

THE ERGONOMIST AS A PROJECT TEAM MEMBER: PERCEPTIONS FROM THE PERSPECTIVE OF COMPETENCES AND TYPES OF KNOWLEDGE

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Abstract: The article aims to call attention to the role of the ergonomist as an essential team member for product and system design to be used by people. The ergonomist is the professional who has the ability to conduct a project where science and application meet. The review of the literature is used to promote a discussion about the synergy between the ergonomist and the project team concerning two aspects: competences and knowledge typologies. This paper develops and characterizes four relationships between the role of the ergonomist and the work of a project team having the concepts of individual competences, collective competences and knowledge typologies. Some propositions of best practices are presented. The main conclusions highlight that the knowledge produced in the work, the technique and the model of man, as well as the competence to examine the real activity (future) are taken as the main attributes of the ergonomist that positively influence the work of project teams.

Keywords: Ergonomist; Individual competences; Team competences; Knowledge typologies.

1. INTRODUCTION AND BACKGROUND

The scenario described by recent theoretical conceptions regarding the era of

knowledge reflects a time of transition and apprehension about what adds value to products and services: intelligent activities rather than routine. Thus, for organizations which seek to gain competitive advantage through innovation, fostering competences in team work and in individuals must be of paramount concern, as well as the administration of multiple functions in different perspectives (Frame, 1999).

One of the qualifications that responds to this demand is Ergonomics, which focuses on issues concerning the work activity and the use of products. Ergonomics has been considered by some studies as a science and as a generator of knowledge (Murrelkh, 1965; Grandjean, 1982). Montmollin (1980) and Leplat (1992) see it as technology because of its application and processing. Despite the conceptual differences, some aspects are common to some existing definitions, such as applying ergonomic studies, the multidisciplinary nature, the use of knowledge from many disciplines, the foundation in the sciences and the object (the conception of work).

The ergonomist's work provides diverse fields of interest, and this, therefore, lies in the formation of teamwork in obtaining good results. Bearing that in mind, this work's syllabus resides in emphasizing the role of the ergonomist as a

vital member of a group of product design and systems that will be used by people. In order to highlight the way the competences and knowledge of the ergonomist collaborates with design work, the article promotes a discussion about the synergy between the ergonomist and the project team by two aspects: 1) the individual and team competences, 2) the types of knowledge developed.

This paper presents a review of the literature and attempts to update knowledge to obtain a new position, considering three consecutive dimensions: research justification, literature substantiation and theoretical foundation, that is, contributions from the authors to the theoretical field of research.

The motivation of this study is due to the lack of works concerning the preconditions for the ergonomic efforts to flourish the ergonomist's knowledge and competences. Thus, the aim is to provide an overview of the rationales that positively influence the work of project teams, outlining the ergonomist's peculiarities. It is important to highlight that, at the extent of our knowledge, the relationships that this paper presents are not theoretically considered in earlier research.

After conducting a systematic search in Scielo, Capes and Scopus databases, it was found that there are no

similar propositions to this specific topic in previous works. Particularly in Brazil, the discussion about this subject is still considered incipient. Table 1 summarizes recent studies that have attempted to empirically explore similar topics, by building the following contributions about the role of ergonomist as an essential team member for product and system design to be used by people:

Table 1 – Summary of early research on the ergonomist as a project team member

Analysis	Scope	Main contributions	Authors
Communication between the professionals involved in visual needs in the workplace	Investigates a joint professional development meeting between optometrists and ergonomists	Finds that communication between optometrists and ergonomists can be improved by developing information-sharing documents	Long (2014)
The ergonomist in a cross-functional team to improve design processes	Demonstrates how ergonomics, environmental and industrial hygiene risks and quality concerns can be tackled simultaneously	Presents a re-designed equipment by an in-house cross-functional team to ensure a 'clean, lean and green' process	Hanson and Vangeel (2014)
Interdisciplinary teams formed in partnerships between universities and companies	A pedagogical approach to anticipate ergonomist engineering design collaboration	An innovative educational model approach based on ergonomics involvement in industrial project	Brunier et al (2012)
Participatory design processes	Participation of ergonomists as project facilitators amongst the various stakeholders in a multidisciplinary venue	Presents a method for participatory design, in which users are encouraged to participate in the design process by sharing their real work activities with the design team	Santos (2012)

Ergonomist in needs analysis for computer systems	Specific contributions of ergonomists at the stage of needs analysis in the design process	Indicates that the various actors are complementary and work collectively to define the various dimensions of the system	Couix et al (2012)
Ergonomist and interdisciplinary team - discussion on work environment issues	Explores and describes the work environment issues discussed by an interdisciplinary team engaged in the work rehabilitation process of low back disability cases	The study builds knowledge on the practical application of a cross-disciplinary framework to address work environment issues	Costa-Black et al (2007)

Our discussion is opened by the sections 2 and 3, drawing attention to project team attributes and the contributions of the ergonomist, respectively.

