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Barriers for transformation: Impediments for transforming the public sector through e-government

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BEHAVIORAL ASPECTS IN THE USE OF ERP SYSTEMS: STUDY OF A GLOBAL ORGANIZATION

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Abstract

Since the 1990's integrated information systems, better known as Enterprise Resource Planning, really started to take off as a potential solution for the integration of all core business areas in the organizations, allowing more visibility by consolidating all the information in one shared database, in real time. On the other hand, implementing a ERP system causes profound changes in the way employees perform their tasks. Research of the concerning literature suggests that ERP systems increase visibility and control within the company, the better access to information contributes to the empowerment of the employees, in the same way that the procedures of the ERP systems engage employees in self discipline and reflection on work practices. The literature review addresses concepts such as Foucault's view of disciplinary power, organizational control and empowerment. The study adopted a quantitative methodology through a survey conducted in a multinational organization with 213 respondents, revealed that the visibility offered by the ERP system fosters autonomy making empowerment easier and that the respondents do not feel more controlled by their superiors or peers. In contrast to previous research, which relates reflexion to improve working practices, the present study relates reflexion with commitment to performing the system's standardized tasks.

KEY WORDS: Information Technology, ERP Systems (Usage), Control, Empowerment

1. INTRODUCTION

This study seeks to test constructs of the specialized literature and analyze aspects of organizational behavior related to the use of ERP (Enterprise Resource Planning) systems through issues such as empowerment, control, reflection on practice, and conformity with rules. Our primary intent is to consolidate prior knowledge – and add information – on the visibility provided by ERP systems. Our study presumes that multiple, profound organizational changes have arisen in the post-implementation phase of the ERP system life cycle, and presumes that they have a considerable potential to generate employee control and empowerment. Our main points of reference were the concepts of **Panoptic Empowerment** and **Reflective Conformity**, proposed by Elmes et al (2005), and **Panoptic Control**, proposed by Sia et al (2002), in light of Foucault's concept of *disciplinary power* and Bentham's *Panopticon*.

In recent years, employee empowerment has emerged in parallel with the traditional function of employee control (Drucker, 1988). The post-ERP implementation environment has revealed the considerable impact of these systems on user behavior, both among managers and among their subordinates. This seeming dichotomy has been reinforced by the literature, with authors such as Hanseth et al (2001) claiming that ERP systems are the ideal managerial control technology and Elmes et al (2005) showing that ERP systems are simultaneously able to provide management with ample visibility (and, consequently, greater control) and contribute to employee empowerment by providing access to information. Placing emphasis on the paradoxical view presented in the literature, in which a control technology such as ERP simultaneously facilitates control and fosters empowerment when such control may impose restrictions, and using as a reference the work of Elmes et al (2005), which introduces another, distinct contradictory concept of reflection and conformity, this study seeks to contribute with a greater understanding of these effects on organizational behavior, providing the necessary subsidies for organizations to effectively manage these impacts, with the organizational culture of different countries as its background.

Our study was conducted in a multinational organization in the post-implementation stage of the ERP system life cycle by quantitative field survey. Respondents from eight countries in which ERP had been in use for at least two years were chosen, for a total sample size of 213. The next section provides a theoretical background which represents the most relevant and related studies up to its completion date and presents the proposed research model, hypothesis and the underlying construct. Section three outlines the methodology and the data collection process. The analysis of results is presented in section four and the final section of this paper concludes with the final considerations and the study limitations.

2. THEORETICAL BACKGROUND AND RESEARCH MODEL

In the 1990s, new approaches to management appeared to keep up with the increasingly competitive environment of the corporate world. These new approaches were followed by new technologies, such as ERP systems, considered one of the most important instruments available capable of providing organizations with a competitive edge. ERP tools imposed themselves as a means of maximizing operational efficacy, cutting costs, integrating business processes, and consolidating information into a single database. In addition, there is the ERP system benefit of enabling a transformation from inefficient business processes toward accepted best of practice processes (Gattiker and Goodhue, 2004).

In implementing an ERP system, organizations envision – in addition to intended cost-reduction benefits – an ideal of control over and visibility of their business, which is emphasized by standardized and integrated processes. An integrated system highlights governance capacity, achieved through the integration of data generated by and used in distinct parts of the organization (Hanseth et al, 2001). On the other hand, the implementation of ERP entails profound changes in the manner in which employees carry out their duties, not least because most ERP implementation processes involve

reengineering of business processes, which leads to radical organizational restructuring and changes them, seeking gains from extraction of novel information.

Several studies have sought to investigate individuals' perceptions on the manner in which work practices have unfolded post-implementation of an ERP system. One such study has found how individual performance can be affected by ERP use, when system users are empowered in high-pressure contexts (sometimes characterized by an overload of work and information) or, conversely, by insufficient provision of relevant information by the system (Elie-Dit-Cosaque et al, 2006).

Some studies have focused on the relation between control and empowerment in the context of ERP system use. An empirical investigation conducted by Psoinos et al (2000) suggested that while information systems (including ERP systems) may contribute to empowerment by providing access to information, they can also restrict employees' freedoms by limiting actions through inflexible processes and increasing performance expectations. Control and empowerment must therefore, be carefully balanced to ensure that the former does not hamper the latter. Hanseth et al (2001) also note that a global organization that implements ERP seeking to strengthen control may in fact obtain the opposite result, that is, less control than it had before.

