# Technology Acceptance in Libraries: A Systemic Approach

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## Introduction

Libraries have experienced important changes within the last twenty five years. Most of them have been conciliated by the continuous change in science, technology, and economic, social and political conditions. All the organizations, seen as systems with a constant exchange within their environment, perceive this transformation from a larger presence of competitors, a constant technological innovation, the need of access to new markets, the development and commercialization of new products, and the demand to maintain financial sustainability. All of the above demand a larger acclimatization need to the conditions of such environment in order to guarantee survival and success.

According to what has been exposed and to the reading of the university library, attention areas can be pointed out as being the ones that affect its future directly:

- Tools to improve processes.
- Technology innovation and supply.
- Changes in publishing market.
- Deeper study of its community of users.
- Impact of changes in education: new models and methods.
- Knowledge management.
- Connectivity to the worldwide web of information.

Besides these attention areas, libraries are urged to revaluate and adjust their missions, functions and services as part of a reinvention which allows them to face a world where other information providers contend for users. All of these imply a change in ways of working, processes, routines, and more importantly, organizational culture. The "market" requires more competitive libraries that can foresee possible demands of users and therefore, to be more proactive in their services offers. In contrast with the passive image of a library, this presumes a major agility for the organizational development of libraries, which allows them to effectively manage information and to deliver it in due time to the user. Hence, there is a need for a larger innovation capacity in organizational culture and the use of technological infrastructure.

Being inserted in an environment growingly dominated by Internet and electronic resources, university libraries, seeing as social organizations, need to understand that their environment is mainly a communication environment where all organizations and businesses are being reinvented based on Internet, its potentials and deficiencies. Internet opens great opportunities and also sets challenges in the creation and development of learning communities that do not constrain, as mentioned before, to university library as the only information provider.

In parallel, there is a need to provide value added services in order to face the accelerated growth of Internet and the growing wireless environment. Internet, even when allows larger access to information, does not guarantee a better quality of it. As a matter of fact, although the amount of digital information available is larger every time, our expectations of assimilating and "digesting" it with reasonable effort and time have also grown. Facing such facts, users demand for a greater organization and control of information and at the same time, they demand simplicity and easiness (usability) in the access to information services, including libraries.

To sum up, more every time there is a complex environment in the information world that determines means and contents for libraries, specially the academic ones, as they are subject to additional pressures from an educational model that tends to center itself more into learning and less into teaching.

For more than a decade, several authors have insisted on the need for libraries to "read" and interpret the changes in the environment so as to remain viable and close to their mission of warranting information access and developing services according to users needs (See Stoffle, Renaud, and Veldor, 1996).

Specially, the most recent technological innovations used in academic libraries tend to emphasize qualitative improvement in order to give effective services, instead of just increasing the amount offered.

We present a case study on implications of technology acceptance in a Mexican library at El Colegio de México, a large research centre in Mexico City specializing in social sciences and humanities. The library is the largest specialized in Social Sciences in the country and it is very based in technology and with a large tradition of service to Mexican scholars. Over 100 people work there and it has a very large ratio of professional librarians to users.

## Libraries and the diffusion of innovations

Innovation in information technologies do not just comprise the process of technology changes in use, but also a change in work conditions of those who make use of such technology. This socio-technical proposal (Cherns, 1976; Pollock, Higging and Murray, 1963) is supported by other studies (Commission of the European Communities [CEC], 1991; Hirschheim, 1985; Long, 1987). Since 1964, for instance, Leavitt developed his "diamond model" to present a dynamic vision of relations among the structure of an organization: duties, people, and technology. According to Leavitt, a change in one of the components implies changes in the rest of them, which presumes a need for a larger legitimization of technology within organizations. Ruel (2002) sustains that the relationship between the "spirit" of a technology (understanding "legitimization" of such technology through the application of a regulatory structure that explains and favors adequate conducts for its implementation) and the fitting level of it, by the user, is more positive if the implementation process includes changes in the internal environment of the organization.

In short, appropriation of a technology by the users will be easier if planning is guaranteed so as to enable changes in the internal environment in order to allow a "better" adjustment between technology and other organizational components.

Acceptance and adaptation of information and communication technologies (ICT)[1] are previous processes to complete assimilation of the same, which leads into the real and intensive use of new technologies; and therefore, into the productivity of the organization. Additionally, such assimilation of new technologies is a necessary condition to increase creativity in the elaboration of new products and services in libraries.

