. Making information available to workers creates the impression that the problem is solved. However, the problem will probably persist if workers are not motivated to learn and pass on that information (knowledge transfer). Implementing an ergonomic solution requires special attention for the method of presentation, as it may be only information stored on some sort of physical or virtual support or it may become vivid knowledge with great potential in creating added value for the entire organization.

“The right people” refer to the social context of knowledge transfer. Numerous researchers showed that understanding knowledge transfer as taking information and putting it into peoples’ heads is a limited interpretation of the KM definition (Thomas et al., 2001). In fact, knowledge is often shared in an informal context, such as storytelling or current work-related discussions between employees. This reveals that organizing trainings and meetings is not sufficient to ensure a comprehensive knowledge transfer. People tend to be more receptive to knowledge in informal contexts and learning is enhanced if they feel comfortable and relaxed. This description is far from what common organizations understand as a working environment. Considering that the cultural context in Western societies significantly changed in the past years, organizations must re-think offices, workplaces and information dissemination methods they use for KM. Considering that experience is an amazing source of knowledge for the organization, creating the most appropriate context for sharing it to less experienced workers ensures maintenance of knowledge within the organization even after the more experienced workers retire or leave the company.

According to (Helali, 2012), in developing countries KM is even more difficult to implement in organizations on account of hierarchical management style, poor learning activities (including trainings) and productivity flaws. Introducing ergonomics solutions in such organizations is challenged by unmotivated workers, lack of group cohesion (workers do not have the feeling they belong to a working group, they do not feel appreciated and respected by their colleagues and superiors) and inadequate organizational communication.

To enable the implementation of an ergonomic intervention based on KM techniques, organizations must pay attention to all the above challenges and find proper solutions for each one. The importance of these solutions stands in creating the best conditions for knowledge transfer and achieving long-term KM objectives.

3.2. Proposal of model for implementing ergonomics using KM

In our opinion, KM is essential to implement ergonomic solutions in organizations, as ergonomics is an interdisciplinary science that requires knowledge and experience of experts from various domains such as medicine, engineering, design, and social and psychological sciences. Therefore, knowledge transfer is essential for covering all the important aspects of an efficient ergonomic solution (see Fig. 2).

The experts should be offered the most adequate context for knowledge transfer (meetings, trainings, formal and informal discussions, physical and computer-aided means of communication), the appropriate equipment for testing and measurement, as well as incentives to stimulate learning.

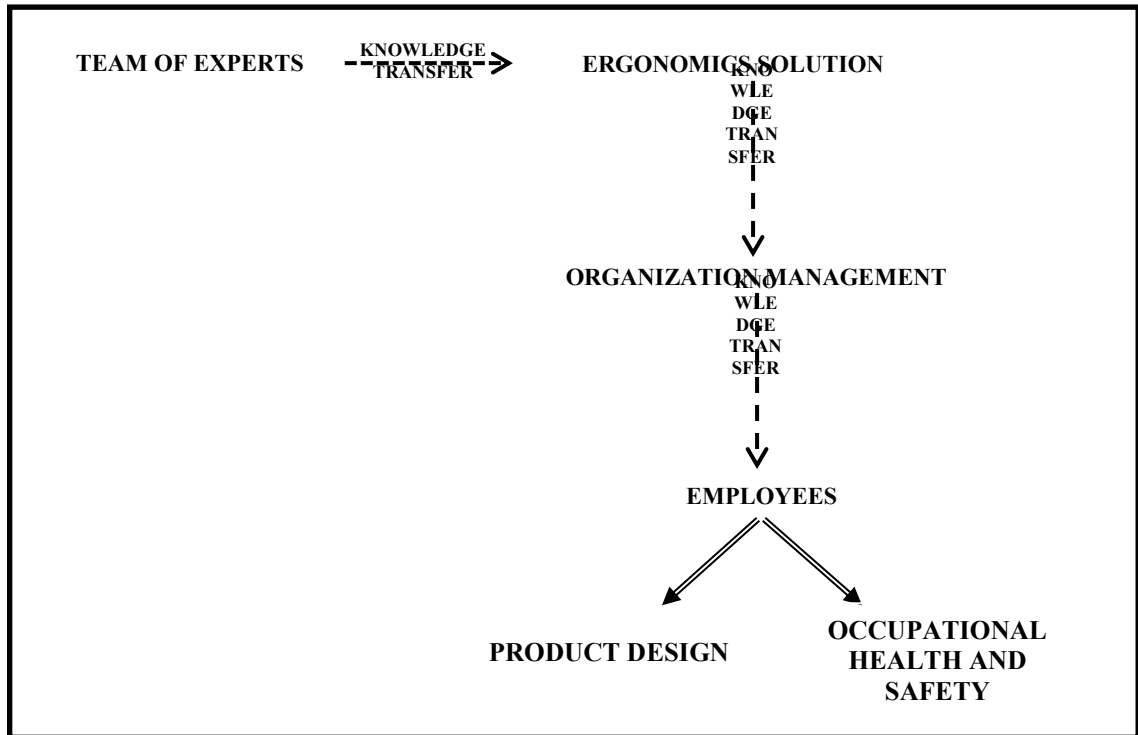


Fig. 2 Proposed model for implementing ergonomics in organizations using KM – based on author’s findings

After the group of experts come to a conclusion and propose a set of solutions, they need to discuss with the management team, share their knowledge and establish the best solution for the specific problem. After this step, the management team must create the proper context and find the best mean of communication to train workers affected by introduction of the ergonomic solution in the workflow. Also, the management team should ensure transparency in this laborious process and to train all its employees to achieve success of the ergonomic intervention.