Our study recognizes the potential of ERP systems to generate control and empowerment, and, particularly, on two prior studies conducted in light of Foucault's perspective of power and Jeremy Bentham's *Panopticon*. These concepts are presented in greater detail below:

1) Sia et al (2002) argue that ERP systems create an *information panopticon* through the visibility of information they provide, giving employees decision-making power while simultaneously making them visible to management, thereby leading to employee empowerment; ERP systems thus make both control and empowerment viable. Sia et al call this duality *panoptic control*. Despite finding evidence of its potential in their study, the authors report that management at the studied hospital tended to keep hierarchical structures in place, leading to greater reinforcement of managerial authority than employee empowerment and, consequently, an unbalanced distribution of power with a high level of control and low empowerment. A qualitative methodology was adopted, followed by a quantitative survey whose data collection instrument was validated in a series of interviews.

2) Elmes et al (2005) define empowerment as any increase in employee power, be it through greater formal authority or through maximization of access to useful information, enabling workers – and, consequently, the organization – to achieve institutional objectives with maximum efficiency and efficacy. Like Sia et al (2002), Elmes et al suggest that employees are empowered mainly because they have greater visibility of information, giving them greater control over the factors affecting the manner in which they carry out their functions. From Foucault's standpoint (1979), they suggest that an organization can empower its workforce without actually transferring power to employees, by considering power to be the "property" of the entire system. The authors call this combined concept of empowerment and multidirectional visibility *panoptic empowerment*, and add to the study the concept of *reflective conformity*. In this concept, they suggest that the rules and procedures of organizational processes in an ERP system lead to greater discipline and induce greater reflection of work and of how the ERP system itself works, making both more effective. The results of the study showed a simultaneous increase in control and empowerment, and also found greater conformity and reflection in business processes. They used an interpretive perspective with "Grounded Theory" methods, using the Glaser (1978) approach, and conducted data collection through observation, formal interviews, and informal conversations in a multinational industrial corporation.

Seeking to answer a series of questions regarding behavioral aspects of the use of ERP systems in global organizations, such as user empowerment, control, reflection on work practices, and conformity with rules – to which this study intends to contribute, be it by consolidating prior knowledge or by obtaining new information – the figure 1 below suggests a structured model built around a few research hypotheses. The research model considers a structure in which the integrated nature of ERP Systems (Davenport, 1998; Al- Mudimigh et al, 2001; Al-Mashari, 2003; Souza and Zwicker, 2003; Volkoff et al, 2005) determines: (a) ample visibility of information, (b) conforming to the rules of ERP

systems embodied in unrestricted way and (c) visibility of employee activities. This causal structure is well discussed in previous literature (Davenport, 1998; Dillard et al., 2005; Elmes *et al.*, 2005; Sia *et al.*, 2002).

The Visibility of Information enhances power of users allowing them to make their job more effectively (*empowerment*) (O’Leary, 2000; Psinos et al., 2000; Sia et al., 2002; Elmes et al., 2005; Elie-Dit- Cosaque et al., 2006), as well as the integrated business processes of organization embodied in the ERP Systems enable the autonomy improving the group decision making (Sacol et al, 2003). Within the context of a positivist paradigm, we may then formulate and test the following hypotheses: “H1- The Visibility of Information provided by the ERP system fosters empowerment of system user employees” and “H2-The Visibility of Information provided by the ERP system leads to autonomy of user employees”.

The control is enhanced because workers’ performance can be better monitored given the systematic tracking of transaction details and the real time (Sia et al, 2002). Standardized and accessible information makes visible any deviation from the norm (O’Leary, 2000) , and as Sia et al. (2002) suggest this knowledge of being visible extends the exercise of self-discipline at the individual level. Thus, we propose the following: “H3- The Visibility of Employee Activities provided by the ERP system makes it easier for the organization to exercise control over user employees”.

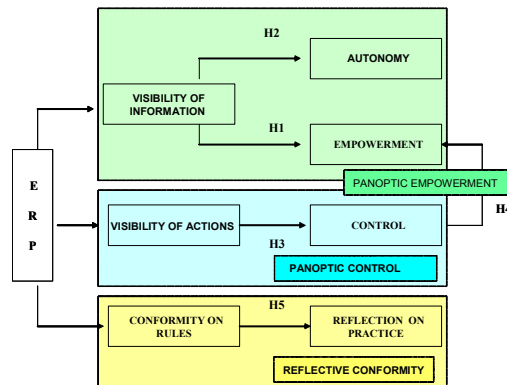


Figura 1 Research Model

Besides the results of Elmes et al ’study (2005) that showed a simultaneous increase in control and empowerment, Saeed et al. (2006) attempted to demonstrate that empowerment and control are intrinsic to each other in the same manner that empowerment supports control on present organizational environment, effective control relies on the empowered employee. So, based on the literature review, we propose the following hypothesis: “H4- Employee control is positively related with empowerment of user employees”.

Dillard et al (2005, p.115) remark that ERP systems are the expression of instrumental rationality revealed in administrative expertise, and “As an instrument of control and domination imposes a mode of organizing and changing social relationships”. Kallinikos (2004, p.10) reinforces this discussion when he observes that “...ERP systems have profound effects on the structuring of work and the forms of human action they enable or constraint.” Eventually, in researches conducted by Saccol et al (2003) in organizations could be noted that the workers with more knowledge on ERP system were more valued by the organization. However, aspects as creativity and innovation in work practices were not used as much they should due to procedures routines. On the other hand, as previously mentioned Elmes et al (2005) suggest that the rules and procedures of organizational processes in an ERP system lead to greater discipline and induce greater reflection of work and of how the ERP system itself works, making them both more effective. Finally, we formulate: “H5- The disciplinary nature of conforming to the rules of ERP systems is positively related with reflection on work practices”.

3. METHODOLOGY

Our study was divided into two phases. The first, exploratory, phase consisted of a review of existing literature on the theme for increasing our understanding of the constructs above. We used several sources, as literature review, interviews, and documents on ERP implementation in the subject organization. Secondly, a quantitative field survey was made with a structured questionnaire as the data collection instrument, seeking to test and verify the inferences and conclusions of the previous authors.

