Effects of Technological and Organizational Features on Intranet and Portal Usage

Analysis of the Effects of Technological and Organizational Features on Intranet and Portal Usage

ABSTRACT

The paper's purpose is to analyze the effects of technological and organizational features on intranet and portal usage. Technological features comprise common intranet functions such as collaboration, search engine, personalization, workflow and content management. Intranet organizational features were associated with intranet support team's profile, existence of specific budget for the intranet project and relationship with users. The research model was based on TAM, TTF and on several checklists from intranet literature. A survey was conducted with intranet managers from 98 Brazilian and 70 Portuguese organizations. Factor analysis has unveiled intranet integration features as a separate construct from technological features. The results have demonstrated that the evolutionary path from intranets to knowledge portals is hard and long, as many analyzed intranets were at the basic stages. The results have also given evidences that intranet integration and organizational features have more impact on intranet quality and usage than technological features.

Keywords

Intranet, Enterprise Information Portal (EIP), Knowledge Management (KM), Technology Acceptance Model (TAM)

INTRODUCTION

Intranet is an appropriate tool to systematize explicit knowledge that is dispersed through departments. Intranets are organizational assets, and an important part of the structural dimension of the intellectual capital, as described by Stewart (1998). Nevertheless, the efficient usage of intranets is closely related to a wider comprehension of information management contribution to organizational performance. Intranet should be understood as a part of organizational context and its usefulness is influenced by culture, values and principles concerning strategic information management. Culture and user behaviors are the key drivers and inhibitors of internal sharing, and organizations should develop ways of stimulating people to use and contribute to information systems (Detlor, 2004). This explains why, despite the wide and varied set of features made possible by intranets, they have been used in most organizations primarily for basic information access, that is, the retrieval of corporate documents (Choo, Detlor and Turnbull, 2000).

According to Choo et al. (2000), intranets are quite helpful in promoting the externalization, combination and internalization processes. The combination process is supported by unified access to multiple content sources and the internalization occurs when there is a dissemination of success stories and best practices on the intranet. Part of intranet content is generated by employees who have decided to document their experiences, and to externalize their knowledge.

In an attempt to consolidate various departmental intranets, organizations are constructing corporate intranets or portals (Choo et al., 2000). A great contribution of portals is to integrate heterogeneous information sources, providing a standard interface to the users. According to the authors, a portal's primary function is to provide a transparent directory of information already available elsewhere, not act as a separate source of information itself.

The paper's purpose is to analyze the effects of technological and organizational features on intranet and portal usage. Later, due to factor analysis, the technological features construct was split in two: intranet integration features and technological features. This paper is organized as follows. First, a short literature review about intranets and portals is presented. The following section discusses how the TAM - *Technology Acceptance Model* (Davis, 1989) and the TTF - *Task Technology Fit* (Goodhue and Thompson, 1995) were adapted to intranet's context. Next, the research model is detailed. The data analysis section describes the exploratory research in where the model was empirically tested in 168 organizations. The last section discusses the limitations of this research and discusses how the survey results can be interpreted.

INTRANETS, ENTERPRISE INFORMATION PORTALS (EIP) AND KNOWLEDGE PORTALS

According to Benett (1997), the 'intranet' concept started to be used around 1995 to refer to the internal usage of Internet technologies for corporate communication. Clearly, the advent of intranets was made possible by development of Web-based technologies. Internet and intranet basically use the same technologies, but their main differences are related to ownership and access (Marcus and Watters, 2002). Despite the technological similarities, intranet and Internet are distinct informational spaces due to their specific objectives, users and design styles (Nielsen, 2000).

Effects of Technological and Organizational Features on Intranet and Portal Usage

The boundaries between intranet and portal definitions are not rigid; therefore it is better to interpret them not as black or white objects, but as a gray scale where the basic unidirectional intranet and the knowledge portal are the extremes. The better choice is to consider the portal as a gradual project, allowing organizations to expand later the capabilities and features delivered trough the intranet. Portals are evolving into more complex and interactive gateways, so they may integrate in a single solution many information systems. They are becoming single points of entry through which users and communities can perform their business tasks, and also evolving into virtual places where people can get in touch with other people who share common interests. Due to this evolution from intranets towards portals, many organizations are using them as the major technological infrastructure of their KM (Knowledge Management) initiatives.

The lists of portal features suggested by Delphi Group (2000), Terra and Gordon (2002), Firestone (2003) and Hazra (2002) were consolidated and used to inspire variables of the intranet technological feature construct.

