THE IMPLEMENTATION OF INFORMATION TECHNOLOGY AND ITS ASSOCIATION WITH ORGANIZATIONAL PROFILES

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Abstract:

The strength of IT (Information Technology) as a critical aspect of organizational success is related to today's competitive business environment. Three significant changes have transformed such environments, that is to say: coming of a global economy, transformation of industrial economies/societies into service economies based upon information and knowledge and finally the transformation of the company's business environment.

Degree of organizational innovation and the capacity to absorb technology have been acknowledged as decisive factors for the implementation of Information Systems due to the fact that they can drastically affect the organizational environment. The main objective of this study is the identification of relationships between some variables that can be classified into characteristics of organizational culture and others that refer to profile aspects of the organizations. This study presents some factors of the organizational culture considered critical for the capacity of assimilating technologies. Research with directors in the area of Information Systems was undertaken, achieving some interesting results. Among them is noteworthy that the capacity of assimilating an information technology is strongly related to the size of the companies and to the high administration's willingness to assume risks.

This study enabled the identification of variables that may affect the success of the absorption of IT in an organization Conclusions and recommendations are based upon the results of this research.

Keywords: Organizational Culture, Implementation of Information Systems, Business Technological Innovation, Assimilation Capacity, Information Technology.

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1. INTRODUCTION

The strength of IT (Information Technology) as a critical aspect of organizational success is related to today's competitive business environment. Three significant changes have transformed such environments, that is to say:

- Coming of a global economy
- Transformation of industrial economies/societies into service economies based upon information and knowledge.
- Transformation of the company' s business environment.

Under a managerial and business perspective, an Information Technology is the organizational and managerial solution for challenges and problems that arise in a business environment.

The present study intends, by means of a field survey performed with directors in the area of Information Systems, to explore the relationship among some variables related to capacity of absorption of IT in each type of organizational culture studied and provide the results that corroborate the statement of the importance of a company's cultural aspects for the assimilation of a new Information Technology.

2. INFORMATION TECHNOLOGY:CONCEPTS AND BRIEF HISTORY

The eighties witnessed a revolution in the processing of databases, automation of activities, telecommunications and other uses of Information Technology.

During the nineties, organizations began to use Information Technology where its applications could not have been envisaged, not even thought off in the previous years. The use of bar codes became a routine in many stores, as well as management systems for stock and inventories. Banks increased the use of automatic teller machines for their clients and today, among the companies, the use of communication resources such as voice mail is a quite common matter.

There is a consensus that information technologies will take over an even more leading role in the companies, similar to what is taking place with the traditional resources: human, capital or energy ones (Verde, 1981: 41).

Nowadays, dozens of information technologies offer capabilities for decision taking. The large number available, makes it sometimes difficult to discern the differences among the IT systems, as well as the decision taking processes. Often, IT systems are specialized in supporting certain types of decision taking.

Information Technology consists in the technology that encompasses the use of new facilities and resources for collection, storing, processing, retrieval and dissemination of information based upon the technological developments in computing and in communications.

Information Technology may also be defined as the complex of computer programs, hardware, personnel, procedures, documentation, inputs and results used in the business universe.

3. IMPACTS ON ABSORPTION OF IT SYSTEMS AT EACH LEVEL

The concept of value made popular by Porter (1985) is useful to insert the contribution of IT in the context of an organization, specially taking into account its interaction with the different activities required within the company.

The concept of the value chain distinguishes two types of activities that are essential for all organizations: primary, related to the creation processes and, of support, for the coordination and information of the organizational processes (Andreu, Ricart and Valor, 1992).

The support activities are called organizational infrastructure. According to Andreu, Ricart and Valor (1992), an Information System (IS) consists in the integrating element of support activities. For the performance of primary activities in the value chain, the support based upon IS is required. Information Systems are intended to interact with all the other activities, be they primary or of support.

The development plan of IT/IS aligned to the business strategies of the organization is connected to certain characteristics, which somehow lead to the definition of the appropriated IS tool to be utilized.

