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INTERACTION BETWEEN INFORMATION SYSTEMS AND WORK IN THE BRAZILIAN BANKING SECTOR

A INTERAÇÃO ENTRE SISTEMAS DE INFORMAÇÃO E O TRABALHO NO SETOR BANCÁRIO BRASILEIRO

LA INTERACCIÓN ENTRE SISTEMAS DE INFORMACIÓN Y EL TRABAJO EN EL SECTOR BANCARIO BRASILEÑO

ABSTRACT

This article presents the results of a research to understand the conditions of interaction between work and three specific information systems (ISs) used in the Brazilian banking sector. We sought to understand how systems are redesigned in work practices, and how work is modified by the insertion of new systems. Data gathering included 46 semi-structured interviews, together with an analysis of system-related documents. We tried to identify what is behind the practices that modify the ISs and work. The data analysis revealed an operating structure: a combination of different practices ensuring that the interaction between agents and systems will take place. We discovered a structure of reciprocal conversion caused by the increased technical skills of the agent and the humanization of the systems. It is through ongoing adjustment between work and ISs that technology is tailored to the context and people become more prepared to handle with technology.

KEYWORDS Interaction between work and information systems, banks, structure of reciprocal conversion, humanization of systems, incorporation of technical aspects in work.

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RESUMO Este artigo apresenta os resultados de uma pesquisa com o objetivo de entender em que condições se dá a interação entre o trabalho e três sistemas de informação (SIs) específicos usados no setor bancário brasileiro. Buscamos compreender como os sistemas são redesenhados nas práticas do trabalho e como o trabalho é modificado pela inserção dos novos sistemas. A coleta de dados foi baseada em 46 entrevistas semi-estruturadas e na análise de documentos referentes aos sistemas. Buscamos identificar o que subjaz às práticas que modificam os sistemas e ao trabalho. A análise dos dados revelou uma estrutura de arranjo operacional: uma combinação de diferentes práticas, que assegura que a interação entre os agentes e o sistema aconteça. Encontramos uma estrutura de conversão recíproca, gerada pela tecnicização dos agentes e pela humanização dos sistemas. É neste ajustamento continuado entre o trabalho e os sistemas que a tecnologia se adequa ao contexto e que as pessoas se tornam mais bem preparadas para lidar com a tecnologia.

PALAVRAS-CHAVE Interação entre trabalho e sistemas de informação, bancos, estrutura de conversão recíproca, humanização de sistemas, tecnicização do trabalho.

RESUMEN Este artículo presenta los resultados de una investigación con el objetivo de entender en qué condiciones se da la interacción entre el trabajo y tres sistemas de información (SIs) específicos usados en el sector bancario brasileño. Buscamos comprender cómo los sistemas son rediseñados en las prácticas del trabajo y cómo el trabajo es modificado por la inserción de los nuevos sistemas. La recolección de datos se basó en 46 entrevistas semi-estructuradas y en el análisis de documentos referentes a los sistemas. Buscamos identificar lo que subyace en las prácticas que modifican los sistemas y en el trabajo. El análisis de los datos reveló una estructura de arreglo operacional: una combinación de diferentes prácticas, que asegura la interacción entre los agentes y el sistema. Encontramos una estructura de conversión recíproca, generada por la tecnicización de los agentes y por la humanización de los sistemas. En este ajuste continuado entre el trabajo y los sistemas, la tecnología se adecua al contexto y las personas se preparan mejor para lidiar con la tecnología.

PALABRAS CLAVE Interacción entre trabajo y sistemas de información, bancos, estructura de conversión recíproca, humanización de sistemas, tecnicización del trabajo.

INTRODUCTION

The increasing use of information technology (IT) leads to significant changes in work (TAVARES, 2008). The introduction of IT resources results in intentional and non-intentional consequences (VAAST and WALSHAM, 2005), which are interpreted and understood in various different ways by users (PINSONNEAULT and RIVARD, 1998). In the area of information systems (ISs), researchers are faced with the task of predicting how users will react to new technologies and explaining the justifications and motives for these reactions (BEAUDRY and PINSONNEAULT, 2005). Two main lines of research try to address the scope of this phenomenon. The first is focused on the antecedents of IT use and is represented by technology acceptance models (DAVIS, 1989; Venkatesh and Davis, 2000). The second line of research is centered on adaptations made by users and their effects on results, such as group performance (DESANCTIS and POOLE, 1994). This approach reveals the complex nature of adaptation, describing how users modify their skills, knowledge and commitment (TYRE and ORLIKOWSKI, 1994), change their work and use technology in unpredicted ways.

Based on this second approach, the aim of this research is to understand the conditions existing in the interaction between work and information systems in the banking sector in Brazil. We sought to understand how the systems are redesigned by their users in their work practices and how their work is modified by the insertion of new systems. The investigation was defined by the selection of two banking institutions and three information systems used by them – two risk management systems and one asset management system. Data gathering was based on 46 semi-structured interviews with IT managers and users, together with an analysis of system-related documents.

We identified practices adopted by the agents which are inherent to ISs and work. We observed these practices and interpreted them by understanding the interaction between the ISs and work in the context analyzed. The interviews revealed practices that are relevant to the interaction between agents and IT artifacts, which are reconstructions of ISs and modifications on work. They were organized in a typology of practices associated to the systems and to work. By analyzing the origins of these practices and their relationships with the agents and IT artifacts, we find a structure of operating arrangement: a combination of elements which ensures the functional interaction between users and systems. By interpreting this visible structure, we find a structure that underlies the interaction between systems and work, with elements of power and resistance,

confluence of individual and organizational interests and conformity and conformism. A joint examination of these elements gave rise to the conclusion that the interaction between ISs and work in banks is defined as a structure of reciprocal conversion, which is caused by technical skills of the agent and humanization of the systems.