2. PROJECT TEAMS AND THE DIVERSITY OF MEMBERS

The idea of designing the organizational structure in the form of work teams comes from the 1990s, with corporate restructuring by flattening and reducing the number of hierarchical levels and delegation of authority to lower levels. A considerable change took place from the departmentalized way of organizing to adopting a process of activities (Davenport & Prusak, 1998). The creation of networks can be understood as a response to environmental challenges faced by organizations in order to build strategic capabilities and competences (Santos, 1999).

Led by the company's goals and being able to make decisions, team members take control and plan their activities, regardless of the hierarchical level to which they are linked (Santos, 1999). Teams consist of highly versatile individuals having entrepreneurial and anti-bureaucratic behavior, as well as high tolerance for ambiguity focusing on long-term activities (Beatty & Schneier, 1997).

These are professionals who are willing to collaborate and have functional abilities and individual characteristics such as creative behavior and tolerance to change (Leung et al., 2003). Teams are superimposed on the functional structure or integrated in the organizational design, and although temporary, tend to have long life (Cohen, 1995).

The group consists of individuals who have complementary competences strategically and mutually committed to quality, customer relations and productivity. The group must have common

goals related to the project. As team members, these professionals have the opportunity to move to their level of work and let new ideas and creative thinking flourish, making decisions that will make a difference and interacting with professionals from different areas (Natale et al., 1995).

By strategically rethinking the workflow, in terms of key business processes, companies have increasingly been able to design an environment that facilitates team work using the competences and knowledge of employees (Neailey & Barker, 1999). This type of organization is classified as adhocracy, the structure in all structural configurations which is less influenced by the classical principles of management. It represents fluid structures and is associated with horizontal decision-making power. This structure is typical of project teams and innovation, in which the degree of expertise and knowledge are high, and has decision-making as one of the main advantages (Mintzberg, 1995).

The workflow is redefined to provide professionals greater influence on decision making. Interoperability and self-managing teams are typical methods to increase the power that employees have to take their own initiatives and propose solutions for change and improvement (Bohlander et al., 2005).

In a broader concept, the main characteristics of the network-based teams are (Santos, 1999):

- Clarity of purpose and goals, and creating the identity of the team;
- Involvement in the processes of organizational change;
- Sharing information based on mutual trust among team members and between teams to support decision making;
- Made up of specialized professionals with complementary expertise;
- Commitment to goals, targets and joint working approach;
- Mutual accountability in goal setting and team performance;
- Expansion of continuous individual and collective competences.

It is through this flattening, that is, reducing the differences, that they can become more involved and increase the quality of work life while the company's performance is enhanced. It is an approach to a more egalitarian and cooperative work, which eliminates the differences in status and power and emphasizes collaboration (Bohlander et al., 2005). The prospect of self-management of employees proposes a radical change of hierarchical supervision

to a collaborative way of managing workers (Santos, 1999).

The design of a project is a highly complex concept. In order to reduce this complexity, it is necessary to assign different tasks to team members according to their technical expertise and their knowledge. Simultaneously, this principle is a source of new complexity. There is a need to integrate the different parts of the project throughout the design. Furthermore, to make sure this integration takes place, members must coordinate. These members may look for different goals considering different points of view. Disagreements on the issues to be resolved are therefore probable (Beguin, 2007).

On the one hand there is a principle of division of labor, with members who have their own knowledge and their own logic. On the other hand, there is a requirement of interdependence and consistency. Then, the plan to achieve is a link between the arbitrary power of the expert members and a requirement for convergence within a unique design that allows others to interfere in the activity to avoid cacophony (Beguin, 2007).

3. THE ERGONOMIST AS A TEAM MEMBER

The ergonomist is an essential member of the team for product and system design to be used by people. He/She is a professional who has the ability to run a project where science and application, necessity and usefulness, discipline and practice are a wide scope of action, production and reflection (Guerin et al., 2001). He/She is also a specialist in the functioning of man in "a world of engineers" as he/she contributes to the first magnitude because he/she has (Beguin, 2007):

- Knowledge about the general functioning of humans and their activities, and more specific knowledge about the adaptation of technical devices to man;
- Criteria based on working conditions;
- Methods by analyzing situations;
- Knowledge resulting from field studies.