Such characteristics are defined as follows:

- The IS/IT planning process may benefit from external help for methodological reasons or from the use of experience of others;
- All the key areas must take upon themselves an active responsibility in the process;
- An important consideration is the cost/benefit analysis to be made at different stages: costs are estimated by the IS department and benefits are estimated by the area that sets forth the business strategies;
- During the IT definition process, to establish close and clear communication between the technical and managerial personnel is of major importance.

Development of an IS requires the integration of the organizational structure's managerial systems, in order to support the operational and strategic levels.

It can happen that even in organizations at the stage of strategy definition, although the Information Systems are integrated with other systems, the learning stage of a specific IT does not easily achieve maturity.

The major challenge for organizations is to reach a strategic definition that keeps up an innovative spirit allowing its members to progress in search of maturity and absorption of Information Technology.

The impact of an information system within an organization will be a function of the system's characteristics and of the organization itself.

Organizational systems may represent a hierarchy level within the organization. There are five types of organizational systems, which are presented in Table 1.

Table 1: Types of organizational systems

Types of Systems	**Functions**	**Key Characteristics**
Operational	Structure the work	Rationalization of the work
Supervision and control	Assess performance and motivation of personnel	Standardization Measurements Evaluation Feedback Recognition
Planning and Decision	Give support to the intellectual process	Models Analysis of Data
Communication	Improve human communication	Communication procedures Assessment of communication
Inter-organizational	Facilitate inter-organizational transactions	Structure or mediate inter-organizational transactions

With systems that are mature and well established, the positive or negative impacts are connected to the effect on the people's work and social life.

3.1. Impacts of the Operational Systems

The evolution of operational systems may entail great advantages, not only for the companies but for the employees as well, since the Information Technology would permit that people work away from the central office. The employees could easily perform their input or data collection tasks from the central station, being anywhere else.

3.2. Impacts of the Supervision and Control Systems

Many sections inside an organization view Supervision and Control Systems as a threat.

Indeed, the Systems have had a very strong impact, leading to the company's redesign due to a significant decrease of this medium level management. Supervision and Control essentially rely upon human judgement. As human judgement is unreliable, the Systems arise as an objective way of setting rules and criteria for the analysis and performance indexes that are useful for decisions.

3.3. Impacts of the Planning and Control Systems

Planning and control systems have impacts on the content, satisfaction and work opportunities. The theme of decision taking within the organizational merits is to answer the question: do decisions based on computing systems contribute to an efficient organizational model?

3.4. Impacts of the Communication Systems

Many of the impacts of communication systems are due to the geographical extension of business and to the need of establishing an efficient communication network among the employees of the different regions. In addition to the advantages with regard to the speeding up of the company's internal procedures, with the efficiency of communication among the members of the organization, a very actual and important impact is the development of new business partnerships.

3.5. Impacts of the Inter-organizational Systems

Inter-organizational systems are intended to connect business partners frequently by means of a middle-party. Example: systems of electronic transfer of funds between banks.

For Davenport (1993), a radical or incremental change are terms that suggest means to achieve the improvements needed in view of the competitiveness of the current market.

The identification of needs in the context of alternatives in future scenarios may lead to the decision of a radical change. The incremental change, in turn, may be appropriate for decisions that require quick short-term changes or in situations when the radical change is unnecessary.

4. PROCEDURES FOR THE IMPLEMENTATION OF AN IT

4.1. Choice of an Implementation Strategy

Conversely to what takes place with specialist systems, those based upon Taylor's principles, the current IT systems seek to understand the needs of the users of each area and the extension of their activities.