INFORMATION SYSTEMS ACCEPTANCE

Perceiving intranets and portals as specific types of information system is a way of exploiting previous studies related to user behavior, technology acceptance and its organizational impact. One of the most referenced models of Information System (IS) adoption is the TTF (Task Technology Fit) model (Goodhue and Thompson, 1995). The model analyzes the linkage between IS usage and individual performance. According to TTF, a technology has a positive impact on individual performance when it is used and has a good fit with the tasks it supports.

The TAM (Technology Acceptance Model) was developed to explain and predict computer usage behavior (Davis, 1989). TAM has received substantial theoretical and empirical support from hundreds of studies, becoming a generally accepted cognitive model for predicting user IT acceptance (Detlor, 2004). TAM has two variables which influence attitudes and use: perceived usefulness and perceived ease of use.

A combination of TTF and TAM into one extended model has proven to be a superior model to either the TAM or the TTF model alone (Dishaw and Strong, 1999). Therefore, the intranet quality construct presented in this paper will use concepts from both models, adapting them to the intranet's context. For different reasons, the following TTF factors have not been taken into account for the development of the quality construct: TTF3, TTF6, TTF7, and TTF8. Authorization (TTF3) is not a critical issue for intranets, which are virtual environments that are usually accessible to all the users within the organization. Production timeliness (TTF6) and relationship with users (TTF8) were removed as they were beyond the scope of this research because intranet managers would be involved. Finally, reliability (TTF7) was eliminated from the quality construct due to the high predictability of intranet environment. As the amount of users is known by the organization, it is easy to scale the system to support it in a reliable manner.

On the other hand, the factors TTF1, TTF2, TTF4, and TTF5 were incorporated into the quality construct. The quality dimensions comprised by TTF1 (accuracy, novelty, level of detail) are fundamental because information retrieval is the most basic motivation for intranet existence. Analogously, locatability (TTF2) is also critical, because it will be worthless to have high quality information, if the user is not able to find or understand its meaning. Compatibility (TTF4) was kept in construct because one of the greatest portal's challenges is to integrate heterogeneous IS. Ease of use (TTF5) was chosen for being not only a TTF factor, but also a TAM concept.

RESEARCH METHODOLOGY

The research model (Figure 1) has been designed to analyze the relationships among the existence of intranet technological, organizational and integration features, intranet quality and intranet usage.

Effects of Technological and Organizational Features on Intranet and Portal Usage
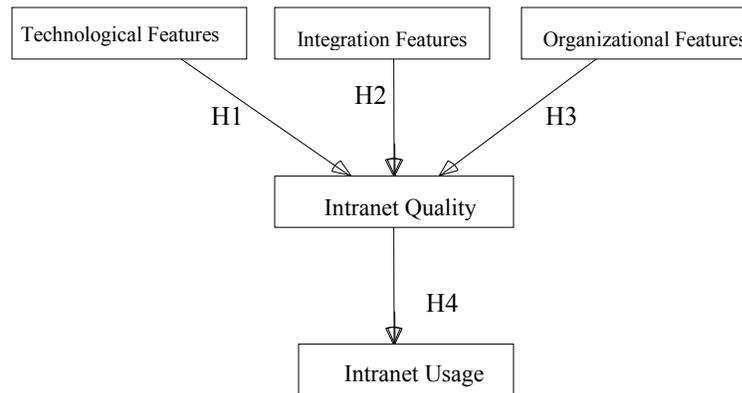
Figure 1. Hypothetical Research Model

The research model has five constructs: intranet technological features, intranet integration features, intranet organizational features, intranet quality and intranet usage. The research model's variables were translated into a Web-based questionnaire using Likert-type scales (0-10) with the extremes "totally disagree" and "totally agree". The expression intranet was used in the questionnaires instead of portal in order to not intimidate those respondents whose intranets were at the basic stages. The quality construct was based on TAM and TTF models, and its variables are illustrated in Table 1.