Our subject organization, “Alpha”, is a Belgium-based multinational in the food sector, with 88 offices in 57 countries, 54 production facilities in 40 countries, and with a population of ERP users about 700 employees. The organization adopted the Baan ERP system in 1997, when it had 79 branches. The organization is in the post-implementation phase of the life cycle; the system has been in place at least two years in most branches. It was implemented for two main reasons: software standardization – the company used 19 different software packages at the time – and preparation of 38 branches for the Y2K bug. Analysis of the specific literature shows that most case studies of ERP implementation have focused on SAP systems; few studies of organizations with Baan systems have been conducted.

In light of the difficulties in contacting respondents in all the countries with the implemented Baan system, our criteria for sample definition was to select those countries in which the system was used by 20 or more employees. This narrowed our sample locations to Belgium, Spain, Portugal, Romania, England, Canada, the U.S., and Greece. This type of nonprobability sample, that is, a sample in which the probability of individuals to be chosen for the sample is not known to be equal (Malhotra, 2006) is done at the researcher’s convenience, and is therefore known as a convenience sample. Based on variables found in the literature (Sia et al, 2002; Elmes et al, 2005), we developed a questionnaire to measure the constructs required for hypothesis testing. In order to ensure that items corresponded to theoretical constructs, and, consequently, validate our data collection instrument, we conducted a pilot test (Sprangers and Hoogstraten, 1989) with 14 respondents (managers and non-managerial employees) using the Baan system in a production plant in Athens, Greece.

We used a structured, formal questionnaire with closed-ended questions in pre-established order (Malhotra, 2006). Notably, the questionnaire was self-filling, without respondent’ identification. Marconi and Lakatos (2000) note the advantages of self-filling questionnaires: they allow greater freedom in answering thanks to anonymity and dampen the risk of answer distortion, as there is no researcher influence whatsoever. We used a multiple-item Likert-type scale of one to five, with one (1) being complete disagreement and five (5) being complete agreement. We were concerned that respondents might not fully understand the questions due to the complex nature of the subject and therefore, devised three versions of the questionnaire: one in Portuguese, one in English, and one in Spanish. Questionnaires returned with only one of their two parts filled in were excluded from the sample.

The questionnaire comprised two parts, each of which was saved as a worksheet in an Excel workbook. Part 1 was composed of multiple-choice questions for the following variables: Country, Gender, Age, Department, Organizational Level, Position, Academic Background, and Years of Service. For the second part of the survey, we devised 20 statements based on inferences from Elmes et al (2005) and on the data collection instrument used by Sia et al (2002). These statements were distributed according to certain aspects described in the study hypotheses.

Access to the Baan user population was provided by the company’s Intranet and valid corporate email addresses. Due to security reasons, the company’s IT department would not allow employees access to an electronic form made available in a regular website. Our data collection strategy consisted of making employees aware of the survey through email messages, highlighting the importance of the study and its scholarly nature and purpose. Before mailing these messages, we contacted the company’s general management in each sample country, by telephone, in order to provide clarification on the study’s objectives and foster cooperation to ensure maximum, satisfactory results.

Data collection began on March 30, 2008, and concluded on May 30, 2008. Over the course of these two months, we received 240 responses; 213 of these questionnaires were considered valid (response rate, 89%). The 27 remaining questionnaires (11% of total) were excluded from the sample due to inconsistencies in data or incomplete response (one of the two parts of the questionnaire missing). Response was considered incomplete if less than 90% of the second part of the questionnaire had been filled out.

4. ANALYSIS OF RESULTS

4.1. Data Analysis Procedures and Sample Characteristics

Data analysis was carried out with the Microsoft Excel for Windows spreadsheet software and the SPSS for Windows statistical package. We sought to describe respondents' demographic characteristics and compare their responses to analyze any possible patterns: high levels of agreement or disagreement with certain statements and grouping of statements related to empowerment, control, self-discipline/conformity and reflection on practice factors. Data were analyzed through univariate and multivariate procedures (Hair et al, 2005). To validate our research model, we used descriptive sample analysis, factor analysis, Pearson correlation analysis, and univariate analysis of variance (ANOVA). We verified three hypotheses through descriptive analysis, by measuring mean agreement with the questionnaire's statements. We then tested two factor association measurement hypotheses through Pearson's correlation coefficient, seeking to measure the degree and magnitude of the relationship. ANOVA was used to detect any statistically significant differences between the perceptions of different groups, as defined by respondents' demographic data and average factor scores. For both ANOVA and correlation analysis, we created a score for each construct to be tested, determined by averaging the construct's component items.

The sample was distributed as follows: 81 respondents in Belgium, 29 in Spain, 28 in Romania, 26 in the United States, 18 in Greece, 14 in Portugal, and 11 in the United Kingdom. The majority of respondents (54.1 %) were male. Respondents were concentrated (38.2%) in the 30–39 age bracket; 50% of respondents were 40 years old or older and 51.4% were college graduates or had a graduate education. As for organizational aspects, 58.7% of employees were non-managers; interestingly, 55.6% of managers who responded were stationed at the company's headquarters in Belgium. Allocation of respondents was broken down as follows: 27.3% worked in the Sales areas and 28.3% in Operations/Production.