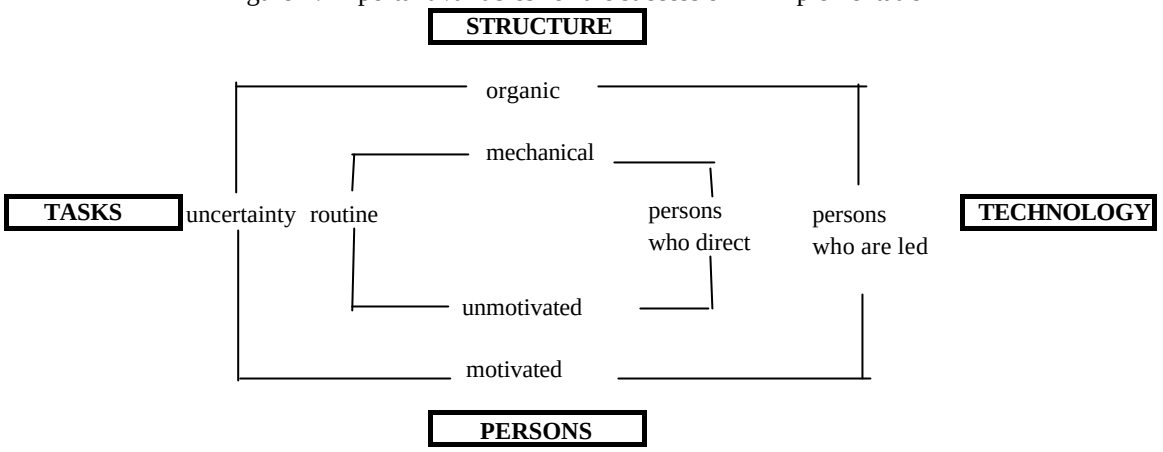
Technological innovation is a process of manifold stages that comprise the identification of an opportunity, generation of systems that will support the exploration of such an opportunity, development and tests of prototypes and finally use of technology in the entire chain of the organization's procedures.

The new model introduces a differentiated structure in the organizations, known as a matrix structure which consists in designing a flexible and multifunctional structure that favors the development of projects which integrate the diverse functional areas, as well as the diverse regions that form the organization.

4.2. Organizational and Implementation Variables

The success of implementing an IT in any business organization rests upon the relationships among four variables: tasks (what is done); the technology (how it will be done); persons (utilize technology to perform the tasks) and structure (support for the persons to carry out tasks). The mutual dependence of these four elements may be illustrated in Figure 1:

Figure 1: Important variables for the success of TI implementation



The inner cycle of the figure represents one type of organization that may be characterized as bureaucratic in which prevails a large amount of routine work within another rigid structure. Such is the case of organizations like the government, that can be defined as "procedure cultures". In this type of culture, usually the low risk existing and the routine work result in a relative de-motivation of the personnel. This is the so-called "Taylor Cycle".

Another organizational variable is the organic type of structure. The organization is viewed as more flexible, more agile to react to the circumstances.

5. ORGANIZATIONAL CULTURE

The organization theory suggests that to be very successful, an innovation must be compatible with the organization and its values.

According to Quinn (1998), the typology of organizational values is based upon two dimensions of implicit beliefs: (1) spontaneity and flexibility (regarding the decentralization and differentiation) versus foresight and order (with regard to centralization and integration) and (2) external (regarding competitiveness and global system) versus internal (regarding maintenance of the social technical system). This results in four cultures: developmental (flexible and external), rational (flexible and internal), hierarchical (predictable and internal) and group (predictable and external)

Specialists in Information Systems suggest that most information technologies are more effective when implemented in organizations with congruent cultures, because of the resistance of the organization's members.

6. ABSORPTIVE CAPACITY

The capacity of absorption relies on a previous knowledge and the knowledge within the organization permits the storage and the retention of value of the innovation in Information Technology (Cohen and Levinthal, 1990). Managers at all levels must address the balance of innovation and formalization because technology implementation is continuous at all organizational levels. To develop the absorptive capacity, managers with capabilities to develop ideas, not usual to the culture and to bring them into the company are more successful (Berthoin, Dierkes and Hahner, 1997).

There is no standard for the measurement of absorptive capacity. The preceding knowledge suggests that it is cumulative (Levinthal, 1994). The capacity of a company to assimilate rests upon the acquisition or absorption of information, as well as on the capacity to explore it (Cohen and Levinthal, 1990). This depends as much on the company's interface with the environment, as on the transfer of knowledge by the sub-units (Cohen and Levinthal, 1990). It is clear that the assimilation capacity includes two major components: knowledge within the organization and use of the communication channels in tune with external and internal information sources.