Major problems in some organizations are the working environment and the management style. The management team should ensure that workers feel appreciated and that they trust the management team. Also, meritocracy and a participative management style create a better social environment for KM as compared to other management styles. If workers feel they are important members of the organization and if they are encouraged to share knowledge with their colleagues in formal or informal contexts, they will certainly be open and flexible to any change the management team implements.

When creating a new product, introducing ergonomic principles in the design process is essential to the success and usability of the respective product. However, many designers tend to leave aside ergonomics, as they feel that it increases workload and the necessary time for development of the product. In a study applied to a panel of 12 experts in design, (Kim et al., 2007) concluded that few of the respondents had any training in ergonomics and the

majority were reserved when asked if they would accept introduction of ergonomics in their responsibilities. Also, when they were asked about injuries occurred during the construction of the products they designed, the respondents stated that they have the less responsibility for work-related injuries and that workers have the highest amount of responsibility for these injuries. These responses reflect again the necessity of involving employees in the process of knowledge transfer and the creation of a proper social context for KM, so that both knowledge and issues faced would be easily transmitted from an organizational level to the other and across departments.

An ergonomics intervention can only be successful if the organization implements KM principles and integrate both KM and ergonomics into a more comprehensive management system.

3.3. Case study: KM applied by ergonomics consulting companies in the US

For a deeper understanding on how KM can (and should) be used for implementing ergonomics across organizations, the authors studied several US-based consulting companies that provide ergonomics-related support. In Table 1, six companies were compared based on the services they provide in order to observe the extent to which these use KM as part of their offering.

Table 1. Comparative overview of US consulting companies

S. No.	Company	Services	Comments
1.	Ergoweb	- Online and onsite consulting services - Online software system	- The software is an online process management system that enables continuous improvement
2.	ErgoFit	- Consulting services - Training services - Workplace evaluation services based on dedicated software	- The company addresses small businesses
3.	Humanscale	- Consulting services - Ergonomics training	- The company also designs ergonomic office tools - It does not offer ergonomics software
4.	Humantech	- Software application for training, data, reporting and continuous improvement - Web-based solution dedicated to offices - Consulting services - Training services	- The company offers support for engineering and design
5.	Saturn Ergonomics Consulting	- Consulting services - Mobile applications for analysis and design, short training videos and live consulting sessions	- It also provides lean manufacturing training
6.	United States Ergonomics	- Risk assessment - Consulting services - Testing - Training and certifications	- It is focused on office, industrial, healthcare and laboratory ergonomics - It does not offer ergonomics software

Out of the six analyzed companies, two do not have IT-based support services such as mobile applications, online platforms and ergonomics dedicated software. Also, one company does not offer training services. Currently, the main means of knowledge transfer used across organizations are trainings and IT services for ergonomics (online platforms and software). This reveals that all ergonomics consulting companies focus on knowledge transfer when addressing their clients’ challenges and requirements. Based on the model proposed in Fig. 2, the team of experts is represented by the consulting company, owning knowledge necessary for problem identification and finding the appropriate solution. Once the company obtains ergonomics solution, a discussion with the management team from

the client organization is imperative. Following the approval of the solution, employees go through trainings, regarding themes such as how to become able to comply with new tasks or to learn how to correctly perform their tasks, how to use machines and tools etc. Also, managers are involved in a continuous improvement system, using evaluation and data tracking systems. All these services and processes would be impossible without the help of knowledge transfer. It enables successful implementation of the services required by the client and it stands at the heart of what consulting services are.

4. Conclusions

Ergonomics is essential for the success any organization due to its interdisciplinary character. It involves knowledge and experience of experts from various domains and it ensures workplace safety, health and well-being. In nowadays changing and permanently developing cultural and technical context, implementing ergonomics in organizations would be almost impossible and certainly inefficient if it were made without the help of KM. The main reason that stands behind this statement is that a KM system has a set of requirements that offer the best conditions for implementing ergonomics solutions, including the following:

- Knowledge is a very subjective notion and its use and storage should not be reduced to documents, computer files and organizational information. Knowledge extends from workers experience to technical innovations and economic changes;
- Organizations should pay special attention to the communication method used, as knowledge becomes useless if workers are not encouraged to learn it and use it in their daily activity;
- The social context of knowledge transfer is very often informal. This is highly important when considering the time and context of knowledge transfer;
- Organizations should pay special attention to the management style and the organizational culture. Employees should feel important, respected and motivated to learn and achieve higher levels of self-development in order to be open for major changes such as ergonomics interventions.

As the final conclusion of the paper, organizations should invest time and resources to implement KM, as this creates the best framework for introducing major improvements generated by ergonomics.

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