Throughout this research, technological acceptance by a user or an organization is understood as the demonstrable will to use a specific information technology for the duties it was designed and planned for at its implementation.

Considering this operational definition, we can add that technological acceptance, besides having repercussions on the use of new technologies, sets the grounds for real appropriation of such technologies and makes possible to intermediate users (librarians) to be diffusion agents of such technologies. In the case of Mexico, for example, it is common that university authorities assume that academic libraries should not only adjust to changes, but also that they must lead diffusion of change processes of information technologies inside their institutions.

Even in some university environments, authorities ask libraries to legitimize themselves as a physical space between four walls, just as we know them nowadays. The vision of virtual libraries those authorities have is of an accessible space from a desk computer, without printed books or journals. This misleading conception comes from the illusion other information providers try to sell.

This environment makes libraries and librarians to play a new role in their institutions in order to push a vital, dynamic and creative process. Goldstein (1994) assures that introduction of new technologies for information management has created an unbalanced condition in libraries and therefore, creates opportunities for organizational transformation. In fact, the degree of acceptance or rejection of a new technology by a library has an impact on its organizational culture.

In conclusion, from the library's management point of view it is necessary to have methodological tools that allow to anticipate what technologies are adequate and above all, that allow to plan actions to face the impact this technology will have on intermediate (librarians) and final users.

## Technology acceptance in libraries

Planning technological diffusion in library's work environments, especially in acceptance and adaptation stages, turns into an important process to propitiate the type of technologic innovation we have been talking about. If this is not carried out with a focus where the different factors and actors that are part of the organization participate and get involved, deterioration in organizational environment[2] and a decrease in productivity can be produced. The experience has proved that lack of planning in the acquisition of information and communication technologies in Mexican libraries may produce, besides what has been mentioned, a resistance to change in the routines, and a

[1] The information and communication technologies (ICT) term comprises hardware, software and telecommunication technologies. It can indicate one or more specific collections of hardware and communication technologies (Vriens, 2005).

[2] The organizational environment is seen as "a collective attitude, continuously produced and reproduced in the interactions among the organization's members".

difficult adoption of regulations and standards of quality and quantity that go along with technological innovation.

These problems are related to acceptance processes of those who are in charge of implementation (planning and design of acclimatization and personalization) and technology operation (intermediate and final users). An additional consequence to these problems can be its negative effect on the organizational environment.

In contrast, when conditions favor acceptance of information and communication technologies by users (intermediate and final), these contribute to a better use of information contents, which in turn gives place to obtain improved benefits to support the academy. Otherwise, when there is resistance or sharp rejection, the user will look for alternatives (and even will show dissatisfaction) to the proposed technology and more than likely, search, organization and information selection processes will become less efficient[3].

In the case we are about to present, to the analysis of the original problem of low productivity and deterioration of work environment due to technology acceptance, factors must had been added in order to allow diagnosing the situation and to plan an intervention process to favor technological change through organizational learning processes, but also to consider their impact in and their casual relationship with the following aspects:

- Productivity.
- Change in processes' routines.
- Regulations and standards of quality and quantity.

## Case study

The priority purpose of the case study was to understand, as well as possible, the phenomenon, meaning the implications that non-planned technological change had in productivity and organizational environment, as well as the intervention environment created so as to better the problematic situation. The heuristics of the case study was rebuilt in order to allow future comparisons with other similar cases in academic libraries and fortuitously, to make use of the experiences from this study to other contexts or situations. As it was mentioned before, the generalization of the registered facts in the case were not looked for; however, the possibilities the case presented for the expansion of knowledge in the systemic planning of technologic change area in a specific environment were pointed out.

Data collection techniques used for the study were made upon participant observation, field notes, interviews, and semi and not-structured discussions, as well as group discussions.

Data analysis in the study, besides codification of all possible values, followed a technique of adjustment to a pattern, built over the base of theoretical proposals expressed in the model of technological cycles, similar to the quasi-experimental design

[3] The term 'user' can have a general interpretation making reference to the person using technology. However, throughout this text, references to users are specifically thought for the members of the organization called library, meaning professional librarians and technicians related to the duties in the library. This is a contrast with the concept of final user, which is the one that makes use of the library.

of non-equivalent depending variables (Campbell, Stanley, and Gage, 1966). Also, the chronological series analysis was used, always trying to "explain" the case from the establishment of casual relationships among independent variables and the behavior of the dependant variable (for example, between the use intention and the use frequency or productivity in the model by Saga and Zmud, 1994), as it is described in Yin (1994).