6.1. Organizational Knowledge

At least two types of knowledge are needed in IT innovations: (1) administration of knowledge or knowledge related to the context, such as time to investigate new information and technologies and (2) technical or scientific knowledge, such as knowledge in IT development and installations (Choudhury and Sampler, 1997). Knowledge related to the exploration may more commonly take place at the managerial level, just like the detailed technical knowledge is more frequent at specific levels of technical knowledge (Chodhury and Sampler, 1997).

6.1.1. Managerial Knowledge

The balance between acquisition or development and stabilization or formalization of new technologies is determined by the high administration (Minner, 1994).

To experiment with new ITs, organizations must develop information and process mechanisms able to detect business, events, markets and technological developments relevant for their survival (Daft and Weick, 1984).

The values apportioned by the organization influence the attitude regarding learning and change. For instance, hierarchic cultures and their interests in control and bureaucracy may be hindrances for the potential learning that is needed to implement inter-organizational systems (MacDonald, 1995; Osborn and Hagedoorn, 1997). Group cultures may support learning through teams of processes. Rational cultures should encourage learning due to its emphasis in establishing direction and productivity. Therefore, a positive relation is expected between the group, developmental and rational cultures and managerial knowledge, while a negative relation between the hierarchic cultures and managerial knowledge is found.

6.1.2. Internal Technical Knowledge

The assimilation capacity may exist not only at managerial levels but also at implementation levels: those of the technical specialists. Usually, internal mechanisms, such as personal development, are used to build up the assimilation capacity, but some organizations may simply try to "buy" the assimilation capacity be means of hiring consultants (Cohen and Levinthal, 1990). The critical knowledge needed to integrate new technical knowledge might be acquired only through long term experiments and with personal development (Cohen and Levinthal, 1990).

However, an organization may have technical knowledge without having assimilation capacity. Management may gain technical knowledge by hiring the best technical professional, but without adding absorptive capacity. Management must hold and integrate these persons within the organization. The best investment in assimilation capacity is to send such professionals for an advanced technical training.

Organizational culture influences the attitudes regarding the acquisition of knowledge in cross-functional learning (Guha, Grovber, Ketting et al., 1997): learning from others was the key model noticed in the companies that had successfully implemented changes in the business process.

6.2. Communication Channels

Absorptive capacity is the knowledge of recent technological developments in a given field enabling assimilation by the organization (Cohen and Levinthal, 1990). Different sources of information and communication channels may provide an important scanning of the environment to detect new developments and opportunities.

6.2.1. External Information Sources and Communication Channels

Frequently issues of organizational learning are related to internal aspects of the organizations, while external information is also needed for innovation (MacDonald, 1995).

Companies try to acquire technological knowledge from information sources and external communication channels – ex. meetings among professionals, workshops (Zmud, 1983). The existence of a formal technical group increases the transfer of technical knowledge from outside to inside the organization (Zmud, 1983). The best internal knowledge is to make proper use of the information sources (Chakrabarti, Feinerman, Fuentevilla, 1983).

An organic or developmental culture would be the best type to enable the organization to establish the necessary links with the environment (Cohen and Levinthal, 1990). Recent studies suggest that when there are more functions delineated in teams of product development, the greater will be the variety of the information sources used. The result is a greater variety and level of external communication and a better performance.

Innovation studies suggest that project teams assess more often the internal and external information sources, which is very important for the successful implementation of an IT innovation (Nilakanta and Scamell, 1990).

Individuals, organizations or agencies that share a common culture and are the potential adopters of innovations compose the social system in which the communication channel must operate (Mahajan and Peterson, 1985).

Recent studies also disclosed that the culture shapes the company's perceptions. Where an event in an environment is consistent with the organization's values, the reply will be faster, than if the event collides with the existing cultural values (Berthoin, Dierkes, Hahner, 1997).

6.2.2. Internal Communication Channels

An internal communication channel is defined as the means by which information moves from one point to the other within the organization. The internal communication channels may supply the integration of the organization's members with the external information about an innovation and lead them to influence the introduction of innovations (Zmud, 1983).

