



ETdA for commercial area with free circulation of people: a sustainable model?

Isabel F. Loureiro, Celina P. Leão, Pedro Arezes
Department of Production and Systems Engineering
id2500@alunos.uminho.pt, {cpl, parezes}@dps.uminho.pt

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Ergonomic, Analysis, Intervention, Risk perception, Systems

ABSTRACT

The economic market diversification allows the differentiation of a greater number of ergonomic contexts. The appearance of commercial areas with free circulation of people represents a new social-technical system that provides the interaction between clients and professionals in common areas. In such contexts, clients are assuming a vital role in top management strategies becoming intrinsically linked to the organizations. From the ergonomic analysis point of view, it is necessary to understand the individuals' real activities in this new scenario. New ergonomic approaches are required since traditional ergonomic analysis is focused in occupational environments. The Ergonomic Tridimensional Analysis, ETdA, follows the emerging challenges to the ergonomics domains. This paper allows a better knowledge of the ETdA model conceptualization. The set of relationship, observation tools and the ETdA ergonomic factors should be considered in the ergonomic analysis development effectiveness. A case study was made using the trinomial represented by the related dimensions: analyst, professional and clients. The data analysis shows that clients' dimension contributes significantly to the ergonomic intervention. They highlight some risky situations that otherwise could not be identified and that can be useful to support the ergonomic decision. The ETdA model is in line with the ergonomics challenges that propose a greater clients' involvement on the ergonomic issues.

INTRODUCCION

The Ergonomic Tridimensional Analysis, ETdA (Figure 1), is a new approach in Ergonomics. It is a continuous model (and consequently a feedback model) that assists the ergonomist (analyst) in his ergonomic analysis leading to the establishment of

priorities lists. The diagnosis of the studied conditions and the consequent adjustments represent the ergonomic intervention.

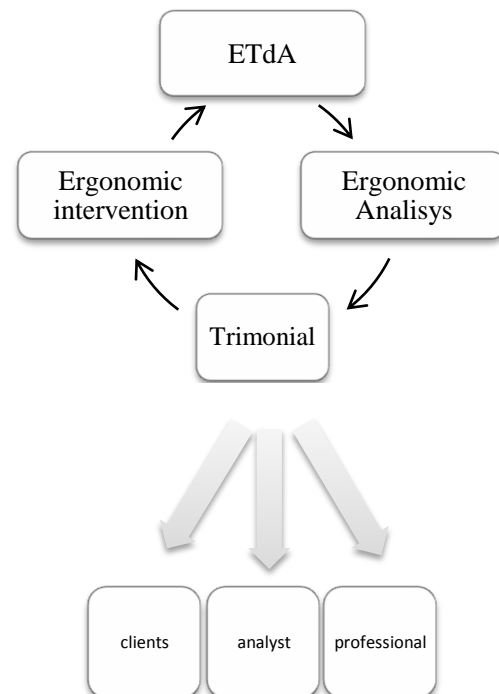


Figure 1:ETdA continuous model

This model was developed to be used in commercial areas with free circulation of people (CAFCP). In fact, the emergence of these areas represents a new social-technical system (Querelle and Thibault 2007) where the traditional commercial activities are replaced by CAFCP, providing clients and professionals interaction. In this new market context, clients are assuming a crucial place in the products and services distribution channel (Loureiro et al. 2010a).

This market customization leads to an organizational modification according to clients' individual requirements, including: utility, functionality, environmental adjustment, aesthetics, prestige, usability and pleasure (Dzissah 2005; Loureiro 2008; Santos and Tome 2003; Staton 2005; Ziliani 2004). This ongoing concern with the client requires a continuous

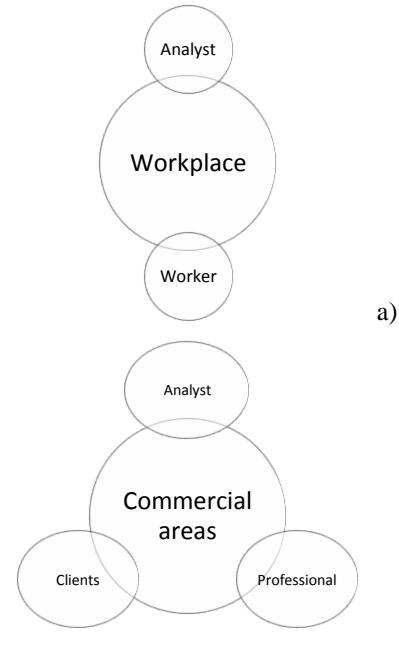


improvement in several key areas such as quality, occupational safety and health, natural environment protection, and cost of products and services (Forcier, 2001).