4.2. Analysis of Respondent Perceptions

Descriptive statistics and the number of valid cases (n) were calculated for each variable (see Table below), as well as percentage agreement rates (PAR), calculated by the formula $(\text{mean} - 1) / 4 * 100$, which converts one-to-five averages into a percentage figure. Agreement was highest with the statements 7,16, 17 and 19(PAR 71.95%, 76.17%, 74.41%, and 72.65%, respectively), showing responsibility, commitment, reflection on practices translating into good work, and interest in obtaining greater knowledge of the ERP system. Low levels of agreement were found with the following statements: 8, with a PAR of 41.86% and a 2.67 average; 9 with a PAR of 44.81% and a 2.79 average;12 , with a PAR of 45.42% and a 2.82 average; and 20, with a PAR of 43.66% and a 2.75 average. The first two statements concern employee control through peer and supervisor visualization of an employee's actions in the ERP system; users disagreed with both statements. Low agreement with the third and fourth statements is a reflection of conformity to rules; we may infer that employees question the rules and procedures imposed by the system, that is, they do not conform. Corroborating this assessment, respondents showed a high level of agreement with the statement 14 (PAR 63.85% and average agreement 3.55), showing non-conformity with the system, although they do show their foremost concern to be "getting the job well done", even if it means not using the ERP system. Lowest agreement was with the statement 4 (PAR = 32.98%, average score 2.32).

Descriptive Statistics							
	N	Mean	SD	Var	Skew.	Kurt.	IPC
1)With the use of the Baan system, I depend less on someone for additional information to execute my job.	213	3,66	0,966	0,934	-0,469	-0,201	66,43
2)Through the Baan system, I have access to historical information making my job easier.	213	3,69	1,071	1,147	-0,575	-0,239	67,37
3) In my job, the Baan System makes information from other functional areas more visible to me improving my decision making.	213	3,09	1,102	1,214	0,078	-0,754	52,25
4)The Baan System gives me an overview of other persons activities.	213	2,32	1,015	1,030	0,419	-0,467	32,98
5)Through the Baan system, I have more autonomy in executing my job.	213	3,40	1,049	1,099	-0,362	-0,399	60,00
6)Through the Baan system, it is very easy for my supervisor to find out my mistakes.	212	3,03	1,206	1,454	-0,162	-0,827	50,83
7) Management trusts me to do the operation right when I use the Baan system.	213	3,88	1,021	1,042	-0,774	0,176	71,95
8)Through the Baan System, it is very easy for users from other departments to see my job performance.	212	2,67	1,045	1,093	0,282	-0,299	41,86
9)The Baan System increases the control of my supervisor over my job performance.	212	2,79	1,202	1,445	0,209	-0,834	44,81
10) The Baan System increases my commitment with others departments.	213	3,13	1,102	1,215	-0,019	-0,719	53,17
11) I have more control over my tasks with the Baan system.	213	3,21	1,169	1,366	-0,204	-0,881	55,28
12)I can't improve my job because the rules and procedures of the Baan system don't allow for it.	213	2,82	1,169	1,367	0,112	-0,795	45,42
13) The Baan system doesn't allow reversing transactions when I make mistakes.	213	2,98	1,173	1,377	0,090	-0,725	49,53
14) In order to perform my job on the most efficient way, besides the Baan system I use of other parallel (or alternative) resources.	213	3,55	1,350	1,824	-0,539	-0,957	63,85
15) I think that the rules and procedures of the Baan System make me engage in greater self-discipline.	212	3,25	1,011	1,023	-0,436	-0,071	56,25
16)By using the Baan system, I understand that my acts have impacts on other departments / other people.	213	4,05	0,985	0,969	-1,052	0,937	76,17
17)If I don't perform my job well in the Baan System, it is likely that other processes depending on my inputs will be interrupted.	213	3,98	1,109	1,231	-0,853	-0,168	74,41
18) The Baan System increases my reflexion on improvements of my work practices.	213	3,06	1,104	1,218	-0,015	-0,523	51,53
19) I am interested in acquiring more knowledge concerning the Baan system in order to improve my work practices.	213	3,91	1,129	1,274	-0,727	-0,439	72,65
20) I perform my job according to the Baan system demands without questioning its procedures.	213	2,75	1,202	1,445	0,155	-0,853	43,66

Table 1 Questionnaire (Part 2) and Descriptive Statistics

4.3. Factor Analysis

Tests showed that factor analysis could be an appropriate method for analysis of correlation matrices, by means of the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO 0.846) and Bartlett’s test of sphericity. Factors are determined by their factor loadings, which must be significant; their values are obtained by rotating the loading matrix with Varimax rotation, a method that seeks to minimize the number of variables with large loadings, simplifying interpretation (Malhotra, 2006). Measurement scales are analyzed through communalities and Cronbach’s alpha coefficient, based on the tenet that, if all items in a measure are drawn from the domain of a single construct, responses to these items should be highly correlated (Churchill, 1999). The lowest acceptable threshold for Cronbach’s alpha coefficient is usually set between 0.6 and 0.7 (Hair et al. 2005). The measure of communalities, which refers to the variance shared by the original variable and all other variables, was included in the analysis.

Validation of the constructs mentioned in prior studies was carried out through factor analysis, in which factor loadings showed the significance of responses, which are able to express the behavioral impacts of the research model as perceived by individuals in the sample, with loadings distributed among the variables of four factors which we found and named **Empowerment, Control, Reflection, and Conformity to Rules** (see Table 2 below). We had total explained variance of approximately 60% (within acceptable limits) and an eigenvalue criteria of >1, as recommended for definition of factors. We considered the values closest to 1 (in modulo), which indicate strong correlation between the statement and the factor it is supposed to represent. We did so also with the **Conformity to Rules** construct, which did not show satisfactory reliability as measured by Cronbach’s alpha, but it showed high communality (>0.50) and we therefore decided to keep it.

