

Macroergonomic Analysis of Structure (MAS) of Community Association of the City of Florianópolis

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ABSTRACT

This article aims to make a macroergonomic analysis of a residents association. An analysis was made of the macroergonomic structure (MAS) of an organization belonging to a small residential neighborhood in the city of Florianópolis, Santa Catarina, Brazil. The items that were analyzed are: the technological subsystem, the personnel subsystem and the external environment. A proposal for an ideal work structure system for this type of organization was created and compared with the diagnosed work structure that was in operation. From the comparative difference of the structural dimensions, guidelines were generated for a better structure of the work system. The guidelines are: the creation of intermediate positions, the creation of more working groups, greater autonomy over the decisions of members and directors and more solid organizational goals in the long term.

Keywords: Macroergonomics, Organizational ergonomics, Work system, Community association

INTRODUCTION

Article 53 of the Brazilian Civil Code clarifies that “Associations are constituted by the union of people who are organized for non-economic purposes.” In Brazilian society, there are several types of associations with different objectives, but with similar characteristics. All associations are private law entities, made up of two or more people who have a common objective and are mandatorily constituted by statute. Resident associations are voluntary association institutions that function fundamentally oriented towards political mobilization around the demands of the communities. Residents or property owners in a given region can join these institutions.

There are scientific demonstrations that macroergonomics can improve the performance of work systems in terms of productivity, quality, safety and health, quality of working life and user satisfaction, among others (Hendrick and Kleiner, 2002). Macroergonomics has a top-down approach, as it detects the variables that are relevant in the socio-technical system and their implications for the work structure and at the same time becomes bottom-up, due to the fact that these variables are addressed by methods of analysis and participatory implementation by subsystem actors. This participation of the actors

in the whole process is extremely important for less resistance to the changes that will happen after the analysis, since the diagnosis of what needs to be restructured was also made by them (Hendrick and Kleiner, 2002).

The first models of sociotechnical systems that had three components (social system, technical and environmental system) were developed by Trist (1981) and Pasmore (1988). Using the knowledge of microergonomics (physical and cognitive). Macroergonomists have for some time highlighted the importance of a systematic approach that develops better well-being and performance (Smith and Saintfort, 1989). Knowledge from other fields of ergonomics enables researchers to develop better system designs (Zink, 2000).

THE ASSOCIATION

For analysis, an association of residents of the city of Florianópolis was chosen. The association belongs to a small neighbourhood that has between 500 and 1,000 residents. The neighbourhood is residential, with mostly houses. The few buildings in the neighbourhood are no more than 3 stories high. The association is a legal entity governed by private law, with no economic, party-political or religious purpose. Any person over 16 years of age who is a resident or established in the neighbourhood can join the entity, who must pay a monthly membership fee. The association's financial resources are contributions arising from agreements and contracts, subsidies and assistance from the public authorities, monthly contributions from members and also income from events, exploitation of services and goods belonging to the entity.

Every two years, a general election is held with all members of the board, where the members of the executive board are defined. The executive board is formed by the positions of: President; Vice president; Administrative director; Community director; Director of Environment; Director secretary. In addition, biennial elections are held for the six positions (3 effective and 3 alternates) belonging to the fiscal council, the body responsible for verifying and overseeing the organization's accounts and contracts. The association's organizational structure also includes work groups created to carry out specific tasks. Example: organization of community events, maintenance of the neighbourhood vegetable garden, among others.

METHOD

For application in the residents' association, the Macroergonomic Structure Analysis (MAS) method was chosen (Hendrick, 2006). This method empirically combines analysis models of three sociotechnical systems: technology subsystem, personnel subsystem, and characteristics of the relevant external environment. MAS compares these systems with a fourth element, the work organization structure. From the results, it is possible to compare them with the structure of the pre-existing work system, or even serve as a guideline for the creation of a new one.

The method uses 3 dimensions of Analysis. Formalization, Centralization, Complexity:

- Formalization, from a macroergonomic perspective, is the degree of task that the work system is elevated to. Its highly formalized systems do not allow the employee to use creativity to develop tasks, a consequence of standardization, generating a lack of motivation. In a system with little formalization, unpredictability ends up creating difficulties in disciplining its members;
- Centralization is defined by an analysis of the origin of the decisions taken in a work system. When centralized, it presents a high hierarchy of positions and decisions are concentrated in a few members, who generally occupy top-level positions in the organization. In highly decentralized systems, work systems encourage lower-level workers to have more education and training, or greater professionalism;
- Complexity refers to the degree of differentiation and integration that exists within a work system structure. Differentiation refers to the degree to which the work system is segmented into different parts. Integration refers to the number and types of controls that are used to integrate the targeted parts for the goals.

MAS analyses the 3 elements of the socio-technical system in comparison with the fourth system (work structure) to generate a report where it is possible to point out where the problems are and the guidelines for developing a solution.