The case study included the following items:

- Productivity measurement in 1999, in terms of quantity and quality standards.
- Previous evaluation, based upon data from previous step, in the application of questionnaires on organizational environment and sessions with focal groups (1999).
- Analysis of organizational environment and its relationship to productivity (1999).
- Analysis of planning processes at the library from 1990 to 2003.
- Analysis of deficiencies in the planning processes of technological change at the library (1990-1999).
- Recommendations that guided further intervention (2000).
- External evaluation carried out by international experts (2002).
- SWOT-analysis (strengths-weakness- opportunities-threats) carried out by academic personnel at the library (2003).
- Continuous design and application of the intervention model (2000-2003).

In order to analyze and present the case with a certain linearity , a preliminary systemic analysis of collected information lead to a first identification of technological cycles characterized by a way of thinking and acting on the three aspects mentioned in the previous page, related to information technologies and their incorporation to the processes at the library. Authors such as Mintzberg, Raisinghani and Theoret (1976) and Poole (1981) have perceived change process from two perspectives: as a unitary sequence and as a pattern of multiple sequences. In the first case, it is assumed that the adoption process is arranged and it occurs in a lineal sequence. In the second case, it is assumed that the process is random and the phases and sequences of its occurrences cannot be predicted. Under this last assumption, we may say that the three cycles mentioned ahead articulate the phases that went along the process of technological change at the library and its management during the period from 1990 to 2003.

The characteristic that identifies each one of these three cycles is the way in which the management of the organization interpreted, by that time the role of technology in the learning processes, after a "reading" of the institutional environment and the tendencies of the technology application in academic libraries. The cycles were:

**Cycle 1: Adaptation of new technologies (1990-1994).**

Trend: To adapt and integrate new technologies into the processes and routines of the library. The main assumption was that new technologies increase productivity.

Type of planning: Centralized and deductive.

**Cycle 2: Learning and group work (1995-2000).**

Trend: To increase collective knowledge trough group work and communities of practice, around concrete problems. An assumption was that collective learning and group work reduce stress caused by integration of new technologies into the processes and duties at the BDCV. Another assumption was that group work reduces adapting time and increases the frequency of use of technologies.

Type of planning: Participative

**Cycle 3: Appropriation: generative learning (2000-2003).**

Trend: To create knowledge related to technology use. The assumption was that learning on the use of technologies is a formal and social process of teaching-learning, which is susceptible to being improved through research-action, reflection and permanent questioning.

Type of planning: Collaborative orientation for the development of projects.

In the cycles description it is evident that the increase in the complexity and use of more specialized tools to plan the change and to adapt and integrate planning into the processes and services at the library, with the consequent complexity of utilized routines and regulations.

The identification of these cycles allowed to extract the main characteristics of each one of them, the learning obtained throughout these years and the main conclusions that give support to organizational change outlined in 1999; specially, in favoring group work and delegation of the decision making process.

**Diagnosis and intervention**

In the Saga and Zmud (1994) model of technological acceptance, the variables that have a more direct influence on the use frequency are: the beliefs of personnel on the effectiveness, utility and accessibility of the new technology, as well as the attitudes towards the use and the use intentions.

In turn, these variables are influenced by others such as the participation of user, the previous knowledge and the intervention of the management. In our case, the intervention of the management was focused on three factors:

