Information technology diffusion in higher education

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Abstract

This project examines information technology (IT) planning, implementation, and diffusion in an academic environment, that of Portland Community College (PCC), the largest college in Oregon. PCC tries to keep pace with the latest technologies by anticipating and implementing new technology solutions in efficient and effective deployments. IT managers and employees at PCC were asked to complete a survey that included questions about IT planning, implementation, and diffusion. This paper proposes a conceptual framework based on previous models of technology adoption. The integrated, three-stage framework involves IT planning, actual IT implementation, and IT diffusion. The study identified adequate training and resistance to change as leading obstacles to IT deployment processes.

1. Introduction

Higher-education organizations invest major sums of money in technology solutions to support decision-making and serve their students and communities. However, information technology (IT) deployments can be inherently uncertain, and implementing technology solutions has been notoriously problematic. IT implementation disasters cost millions to stakeholders despite many studies that outline how to implement successful IT projects. For example, in 1996 the Oregon State Department of Motor Vehicles spent $120 million in computer upgrades [1], and in 2003 the Portland Water Bureau spent $20 million for a new billing system installation [2]. What went wrong with these systems? The IT implementations failed because both agencies failed to identify compatibility issues and assess potential risks prior to IT deployment [3]. Technologies change rapidly, so there is tremendous pressure on organization managers to plan, implement, and adopt new technology solutions [4]. In higher-education institutions, direct interactions between internal and external stakeholders are crucial to providing successful facilities and services to students and the academic community.

This case study presented here discusses how PCC’s IT practice and procedures fit with technology diffusion models. We will identify major issues with regard to planning, implementation, and the degree of acceptance of technology solutions.

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We begin with a brief background on Portland Community College (PCC), its technology environment, and challenges. The next section provides a literature review on IT implementation, explores the models involved in technology diffusion, and states the research questions of the proposed conceptual framework. Next, we provide an overview of the methodology used for the case study and presents the analyses and findings derived from the primary data. The paper concludes with lessons learned and suggestions for future research.

2. Portland Community College

PCC was created in 1961 by voters of the five counties located in Portland metropolitan area. PCC is the largest college in Oregon with three campuses, six training centers, and 198 community locations in the metropolitan Portland region covering 1500 square miles. PCC has renovated its facilities and built new buildings in the district campuses thanks to two bond measures for $61.4 million and $144 million approved in 1992 and 2000, respectively. PCC employs 3500 staff, and its student enrollment reached 88,255 as of 2006. The 2006/2007 PCC budget totals $311 million, with state sources providing 42% of PCC funding [5]. PCC engages in strategic alliances to manage its resource interdependencies. It has partnerships with business and public-sector agencies that provide local workforce training programs. For example, PCC has co-admission programs with Portland State University and Oregon Institute of Technology, among others.

The college offers 2-year associate degree programs, lower-division college transfer courses, and professional and technical career training programs. PCC also maintains a wide range of academic and professional programs with online courses and degrees. The core competencies that make PCC unique from other 2-year schools are a broad selection of programs and convenient facilities located in metropolitan communities. Other PCC competitors are Mt. Hood Community College and Clackamas Community College, but neither has the resources to imitate the competitive advantages found at PCC.

The following is the “Strategic Direction” objective for the PCC technology vision:

Technology pervades all aspects of the college today and will continue to be critical to our success as we serve our students and communities. The use and application of technology and related resources directly impacts the classroom and support areas and, basically, how we do our business on a day-to-day basis. Knowing that change in technology will continue at a break-neck speed, Portland Community College is committed to keeping pace with that change in order to remain current. Our aim in the use of technology is to be innovative and responsive to college needs.

PCC’s tall organizational hierarchy has both functional and geographical divisions. PCC has confronted some of the typical organizational design and communication problems associated with tall hierarchies. IT specialists report to different functional and geographical managers, although PCC has only one IT department. Recent organizational changes regrouped all technical teams under a single department, and a matrix organization structure was implemented to more efficiently manage growing computer challenges. Each campus has a Campus Technology Services team responsible for providing a high-performance computing environment for system users on campus. The PCC Network Technician reports to two supervisors, a Campus Technology Manager and a Central Technology Manager [6]. In addition to this support, many Technology Solutions Service (TSS) functions are provided centrally by the Solution Services Department (a team of programmers) and the Technical Services Department, both located at the main Sylvania campus.