The discovery of this structure of reciprocal conversion constitutes the theoretical contribution of this research. By identifying the humanization of systems, we understand how they are reconstructed by their users in work practices. By knowing the technicisation of work, we understand how this is modified by the insertion of new systems, tools and processes. An understanding of how the use of these systems occurs in practice and how they interact with work is relevant, because ISs are critical for the economic competitiveness of banks. In a larger context, the optimization of IT investments contributes to develop the financial infrastructure of the country, which is crucial for the national economy, particularly in Latin America, where economic instability was a problem in recent history. There is also a methodological contribution, based on (i) specification of concepts based on empirical data and (ii) creation of an analytical grid that can be used in future analyses. Lastly, the research revealed aspects of interaction that can be applied in a more direct way by managers, relating to the fact that systems should be open to modifications and to the importance of conceptual training.

REFERENCE THEORIES

With the diffusion of IT usage in organizations, a growing number of researchers have sought alternative ways of studying the interactions between users and IT resources (WALSHAM and SAHAY, 1999). Among the new research approaches are the articulations made on the basis of the assumptions of Structuration Theory (GIDDENS, 1984). Structuration Theory represents a possibility for IT research: a theoretical approach that helps to understand the interaction between users and technology, its implications and how to deal with the consequences (JONES and KARSTEN, 2008; POZZEBON and PINSONNEAULT, 2005). This theory was used in many IT researches (WALSHAM, 2002; NICHOLSON and SAHAY, 2001; MAZNEVSKI and CHUDOBA, 2000; WALSHAM and SAHAY, 1999).

Two elements discussed in Structuration Theory can be particularly useful for research into the use of IT: the notion of duality between structure and action

and the learning capacity of the actor (POZZEBON and PINSONNEAULT, 2005). The study of the duality between structure and action emphasizes the construction and reconstruction of social practice. Structure is something that is incorporated into practice in a recursive way. This consists, in recurring practice, in the user shaping the structure of the technology and the structure, in turn, shaping its use (ORLIKOWSKI, 2000). The real nature of technology and its consequences emerge from human action (GIDDENS and PIERSON, 1998). The structure of technology is not external or independent from human action, but exists as a set of behavioral rules and as the ability to explore resources that emerges from the interaction between people and technology (WALSHAM, 2002). Structure shapes social life, but it not the shape in itself. It exists only through human action (GIDDENS, 1984). This does not mean that technology will not have an effect on social practice, but this effect will depend on how agents interact with technology (GIDDENS and PIERSON, 1998). The IT user is therefore a social actor: someone who plays the role of an agent in the adoption, use and adaptation of IT resources.

The other relevant element is the vision of the social actor as someone with the ability to learn and think. Social actors learn standards of action and interaction that become standardized, or even institutionalized, thus forming the structural features of the organization. When reproduced by the actors, these structural features make human action/interaction possible and restrict this interaction (POZZEBON and PINSONNEAULT, 2005). Action/interaction standards are related to the use that the individual will make of IT.

This view of technology through practice is focused on the structures that emerge as people interact with technology, either by building it, perfecting/streamlining its use, modifying it or inventing it (ORLIKOWSKI, 2000). Two aspects of technology coexist: technology as an artifact and the use of the technology. Technology is, on the one hand, a phenomenon with cultural and material features, namely a technological artifact. At the same time, the use of technology involves repeated experience, a personal ordering and an edited version of the technological artifact, which is experienced differently by each individual. Orlikowski (2000) called this aspect technology-in-practice.

Some misunderstandings are frequent in IT research when Structuration Theory is applied. It is common to see studies that follow the assumption of technology stability. After the development and stabilization of IT, technology would not vary very much (WOLGAR, 1991). Technology structuration models are based on the flexibility in the way

how technology is appropriated and avoid technological determinism. The idea of technological stability is falsified by empirical research, which shows that people change their concepts and technologies long after their planning and development (RICE and ROGERS, 1980). The focus is on human action and on how it represents emergent structures through interaction with technology. Focusing on how the structure is constructed and reconstructed in social practice shows that, although the user may use technology the way it was intended, he varies its uses, ignoring certain properties of the technology, working to avoid them or creating new forms that may be even contradictory with initial expectations (ORLIKOWSKI, 2000).

The perspective of the individual as an agent in the use of IT was a starting point that brought us closer to the central question under investigation. From this, we drew the ideas that (i) social construction of IT occurs in a situation in which different individuals negotiate what the technology will be and (ii) individuals make specific uses of IT, adapting it to their needs.

METHODOLOGICAL ASPECTS

Institutions and systems

The choice to study the Brazilian banking sector was based on the fact that banks are the largest investors in IT in the country, having invested a total US\$ 3.5 billion in IT in 2008 (FEBRABAN, 2009). This investment represented 12.3% of the revenue earned (MEIRELES, 2008). Our research was conducted at two financial institutions in Brazil. Bank 1 is one of the largest private banking groups in the world, with more than 8 million clients in Brazil. The second institution (Bank 2) is a government-controlled Brazilian bank with more than 20 million clients.