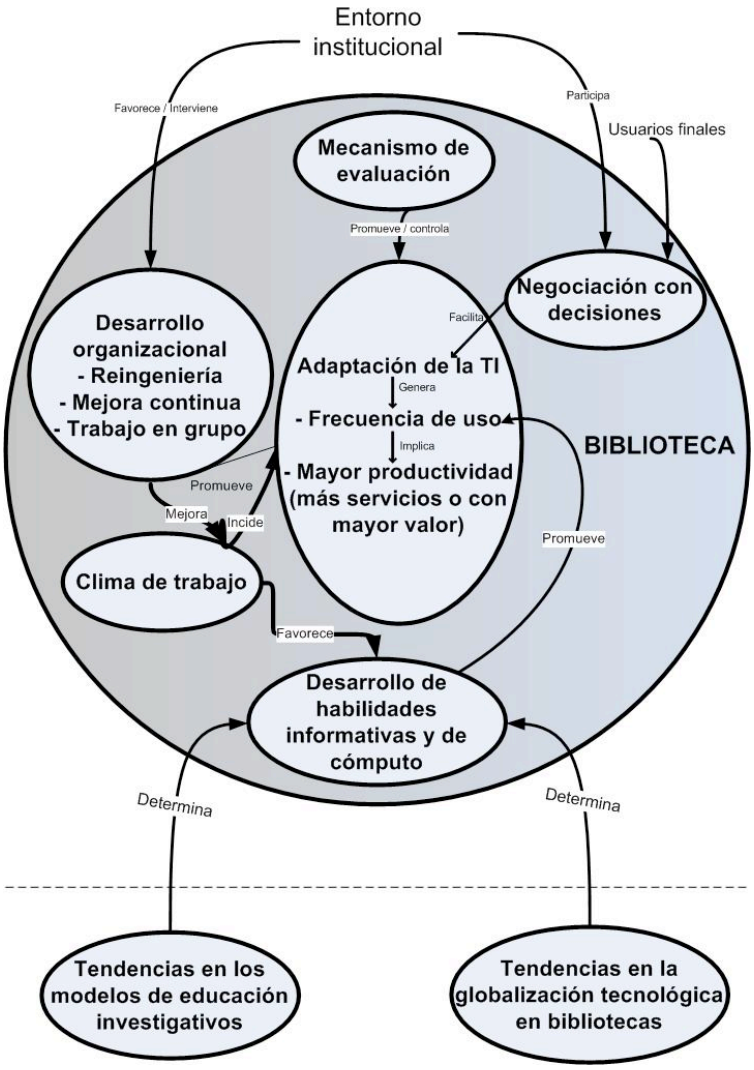
- Participation of academic personnel in the planning processes of technological change.
- The consideration of the academic personnel's perceptions in charge of adaptation processes (routinization and normalization).
- Previous knowledge of personnel on information technology and learning processes.

One of the questions that came up throughout the study made reference to the degree of whether productivity and expectations which the management had about it had been affected by the different shapes the professional work from personnel took and the flow of their activities, as a result from changes in technologies. Differentiation of personnel according to their abilities, as well as the individual or collaborative way of working had to be incorporated in the analysis as essential elements that could contribute to

adapting new technologies, whether the learning curve was slower or faster. The study found that these elements explained technological acceptance as a whole and that specific characteristics of every technology implemented resulted in being marginal at the time of explaining changes in productivity. In other words, contextual aspects turned out to be more critical than technical aspects of the library automation system adopted.

In order to help the understanding of the case studied and the different factors that shape it, the following graphic:

**Figure 1 Case's environment**




This graphic shows those factors, which being part of a non-transactional environment are; however, very important for the library: the tendencies in information and communication technologies and in educational models.

From a systemic perspective, social organizations, such as the library, are composed of actors who interpret each other as members of this organization and such mutual acknowledgement allows the organization to function as a macro level system, with auto-organization properties, as an autopoietic social system. (Maturana and Varela, 1980; Luhmann, 1996; Scott, 2002).

A major systemic property is the resistance to disturbances introduced by changes in the environment, which fertilizes the ground for planning processes that give shape to the organization in order to intervene it through micro-processes that allow change. Such micro-processes, as explained in technological change plan, must make people involved to participate in a collective learning based on reflection and action, even if the group of strategies and policies that guide change are often given from the highest levels of the organization.

However, the most common situation in the case study was the one that came up during the studied period; it consisted of integrating policies, strategies and details of planning as part of the change process itself. Therefore, intervention must begin from the group's understanding that the need for a change is a continuous educational process about the particularities of change management, which in turn is assumed as a change in the organizational culture (Scott, 2002).

In the middle of 1999, based on the results from interviews made to academic personnel, it was determined that it was necessary to modify the work structure. It was considered that the main goal was to reinforce individual capabilities and productivity starting from group work, as well as to impel self-management capacity and collaboration among parties. From that moment, different group works were generated, under the assumption that the organization was mature to learn, share knowledge and establish communities of practice. (Wenger et al., 2002).

The following groups were formed for the everyday operation of the library:

- Selection.
- Thematic Cataloging.
- Descriptive Cataloging.
- Validation of Authorities.
- Attention to Users.
- Management.