In such contexts, the clients command the corporation destiny, supporting the top management strategies and stretching the different organization hierarchies (Lindon et al. 2000) and become intrinsically linked to the organizations. The quality of goods and services are improved through the participation of individuals at all organization levels (Taveira et al. 2003). Therefore, the total quality management philosophy must be focused not only in workforce satisfaction, but also in clients' satisfaction, since in modern social-technical systems they are intrinsically linked to the organizations (Loureiro et. al 2010a). The traditional ergonomic methodologies described in literature present some limitations when used in these new social-technical systems. They are subjective analysis based only in Ergonomist and employee evaluation and just focused in occupational environments. The development of new ergonomic approaches is required. These should allow a more detailed analysis of the real activities of individuals, considering the CAFCP not only in an occupational perspective, but also from a usability point of view. Effectively, the CAFCP are common areas where clients and professionals interact and can, equally, be exposed to the same ergonomic risk factors. An evolution in the traditional ergonomic occupational analysis is proposed. The binomial constituted by the dimension of the ergonomist (analyst) and employee gives rise to the trinomial composed by the dimensions of the professional, analyst and clients (Figure 2) (Loureiro 2008).

The ergonomic factors that allow the ETdA operability are intrinsically, or extrinsically, linked to the professional, being respectively considered as environmental or occupational. If they are inserted in the organizational schemes of the social-technical systems it will be occupational, otherwise, environmental, when related to the non-occupational contexts (Loureiro et al. 2008) (Table 1).

The proper study of the ergonomic factors in a tridimensional perception will assess the risk situations in commercial areas with free circulation of people and make easy the ergonomic intervention. In this new ergonomic context, a multiplicity of relationship was identified and characterized (Figure 3).



Figures 2: Binomial (a) versus Trinomial (b) ergonomic approach

Table1: ETdA ergonomic factors

Environment Factors	Occupational ergonomic factors	Individual ergonomic factors
Noise	Professional training quality	Work postures
Illumination	Decision making	General physical activity
Thermal environment	Restrictiveness	Communication /inter-relation
Risk accident	Job content	Attentiveness
	Work dimensions	

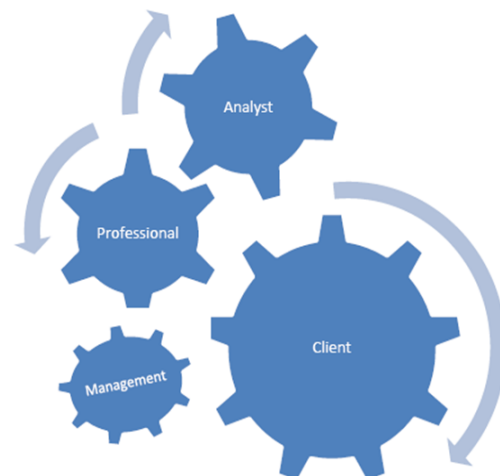


Figure 3: ETdA relationships' mechanism.



From the ETdA point of view, it is necessary to understand all the mechanisms that regulate these relationships because they can contribute to the business improvement strategies (Loureiro et. al 2010b). The relationships identified were: Analyst/Professionals (AP), Analyst/Clients (AC), Clients/Professionals (CP) and Management/Clients/Analyst (MCA).