MEASUREMENT ITEM	Factor Loadings	Communalities
FACTOR 1 - Empowerment: represents the dominant characteristics that concern construction of the employee’s decision-making identity through accessibility of information provided by use of the ERP system. The fact that all four variables initially suggested for this factor were kept is indicative of the scale’s considerable explanatory power.		
Alpha de Cronbach : 0,795		
% Variance explained in Varimax rotation: 19%		
Eigen-value : 5,064		
1) With the use of the Baan system, I depend less on someone for additional information to execute my job.	0,71	0,544
2) Through the Baan system, I have access to historical information making my job easier.	0,761	0,631
3) In my job, the Baan System makes information from other functional areas more visible to me improving my decision.	0,747	0,569
5) Through the Baan system, I have more autonomy in executing my job.	0,747	0,598
11) I have more control over my tasks with the Baan system.	0,515	0,594
FACTOR 2 - Reflection chiefly expresses concern with and commitment to good performance in order to avoid the negative impacts that actions performed poorly within the ERP system may have on other areas, leading to self-discipline in performance of daily activities. It is worth noting that the highest-loading variables in this factor suggest a different interpretation of reflection on work practices than that provided in the prior literature.		
Alpha de Cronbach : 0,769		
% Variance explained in Varimax rotation: 17%		
Eigen-value : 1,760		
10) The Baan System increases my commitment with others departments.	0,594	0,477
15) I think that the rules and procedures of the Baan System make me engage in greater self-discipline.	0,541	0,485
16) By using the Baan system, I understand that my acts have impacts on other departments / other people.	0,799	0,656
17) If I don’t perform my job well in the Baan System, it is likely that other processes depending on my inputs will be impacted.	0,737	0,555
18) The Baan System increases my reflexion on improvements of my work practices.	0,499	0,505
19) I am interested in acquiring more knowledge concerning the Baan system in order to improve my work practices.	0,598	0,424
FACTOR 3 - Control refers to the visibility of actions provided by the ERP system, which leads to increased control of one’s performance by peers and superiors. The factor is explained by three high-loading variables of those initially suggested.		
Alpha de Cronbach : 0,800		
% Variance explained in Varimax rotation: 15%		
Eigen-value : 1,550		
6) Through the Baan system, it is very easy for my supervisor to find out my mistakes.	0,737	0,671
8) Through the Baan System, it is very easy for users from other departments to see my job performance.	0,812	0,666
9) The Baan System increases the control of my supervisor over my job performance.	0,859	0,799
FACTOR 4 - Conformity to Rules was initially to be explained by five variables, was ultimately represented by two assertions: one denoting the meaning of the conformity and discipline inherent to ERP system procedures and the other suggesting non-conformity to rules as defined by parallel use of systems or resources other than ERP.		
Alpha de Cronbach :- 0,600		
% Variance explained in Varimax rotation: 9%		
Eigen-value : 1,003		
14) In order to perform my job on the most efficient way, besides the Baan system I use of other parallel (or alternative) systems.	-0,719	0,611
20) I perform my job according to the Baan system demands without questioning its procedures.	0,734	0,505

Table 2 Factor Analysis

4.4. Univariate Analysis of Variance (ANOVA)

Seeking a more in-depth analysis of the factors that mirror impact on behavior in the organizational environment, we used sample segmentation, analyzing possible relationships between perceptions and

the demographic variables that make up the first part of the questionnaire. We employed one-way univariate analysis of variance (ANOVA), a statistical test used to compare means in two or more populations; in this particular case, it was used to detect whether there were any statistically significant differences between the perceptions of different populations. The null hypothesis is that samples arise from populations with equal means for a dependent variable (Hair et al, 2005).

ANOVA uses the *F*-test to prove significant variance between mean group scores. In this case, groups may be countries, age brackets, or departments within the organization. However, according to Glass and Hopkins (1996, p. 405 *apud* Vidal, Zwicker & Souza, 2003), when used to compare groups with different variances, ANOVA may not produce accurate results. In such cases, one may use the *Brown-Forsythe test*, which does not presume homogeneity of variance and corrects the results of the *F*-test (*F**). Although univariate ANOVA allows us to reject the null hypothesis that group means are equal, it does not pinpoint the location of significant differences. In-depth investigation of a specific group means that may be of interest requires *post hoc* tests such as Tukey's honestly significant difference (HSD) (Hair et al, 2005).

ANOVA revealed no significant differences between countries in the Empowerment and Reflection factors, whose mean values ranged from 3 to 4. There were significant differences in the Control factor between Belgium and Romania, between Romania and Greece, and between Romania and the UK (see Table). Belgium data (81 respondents, 2.51 mean) suggests significant disagreement regarding control issues addressed by the visibility provided by ERP systems, while Greece and Romania show higher agreement (means 3.26 and 3.52 respectively) and a smaller number of respondents. Likewise, Romanian respondents (mean agreement, 3.52) disagreed markedly with those in the UK (mean, 2.36).

Our analysis of Organizational Level groups found no statistical differences between them in the Empowerment, Reflection, and Conformity to Rules factors, while there was a significant difference in the Control factor, as shown by a striking difference in mean agreement: the mean agreement (or, rather, disagreement) of managers was 2.44, while that of respondents in non-managerial positions (the majority of the sample) reached 3.12. There was a total of 125 respondents in the sample. Post-hoc testing with Tukey's honestly significant difference could not be performed, as there were less than three groups to compare.

Among Level of Education groups, ANOVA found no significant difference in the Empowerment, Reflection, and Conformity to Rules factors. Significant differences were found in the Control factor between respondents with secondary-level education and those holding master's degrees, and between those with secondary-level education and those holding doctorates (see Table). The mean agreement of respondents with a secondary-level education (3.07) – respondents who usually hold non-managerial positions and make up the majority of the sample – corroborates the notion that respondents without a graduate education feel that ERP increases the control their superiors hold over them. Respondents with master's or doctorate degrees showed significantly lower mean agreement with this statement (2.55 and 1.44 respectively), meaning they do not feel controlled, watched, or monitored; this leads us to infer that graduate-level respondents hold managerial positions.