We investigated the process of development, implementation and use of the risk management systems and asset management system used by these banks. In the first type of system, the Bank extends credit and runs its risk management analysis. The system operates based on a workflow from the time when credit is initially requested, which is either evaluated automatically or by an analyst, until the moment when the funds, if any, are released to the client. Both banks opted to develop their systems, henceforth referred to as Risk (Bank 1) and Risk Portal (Bank 2), internally. Risk was implemented in 2006 and had 7,069 users in 2007. Bank 2 could not inform the number of users of its Risk Portal, which was implemented in 2001. The asset management system, henceforth referred to as Asset, was developed by the

leading provider of asset management tools, henceforth referred to as KNL. Both institutions based their operations on this system. It consists of a platform with various modules, such as portfolio assessment and calculations of investment quotas. The system has approximately 90 users in Bank 1 and 80 in Bank 2. In Bank 1, Asset was implemented in 2003, replacing an older system. In Bank 2, implementation was carried out when the Bank's custody area was created in 2004.

Data gathering

Data were gathered through semi-structured interviews and an analysis of system-related documents. The conduction of the semi-structured interviews was based on two types of protocols, one for IT managers and another for users. Both protocols were designed to identify the construction and reconstruction of social practice: how users shape the structure of technology and how this, in turn, shapes its use. We sought to identify how people interact with technology by perfecting and reinventing it. We also aimed at understanding the institutionalized standards of action, which constitute the structural features of the organization and shape human action. The protocol for managers was designed to enable us to understand (i) the main functions of systems, (ii) their conditions of use, (iii) the benefits and losses that systems bring to the organization and its users, (iv) the frustrations of users, (v) how the systems were deployed and (vi) the organization's perceptions of the relationships between individuals and systems. The protocol used in the interviews with users was designed to enable us to understand (i) which elements of the systems are used, (ii) how they are used, (iii) perceptions of the implementation of the systems, (iv) how the users were trained to use the system, (v) their opinions on the systems, (vi) the benefits and losses that systems bring to the organization and to users, (vii) how they perceive the influence of the systems in their work and (viii) their expectations and career goals.

A total of 46 people were interviewed between September 2007 and March 2008, as detailed in Table 1.

The number of interviews was defined by using the criteria of saturation, which designates the moment when any further data is unlikely to significantly change the understanding of a phenomenon (CRESWELL, 1998). When answers became redundant, we stopped conducting our interviews. This explains the relatively low number of interviews at the second bank, since the aim of these interviews was to validate the facts revealed at the first institution.

An analysis of system-related documents was carried out with the material provided to us by the Banks and KNL, with the aim of helping us to understand the inherent characteristics of the ISs.

DATA ANALYSIS

We began the data analysis by choosing the following core elements to the understanding of the conditions of interaction between work and information systems: (i) the agent, (ii) the IT artifact and (iii) practice. The *Agent* was defined as someone who plays an active role, either directly or indirectly, in the interaction between work and the ISs. The *IT artifact* was defined as the technological element present in the interaction being studied. *Practice* is a recurring action existing in the interaction between the user and the IS (ORLIKOWSKI, 2002) which defines the changes in work practices and in systems.

An examination and analysis of these practices allow us to identify which ones are relevant to the interaction between the agents and the IT artifacts and constitute reconstructions of IS and modifications to work practices. These practices were organized in a typology of practices associated to the systems and to work. By analyzing the origins of these practices and their relationships with agents and IT artifacts, we find a visible structure. By

Table 1 – Interviews conducted

BANK	INTERVIEWS	IDENTIFICATION CODES
Bank 1	6 IT managers	E1-E6
	20 users of Risk	E7-E26
	7 users of Asset	E27-E33
Bank 2	5 IT managers	E34-E38
	4 users of Asset	E39-E42
	4 users of Risk Portal	E43-E46

interpreting the visible structure and searching explanatory elements, we revealed the structure underlying the interaction between systems and work.

Details from the data analysis are presented in the sections below. First, to identify the practices, we organized the main ideas emerging from field research into topics, as shown below.

Topics revealed

The construction dynamics of the IS

Since systems were created, several stakeholders were gathered together to develop the tools which are best suited to the needs of users (E2, E4, E5, E10, E27, E31, E35, E38, E39 and E41).

- The system... is completely specified by the various stakeholders... We do this in an attempt to bring the system closer to meeting the actual needs of users. (E2)

The role of the user as an agent in the construction of the system extends to stages when changes were incorporated to improve it, due to the dynamics of the business. The processes of acquiring and improving the systems are characterized by struggles regarding who has the power to have their requests given priority (E2, E4, E5, E35 and E37). IT departments have demand volumes that exceed their ability to meet them. There are people responsible for defining what will be modified in the system, how this will be done and with which priority.

After production processes were structured around the systems researched, its use became mandatory, although the functions and fields that people use and the way they use them still vary (E5 to E8, E11, E17, E19, E20, E28, E30, E40 and E44).

- If we did not have it, we would simply be unable to work. (E11)

The interviews revealed that no system is perfect. Already when launched, the system has some points that need to be changed and improved. Over time, some functions became obsolete and new requirements emerged (E2, E4, E5, E35 and E38).

The use of risk management systems shows that the level of user autonomy influences the practical process of system design:

- Some systems are operating systems. They are those systems that you need to ensure that they will work

in a given manner... What are the systems that have user flexibility? The systems that deal with information. (E2)

The idea behind these risk management systems was to ensure that the operating level will have the least possible autonomy in extending credit. The system imposed rules that users have to comply with which effectively restrict their freedom in terms of use of the system. However, users who are decision-makers regarding credit approval have more freedom of action. The enhancement policy is adjusted to the purposes of the system (E7, E23, E37 and E43). Operating-level users of risk management systems find difficult to express their opinion about how to enhance the IS. Only users at certain levels contribute with ideas on what to incorporate in terms of changes in the IS. Operating-level users redesign the systems according to the type of individual use that they need, as presented in the next section.