These professionals are essential on a project and the way it is run because they bring "a project into a project". For the ergonomist, the function of human activity and its status (actual work) are variables that must be integrated by the designers. These are dimensions that should guide the choices (Beguin, 2007).

One of the most significant contributions of the ergonomist is the fact that he has a proven method to understand the work before transforming it. This is the ergonomic diagnosis, in which two functions are distinct: first, the ergonomist works on the project design to make goals. In the second, he/she develops and conducts the project to achieve the goals. Table 2 shows the functions of the ergonomic diagnosis (Guerin et al., 2001).

Table 2 – Ergonomic diagnosis of situation.

Role of the Ergonomist: two variables are considered and integrated by the designers:	
1) The function of humans	
2) their activity	
Ergonomist works on the project design (in making goals)	Ergonomist working throughout the project (in progress towards achieving the goals)
Defining the status of the operation of man in creation of the project;	He/She has a range of knowledge by analyzing existing situations to help in identifying the nature of the problems to be addressed to achieve the goal
Explaining the operation of man and showing it by analyzing situations	

Source: Adaptation of Béguin (2007).

In addition to knowing his/her interlocutors, the ergonomist also needs to be known. In many cases, the ergonomist plays a role of the expert. Experts differ from designers in relation to the strategic

role in innovative projects, because can be considered in project design constraints for which the other members do not have the required competences. When they have to specify drawing on their knowledge, there is little impact. The new knowledge is diffused when there are experimental projects in which meeting the criteria are clearly established and where there are means of evaluation. All these elements fit into the initiative of the team-project. Sections 4 and 5 go over some constructive concepts regarding individual competences and team competences.

4. INDIVIDUAL COMPETENCES

In recent years, the theme of competence, its development, management and other aspects have been the focus of academic and business discussions regarding different understandings: the individual level (the competence of the individual) and organizational level (called "core competencies"). The organizational competences refer to the combined resources of the company that makes it unique, and therefore the source of competitive advantage. The individual competences are referred to as a particular skill in one area of knowledge (Silva, 2002).

The notion of competence focuses on mobilizing and coordinating resources

with the aim of adding value to the organization, aligned to the proposed concept of measuring intangible assets as the power is measured not by numbers, but by the same power that has to contribute to the development of an organization through individuals. Furthermore, competences can determine several meanings, not only those related to the characteristics of the person, such as knowledge, skills and attitudes, but others focused on the task and results (Fleury & Fleury, 2001).

Competence at the individual level can be thought of as a set of knowledge, skills and attitudes that justify a high-performance believing that the best performances are based on intelligence and people's personality. It can also be understood as a task and set of tasks that are relevant to a position. It is also the ability to perform a task, something that requires knowledge and personal skill. Five dimensions of competence can shed light concerning the performance of individuals (Tremblay & Sire, 1999):

- Knowledge: that is a collection of information, concepts, ideas and academic training relevant to a specific domain that the individual possesses. Recycling and constant learning are key points, so that knowledge does not become obsolete;

- Skills: competences that correspond to the actual demonstration of the skills that one has, the ability to put knowledge into action, ability to turn theory into practice through a personal view of business activities;
- Behaviours: concepts that the individual has about himself and that are reflected in the attitudes, values, emotions, actions and reactions to a situation, behavior that involves the impulse and determination to innovate and continuously improve the conviction, in addition to entrepreneurship;
- Traits: this refers to personality traits that make a person behave in a certain way;
- Motives: behavior at work concerning one reason or a specific target that engages the internal forces to generate reactions.

Individual competence, therefore, is not a state or knowledge one has, neither the result of training. It is mostly like putting into practice what is known in a given context, usually marked by labor relations, organizational culture, unforeseen time constraints and resources, etc. It is possible to speak of competence only when there is competence in action, that is, knowing how

to mobilize knowledge in different contexts (Lebortef, 1995).

5. TEAM COMPETENCES

For this study, two types of competences in project management can be highlighted: the individual and the team levels. The first, already dealt with, refers to the skills and abilities of individuals in solving problems. Team competence, in turn, correlates with the ability to solve complex problems in a multidisciplinary context (Frame, 1999).