Sites	ANOVA		Brown- Forsythe		Belg vs Rom Mean Diff	Belg vs Rom Sig	Tukey HSD		Rom vs UK Mean Diff	Rom vs UK Sig
	F	Sig	F*	Sig			Belg vs Grc Mean Diff	Belg vs Grc Sig		
Control	5,03	0,00	4,26	0,00	-1,0716 vs 1,0716	0,00*	-0,7530 vs 0,7530	0,03*	1,160 vs -1,160	0,01*
Education	ANOVA		Brown- Forsythe		Sec vs Master Mean	Sec vs Master Sig	Tukey HSD		Sec vs Doct. Mean Diff	Sec vs Doct. Sig
	F	Sig	F*	Sig			Sec vs Doct. Mean	Sec vs Doct. Sig		
Control	4,50	0,00	5,94	0,00	0,53 vs -0,53	0,019*	1,63 vs -1,63	0,03*		

* denotes significant difference at a sig. Level of 5 %

Table 3 Factor ANOVA, sample broken down by country and Level of Education

ANOVA of the Control factor again showed significant inter-group differences when respondents were divided into groups according to the department in which they worked, while, once more, there were no significant differences regarding agreement with the Empowerment, Reflection, and Conformity to Rules factors (see Tables below). Disagreement with the Control statements was most pronounced among employees of the company's Lab and R&D Department (2.07), compared to the Financial (33), Sales (57), Accounting (15), and Operations/Production (62) departments, which showed mean agreement values of 3.18, 2.98, 3.58, and 2.81 respectively. This may be explained by the fact that use of the ERP system is more widespread in these departments, which may lead to increased recognition of the activity and performance visibility afforded by ERP among the employees of these departments. The difference in agreement may also be explained by the nature of each department; the Marketing department (mean agreement, 2.38, 8 respondents), for instance, differs markedly from the Accounting department (mean, 3.58, 15 respondents), whose activities feature a high level of monitoring and control. The difference between Accounting and IT (mean agreement, 2.50, 10 respondents) is likely because the IT department does not use the ERP system and therefore does not recognize the monitoring and vigilance imposed by it.

4.5. Hypothesis Testing

After the reliability of scales has been assessed, the next stage is hypothesis testing. We will test hypotheses H1, H2, and H3 by using the mean scores of significantly loaded explanatory variables, and in hypotheses H4 and H5, we will analyze the intensity of association between factor variables with **Pearson's** correlation coefficient. To carry out this test, we created a score for each construct from the mean of its component items.

Hypotheses one and two, "H1 – The Visibility of Information provided by the ERP system fosters empowerment of system user employees" and "H2 – The Visibility of Information provided by the ERP system leads to autonomy of user employees", concerning the visibility of information provided by the ERP system and its role in facilitating empowerment and fostering autonomy, were proven by verifying mean respondent agreement with questionnaire statements that explain the Empowerment factor. Respondents agreed somewhat (average agreement 3.6) with the assertion that ERP provides visibility of information, thereby fostering autonomy and facilitating a decision making. With access to a greater volume of information comes increased employee power, as employee decisions are now supported by a more secure and reliable information base. According to an interviewee in the company's Greece branch, adoption of the ERP system was followed by delegation of greater responsibility and autonomy to operational areas, which then showed greater and more significant changes. Prior to ERP implementation, all transactions were performed by employees in the Financial department; according to the interviewee, the ERP system encouraged the (logical) conclusion that each department should carry out its own transactions. ANOVA revealed significant differences in the average agreement with factors related to these hypotheses between age brackets: respondents aged 50–59 or >60 expressed greater perceived recognition of the Empowerment factor than did employees in the 30–39 age range.

The third hypothesis, "H3 – The Visibility of Employee Activities provided by the ERP system makes it easier for the organization to exercise control over user employees", verifies whether the visibility of actions provided by the ERP system makes it easier for the organization to exercise control over employees who use the system. Respondents disagreed slightly (average agreement, 2.7) with the assertions that express the visibility of actions provided by the ERP system to employees' peers and superiors. We were unable to confirm the effects of this concept as presented in the studies of authors mentioned previously in this article. Agreement with the two component variables of the Control factor with greater explanatory power (0.812 and 0.859) ranged from neutrality to disagreement, (41.86% and 44.81%, averages 2.67 and 2.79 respectively), that is, respondents did not express recognition of increased control over their work performance, whether exercised by their superiors or by their peers. Respondents were neutral to the assertion that ERP makes it easier for superiors to spot errors (mean agreement, 3.03). From these results, we may infer that, although ERP systems make employees' actions more visible to their superiors and peers, employees did not feel more controlled,

monitored, or watched, as Sia et al (2002)'s Panoptic Control proposed they would. H3 is therefore not supported.

ANOVA revealed significant differences in the mean agreement of respondents with the Control factor. Managers and respondents holding master's and doctoral degrees disagreed more with the Control statements than did respondents with a secondary-level education; respondents working in Belgium disagreed more than did respondents in Romania and Greece, who showed the highest levels of agreement with the Control assertions; likewise, respondents in the UK disagreed more with these assertions than did those in Romania. Respondents in the Lab/R&D department disagreed most with the Control factor, as in comparison to those in the Financial, Sales, Accounting, and Operations/Production departments. These figures may be explained by the fact that ERP use in the Lab/R&D department is less prevalent than in other departments, which suggests that R&D employees underrecognize the visibility of actions and performance provided by the ERP system.