What reinforces the systems as technology in a constant state of transformation is the dynamics of the business (E4, E5, E27, E29, E30 and E37). These dynamics are so intense that parameters can be specified for risk management systems to ensure that new products can be launched without IT support. In Asset, the introduction of new products and additional modifications is the responsibility of KNL, but the pace of development is slower than desired.

Types of use

We identified and present below four types of use of the systems: total use, partial use, combination and adaptation.

Total use

Total use can be understood as a user utilizing all the functions and fields in the system. This was practiced by only one person using the Risk Portal (E43) and the Asset manager at Bank 1 (E6).

Partial use

Partial use of the system is related to the restricted use of functions and/or fields. This was predominantly associated with the user's job (E2, E5, E7 to E9, E12, E16 to E20, E23, E27 to E29, E31, E43 and E45). Systems are based on workflows in which people use the portions of the system that are related to their job. Certain portions appear to have more flexibility, in the sense that the user can select how to use the system.

Fields that were not filled in at earlier stages of the work

cannot be used by a user accessing the IS later, which increases the partial nature of its use (E8 and E15).

Another factor associated with partial use is that the person who designed the system is not necessarily the user. As people leave the organizations, new users may prefer to work in another way, and that requires other functions and fields.

- The person that designed the system is not necessarily someone who will use it... There may well be features that were included to automate a process because someone wanted it that way. As and when this person leaves, it may never be used again. (E2)

The ability to use a system, which is influenced by training, was also influential in terms of partial use (E5), as users may not know about certain functions and fields in the system or how to use them.

Combined use

This type of use consists of combining the system with other software, other internal systems or external databases, such as the Central Bank and Serasa databases.

The use of ancillary software is often necessary (E5, E7 to E12, E15 to E20, E23, E27, E28, E30, E31 and E45). Risk and Asset were designed to further these combinations by allowing the input and output of data to Excel, for example, thus reducing system development costs. The use of systems with other software is shown below:

- I use it with Excel, the Internet and Word. With Excel, to know if it is a cartelized market. Word is used to paste a screen in a document in order to facilitate work. Because I work with loans to agribusiness, the Internet helps me to access areas that I do not know much about. (E10)

The combination with complementary internal systems, which is present in all the ISs, is permitted in order to avoid duplicate data (E7, E27, E29, E39 and E41).

In the case of Asset, Bank 2 also develops complementary internal modules which are more practical, safe and functional (E29 and E39).

The user may also choose to search data in complementary systems, as and when need is perceived, although this was not planned (E9, E12, E15 and E30).

Finally, accessing external databases to obtain complementary information, such as searching the Central Bank database (E4, E7 to E9 and E15).

Adapted use

The last type of use shown is the adaptation of the system to purposes for which it was not originally designed. This type of use was shown in the use of the Risk system to analyze credit proposals for Agribusinesses (E10 and E11). Agribusiness products are incorporated as being common individuals or corporations, and this generates less information than an analyst needs.

Assimilation of ISs

To understand how the systems are assimilated in work, it is important to know how people were trained to use them and the benefits and losses identified after the systems have been implemented.

The role of training in the assimilation of systems

The habit acquired in any given type of work needs to be modified after the introduction of a system that imposes other routines. Training has been seen as a facilitator in this process. Users of the Risk Portal never had formal training. Managers and users believe that, because the system has a simplified interface, its use requires little explanation. Branches are informed about the system and are given an operator's manual. This discussion is shown in the following statement:

- Since people always use systems adopting the same standard, they are used to it. (E38)

In terms of risk management ISs, there has been a change in the type of knowledge required from users in branch networks. The system can handle various products, because users do not need to know all the details. However, they need to understand what is behind the products being offered in order to answer the questions asked by clients and correctly classify the type of product. Conceptual knowledge of the products became necessary, although this type of training was not identified.

Individual and organizational benefits

Users identified benefits to the organization through the use of the system, such as safety, increased productivity, improved communication and cost reduction. A majority of the losses identified in these same organizations were related to opportunities to improve the systems which were not developed. They also identified individual gains in the system related to increased efficiency, increased motivation to work and more professional renown.

We found a situation at these institutions in which individual and organizational objectives were aligned. This

was due to the motivation to further career advancement by individuals in the institution or sector being studied. When people have a target to develop their careers in the organization or in the banking sector, systems that give them an opportunity to better perform this work will be well received.

Post-implementation enhancements

In the interaction with ISs, users see opportunities for improvement (E8 to E12, E15, E17, E20, E21, E23, E24, E26, E43, E44 and E45). Nevertheless, requests for such improvements are not always submitted. Among Risk users, the most common situation is that users who are not area leaders do not request changes (E7, E9 to E12, E16, E17, E19, E20, E23, E24 and E28). Changes are requested by the top of the hierarchy (E7 and E12). This is related to the fact that the IS is a control mechanism, and therefore decisions are based on the guidelines established by the risk management area.

The mechanism for requesting enhancements to the Risk Portal is different. In most cases, the system approves or rejects a loan request without it even being examined by an analyst. There is a concern that risk management should be open to the opinion of branches (E45).

Regarding Asset, both banks assume the position of a client in relation to a supplier. Both institutions encourage requests for improvements from all levels, including the operating area (E27, E30, E31). Managers are the persons responsible for receiving requests and defining what should be done and with which priority (E29, E37, E38 and E41).