From the economics point of view, the existence of a CP relationship is very important since its success can determine a sales profits improvement for the organization. The ETdA model defined this relationship as bilateral, because it is a trust relation based on a multilevel interaction, professional skills, professional training, mutual empathy and understanding. It is also important to consider that the agreement in clients and professionals ergonomic analysis has more impact in the ergonomic intervention. The AP relationship usually considered in the traditional ergonomic analysis is essentially occupational and focused in workplace environments, so they become insufficient for CAFCP, where the clients' dimension is also considered. This is also a bilateral relationship but less effective than the first one. The AC relationship is identified as unilateral, since there is no physical interaction between those two dimensions. However, it is important to emphasize that the benefits of the ergonomic intervention proposed by the analyst will bring improvements in the commercial area, thus clients will also benefit from that intervention. The main issue of the management of the new social-technical systems is the clients' individual satisfaction requirements. Therefore, it is necessary to make some adjustments in the organizational framework; utility, functionality, environmental adjustment, aesthetics, prestige, usability and pleasure (Staton et al. 2005; Ziliani and Bellini 2004). This clients' dimension oncoming to the management organization facilitates the ergonomic intervention, creating co-responsibility in the changes to be implemented (Dzissah et al. 2005).

METHODOLOGY

The first step of ETdA model application is the contact between the analyst and the management of the organizations under study. This is a very important issue in the ETdA application as encourages the participation of the entire organization in the success of the process and consequently professionals must also be aware of all the ETdA steps. The second step of this

ergonomic approaching is the application of the ETdA observation tools (Table 2).

Table2: ETdA observation tools'

Dimension	Observation tool
Clients	Questionnaire
Professionals	Evaluation forms
Analyst	Direct and indirect observation

The evaluation forms and the direct and indirect observation of the analyst follow the methodology proposed in the Ergonomic Workplace Analysis (Ahonen et al. 1980). However, some adjustments were made in the professionals' observation tools. The main improved aspect was the establishment of a unique classification scale where the answer set categories' vary in ascending order, according to the seriousness of the situation: very good, good, bad and very bad.

A questionnaire was developed for the clients' dimension. It is a direct administration tool, which presents, as a main advantage, the possibility of quantification of a variety of data and consequent establishment of multiple correlations.

The questionnaire developed was divided in three major parts: (1) client's identification, (2) client ergonomic analysis, and (3) open question (Hill, 2000). The first part of the questionnaire allows the client characterization including the social-demographic characteristics like gender, age and professional activity. To contextualize the client on the ergonomic analysis, subject it is also asked about the client's meaning of the ergonomic concerns and to report the main reasons for the establishment preference. The second part consists on client's perception of ergonomic issues, considering three major groups: environment, occupational factors and service quality. The first group of questions is related with noise, lightning quality and risk of accident in the commercial area with free circulation of people (CAFCP). The anthropometrics limitations related with the attendance balcony and the height of the shelves are considered in the second group. In this group, one item accessed the restrictiveness' issue. It is important to note that the existence of a question where the client must evaluate the general appearance of the establishment intends to focus his attention in the commercial area itself. In the third group of questions, clients were asked to express their opinion about the quality of the professional training and the physical effort of the activity. In the third part it can be set an open-



ended question where clients express their general satisfaction with the establishment. Respondents can declare, in their own words, what could be improved in the service provided and on the establishment general appearance. This issue can have high importance for total quality management, as it reveals the client's perception and opinion about the establishment. The questionnaire was pre-tested to be used in the survey (Khalid, 2004). The questionnaire validation results (sensitivity, validity and reliability) contributed for its improvement. The most important one was the categorization of all the answers in one single version. This adjustment contributes for a better results' understanding. It is important to refer that the questionnaire validation was a significant step of this observation tool development, essentially because it is a questionnaire with a lower number of questions.

The final ETdA task is the statistical treatment of the three dimensions and the formulation of the priority list of changes to be implemented, named the weighting table. In order to achieve this issue, clients and professionals results were submitted to statistical treatment and subject to reorganization for a combined analysis. The different answers categories' included in the questionnaire and evaluation forms were assigned according to three major groups: negative, satisfactory and positive categories. Table 3 presents the categories distributions (Loureiro 2010a).

Table 3: Categories distributions

Categories		
Negative	Satisfactory	Positive
Always	rarely	Never
often	good	Unlikely
very bad, bad	sometimes	very good
dissatisfied	reasonable	Impossible
Little		

The existence of categories showing the severity on a particular situation should be considered relevant and can represent an indicator for the need of a supplementary ergonomic study. The negative categories could be used as an advice-guide, highlighting some risky situations that otherwise could not be detected, and can be useful to support the decision when the analyst and client are in agreement.