PCC is currently wrestling with how to maximize its IT infrastructure. PCC currently deploys a tiered architecture model (see Appendix A). The campuses are interconnected by an optical fiber loop that underlies the organization’s wide area network (WAN). The technology environment is composed of servers running a variety of operating systems including UNIX (HP UX & Solaris), Windows 2003, and Red Hat Linux. The file server is deployed to users on a Novell network. The database environment consists of Oracle 9 and SQL server databases, among others. The desktop platform has approximately 5000 Dell workstations running Windows XP 2003, 2000, and a few Win98, as well as numerous Mac systems. Fig. 1 illustrates the applications and telecommunication network.

In 2002, the college developed an Educational Master Plan (EMP) [7], a roadmap that establishes strategic guidelines for how the institution will focus its efforts, resources, and energy. TSS recognizes the goals and
objectives of the EMP by using practical and proven technologies. A recent TSS project was implementation of portal technology, which gives PCC the ability to integrate secure technology resources into a “single sign-on” point of access—one login/password to manage instead of several, such as Banner Web, email, and WebCT.

Acknowledging that changes in technology will continue, TSS hired Northwest Information Services, a local consulting firm, to facilitate the development of a 5-year telecommunications plan. The consultants interviewed several PCC key stakeholders, including members of the Telecommunications Plan Advisory Committee (TPAC) and other technology experts at PCC. To identify priorities among the many concerns, 12 managers were sent a survey regarding technology environment and network factors. The consultants applied frequency analysis to the survey data, which indicated near-unanimous concern for increased emphasis on technical security. The consultants’ survey did not address PCC technology challenges and implications.

Most service organizations wrestle with effective and efficient implementation of IT solutions, so the adoption rate of IT solutions is very low in the service sector. The biggest issues are organizational planning and implementation challenges in deploying continually improving technology solutions. PCC stakeholders are disappointed with the IT solutions implementations to date. For example, last year, PCC replaced McAfee with Sophos, an enterprise anti-virus solution that was selected from among several competing software products, including McAfee. Sophos was installed in all 5000 workstations by PCC campus teams, but there was little collaboration in the resolution of technical glitches. Consequently, PCC employees believe the Sophos implementation was disastrous.

2. Literature review

Rogers defines an innovation as “an idea, practice, or object that perceived as new by an individual or other unit of adoption” ([8], p. 11). In the context of this study, the innovation is the different categories of information systems that can be used in business. Rogers defines the diffusion process for innovations in five distinct stages, whereas Kwon and Zmud [9] and Somers and Nelson [10] examine IT diffusion in six stages. Several previous studies on innovation diffusion agree on the S-curve theory of innovation diffusion [8,11–13].
2.1. Theory of reasoned action

According to the theory of reasoned action (TRA) developed by Fishbein and Ajzen [14], the main determinant of an individual’s behavior is his/her intention, which is influenced jointly by the individual’s attitude and the subjective norm. In TRA, attitude toward the behavior is defined as “the individual’s positive or negative feelings about performing a behavior” ([14], p. 212). That attitude is determined by assessing one’s beliefs regarding the consequences arising from a behavior and an evaluation of the desirability of those consequences. Subjective norm is defined as “an individual’s perception of whether people important to the individual think the behavior should be performed” [14, p. 302]. The opinion of a referent is weighted by an individual’s motivation to comply with the wishes of the referent.

TRA has some limitations, including a significant risk of confounding attitudes and norms since attitudes can often be reframed as norms and vice versa. A second limitation is the assumption that when someone forms an intention to act, they will be free to act without limitation. In practice, constraints of ability, time, environment, organization, or unconscious habits will limit the freedom to act.

2.2. Theory of planned behavior

The theory of planned behavior (TPB) developed by Ajzen [15], attempts to deal with these limits. The theory is another variant of TRA that takes into account the perceived behavioral control as a third determinant of an individual’s behavioral intention to use a new system. In attempting to apply TPB (which, like TRA, is a generalized model), a decomposed TPB [16] has also been examined in the IS literature which attempts to identify and model the specific antecedents to attitude, subjective norm, and perceived behavioral control relevant to IT use.

2.3. The Technology Acceptance Model

The Technology Acceptance Model (TAM), developed by Davis [17] (see Fig. 2), is an adaptation of TRA. This model defines perceived ease of use and perceived usefulness as two determinants of attitude toward behavioral intention and usage.

In this model, perceived ease of use is defined as “the degree to which a person believes that using the system will be free of effort”; perceived usefulness is defined as “the degree to which a person believes that use of the system will enhance his or her performance” [17, p. 320]. Perceived ease of use, which also determines the perceived difficulty of use, represents the individual’s perceived cost of using the system. The perceived usefulness of a system represents the individual’s view of the benefits of using the system. These two variables are considered in terms of cost–benefit issues.