Emerging forms of control

Risk management systems reduce the autonomy of work at bank branches:

- Users do not have any freedom in their actions, since this is one of the main objectives of the system, namely to standardize and control the process (E36).

Users of a branch network can only extend credit after approval is obtained from the system or from a credit analyst (E21, E24, E26, E37, E38 and E43), and prior to this they must comply with the mandatory rules and apply them. If a manager granted a larger loan in the past, his mistake would not have been identified, whereas now he would not be able to authorize this credit. These types of errors have been eliminated. The decreased autonomy was offset by the decreased responsibility assumed by bank branches.

- The completion of the operation is now done correctly.... At least everything associated with the proposal that goes to the operations center is known to be correct. This responsibility has been removed from our hands. (E21)

Due to the nature of the activities and the skills of the employees, Asset has a different type of control over the work done by its users. The integration between the areas which is enabled by the system appears to ensure mutual control between employees. Because the process is a structured workflow in the system, those responsible for subsequent stages in the process can attribute accountability to people who perform earlier stages of the work.

The practice of technological development

The dynamics of system enhancement tend to be in line with market dynamics (E35 and E38). As a product becomes more complex, it becomes increasingly difficult to automate. Users, on their side, are eager for this automation. As a result, the demand for upgraded systems is a challenge for the banking sector. The development of systems in this area always appears to be lagging behind sector requirements.

System outsourcing tends to reduce costs and facilitate development, because enhancements are generally requested by various clients who share the costs. This gives to the organization more power to access different competencies for systems development and does away with the need for an internal team. The wearing in the relationship between the organization and its vendor is an integral part of the burden of this kind of business deal (E41).

THE VISIBLE STRUCTURE: THE STRUCTURE OF OPERATING ARRANGEMENTS

Identification of practices

In the topics below, we identified practices that link agents to artifacts, which constitute elements of a visible structure. These practices were grouped in two types: practices associated with the systems and practices associated with work.

Among the practices associated with the systems is *shared construction*, which is the design and development of ISs with participation of various agents. This participation is based on the desire to develop a system that is in line with work requirements. It also increases the chances of more benefits being incorporated into the system.

Assimilation of the information system consists of incorporation of the system by its users as a tool in the production process. It occurs through imposition of the use of the system, training strategies and identification of organizational and individual benefits by system users.

Design of enhancements is the practice of users and managers designing enhancements to the IS as a result of the desire to incorporate benefits and update the system in order to meet increasing work requirements. The enhancements designed by users may or may not be submitted to managers. In addition, users request only the most crucial factors for their work, seeking to optimize the resources available.

Incorporation of enhancements refers to changing the system, by selecting enhancement requests. The manager elects what will be incorporated, as well as its priority, based on maintaining the status quo, on the potential benefits and on optimization of resources available for the changes.

Editing of the system consists of the different types of use of the systems practiced by users. These practices are usually necessary to tailor the IS to the different task requirements or individual preferences. They are also driven by the incorporation of benefits which the users believe that they might obtain in terms of differentiated use and which are also in line with the degree of flexibility of the system and the task. Finally, the combination of the system with other ISs and software is based on technical rationality, with the primary purpose of avoiding duplicate data.

Among the practices associated with work, *generalized control* is established by the rules on the use of the systems and by the improved ability to accomplish the tasks. This is a result of the attempt to optimize resources, as well as to simplify operating tasks.

Job enhancement consists of increased complexity as a result of product diversification and the volume of information available. It is a function of the optimization of human resources obtained by the increased free time as a result of automation.

Control of autonomy refers to the restriction of freedom of action of users through automation of tasks carried out by ISs, which should be used in accordance with the established rules. It is based on the objective of users acting within a defined scope of operations.

Restriction of responsibility is associated with the concentration of responsibility associated with any given task in specific industries. This results in optimizing resources, in giving more free time to larger groups and in the objectives inherent in system control.

Programmed tasks refers to accomplishing the task in accordance with the relevant rules, standards and protocols established in the IS logic. The purpose of this is also to optimize resources, because it simplifies what should be done by the user and complies with the objectives of system control: users will complete their activities as determined by the system.

Limitation of technological development consists of restrictions to meet demands with the use of automated systems, which defines the prioritized, pending and available functions.

The practices presented and their origins are shown in consolidated form in Exhibit 1.

Composition between the elements

We now proceed to analyze the relationships between practices, IT artifacts and agents.

Shared construction allows agents to participate by determining what has been idealized for them and what is in fact incorporated in the IS. Incorporation or non-incorporation can represent an improvement or a worsening of the artifact. Once the artifact is created, it should be assimilated by the agents. This assimilation begins with the imposition of the artifact. What the agents will use and how they will use it is partially determined by them, when they believe that it is beneficial or not. The artifact is something new in the productive process for which it is necessary to create a habit in terms of its use. After assimilation, the agents seek to improve the artifact. And this is where a dichotomy appears between what was designed and what was actually incorporated in the system, and between these two stages is what is transmitted or not by the agent. The enhancements transmitted can be incorporated in the IS or vetoed by the manager. If selected, the enhancement to be carried out can be prioritized or postponed. There is also the editing associated with the specific use of an artifact by an agent. This type of editing is represented by additions to or subtractions from the system obtained by combinations and/or partial use of the system. There are also uses that adapt the artifact for other purposes than those for which it was originally designed.