6.2.3. Support Channels for Downward Communication: Meetings and Traditional Reports

Meetings and records allow for a convergence and understanding among managers and employees on the nature of the organization's business activities and the importance of a given technology in the support of these activities. A culture that shares a greater degree of

information (teams), development of new accesses (developmental culture) and greater productivity (rational culture) should be the one that tends to use meetings and records for the implementation of new ITs.

6.2.4. Support Channels for the Transfer of Knowledge: Cross-Functional Structures

The organizational absorptive capacity also rests upon lateral communications, such as transfer of knowledge by the sub-units (Cohen and Levinthal, 1990). Every IT innovation is connected to the social networks and to technical knowledge (King, Gurbaxani, Kraemer et al., 1994). Cross-functional experience is required to favor understanding of the organization, while the absence of communication among departments increases the risk of the group's failure.

When many projects are under consideration, involving hundreds of people, an organic network of self managed teams to facilitate the success of the transfer of knowledge is required (Ayas, 1996).

7. METHODOLOGY

A descriptive quantitative survey with managers of the information area in companies of local, national and global (multinational) operation in São Paulo city was carried out in this study.

A probabilistic sampling, with the random selection of companies from a list was used.

For data collection the National Association of Administrators of Departments of the Information Systems list was used. Personal interviews with IS managers were carried out, and a sample of 100 cases was obtained.

The questionnaire of this survey presented the following concepts:

- Organizational Culture: the culture was assessed through three questions that encompass structures such as "My organization emphasizes the growth through the development of new ideas"; "My organization is a very dynamic and professional place (Culture of Development) and "My organization is a very formal and structured place", "Formal and political ideas unite my organization"(Hierarchical Culture).
- Absorptive Capacity: assessed through organizational knowledge and communication channels.

- Organizational Knowledge

1. Managerial Knowledge

Issues on managerial knowledge seek to analyze the importance that organizations attribute to development and processing of information. The questions chosen analyzed the diffused level of assurance that IT will be predominant in the future, assurance that IT is stable and that no future progress is expected, level of awareness of pressure by the loss of competitive position/leadership due to the absence of IT in the future and role of IT in the organization.

2. Internal technical knowledge

Internal technical knowledge was assessed by questions that aimed to measure the degree of concern in recruiting and developing the best technical personnel as well as to stimulate the knowledge accrued with the cross-functional learning.

- Communication Channels

1. Information Sources

Sources of information were presented as six condensed items of the study of information sources and communication channels by Nilakanta and Scamell (1990).

A frequency of use scale of seven points of the items was submitted (1) Books: references, textbooks, manuals and professional books; (2) Periodicals (ex. Infosystems, Computerworld); (3) Newspapers and professional reports (ex. Journal of Management Systems), participation in congresses; (4) Internal Personnel: groups and internal experts; (5) External Personnel: consultants and external professional organizations and (6) Internal technical memorandum.

2. Traditional Meetings and Reports

Three questions were included: (1) confidence and/or level of use of non scheduled meetings and special studies; (2) regularly scheduled meetings and (3) frequent use of quantitative reports upon adopting or implementing a new IT.

8. PRINCIPAL RESULTS

Based upon the survey's results, efforts were made to identify among the variable of the absorptive capacity, those that are more correlated with aspects of the organizational

culture. Therefore, the techniques used were the Kendall and Spearman Correlations. Variables of the organization's profile, positively related to the variables of absorptive capacity and/or to the aspects of the organizational culture were identified at a second stage. The technique adopted was Chi-Square Analysis.

Focusing on the Organizational Culture and on Managerial Knowledge, the best Kendall's correlation index is highlighted between willingness of the high management to take risks with changes in the organizational structure and in the composition of labor strength with cultural characteristics that emphasize growth by developing new ideas. This suggests that an organizational culture committed to innovations has a greater capacity to implement high impact changes at the level of its technological innovations as well as at that of its personal capabilities and qualifications.