Variable	Inspiration	Question (Statement as it appeared in the questionnaire)
(q1)Quality of information	TTF1	The intranet maintains accurate and up-to-date information at an appropriate level of detail sufficient for users to carry out their tasks.
(q2)Locatability	TTF2	It is easy to determine what information is available on the intranet and locate it.
(q3)Meaning of information	TTF2	The exact meaning of information available on the intranet is either obvious, or easy to find out.
(q4)Compatibility	TTF4	The intranet supports comparison and consolidation of information from different sources, without generating unexpected or difficult inconsistencies.
(q5)Productivity increase	TAM	The intranet enables users to accomplish tasks more quickly, increasing their productivity.
(q6)Job facilitator	TAM	The intranet makes it easier for users do their jobs.
(q7)Job quality gain	TAM	The intranet enables users to improve the quality of their work.
(q8)Usefulness	TAM	Overall, users find the intranet useful in their jobs.
(q9)Ease of training	TAM	Users quickly learn how to operate the intranet to perform their tasks.
(q10)Ease of use	TAM; TTF5	Overall, users find the intranet easy to use.

Table 1. Intranet quality construct

The usage construct was conceived to evaluate how frequently users access intranet features. The questions related to usage construct allowed respondents to answer "not available" if the feature was not present on the intranet. This procedure was used to distinguish between inexistence of features and very low usage of existing features. The 11-point Likert-type scale was presented with the extremes "(0)–very rare usage (once a month or less)" and "(10)–very frequent usage (more than 5

Effects of Technological and Organizational Features on Intranet and Portal Usage

hours per day)" in order to guide respondents. Additionally, the middle of the scale (value 5) had a label "between ½ and 1 hour per day".

In the first version of the research model, technological features and integration features were only one construct with 20 variables. However, after initial data analysis of questionnaires, factor analysis unveiled two factors, and one of them had its set of variables closely related to integration features. Tables 2, 3 and 4 presents the variables related to the intranet technological, integration and organizational constructs.

Variable	Question
(t1)Categorization	Intranet's content is indexed according to a classification schema.
(t2)User indexing	Intranet allows the user to index the documents he/she wants to publish.
(t3)Search	Intranet has an integrated search engine.
(t4)CMS	Intranet allows users to control the document lifecycle just like a CMS (Content Management System).
(t5)Workflow	Intranet offers workflow resources.
(t6)Communities	Intranet supports the creation of discussion lists and/or communities of practice.
(t7)Customization	Intranet has areas where the content is customizable according to user's preferences.
(t8)Notification	Intranet alerts users about special situations, notifying them of process flows and publication of new content.
(t9)Single sign-on	Intranet provides single sign-on function to all information systems.
(t10)Security	Intranet allows users to specify the access level to any information.
(t11)E-learning	Intranet offers e-learning resources.
(t12)K-map	Intranet provides access to a knowledge map.
(t13)Administration	Intranet provides an environment that helps its management.
(t14)Dev. Tools	Intranet provides development tools to deploy intranet applications.

Table 2. Technological features construct

Variable	Question
(i1)ERP-legacy	Intranet provides access to business systems such as ERP, CRM and legacy systems.
(i2)BI	Intranet provides access to BI (Business Intelligence) tools.
(i3)Documents	Intranet provides access to corporate documents such as manuals, product information and project reports.
(i4)External sources	Intranet provides access to external sources of information such as news feeds.
(i5)Groupware	Intranet provides access to groupware features.
(i6)SPOA	Intranet is the unified entry point for all information systems (Single Point of Access-SPOA)

Table 3. Integration features construct

Variable	Inspiration	Question
(o1)Support team	Guruge (2003)	Intranet is supported by a multidisciplinary team.
(o2)Project	Info-Tech (2003)	Intranet development is guided by a project plan that provides a landscape for future deployments.
(o3)Budget	Info-Tech (2003)	Intranet development costs must obey a specific budget which is sufficient to assure sustainable evolution of the intranet.
(o4)Server log	Hazra (2002), Marcus and Watters (2002), Guruge (2003)	The organization analyzes Web server log to evaluate intranet usage.
(o5)User meetings	Info-Tech (2003), Terra et al. (2002)	The organization conducts surveys and/or user meetings (focus group) in order to evaluate the intranet.
(o6)User suggestions	Info-Tech (2003)	Intranet has a section where users regularly post their suggestions.

Table 4. Organizational features construct

Effects of Technological and Organizational Features on Intranet and Portal Usage

From September to November-2006, the questionnaire was applied in a sample that was extracted from 4 Brazilian and Portuguese discussion lists: competitive-knowledge, intranet-portal, the list of the Brazilian KM Society (SBGC) and the list of the Portuguese KM Society. Survey invitations were sent by e-mail in the discussion lists. The four lists had together at the time approximately 1,500 members, but it is hard to predict the response rate as a person could be member of more than one list. Only one answer per organization was allowed. The survey invitations were targeted to the intranet manager. When this function did not exist in the organization, the invitation suggested forwarding to the KM leader, to the CIO (Chief Information Officer) or to the HR (Human Resource) manager, in this order.