Practices inherent to the work generate various modifications. The agents have more control over their work carried out in an intensive manner. They are still monitored, but by automated means, which therefore controls their autonomy. Some have their autonomy reduced as a means of control, while others still have autonomy to perform their activities as the logic within the system provides for this freedom. The restriction of responsibility

ity is associated with the control of autonomy. People that have their autonomy reduced have the burden of certain responsibilities removed from them. The agent has a more comprehensive job description. The addition of information for analysis and product diversification makes the work more interesting. This is also true of the scope of the agent's activities, which was previously restricted to a more limited scope of information handled. The broadening of the task has to be accompanied by a similar scaling up of its programming. A portion of the work consists of a programmed task and the rest is at the discretion of the agent. The automation of tasks often leads to pending issues due to the limitation of technological development, which restricts what is available and what remains pending.

The relationships between practices, artifacts and agents are also summarized in Exhibit 1.

Synthesis of the visible structure

An interpretation of these practices and their relationships with agents and artifacts allows us to define a structure of operating arrangements: a combination of practices ensuring that the interaction between agents and systems will effectively occur. This operating arrangement begins with the participation of the agents when the IS is originally designed, which ensures that the system is the closest to the requirements of users. User training is also a strategy to facilitate the incorporation of the system in the workplace and the changes in work as a result of the system's implementation. The operating arrangement extends to the use of the IS, which is obligatory but with a degree of flexibility as to how it is used. This flexibility is shown in the edited versions of the system in terms of its adjustment to the work activities of an individual. Finally, the interaction between the IS and the user is favored by enhancements in the systems. These opportunities are identified and selected by those who identify them and by system managers.

The changes in terms of work also feature the same combination of elements that contribute to achieving the desired results. These results are leveraged by changes arising from the generalization of control, controlled autonomy, restriction of responsibility, more comprehensive job descriptions, programmed tasks and gaining from the various associated benefits. The changes in terms of work introduced by the ISs are limited only by the boundaries of technological development, which restrict the advancement of these technological tools, thus facilitating preservation of the objectives of the system.

FROM THE VISIBLE TO THE EXPLANATORY

We now proceed to an interpretation of the visible structure. We begin our interpretation efforts by examining the practices and finding their explanations as described below.

Interpretation of the visible structure

The defense of an organization's interests resides in shared construction by groups and individuals. It is characterized by power struggles in which users and groups bring the IS closer to what is considered important. Sometimes this consists of attempts to adjust the system, as a way of transforming a tool into something closer to what is needed.

The assimilation of ISs is characterized by the mandatory nature of its use. The use of the ISs is included in the organization's rules and is governed by interests present in the upper levels of power. The search for individual and organizational benefits is based on the defense of individual interests, the interests of groups and the interests of the organization itself. Another point is that the habit of using the system needs to be developed; training on its use is also a strategy to turn the system into a more natural tool.

After assimilation, the practice of adding enhancements to the system also indicates an attempt to turn it into a natural tool. The interests of individuals, groups and the organization are present in the design of these enhancements and in the selection of ideas.

The incorporation of enhancements is based on the desire to optimize resources (through the ability to develop technology) and to preserve interests. This determines what will be incorporated and when this incorporation will occur.

Editing of the system is another way to try to make the system appear natural as users add or subtract features or adapt it to other requirements. Editing also helps to defend the interests expressed in the incorporation of benefits. Lastly, this practice reveals the technical rationality of optimizing resources.

Generalized control is a strategy to establish rules at work and make oversight easier, largely in order to preserve the interests of the organizations concerned. Employees and rules become regulators. Generalization of control optimizes resources as it eliminates the need for direct oversight. Less direct oversight seems to reduce the levels of resistance to ISs.

Job enhancement results from the attempt to optimize the use of human resources, and the use of an advanced IS avoids making tasks more banal. The employee has a chance to deal with a far larger volume of products, which

requires additional skills. Therefore, this can be seen as a way to optimize human resources within an organization.

Programmed task and reduced autonomy work together in the defense of organizational interests. The objective is that the user complies with what has been established by the organization. In risk management systems, this objective is to ensure that the business area complies with what has been established by the risk

management area. The programming of tasks is also a way of optimizing human resources in an organization by streamlining the activity.

Restriction of responsibility arises as a way to preserve organizational interests. The bank opts to maintain more complex activities under the responsibility of a group. This compensates for the loss of autonomy as the user is free from certain responsibilities.

Exhibit 1 – Interpretation of the visible structure

VISIBLE STRUCTURE			UNDERLYING PRINCIPLES
PRACTICE	ORIGIN	RELATIONSHIPS BETWEEN ELEMENTS	TRANSFORMATIONAL INTERPRETATION
Shared Construction	Construction of the IS according to the work requirements Incorporation of benefits	Designed x Incorporated Improved x Weakened	Defense of interests Natural acceptance
Assimilation of the IS	Imposition of use Habituation Identification of benefits	Mandatory x Voluntary Beneficial x Not beneficial Habitual x New	Defense of interests Natural Acceptance
Design of enhancements	Efforts to incorporate benefits Efforts to update to meet work requirements Absence of communication channels Optimization of resources	Idealized x Incorporated Transmitted x Not transmitted	Natural Acceptance Defense of interests
Incorporation of enhancements	Preserving the objectives of the system Efforts to incorporate benefits Optimization of resources	Selected x Not selected Incorporated x Vetoed Prioritized x Postponed	Optimization of resources Defense of interests
Editing of the system	Tailoring to task requirements Tailoring to individual preferences and abilities Quest to incorporate benefits The natural acceptance of the system at work Technical rationality	Added x Subtracted Adapted x Standardized	Natural Acceptance Defense of interests Optimization of resources
Generalized Control	Optimization of resources Preserving the objectives of the system	Generalized x personalized Supervised x Free Transparent x Vetoed	Defense of interests Optimization of resources
Job enhancement	Optimization of resources Preserving the objectives of the system	Autonomy x Imposed	Optimization of resources Natural acceptance
Control of autonomy	Preserving the objectives of the system	Mandatory x Voluntary	Defense of interests
Restriction of Responsibility	Optimization of resources Preserving the objectives of the system	Interesting x Banal Broad x Restricted	Defense of interests
Programmed Tasks	Optimization of resources Preserving the objectives of the system	Programmed x Variable	Defense of interests Optimization of resources
Limitation of technological development	Limit to investment in technological Development Dependence on supplier Optimization of resources	Available x Pending	Optimization of resources

The limitation of technological development is also linked to optimization of resources. The institutions invest in priority interests, and this is necessary because, considering the dynamics of business development and the increased levels of demand for IT, technology is always a step behind work requirements.