A result that stands out was the negative correlation between the use of IT as a response to competitive market pressures and the persons' willingness to assume high personal risks. This result suggests that the surveyed companies do not yet believe that competitive leaderships and the pressures coming from the market justify the commitment of major efforts and personal risks. The possibility of developing new ideas and innovations may be a greater drive for personal changes than the external pressures.

On the use of meetings and reports one notices a greater frequency in organizations strongly directed to the achievement of tasks and targets and production oriented.

As for the sharing of information, organizations committed with innovation and those characterized by rules and directed towards achievement of targets present a positive correlation with implementation of information technology.

Among the sources/channels of external information only the variable technical memoranda is of important use for the IS area. Noteworthy is the fact that they are most significant for organizations characterized by structures, rules and formal policies and where tasks and achievement of targets are stressed.

Focusing on the Organizational Culture and Managerial Knowledge, the favorable Spearman's correlation between willingness of the high management to take risks and aspects of the culture that in general define organizations that stress innovations, dynamism and are strongly result oriented is enhanced.

Regarding internal technical knowledge, technical training of employees presented a positive correlation with variables of organizational culture that characterize organizations committed with innovations and that have flexible structures, as well as those characterized by rigid structures whose rules and policies are highly formal. This suggests that training is a

necessity viewed as equally relevant by the different types of organizations included in this survey.

Further, it must be noted the negative correlation between confidence in the use of technical specialists at the time of the IS implementation, with the organizations characterized as being dynamic and professionals, by those directed towards production and also by those where the values of loyalty and tradition are found. Therefore, by training, technical knowledge must be transmitted to all levels of employees and not restricted to specialists.

According to the Spearman analysis, the use of reports and quantitative models, correlates positively with the cultures focused on tasks and achievement of targets, a result that agrees with the Kendall technique.

The cross-functional structures are positively correlated with companies characterized by formal cultures, with rigid rules and directed towards tasks and targets.

With regard to the sharing of information, as with the Kendall results, organizations committed with innovation and also those characterized by rules and directed towards the achievement of targets and tasks, have a positive correlation with implementation of information technology.

Further, as presented by the Kendall analysis, among sources/channels of external information, the variable of technical memoranda is that which expresses some importance in the use by the area of IS.

For the performance of the Chi-Square analysis, we used the variables of Absorptive Capacity (Managerial Knowledge, Internal Technical Knowledge, Use of Meetings and Reports and Cross-Functional Structures) that exhibit more expressive correlation with the aspects of Organizational Culture, as well as the aspects of Culture itself. In this way, we sought to understand whether some of the variables in question are related with the characteristics of profile of the organizations, that is to say: number of employees, sector, size and invoicing. For the sector profile, the criterion utilized was grouping of the companies into three major groups: multi-industries (1), consumer goods or transformation companies (2) and services (3). For the size profile, it was used a grouping of the companies in two major types: national companies (1) and multinational/global (2). For the invoicing profile, the utilized criterion was grouping of the different levels of invoicing in two major levels: up to 1 million/year and above 1 million.

The H_0 hypothesis (according to which variables are not related) was rejected for the following cases:

1. Variable of Absorptive Capacity

- Extensive sharing of IT in all the groups of the organization.

The concern to develop an IT that will be shared at all levels of the organization is related to the number of employees of a company, to the sector of this company and to its size.

- Willingness of the high administration to take risks.

The willingness to take risks by the high administration is related to the number of employees of a company and to its size.

- Frequent use and transmission of models and reports.

Transmission of knowledge through the use of models and quantitative reports is related to the sector in which the company operates and to its size.

2. Aspects of Organizational Culture

- Emphasis on growth through development of new ideas.

That was the only variable of Culture that is related to a profile variable. The result shows that the emphasis on innovations is directly related to the size of the company – whether national or multinational.

9. FINAL CONSIDERATIONS

This study enabled the identification of variables that may affect the success of the absorption of IT in an organization.

Evaluation of the importance of these variables is fundamental in the process of IT implementation. Variables referring to the absorptive capacity of IT together with the cultural aspects of the organizations must always be investigated in view of the variables of the companies profile, so that positive impacts can be generated in the assimilation of Information Technology.

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