Analysis of the personnel subsystem: Three main characteristics exert great influence on the organization's work structure: Cultural/demographic factors, which comprise the values and diversity of the employees' culture. Degree of professionalism, which involves the degree of external and internal formalization of individuals. Psychosocial, which are the characteristics of the employee's personality.

Analysis of the external environment: Neghandi (1977) defines the five types of external environments that influence organizations: Socioeconomic (availability of materials and adequate labour), Educational (educational level of employees and their aspirations), Political (governmental actions), Cultural (popular view on activities) and Legal (law restrictions and requirements). In addition, environmental uncertainty also influences the performance of the work system, through change and complexity factors.

Analysis of the technological subsystem: This subsystem can be analysed through two factors: variability and analysability. Variability can be routine, where problems are well defined and have few exceptions, or non-routine, where problems are complex and have many exceptions. Analysability can be engineering technologies (which have many exceptions, but which are treated by logical-rational processes, with moderate centralization and flexibility), or craft technologies (which have routine tasks dependent on the judgment of the person in charge, demanding decentralization and low formalization).

The ergonomist evaluates the subsystems giving them scores from 1 to 5 for each sub-element analysed separately and producing results. By uniting

the analyses carried out separately, it is common to verify that the indications on the structural design of the system are heading towards the same objective. However, in cases with a non-compliant element, it is necessary for the researcher to integrate the results, which can be done by giving weight to the subsystems.

PROCEDURES

Due to the limitations of the research and the impossibility of the researcher being in loco all the time to observe the residents' association, an adaptation of the method was chosen. Instead of observation, it was decided to apply a questionnaire with a member of the association. The questionnaire was applied to the vice president of the association in a conversation that lasted about 40 minutes. During the application of the questionnaire, when asking questions related to each element of the different subsystems, the member was talked to and explained exactly what that question was. Below, you can see Table 1, with the questions asked, the scores associated by the vice president and the reasons given to justify the score.

RESULTS

It is possible then analyze each subsystem separately. In the technological subsystem, there is an organization with an engineering technology subsystem, where there are several exceptions but that can be managed using a defined logical-rational process. Consequently, moderate centralization is created, necessitating flexibility (see Table 2).

Checking the results, it is possible to analyse that the External Environment can be classified, within a study of environmental uncertainty, as being of 'moderately high uncertainty', since it has a low degree of complexity and a high degree of change, as verified in the Table 3.

At the end of the analysis of the three elements, the results are reached as shown in Table 4.

According to the responses of each item for each sociotechnical system, a table was created (Table 5), relating it to the 3 dimensions of analysis (formalization, centralization and complexity). Each subsystem has different weights for forming the average, as Hendrik (2005) states:

The separate analyses of the key characteristics of a given organization's technological subsystem, personnel subsystem, and specific task environment each should have provided guidance about the structural design for the work system. Frequently, these results will show a natural convergence. At times, however, the outcome of the analysis of one sociotechnical system element may conflict with the outcomes of the other two. When this occurs, the ergonomist is faced with the issue of how to reconcile the differences. Based both on the suggestions from the literature and my personal experience in evaluating over 200 organizational units, the outcomes from the analyses can be integrated by weighting them (...) (p. 737)

Table 1. Questions and answers about the subsystems present in the organization.

Subsystem	Element	Question	Score	Justification
Personnel Subsystem	Cultural factors/ demographics	Does the association understand the values and cultural diversity of its members as well as their personal characteristics such as age and gender?	5	The association welcomes cultural differences and creates committees according to skills and interests. Within these committees there are different people with different ages, genders and characteristics.
		Do members who have specific functions have external labor formalization, acquired outside the association?	1*	Associates do not perform functions that are connected with their external training. As an example, the director of the environment has a degree in plastic arts.
	Psychosocial	Does the association manage to ensure that its rules and guidelines are respected by its members?	5*	The association's communication is clear, with a policy of transparency, and rules defined by statute. Just like all decisions are debated and voted on.
Are association members usually open to change? Or do they have more rigid beliefs and do not easily receive changes?		4	Members are always open to changes with a view to improving the neighbourhood they represent. Despite the fact that there are people who have lived in the neighbourhood for a long time who are still a little opposed to changes.	
External Environment	Change	Does the external environment that influences the association have predictability about how the socioeconomic, educational, political, cultural and legal aspects will behave?	2	Even without having a political-partisan bond, the association depends on government actions to have its objectives achieved.
	Complexity	How many components interact with the binding environment? (suppliers, third parties, etc)	2	The association depends only on its members to function. However, the members, the government and residents (even those who are not members) interact with the association.
Technological Subsystem	Variability	Are the tasks variable, complex, without routine and with many exceptions?	5	The functions of each member have many exceptions as they depend on the demand of the moment. Ex.: Pollution; Cleaning of green areas; Drainage plan; Master plan. And commissions are created to solve these problems if they already have a specific board for that area.
	Analysability	Do the tasks have many exceptions but are they handled with logical-rational processes, with moderate centralization and with flexibility?	3	Even though the situations are not centralized, being decided by several people and having a well-defined hierarchical system for decision-making, the person legally responsible for them is the president of the association.