The concept of competences in teams comes from a process that adds a set of individuals to different needs, abilities and intelligences, and transforms them into effective and integrated work. In this case, the objectives and individual energies mix and support the team goals. From this concept, and considering the facilities and barriers concerning the formation and development of teams, some indicators that can be used to establish the basis for identifying the competences in project teams are (Thamhain, 1993):

- Communication: key for a team to obtain high performance. The knowledge of the project plan and the process of generation, storage, dissemination and control of information are critical aspects;

- Collaboration: consolidated teams often have members who have a collaborative spirit rather than individualism, finding results together and always trying to protect themselves against any injustice;
- Mutual trust: this refers to one of the prerequisites for training employees, as an activity interface with information and results from other activities, the team needs to have confidence that such entries are in accordance with the requirements planned;
- Search for results for the project and relationship with the company: the more the team understands the potential and possibilities of the company that it is part of and makes use of its resources, the better the success of their projects.

It is known that the formation of project teams is a necessary, but not a sufficient condition to explore individual and collective knowledge (Inkpen & Tsang, 2005). Investigations such as from Dyer & Singh (1998) demonstrated that this effort requires the ability to recognize and assimilate knowledge offered by a given member, and this occurs in accordance with the development of competences that have an individual and collective character.

With this notion in mind, it is possible to assume that access to available knowledge is intrinsically dependent of individual and collective competences. In order to support this argumentation, the major knowledge typologies found in the literature are contemplated in section 6.

6. KNOWLEDGE TYPOLOGIES

The key to organizational success is increasingly based on individuals, their competences and collective involvement. Identify and pursue new ways to associate resources and market opportunities are essential responsibilities of people to meet the requirement to continuously add value to the organization. This scenario makes product and system design projects demand the acquisition and development of a range of new knowledge (Nonaka & Takeuchi, 1995).

Individuals and teams that deal with knowledge creation have some inherent challenges, namely: how to map the available knowledge and manage project information through individual and collective competences? How to facilitate and stimulate the clarification of tacit knowledge of the team members? How to encourage knowledge sharing and discourage knowledge holding?

Knowledge was formerly defined as “justified true belief”, a tool that may increase the effective action capability of the organizations (Nonaka & Takeuchi, 1995). The knowledge pertinent to business organizations consists of facts, opinions, ideas, theories, principles, models, values, experience, information, context and intuition (Mitri, 2003).

Nonaka & Takeuchi (1995), Davenport & Prusak (1998), as well as Leonard-Barton & Sensiper (1998), contemplate knowledge through some dimensions. Among them, this study emphasizes explicit, tacit, collective and cumulative knowledge.

Explicit knowledge is articulated, codified and communicable through symbols, numbers and formulas; or tangible in the form of equipment, models and documents. This type of knowledge can be found in the format of rules, routines, norms and operational procedures (Popadiuk & Choo, 2006).

Tacit knowledge is created in accordance with the opinions, attitudes and factors that influence personal development (Nonaka & Takeuchi, 1995). **Collective** knowledge lies in the social actions of a group. This involves standards that support communication and coordination (Leonard-Barton & Sensiper, 1998).

Knowledge is also seen as **cumulative**, built over and from knowledge created before. Unlike other organizational activities, the creation of knowledge does not need to be located in a certain place and time and does not need to be monitored. Creative ideas and insights are not necessarily created during work. In contrast with physical resources, ideas are transferred and at the same time are not lost as individuals share them and continue having them (Yakhlef, 2005).

The knowledge typologies presented in this section are also used as a way of giving evidence of the following relations proposed in the discussion.

7. THE ERGONOMIST, THE PROJECT TEAM AND THE RELATIONSHIPS BETWEEN COMPETENCES AND TYPES OF KNOWLEDGE

Based on the perceptions highlighted in the past sections, some relationships can be observed between the role of the ergonomist and the work of a project team having the concepts of individual competences and knowledge typologies. The relationships are formed as follows:

1. Individual level: the role of the ergonomist associated with tacit

knowledge and individual competences;

2. Individual level: the role of the ergonomist associated with explicit knowledge and individual competences;
3. Collective level: the project team associated with the collective knowledge and team competences;
4. Collective level: the project team associated with the cumulative knowledge and team competences.

In the project, activity and future operations depend on the ability of the ergonomist to apply his/her knowledge about the human function and anticipation of the activity. Through this assumption, Table 3 shows the relationship between the ergonomist, tacit knowledge and individual competences.

Table 3 — Individual level: The role of the ergonomist associated with tacit knowledge and individual competences.

Relationship: ergonomist, tacit knowledge and individual competences		
Ergonomist, member of the team	Knowledge typology: Tacit	Individual Competence : characteristics
Anticipation of the activity and application of his/her knowledge in the function of man	Associated with the opinions, attitudes and experiences of the individual, specific knowledge about the adaptation of	Collection of information, concepts, ideas and personal training

	technical dispositive to man	
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Source: author’s elaboration

Still at the individual level, the ergonomist has the essential knowledge to conduct and enrich the project. This knowledge can be explained as an ergonomic diagnosis. Table 4 points up the relationship between the ergonomist, explicit knowledge and individual competences.