Exhibit 1 summarizes the interpretation of the visible structure.

Underlying elements to the scenario studied

The relationships between the practices indicated an underlying structure, which included a series of elements such as (i) power and resistance, (ii) confluence of individual and organizational interests and (iii) conformism and conformity.

Power and resistance are present throughout the process of interaction between the user and the system, as a negotiation process, where each party tries to bring the system and the work closer to its needs and interests. The pressures associated with these different interests are present in shared construction, in the assimilation of the system, in the design and incorporation of enhancements and in the editing of the systems. The changes in work are also related to the issue of power and resistance: the imposition of a new type of control, a new set of limits in terms of autonomy and responsibility and programmed tasks to be performed inherently involves the defense of interests of both the organization and organizational groups.

In addition to these conflicts of interests, the confluence of individual and organizational objectives is present in the interaction between users and ISs. The deployment of systems provides a series of organizational benefits that do not appear to conflict with individual objectives. This confluence of objectives also favors change in the work, as it makes it more acceptable for the individuals concerned.

Lastly, the interaction between users and ISs is characterized by conformity and conformism with what has been established by the organization. Conformity occurs when a person's behavior reflects what he believes that the group sees as correct, whether he believes in it or not. Conformism is the attitude of accepting a situation without questioning, when individuals passively accept other people's attitude and thinking. The user is obliged to use the system in certain work routines, whether he agrees with it or not. Natural acceptance already reflects a degree of conformity with what has been established. Users improve the system because they cannot reject it. Editing the system reflects conformity and conformism, as they occur within the limits permitted by the organization. Conformism and conformity appear again in enhancement requests. Risk management

system enhancement requests feature a conformist structure which follows the risk policy of the institution. In regard to Asset, the banks assume the position of a client in relation to external suppliers. The institutions encourage enhancement requests. Conformism gives way to conformity: the users act according to the interests of the organization and their own interests. Finally, the optimization of resources sought in various practices also underlines the defense of organizational interests and attitudes that conform to those interests.

Interaction between the systems and work

A joint examination of the elements of power and resistance, the confluence of individual and organizational interests and the attitudes of conformism and conformity with what has been established by the organization allowed us to describe a structure of reciprocal conversion. Given the insertion of a new IS which users are obliged to use and leads to changes in work, agents put pressure on management to modify the system in defense of their own interests, interests of groups and interests of the organization itself. They negotiate to turn the system into something closer to their needs. Without questioning the essence of what the organization instituted, the system is humanized by being brought closer to the needs of people who use it. This results in the construction of social dynamics based on interests and requirements which are also being constantly reconstructed/redesigned, and within these dynamics the system is modified according to the pressure and resistance exercised by different groups.

At the same time, during the introduction and improvement of the system, work is also modified by incorporating technical aspects and being exercised by an agent who is adapted to this new circumstance. Agents adapt because they need to deal with the new work routine resulting from the implementation of the system. They interact, respond to the changes in their field of work and get used to them, which triggers new ideas, needs and interests. The agent adapts to the new scenario by approximating the systems and the new type of work required. In short, the work is automated by technology, either with its own inherent changes or those made by the agent.

Regarding the central question of this research, we demonstrate that the interaction between ISs and work at banks is defined by a reciprocal conversion structure, which is determined by the technical skills of the agent and the humanization of the systems. The practices associated with the system are predominantly designed to help in the humanization process, but they also contribute to the technological understanding of the agents by bring-

ing them closer to the system. The practices associated with work, which are clearly more related to the agent's technological understanding, are humanizing elements of the system as well, although to a lesser extent. This is because these practices are social constructions that approximate work with the interests and preferences of the individuals and groups. Organizational, group and individual interests are all defended as a result of the ongoing adjustment of the system, which also allows for technology to be tailored to specific contexts in order to make people better trained to work with it.

Summarizes the structure of interaction between the information systems and work in the Brazilian banking sector.