*The score given for each question was the one that is in the table, however, as there is more than one question for this element, an arithmetic average of the questions was made to be used as the only final score for that element.

Table 2. Classification of 4 categories for the technological subsystem with the category that fits the searched residents' association highlighted.

		Task Variability	
		Routine with few exceptions	High Variety with many exceptions
Problem Analysability	Well defined and analysable	Routine	Engineering
	Ill-defined and unanalysable	Craft	Nonroutine

Table 3. Classification of 4 categories for the external environment with the category that fits the searched residents' association highlighted.

		Degree of Change	
		Stable	Dynamic
Degree of Complexity	Simple	Low uncertainty	Moderately high uncertainty
	Complex	Moderately low uncertainty	High uncertainty

Table 4. MAS results for each variable of the sociotechnical system of the residents' association.

Sociotechnical Variable	Rating Score ^a
Technological Subsystem	
Task Variability	5
Task Analysability	3
Personnel Subsystem	
Level of professionalism	3
Cultural factors	5
Psychosocial factors	4
External Environment	
Environmental complexity	2
Environmental uncertainty	2

a Rating scale: 1 = low, 3 = intermediate, 5 = high.

Because the organization is a voluntary work organization and deals daily with the problems that affect the personal lives of each individual, a weight of 3 was given to the personnel subsystem, 2 to the external environment and 1 to the technological subsystem. Thus, an ideal work system structure was generated for the researched residents' association.

Then, the structure of the work system indicated by the method was compared with the current work structure (diagnosed by the researcher). From the difference between the points, the guidelines for the changes proposed for a better functioning of the structure of the organization's work system were defined (see Table 6).

Table 5. Work structure indicated by the method for the association of residents.

Structural Dimensions	Technological Subsystem ^a	Personnel Subsystem ^a	External Environment ^a	Weighted Rating ^b
Vertical differentiation	2	3	3	2,8
Horizontal differentiation	3	5	4	4,3
Integrating mechanisms	2	5	4	4,2
Formalization	3	2	2	2,2
Centralization: Tactical	2	3	2	2,5
Centralization: Strategic	3	4	5	4,2

^aWeights: Technological Subsystem = 1; Personnel subsystem = 3; External Environment = 2;

^bRating Scale: 1 = low, 3 = intermediate; 5 = high.

Table 6. Comparison of the MAS result with the current work system.

Structural Dimensions	MAS	Current	Difference
Vertical differentiation	2,8	2,5	-0,3
Horizontal differentiation	4,3	4	-0,3
Integrating mechanisms	4,2	2	-0,2
Formalization	2,5	3	+0,8
Centralization: Tactical	2,5	2,5	-
Centralization: Strategic	4,2	4	-0,2

^aWeights: Technological Subsystem = 1; Personnel subsystem = 3; External Environment = 2;

^bRating Scale: 1 = low, 3 = intermediate; 5 = high.

ANALYSIS OF RESULTS

Most structural dimensions showed little difference between the indicated and current work system. Vertical differentiation is slightly less than recommended, therefore, as a guideline for structural improvement, the creation of some intermediate positions between association members and boards is recommended. Regarding the horizontal differentiation, which also presented a small difference in relation to the recommended structure, the suggestion for application is the creation of more working groups (commissions) in addition to those that already exist. Although the integration mechanisms made a small difference, the researcher did not find it relevant to define any guidelines for this structural dimension.

The structural dimension of formalization of the association has the greatest difference in relation to the one indicated. Therefore, as a guideline for improving this dimension, it is possible to evoke greater autonomy of the members of the committees and boards to make decisions, without these having to go through the sieve of the association's presidency or general assembly. The tactical centralization of the association was the only structural dimension of the work system that has exactly the same note as the suggested work system. Regarding strategic centralization, in order to reach

the suggested score, it could develop, through its boards, more solid and clear goals to be achieved in the long term.

CONCLUSION

Although there are no known publications of macroeconomic analyzes aimed at entities that use fully voluntary labor, it was possible to observe that the use of a macroergonomic method for analyzing the work system is possible for organizations that do not aim for profit. The choice of Macroergonomic Structure Analysis proved to be correct and appropriate for the chosen type of organization. The adaptations made, due to research limitations, did not affect the application of the protocol and its results. However, for future work, a greater presence in loco and involvement of the macroergonomist with the organization may result in more accurate investigations and avoid biased diagnoses by members of the organization.

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