DATA ANALYSIS

Descriptive Statistics

It was possible to obtain answers from 98 Brazilian organizations and 70 Portuguese organizations. Among the organizations, 17% were related to government, 14% to the information technology sector, 11% to the banking industry, 8% to chemical and petroleum industry, 6% to the utilities sector, and the rest is distributed across 15 industries. Among the respondents, 42% were from the IT department (webmasters, intranet leaders, CIOs), 18% were from the HR (Human Resource) department, 11% were KM project leaders, and the rest was from other departments (communications, research and development). All intranets had more than 2 years of deployment, 85% of organizations had more than 100 employees, and 59% of the organizations had more than 500 employees. The following table shows the average of the variables related to technological features.

Variable	Average
(t1)Categorization	4.9
(t2)User indexing	4.5
(t3)Search	4.9
(t4)CMS	4.5
(t5)Workflow	4.5
(t6)Communities	5.1
(t7)Customization	5.2
(t8)Notification	4.3
(t9)Single sign-on	5.3
(t10)Security	5.8
(t11)E-learning	4.9
(t12)K-map	4.3
(t13)Administration	6.0
(t14)Dev. Tools	5.3

Table 5. Average of technological variables

The technological means indicate that, for the organizations that participated in this survey, there is still a considerable road ahead to be covered in the evolution from intranet to knowledge portal. Some features usually required in portals obtained an inferior performance, as seen in workflow (t5), knowledge map (t12), notification (t8) and e-learning (t11). The surprise was the lower than expected performance of the categorization (t1, t2), search engine (t3) and content management (t4) features. This was a critical revelation because it implies that the participants are not giving appropriate attention to issues related to non-structured information management.

Variable	Average
(i1)ERP-legacy	6.3
(i2)BI	5.7
(i3)Documents	7.8
(i4)External sources	6.7
(i5)Groupware	5.9
(i6)SPOA	5.1

Table 6. Average of integration variables

Effects of Technological and Organizational Features on Intranet and Portal Usage

The means of integration construct (Table 6) were better than technological ones. Integration variables are related to features that are usually required in basic intranets, according the classification schemas proposed by Terra and Gordon (2002), Chadran (2003), Marcus and Watters (2002). Table 7 illustrates the results of the organizational feature construct.

Variable	Average
(o1)Support team	4.9
(o2)Project	5.1
(o3)Budget	5.5
(o4)Server log	5.2
(o5)User meetings	3.9
(o6)User suggestions	5.4

Table 7. Average of organizational variables

Table 7 shows that there is little organizational support to the maintenance and development of intranets. The intranet team does not have the ideal multidisciplinary profile (o1), sufficient budget (o3) and formal planning (o2). Moreover, the results give evidences of low interaction between intranet team and users (o5 and o6). As the number of persons in the intranet team is usually less than necessary, it is natural to suppose that there is not enough time or availability to listen to the users. If we consider that the destination of human and financial resources is an indicator of the importance of an area or a project within the organization, we will conclude that the intranet team lacks strategic visibility. This conclusion is similar to the one obtained by Breu, Ward and Murray (2000) in two detailed case studies in British organizations. The authors pointed out that the absence of clear responsibility for the intranet is one of the main reasons of intranet's stagnancy as an ordinary support system that does not bring any strategic impact to business.

Variable	Average
(q1)Quality of information	6.0
(q2)Locatability	5.9
(q3)Meaning of information	5.9
(q4)Compatibility	4.7
(q5)Productivity increase	6.6
(q6)Job facilitator	7.0
(q7)Job quality gain	6.8
(q8)Usefulness	6.9
(q9)Ease of training	6.7
(q10)Ease of use	6.9

Table 8. Average of intranet quality variables

Intranet quality attributes (Table 8) obtained relatively betters results than technological, integration and organizational features. This result implies that, in spite of its technological and organizational limitations, intranets are still perceived by its users as useful and easy to use. It is relevant to emphasize that the variables related to perceived usefulness (q5, q6, q7 and q8) and to perceived ease of use (q9 and q10), inspired by the TAM model (Davis, 1989), obtained better averages than the quality attributes inspired by the TTF model (Goodhue and Thompson, 1995). This evidence can be interpreted as a sign that intranets need a better fit to organizational processes.