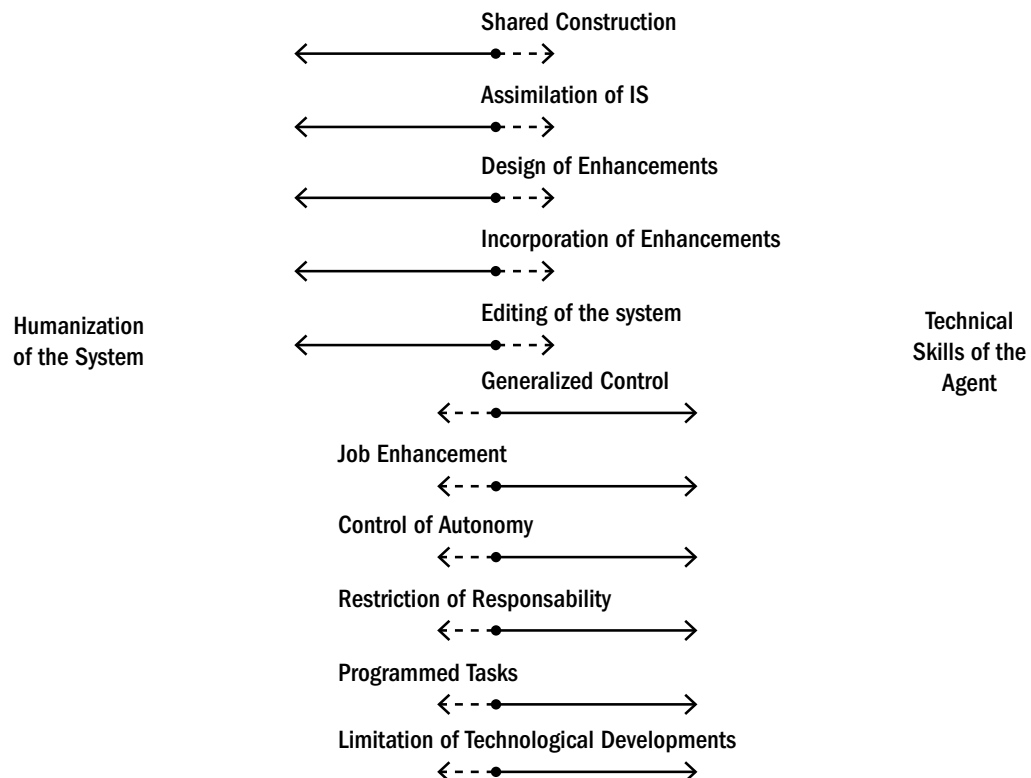
FINAL REMARKS

We conducted this research with the aim of understanding the conditions in which the interaction between work and the three information systems used in banks occurred.

By organizing the data on the core issues that emerged from the field and analyzing these issues, we identified practices which are relevant to the interaction between agents and IT artifacts. They are (i) shared construction, (ii) assimilation of the IS, (iii) design of enhancements, (iv) incorporation of enhancements, (v) editing of the system, (vi) generalized control, (vii) job enhancement, (viii) control of autonomy, (ix) restriction of responsibility, (x) programmed tasks and (xi) limitation of technological development. These practices were organized into a typology that divides them into practices related to systems and practices related to work. We identified their origins in order to explain the relationship between practices, IT artifacts and agents.

By analyzing these relations, we revealed the visible structure: an operating arrangement between various elements which ensures that the interaction between agents and systems, through work, will occur. By examining the practices, we found a structure which contained elements of (i) power and resistance, (ii) confluence of individual and organizational interests and (iii) conformity and con-

Figure 1 – Reciprocal conversion structure



formism. A joint examination of these elements revealed that the interaction between work and systems is defined by a reciprocal conversion structure which involves the humanization of the systems and a more technical approach to work. Agents constantly negotiate to turn the system into something as close as possible to what they desire. In this process, the system is humanized by coming closer to the needs of people. At the same time, work is also modified by incorporating technical aspects and being exercised by an agent who is adapted to this new circumstance. Agents adapt to the new scenario by approximating the systems and the new type of work required. Indeed, the work is technically streamlined by its inherent changes or by the technical skills acquired by the agent.

The research represents a contribution that complements previously proposed theories regarding (i) adaptations made by technology users and their effects and (ii) changes in work practices arising from the interaction between people and technology. This contribution is made to the extent that this research broadens the understanding of how users actually use technology in such an unpredictable manner, through adaptations, reinventions and appropriations, and how the work is modified by the introduction of new IT tools.

The initial idea that the implementation of a technology is only one of the stages of its assimilation has been reinforced. We showed how the meanings of technologies, their properties and their applications are processed by individuals in the process of interaction with technology. As proposed by Orlikowski (2000), we showed how technology-in-practice and technological artifacts transform each other. This corroborates the notion of implementation of a technology as a stage of assimilation. A technological artifact, once released, is reconstructed and becomes technology-on-practice. At the same time, certain features of technology-in-practice are often incorporated into the artifact during its enhancement process. Transformation of the systems and work occurs continuously. As the dynamic of the banking sector is characterized by constant changes in needs and interests, a completion and stabilization of technology and work proved to be utopian.

In short, this research revealed how, in recurring practice, users shape the structure of technology and social structure, in turn, shapes its use, as Orlikowski (2000) suggested. We explored and demonstrated the idea that the real nature of technology and its consequences emerge from human action (GIDDENS, 1979, 1984; GIDDENS and PIERSON, 1998, WALSHAM, 2002). This understanding is relevant because ISs are critical for economic competitiveness in the bank sector. The optimization of

IT investments contributes to develop the financial infrastructure of the country, which is crucial for national economy, particularly in Latin America, given the problem of economic instability in recent history.

The procedures adopted provided a methodological basis for the research. In its development, we formulated and specified concepts based on empirical data. By doing this and by adapting methodological procedures, we created an analytical grid that can be used in future analyses. Naturally, this grid can be expanded or reduced for analyses in other contexts.

Lastly, the research revealed aspects of interaction that can be more directly applied by managers. Managerial contribution lies in suggesting of a perspective which indicates that: (i) systems should be open to modifications in principle, as enhancements will depend on the participation of agents, on struggles between them and on the capacity for developing technology; (ii) the creation of habit regarding a new tool is critical, but changes in new systems and work are deeper than any instrumental training, as they require conceptual skills. This is what changes in work is dependent upon.

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