Although there was no express recognition that the increased visibility of actions provided by the ERP system facilitates control, our fourth hypothesis, "**H4 – Employee control is positively related with empowerment of user employees**", verifies whether employee control is positively correlated with empowerment of user employees. Our finding of a positive correlation between control and empowerment corroborates the **Panoptic Empowerment** concept defined by Elmes et al (2005), that is, the association of these two constructs arises with the visibility of information provided by the ERP system, which leads to greater autonomy and decision-making power for employees in operational positions, consequently giving them a greater sense of responsibility and fostering a concern with their actions within the ERP system. Pearson's coefficient was found to be 0.374 at a significance level of 0.01.

Our final hypothesis, "H5 – The disciplinary nature of conforming to the rules of ERP systems is positively related with reflection on work practices" tests whether the disciplinary nature of conforming with ERP rules is positively correlated with reflection on work practices. The concept of Reflective Conformity identified by Elmes et al (2005) emerged in our hypothesis testing, revealing a correlation between Reflection and Conformity to Rules – however, the correlation was negative. H5 is thus rejected. This may be explained by the fact that the Conformity to Rules construct sought to measure conformity that does not derive from hierarchical power, but rather from the inherent disciplinary power of ERP system procedures. Conformity was measured by two variables: one referred to the use of parallel resources in addition to the ERP system in order to perform tasks more efficiently, that is, non-conformity, and the other stressed conformity as performance of activities in accordance with the system's demands, without questioning its procedures. Our analysis revealed that respondents do not conform to the rules. Agreement with the statement that referred to the use of parallel resources was above average (PAR, 63.85%; mean agreement, 3.55), while agreement with "not questioning the system's procedures" ranged from neutrality to disagreement (mean agreement, 2.75; PAR, 43.66%). This shows a latent concern with doing a good job, even if it means not using the ERP system.

Regarding Reflection, Elmes et al (2005) captured this concept as being allied with conformity to the inherent rules and procedures of the ERP system, that is, the limits imposed by ERP systems are explained by Elmes et al (2005) from the standpoint of Foucault's "regime of truth" – the power of discourse that values disciplinary action. According to Elmes et al (2005), increased reflection on practices arises from the search for solutions to problems related to the use of ERP systems, or rather, the restrictions imposed by ERP systems would trigger reflection on how to improve one's practices at work. This Reflection construct featured the highest levels of agreement, as shown by the following variables: recognition that the respondent's actions may have an impact on other areas of the company had the highest PAR overall (76.17%) and a mean agreement of 4.05; user commitment to performing well within the system, PAR 74.41% and mean agreement 3.98; and interest in learning more about the ERP system in order to perfect work practices, PAR 72.65% and mean agreement 3.91. When asked whether ERP increased their reflection on how to improve work practices. However, respondents were neutral (PAR, 51.53%; mean agreement, 3.06).

This result showed that ERP system users are greatly concerned with their responsibilities and their commitment, and their **Reflection** on work practices is translated into a concern with doing a good job; however, their vision strayed from that proposed by Elmes et al (2005), according to which the ERP system would foster reflection on improving one's work practices in addition to promoting conformity to the system's rules. According to our results, it would be more realistic to characterize the Reflection construct as fostering increased user responsibility, so that users may correctly perform activities that were made highly standardized by the implementation of ERP.

5. FINAL CONSIDERATIONS AND LIMITATIONS

Interpretation of the results of our field survey led to the following conclusions:

- Although ERP provides greater visibility of employees' actions, respondents did not report feeling more tightly controlled or monitored by their superiors or peers. This contrasts with the results reported by Sia et al (2002), who recorded the **Panoptic Control** mechanism, and Elmes et al (2005), who claimed that employees know they are being watched and that access recorded by the ERP system correlates with disciplinary power, in accordance with Foucault's perspective. We must note that ANOVA showed significant differences in the average perceptions of manager-level respondents, with greater disagreement regarding the Control factor; this finding is coherent with the fact that employees in managerial positions do not feel the effects of vertically exercised disciplinary power.
- As for **Panoptic Empowerment**, verified by Elmes et al (2005) but not corroborated by Sia et al (2002), our results showed that the real-time, multidirectional visibility of information provided by the ERP system within Foucault's perspective fosters autonomy and increased decision-making power. This helps empowerment, regardless of the manner in which hierarchical power is transferred. None the less, the concept of Panoptic Empowerment – which Elmes et al (2005) stress is a contradiction, as it productively correlates high levels of control with high levels of empowerment – was not corroborated by high levels of control as reported by our respondents.
- The **Reflective Conformity** concept identified by Elmes et al (2005) correlates **Conformity to Rules** – brought about not by hierarchical control, but rather by the inherent disciplinary power of ERP procedures – with increased **Reflection** on work practices; that is, the limits imposed by these systems are explained by Elmes et al (2005) in light of Foucault's "regime of truth" – the power of discourse that values disciplinary action. According to Elmes et al (2005), increased reflection stems from the search to solve problems related to use of the ERP system, or rather, the restrictions of ERP systems would lead employees to reflect on their work practices. Our results, however, showed a negative correlation. The present study has shown that users of an ERP system show great concern for their responsibilities and commitment, and their **Reflection** on their practices translates into a concern for doing a good job. Our view strays somewhat from that of Elmes et al (2005), however, according to which ERP systems would promote reflection on work practices in addition to obedience to the rules of the system. A more appropriate characterization of this construct would be that reflection fosters increased user responsibility, to ensure that users carry out their activities (which become highly standardized upon implementation of ERP) correctly.