Furthermore, starting in 2000, the following transversal groups were created:

Substantive programs:

- Collection Development Program.
- Electronic Resources Access Program.
- Collection Preservation Program.
- Bibliographic Control Program.
- Authorities Control Program.
- User Instruction Program.

- Services Program.

Support Programs:

- Continuous Improvement of Processes and Services Program.
- Administrative Personnel Training Program.
- Automation Program (Administrative Processes).
- Diffusion and Signals Program.
- Financial Support Program.
- Professional Development Program.
- Spaces, Furniture and Equipment Fitting Program.
- Information for Decision Making Program.
- Security Program.
- Institutional Cooperation Program.

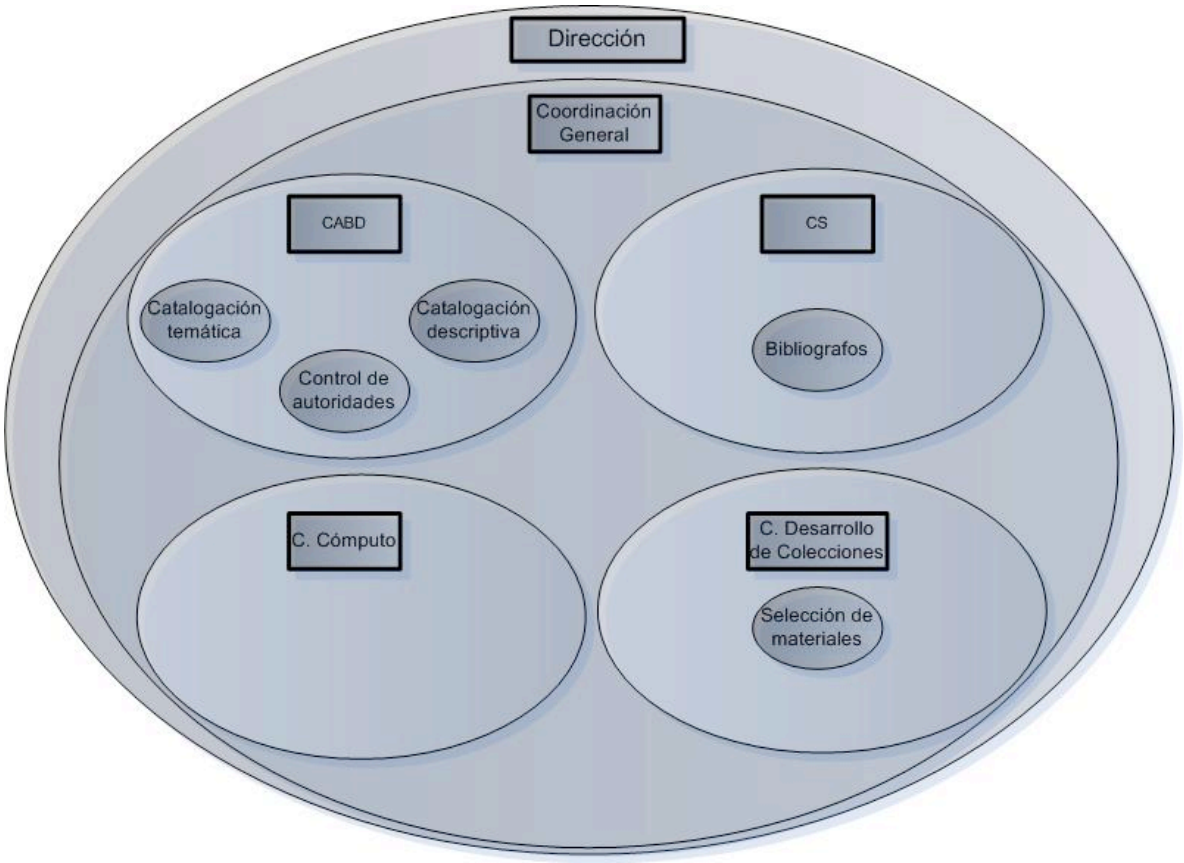
Work groups had a leader, who was rotated every three months. Work groups were integrated to the co-ordinations and leaned on general regulations, which were elaborated for their functioning, and that included the following aspects:

- Members.
- Group leaders.
- Scope of group action.
- Responsibilities of group leader.
- Responsibilities of group members.
- Responsibilities of Coordinator.