It is the authors' belief that the three dimensions results should not be equally weighted. The weighting of all the dimensions is a more reliable

process of diagnosis of the commercial area in study, facilitating the ergonomic intervention.

CASE STUDY

A case study was analyzed in a private health sector using the ETdA model. This study was carried out among the health sector, in six parapharmacies located in different geographic regions in the North Portugal. Several factors had contributed to the six parapharmacies selection, namely location, availability, contact and accessibility (Loureiro 2008).

A total of 600 questionnaires were delivered (100 for each establishment) to be distributed to clients' ETdA dimension. Each questionnaire was directly delivery in hands by the professionals and was completed in locus or at home.

Results analysis

The response rate was 33.7 % (n=206) distributed by the considered establishments. The results shows that client's age ranged between 13 to 75 years old, with a mean age of 36 and around 88% of the respondents were female (Figure 4).

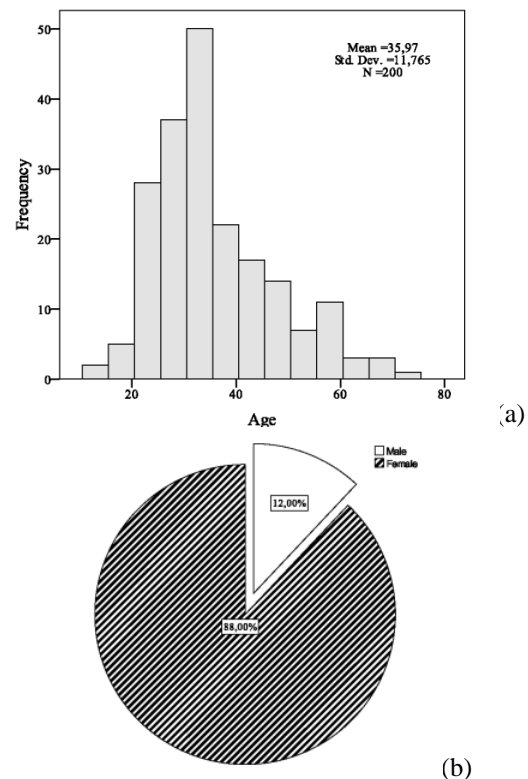


Figure 4: Clients' age distribution (a) and gender distribution (b).



The existence of two clients aged 13 and 14 years, increase the liability of the establishment, reinforcing the importance of potential ergonomic risk characterization (Loureiro et al., 2009). The establishment of a correlation between the outcome variables: environment, anthropometric and professionals' ergonomics factors and the clients' accident perception of a risky situation, explore the possibility that using client's perception of risk accident will affect the ergonomic issues and can contribute for the changing proposals to be implemented. Table 4 shows a summary of the result's descriptive analysis (Loureiro et al. 2020c).

Table 4: Variables response independence degree (Chi-Square Test, $p < 0.05$)

	Environment ergonomic factors		Anthropometric ergonomic factors
	Noise	Quality illumination	Trading desk
Risk accident	0.029	0.029	0.000

The findings revealed that clients' perception of risk is related with all the environment ergonomic factors studied. It was also related with an anthropometric ergonomic factor: trading desk dimension.

To analyze with more detail the effect of clients' and professional evaluation in the ergonomic approach, a deeper analysis was done. The clients' results show that the environment factors, noise and lighting quality, have a positive answer tendency, like anthropometric issues, quality service provide (professional training and restrictiveness) (Figure 5).

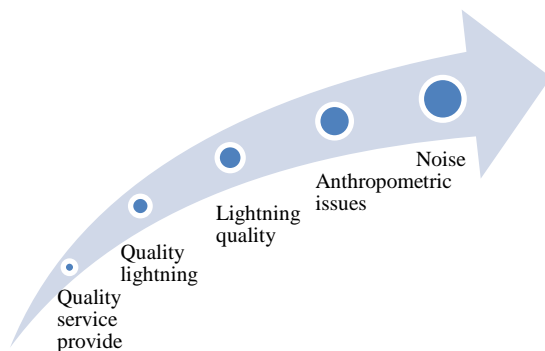


Figure 5: Satisfactory category tendency

The risk accident perception and general physical activity have the largest percentage placed in satisfactory categories. The professionals' results follow satisfactory category tendency.