Some limitations should be considered in this study. First, our results do not permit a generalization of findings for the user population of systems ERP, getting restricted to the sample. The second limitation is concerning the problems of scale of Conformity to Rules. The reliability of Cronbach's alpha coefficient indicates that subsequent analysis should be seen with some reservations. The results of this factor suggest the need for improvement in the scale, probably through a search of the theoretical framework for new items that would assist in adequately explaining its meaning. The impossibility of identifying a relation between cause and effect by correlation analysis is the third limitation. However, as the literature points to the existence of such variables, the final analysis considers this relation as proposed in the literature. Future research can go deeper into behavioral

aspects, especially the control factor, taking into account the findings identified here as well as cultural dimensions of the countries.

References

- Al - Mashari, M. (2003). Enterprise resource planning (ERP) systems: A research agenda. *Industrial Management + Data Systems*, 103, p. 22.
- Al- Mudimigh, A.; Zairi, M.; Al- Mashari, M.(2001). ERP software implementation: an integrative framework. *European Journal of Information Systems* 10, 216–226.
- Churchill, G.A.(1999). *Marketing research: methodological foundation*. 7th ed. Orlando, USA: The Dryden Press.
- Davenport, T. H. (1998) Putting the enterprise into the enterprise system. *Harvard Business Review*. 76, 4, 121(11).
- Dillard, J. F.; Ruchala L.; Kristi, Y. (2005). Enterprise resource planning systems: A physical manifestation of administrative evil. *International Journal of Accounting Information Systems*. 6, 107–127.
- Drucker, P.F. (1988). The Coming of the New Organization. *Harvard Business Review*, 66, n.1, 45-47.
- Elie-Dit-Cosaque, C.; Kalika, M.; Straub, D. W. (2006). Evolutions of the Work Environment and Work Practices in a Post ERP Implementation Context. In *Proceedings of the Twelfth Americas Conference on Information Systems*, Acapulco, p. 2501-2511.
- Elmes, M. B.; Strong, D. M.; Volkoff, O. (2005). Panoptic empowerment and reflective conformity in enterprise systems-enabled organizations. *Information and Organization*. v.15,1–37.
- Foucault, M. (1979). *Discipline and Punish: The birth of the prison*. Peregrine Books: London.
- Gattiker T.F. and Goodhue D.L. (2004). Understanding the local-level costs and benefits of ERP through organizational information processing theory. *Information & Management* 41(4), 431-443.
- Glaser, B. G. (1978). *Theoretical sensitivity*. Mill Valley, CA: Sociology Press.
- Glass, G. V. and Hopkins, K. D.(1996) *Statistical Methods in Education and Psychology*. 3^a. Ed. Boston: Allyn and Bacon.
- Hanseth, O.; Ciborra, C. U.; Braa, K. (2001). The control devolution: ERP and the side effects of globalization. *Database for Advances in Information Systems*; 32,4;34. Fall.
- Hair, J. F.; Tatham, R. L.; Anderson, R. E.; Black, W. C. (2005). *Análise Multivariada de Dados*. 5th ed. Porto Alegre: Bookman.
- Kallinikos, J. (2004). Deconstructing information packages: Organizational and behavioural implications. *Information Technology & People*. 17, 1; pg. 8.
- Malhotra, N. (2006). *Pesquisa de Marketing: uma orientação aplicada*. 4th ed. Porto Alegre: Bookman.
- Marconi, M. A. ; Lakatos, E. M. (2000). *Metodologia Científica*. 3^a. Ed.São Paulo: Atlas.
- O’Leary, D.E. (2000) *Enterprise Resource Planning Systems: Systems, Life Cycle, Eletronic Commerce and Risk*, Cambridge University Press, Cambridge.
- Psoinos, A.; Kern, T.; Smithson, S. (2000). An exploratory study of information systems in support of employee empowerment, *Journal of Information Technology*, 15, n.3, 211-230.
- Saccol, Amarolinda Z.; Macadar Marie A.; Rodrigo Oliveira S. (2003). Mudanças Organizacionais e Sistemas ERP. In: Souza, César Alexandre; Saccol, Amarolinda Zanela (Org). *Sistemas ERP no Brasil: Enterprise Resource Planning. Teoria e Casos*. São Paulo: Atlas.
- Saeed, A. M.; Marcon, T.; Gopal, A., 2006. The Question Concerning Empowerment: subjects of the enterprise or enterprising subjects? In *Proceedings of the Twelfth Americas Conference on Information Systems*, Acapulco, 2520-2527.
- Sia, S. K.; Tang, M.; Soh, C.; Boh, W. F (2002). Enterprise resource planning (ERP) system as a technology of Power: Empowerment or Panoptic Control?. *Database for Advances in Information Systems*;33, 1: n.1, 23-37.
- Souza, C. A. and Zwicker, R. (2003). Sistemas ERP: Conceituação, Ciclo de Vida e Estudos de Casos Comparados. In: Souza, César Alexandre; Saccol, Amarolinda Zanela (Org). *Sistemas ERP no Brasil: Enterprise Resource Planning. Teoria e Casos*. São Paulo: Atlas.
- Sprangers, M and Hoogstraten, J., (1989). Pretesting Effects in Retrospective Pretest-Posttest Designs. *Journal of Applied Psychology*, 74, 2, 265 – 272.
- Vidal, A.G. R.; Zwicker, R.; Souza, C.A.. A Informatização em Empresas Industriais Paulistas: um Estudo Exploratório. In: *Anais do Encontro Nacional da Associação Nacional de Pós-Graduação em Administração*. ENANPAD, 27^o,2003. Atibaia. São Paulo .Atibaia: ANPAD, 2003.
- Volkoff et al. (2005). Understanding enterprise systems-enabled integration. *European Journal of Information Systems*. 14, 110–120.