The dissonant result of the attribute "consistent consolidation of different information sources" (q4) indicates that the integration between intranet and corporative systems (technological variables i1, i2, i3 and i4) is superficial and frequently occurs only at the access level, generating conceptual divergences among systems.

Effects of Technological and Organizational Features on Intranet and Portal Usage

Variable	Average	N.A.
(u0)General usage	5.7	0%
(u1)Structured information sources	5.6	23%
(u2)Non-structured information sources	6.3	3%
(u3)Collaboration	6.4	20%
(u4)e-learning	4.5	33%
(u5)Knowledge map	4.1	40%
(u6)Search tools	5.6	20%
(u7)Workflow	4.9	31%

Table 9. Average of the intranet usage variables

The intranet usage construct (Table 9) presents the "N/A column" (not available), because its variables could have this option as an answer in the 11-point Likert scale ranging from "very rare usage" (0) to "very frequent usage" (10). This procedure was used not mix the low usage of an existing feature of intranet with the non-availability of such feature. There was a concentration of answers in the middle of the scale, indicating a diary usage of the intranet from ½ to 1 hour. This level of usage reinforces the perception of portal not as a critical and essential system, but as a support system confirming previous studies of Breu *et al.* (2000). In some features, such as e-learning (u4), knowledge maps (u5) and workflow (u7), a great percent of missing values were given, resulting in the exclusion of these variables in the further steps of the research. On the other hand, access to non-structured information sources (u2) and collaboration (u3) appeared as the most popular features of portals. As identified by the literature review and by this survey, access to non-structured sources is one of the most elementary features of intranets, as shown by the very low percentage (3%) of non-availability. A negative surprise was the lower than expected value of non-availability of search tools.

Reliability and Validity Tests

It was necessary to perform reliability and validity tests because the exploratory research model was designed by adapting previous validated models, such as TAM and TTF, into portal's context. In order to specify a model that represents the Brazilian and Portuguese realities, it was necessary to verify if the relationships among variables are equal in both groups. Therefore, a Levene's test (equality of variances) was performed (Hair, Tathan, Anderson and Black, 1998). In spite of tiny differences in some variables, the tests concluded that using a single model to understand the Brazilian and Portuguese realities would be possible.

In this research, factor analysis was used to validate a scale by demonstrating that its variables load on the same factor, and to drop proposed scale items which cross-load on more than one factor. Factor analysis was applied resulting in only one factor for each construct. Reliability analysis (Table 10) also revealed adequate index for all of the constructs and none of the variables were deleted.

Construct	Cronbach´s Alpha
Portal technological features	0.9426
Portal integration features	0.8576
Portal organizational features	0.8818
Portal quality	0.9489
Portal usage	0.7013

Table 10. Reliability analysis

Convergent and discriminant validities were also performed, but for parsimony reasons, are not presented in this paper. All constructs obtained sufficient scores in convergent and discriminant validities.

Path Analysis

Nomological validity assesses the relationships among theoretical constructs, confirming significant correlations. According to Babbie (1999), path analysis, also called trajectory analysis, is a technique to understand the relationships among variables and it is based on regression analysis, showing through path coefficients how intense the relationships are. The regression coefficient is the linear correlation between the observed and model-predicted values of the dependent variable, and its large value indicates a strong relationship.

Those constructs marked with ** indicate that the relationship is significant at the level of 1%, and those marked with *** are at the level of 0.1%. The bigger the regression value, the greater is the influence of the independent variable on the dependent variable, as shown in Table 11.

Constructs		Regression	Std. Error	t-Value	Sig.
Independent	Dependent				
Organizational features*** (H3)	Intranet quality	**0.45**	0.07	6.11	0.45
Integration features*** (H2)		**0.33**	0.07	4.54	0.33
Technological features (H1)		**0.08**	0.09	0.98	0.08
Intranet quality*** (H4)	Intranet usage	**0.63**	0.06	10.58	0.63

Table 11. Path coefficients of the research model

The model analysis revealed that integration and organizational features had a greater impact on the perception of quality than technological features did. Concerning the research model (Figure 1), only Hypothesis 1 (H1) was not confirmed by path analysis. This is an interesting conclusion, because it gives evidences that the respondents perceive intranet quality as a concept, not only restricted to the information system itself, but also related to the organizational context that makes it work.