In the ETdA model, negative and satisfactory categories should not be underestimated. They can symbolize an indicator for a supplementary ergonomic study. Therefore, the existence of categories in the two dimensions, that show severity in every ergonomic factors analyzed should be considered according to the relevance of each subsystems involved. In order to understand the impact of negative and satisfactory categories an exploratory analysis of the clients and professional dimension results' was done. The larger impact was in two particularly issues: professional training quality and restrictiveness. Considering the clients evaluation, the existence of negative categories in the professional training quality, sustains the idea that investment in professional training is beneficial not only to the corporate profits but also to increase service quality and client's fidelity (Table 5). Therefore, this particularly issue it is related with the subsystems: management strategies (Loureiro et al. 2010 a).

Table 5: Professional training quality (%) (negative categories)

Ergonomic factor	Clients' dimension results	Professional' dimension results
Professional training quality	2.6	0.0

The analysis of the restrictiveness issue confirms the importance of the negative categories in clients' results in the ergonomic intervention goals. If the analysis were only performed by professionals, the 6.3% obtained could be devalued. Since this issue is related with the client's service quality, and this is a particularly top management principle, the 9.8% related to the client evaluation is an indicator of the need for more and better investment in this area (Table 6).

Table 6: Restrictiveness' negative categories (%).

Ergonomic factor	Clients' dimension results	Professional' dimension results
Restrictiveness	9,8% (negative categories)	6,3% (negative categories)

A similar analysis can be done with other issues, showing that clients' involvement in the



ergonomic analysis will benefit the ergonomic intervention and consequently the professional environment.

It is easier to make organisational changes where the principal intervenient, the client, has the same opinion of the analyst and/or the professional. This co-production of the ergonomic priorities list seems to be more effective, contributing to an efficient ergonomic intervention.

FINAL CONSIDERATIONS

The sustainability of ETdA model is clear in its realistic overview of the real work in commercial areas with free circulation of people. Indeed, these areas are scenarios for different actors, and each one should be aware of the importance of ergonomic issues in modern society.

The understanding of the mechanisms that regulate the interaction between all the ETdA participants contribute for the success of management strategies. This issue will have a positive impact in the professional workplace (commercial area with free circulation of people, CAFCP) and consequently in clients' general opinion of the area under study. ETdA is a potential social instructive model, since the inclusion of clients' dimension in the ergonomic analysis it is important to focus the clients attention to ergonomics issues. This will contribute to this knowledge domain propagation. This is a model that will increase the population awareness for ergonomics, leading to co-production responsibility in society and in modern socio-technical systems.

ETdA can be seen as a continuous model. In effect, clients' dimension results highlight some risky situations that otherwise could not be detected. This particularly issue is useful to support the analyst decision when the professional and clients are in agreement. Considering the managements point of view, it seems easier to make organisational changes when the principal intervenient, client, has the same opinion of the analyst and/or the professional. The agreement in clients and professionals positive results has more impact in ETdA ergonomic intervention to be presented to the top management. Evidently, professionals will benefit of this management procedure.

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AUTHORS BIOGRAPHY



ISABEL F. LOUREIRO received her graduation in Pharmacy from Porto University in 1995 and in 2008 her MSc degree in Human Engineering from University of Minho. Presently, she is at University of Minho as an investigator developing her PhD in Industrial Engineering and Systems, since 2009.



CELINA P. LEÃO received her MSc degree in industrial Mathematics from University of Strathclyde/Glasgow Caledonian University, Scotland, in 1994, and in 2003 her PhD in Engineering Science from Porto University, Portugal. Presently she is at University of Minho, Portugal, as an Assistant Professor and as a researcher with the Algoritmi Center. Her main interests are in studies of numerical methods and statistics in engineering.



PEDRO AREZES has as degree in Industrial Engineering, a Master in Human Engineering and, in 2002, received his PhD in Production and Systems Engineering, all from the University of Minho. At the moment, he is an Associate Professor at the Production and System Department, and he also coordinates the research group of Human Engineering and the Ergonomics Laboratory.