Table 4 — Individual level: The role of the ergonomist associated with the explicit knowledge and individual competences.

Relationship: ergonomist, explicit knowledge and individual competences		
Ergonomist, member of the team	Knowledge typology: Explicit	Individual Competence: characteristics
Ergonomic diagnosis: the ergonomist collects data and assesses it concerning issues related to ergonomics in the project by applying specific tools	Articulate, communicable, easily transferred. Knowledge shared by structured information	To make the ergonomic recommendations, the ergonomist has criteria based on working conditions and methods by analyzing situations

Source: author’s elaboration

At the collective level and to conduct a satisfactory project, every member should be allowed to intervene, in such a way that a member is not privileged

to the detriment of the logic of others. Interaction and communication between the fields of knowledge form an integration of knowledge produced. Table 5 illustrates the relationship between the project team, collective knowledge and team competences.

Table 5: Collective level: Team project associated with the collective knowledge and team competences.

Relationship: project team, collective knowledge and team competences		
Project team	Knowledge typology: Collective	Team competences: characteristics
Diversity of members, a requirement of interdependence and consistency of a unique project	Resides in the collective actions of a group, exchange of knowledge through documents, meetings and communication	Collaborative spirit instead of individualism, collective search for results; communication, control and dissemination of knowledge - critical aspects

Source: author’s elaboration

The arbitrary power of the expert team members, as well as the appropriation of knowledge generated by the team can ensure the development of individual competences. Thus, there is a promotion of integration of all results. Table 6 presents the relationship between the project team, cumulative knowledge and team competences.

Table 6: Collective level: Team project associated with the cumulative knowledge and team competences.

Relationship: project team, cumulative knowledge and team competences		
Project team	Knowledge typology: Cumulative	Team competences: characteristics
Arbitrary power of the expert team members and appropriation of the knowledge generated by the team	Built on and from knowledge created earlier, appropriation of knowledge and continuous expansion of individual competences	Mutual trust with information and results from other activities; Team's ability to pursue the project results and to relate to the company

Source: author's elaboration

8. FINAL CONSIDERATIONS

It was observed that, in addition to generating knowledge about the work situation, the ergonomist understands this knowledge by diagnosing the real situation and putting his competences into practice in terms of behaving effectively concerning the reality of the work, as well as conducting the project.

This work aimed to emphasize that the best work performances are based on the knowledge and competences of individuals, only ones able to maintain the creative development of innovative ideas. It could be observed that the knowledge produced in the work, the technique and the model of man, as well as the expertise to analyze the

real activity of work (future) are the main reasons that enable ergonomists to positively influence the conduct of a project. This proposal is justified because the ergonomist:

- Articulates with the other members;
- Expands the opportunities to negotiate solutions;
- Promotes collaboration mechanisms;
- Associates different rationales for the project.

Finally, grounded on the four relationships presented, some propositions of best practices for ergonomists inserted in teamwork can be indicated:

1. Relationship: ergonomist, tacit knowledge and individual competences

The ergonomist maintains current knowledge of relevant national and international strategies for the practice of ergonomics and demonstrates knowledge of theoretical concepts relevant to ergonomics.

2. Relationship: ergonomist, explicit knowledge and individual competences

The ergonomist keep ergonomic findings documented appropriately and provides a report in terms understandable by the client and appropriate to the project.

3. Relationship: project team, collective knowledge and team competences

Ergonomists are not only specialists of working conditions but they also become actors in the project development. They create a situation where they learn and generate collective knowledge in the project that can be in balance for all the actors.

4. Relationship: project team, cumulative knowledge and team competences

Team members effectively monitor the project results and ergonomic intervention and produce reflection or evaluative research relevant to ergonomics.

Moreover, the interprofessional characteristics found in team projects is always advantageous in its development. Exchanging ideas in the group makes the final proposal more effective in terms of interpreting the requirements needed for the project and meeting all ergonomic and production needs.

It is worth mentioning possibilities for empirical research on the subject of the influences of the competences and types of knowledge of the ergonomist in product design and systems that will be used by people. In addition, the highlighted best practices could serve as indicators for case studies that aim to analyse the role of the

ergonomist as a project team member. With the same perspective of recent studies conducted by Delgoulet et al. (2012) about skills acquisition, future researches could concentrate an empiric analysis on types of knowledge and competences in terms of organization and work tools that different workers hold in the context of a rapidly changing environment.

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