Additionally, the "intranet integration features" construct had a more significant impact on quality than technological features. This conclusion reinforces the hypothesis that the evolution from intranets to knowledge portals is actually a step towards the integration of corporative information systems. A recommendation to intranet managers is to give priority to investments on making more systems accessible through the intranet, instead of deploying more advanced features. The model analysis also confirmed that intranet quality had a positive impact on the intranet usage, indicating that investment on quality would probably result in a more intensive usage.

CONCLUSION

This survey aimed to reach a wide number of organizations, producing a panorama of intranet quality and usage. Users were not directly involved in this survey whose target was intranet managers and KM leaders. The questionnaire instructions recommended that the respondents should have their users in mind while answering. Although the respondents were not totally impartial, as they were involved in the subject of the evaluation, they were very skeptical, as proven by the low means obtained in many variables. It is important to report that many of the respondents have found the model quite useful as a diagnosis mechanism for their portals. Some respondents have commented that the questionnaire has helped them in identifying strengths and weakness of their portals initiatives, increasing the benefits of using intranets to support KM practices.

The knowledge portal is a target to be pursued, but is still far from the reality of the studied organizations, because the KM features are deployed in a limited manner and scale. Despite the existence of collaboration features, the intranets analyzed in this survey are more adequate to support information management than KM. Basic features like collaboration, security, infrastructure management and integration to information systems were available in a large number of organizations and were deployed in an advanced stage. On the other hand, advanced features, such as workflow, knowledge maps, notification and e-learning, were missing. This result gives evidences that organizations follow a logical order to evolve their intranets: basic features are deployed prior to advanced features, i.e., the evolutionary process is incremental and iterative, without bypassing intermediary stages.

Furthermore, the lack of human and financial resources delays the evolution from intranets to enterprise portal. Therefore, if the existing organizational conditions continue the same, the organizations will not experience a sudden improvement of technological features. The intranet team will not have the necessary breath to deploy new features. The conclusion is that the

path from intranets to portals is a long road that tends to be covered in small and slow steps for the majority of organizations that participated in this survey.

Another conclusion that sounds like a warning to organizations is that intranet support teams have less human and financial resources than recommended. In most of the analyzed organizations, intranet management is near amateurism and the daily usage of intranet is between half-hour and one hour, emphasizing intranets as support systems.

A critical issue identified by this research was the reduced level of interaction among intranet teams and users. The results demonstrated that users have few formal mechanisms to express their opinions, and most of the organizations prefer to understand users through the analysis of web logs, not through meetings and evaluation surveys. This precarious scenario of intranet's organizational features deserves attention, since "organizational features" have a strong impact on "intranet quality", according to the path analysis. In summary, the advice to intranet managers is the following: before looking for technological problems in the intranet, identify deficiencies in the intranet team (number of persons, their skills, financial support). This analysis will probably result in the identification of the needs of structuring a long-term planning for the intranet, finding ways to involve users and developing the skills of the intranet team.

These conclusions are similar to those obtained by the Australian researchers Barker and Robertson (2005) in a survey that involved 284 organizations. The authors concluded that intranet teams usually do not have the necessary skills to produce a good intranet. The Australian research revealed that only 31% of the teams have someone with Library Science background, and 52% of the team members have background on information architecture and usability, which are considered fundamental aspects to assure a good intranet. According to Barker and Robertson (2005), only half of the studied organizations had a content management system and 42% of the participants have considered that the human and financial resources dedicated to intranets are poor or very poor.

Factor analysis emphasized the importance of the integration factor in the set of intranet's technological features. Maybe intranets and portals are the front-end and the most visible part of an information systems integration movement that will certainly require a long-term organizational effort. These assertives need to be analyzed in the future, since the technological evolution may allow the deployment of advanced features in a larger scale, altering significantly the relationships between technological features and the user's perception of quality.

At least, the results of the intranet quality attributes have brought some hope. In general, intranets were considered useful and easy to use by the users. The model analysis revealed that intranet quality has a very intense influence on usage, reinforcing the importance of monitoring quality factors, such as information accuracy, perceived usefulness and ease of use.

The technological potential of intranets and portals is certainly very promising. However, it is hard to convert the promise into reality, since information system success requires the combination of technological and organizational variables, and not always the intranet team has top management support or background to deal with these multiple dimensions.

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