It is important to highlight that groups were formed only by members from the academic personnel, and that one person could be part of one or more groups, regardless of the Department. According to that, one person could be group leader and at the same time, part of another group. In the hierarchy line, the same person could depend of one or more co-ordinations; even of the Direction.

This type of organization required an information flow from each one of the groups and co-ordinations. Due to that, group leaders had to carry out communicative processes inside and outside the work groups. Figure 2 presents the functional organizational chart of work groups, existing since 2000.

**Figure 2. Functional organizational chart 2000.**




**Source: own elaboration**

The selection of members of each one of the groups was done according to capacities detected as strengths for each member.

## Conclusions of the case study

Throughout the three cycles established a priori, the case studied sets a pattern of regularity among the planning and technological change management factors. Productivity and environment kept acceptable levels within the first two technological cycles and added value was increased in processes and services at the library. However, it is at the end of the last cycle that productivity decreased and a perception of a disturbed organizational climate was generated. This suggested a need to adapt a planning process to the forthcoming technological change by starting with an organizational restructuration and a major "leveling" of structure, favoring work groups in order to promote future creation of communities of practice (Wenger et al., 2002), a goal that was not completed during the period studied.

By 2002, functions of the direction and co-ordinations were oriented towards work group and towards shared decision making. In the Collection Development Coordination, for example, one of the functions was to "carry out, with collaboration from bibliographers [from other department], the discarding of books that [were] not of

interest for the collection development, according to policies established" (BDCV, 2002).

It is in the Data Base Access Coordination where it can be observed at the end of the period studied that stronger learning allowed to orientate work to knowledge management in relation to information technologies, specially in the duties the group set forth in order to facilitate access to collections, apply international regulations for information transference and exchange, and in the access to digital documents reports. In this coordination, work group was extended towards the rest of the personnel, to include support staff.

The intervention done in 1999 looked to favor restructuring of the organizational climate and the return of productivity indicators to levels observed before diagnosis. In the recommendations made to the Direction by academic personnel in 1999, it was imperative to change styles of organizing and managing work at the BDCV so as to stop deterioration of work relationships among personnel. The hypothesis used for the intervention was that if changes were not carried out, the environment would worsen and an abrupt change of management would have been imperative. Timely intervention facilitated that such change of management would have been planned to happen at the end of 2003.

The external evaluation carried out in 2002 found that the structure and environment have been strengthened; and they were solid, even though they needed improvement, especially in the relationships among administrative personnel. Also, it was pointed out a need to make additional adjustments to keep the prestigious level at the library.

Determination of weaknesses and strengths, carried out in 2003 as part of the strategic planning of El Colegio, gave less optimistic results in relation to the organizational environment. Academic personnel kept sensing work environment as an organizational weakness, but it had less force as the one manifested in 1999. It was not possible to conclude whether the environment was improved substantially at the end or not, but it is clear that it did not worsen; it was just less suffocating as it was perceived towards the end of the century.

Much innovation has been produced at the library since then, under a new administration that began functions at the beginning of 2004, and many of the observations from external evaluators, allowing the building of stronger foundations for a knowledge management philosophy that begins to bear fruits, by voicing results in the recent Masters in Library Science Program that El Colegio began in 2004.

The analysis of documents from the period allow to verify that a process of continuous improvement has been developed, supported by careful planning, which has allowed to soothe possible decreases in productivity and to preserve work environment.

The change to favor work groups has been the detonator for other changes in the organizational culture, particularly the one that gave place to the possibility to value the chance to move forward in the development of academic personnel as very important, a need highlighted by the postgraduate program in library science that the BDCV develops since 2004.

## CONCLUSIONS

This work reached its objective to search for the possibility to plan acceptance and adaptation processes of information technologies and organizational change. During such process, the questions posed at the beginning were able to be answered.

It was found that appropriation of a technology by users will be easier if planning is guaranteed so as to enable changes in the internal environment in order to favor a "better" adjustment among that technology and the other organizational components.

It was also found that productivity in an academic library can be maintained during technological changes with an adequate prevision of learning factors that must be incorporated in parallel to the implementation, such as changes in routines of processes and the strengthening regulations and standards of quantity and quality. Also, work group must be favored, as a collective learning mechanism on the implementation problems. Curves of this learning are multiple and keep a complex dynamism, as technological change in the ICT used by libraries assumes simultaneous acceptance and adoption of different technologies that interrelate and demand for processes that do not only correct mistakes, but also that favor work group and organizational knowledge.

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