Taylor and Todd [16] suggest perceived usefulness, perceived ease of use, and compatibility as antecedents of attitude (largely consistent with TAM). In addition, they suggest that peer influence and superiors’ influence are antecedents of subjective norm. Finally, they model self-efficacy, resource-facilitating conditions, and technology-facilitating conditions as determinants of perceived behavioral control. The theories examined so far have been enhanced in several ways from the basic uptake models from the 1960s to date. Considerable empirical research has been conducted in order to discover the factors influencing the adoption and diffusion patterns of innovation. Several other authors [18–22] explore technology diffusion in different industries, and all conclude that there are generalizable constructs even as technologies diffuse.

![Technology Acceptance Model](image-url)
3. Methodology

In this paper, we focus on three dimensions of IT adoption: IT planning, actual IT implementation, and IT diffusion. Each dimension is necessary for the success of the following one, and vice versa. IT planning involves aligning business strategies to current and future operations. Clear and concise priorities for the expenditure of resources increase overall performance of the organization. IT implementation includes efforts to select and implement new technology solutions, develop necessary skills, and measure the effectiveness of new systems. IT diffusion manages change and the adoption of new technology solutions by the organization members. Successful technology integration in business strategies [23] and adequate training has enormous impact on IT diffusion in any organization (see Fig. 3).

3.1. IT planning

IT planning generates strategic guidelines for IT development based on organizational goals [24]. Diffusion is the process by which a technology is communicated through certain channels over time among the members of an organization. IT planning includes the first three phases of Rogers’ five-stage model of the implementation process [8]:

1. **Knowledge**: The individual becomes aware of a technology solution and has some idea of how it functions and fulfills needs.
2. **Persuasion**: The individual formulates a favorable or unfavorable idea toward the technology.
3. **Decision**: The individual participates in activities that lead to adopting or rejecting the innovation.

The IT planning dimension also covers the first two stages of Cooper and Zmud’s [25] six-stage model of the IT implementation process:

1. **Initiation**: The process indicates that organizational problems and opportunities have to be identified before IT solutions are undertaken. The organizational need (pull) or technological innovation (push), or both, are the factors behind this strategy. An IT solution is determined based on the needs of the organization.
2. **Adoption**: The process indicates that organizational backing for implementation of an IT solution requires considerable rational and diplomatic negotiation. Managers approve the necessary resources to execute the implementation effort.

3.2. IT implementation

IT implementation is defined as “the process of assuring that the information system is operational and then allowing users to take over its operation for use and evaluation.” [26, p. 717] Defining the scope and boundaries of an IT implementation in an organization is difficult due to the relatively complex environment. IT implementation includes everything that takes place from the moment the system is purchased until the system is fulfilling its purpose for members of the organization.
IT implementation includes the fourth stage of Rogers’ five-stage model: Implementation—the individual decides on a technology solution to adopt. Furthermore, Rogers explains the characteristics of implementing a new technology:

- **Its relative advantage**: The extent to which the new technology is perceived as better than the current technology.
- **Compatibility**: How the new technology fits with current technology.
- **Complexity**: How challenged the new technology is.
- **Trialability**: Whether the new technology can be tested.

IT implementation also covers the third stage of Cooper and Zmud’s [25] six-stage model of the IT implementation process:

- **Adaptation**: The process indicates that an IT solution is implemented and appropriate training is completed. In terms of product, the IT solution is ready to roll out.

The successful implementation of IT in any organization depends on many interrelated factors. Whether users call an IT implementation a failure or a success often depends on their expectations, by typically an IT implementation is successful if it meets the user(s) needs. The expected results of an IT implementation should be sufficiently realistic to win the commitment of employees. According to Shenhar and Levy [27], to be successful any approach to IT implementation must take into consideration both the technical and social systems that make up the organization. To assess an IT implementation, Shenhar proposed several dimensions (technical performance, efficiency of execution, business performance, etc.) and measurement tools (cost analysis, system usage estimation, incremental performance in decision-making effectiveness, and employees’ efficiency). Finally, managers should conduct a survey to assess user satisfaction.

3.3. **IT diffusion**

Senge [28] states that an organization’s structure is at the root of difficulties encountered when learning a new technology, calling the “basic diseases of the hierarchy” an obstacle to the learning initiative.

Many technology specialists fear that a new technology for their particular work process will render them unnecessary to the organization. Moreover, they are often discouraged by the extra work and effort required to learn new software or a whole new IT system.

IT diffusion includes the last three stages of Cooper and Zmud’s six-stage model of the IT implementation process [25]:

1. **Acceptance**: The process indicates that employees are invited to apply the IT solution. In terms of product, IT solution is on production.
2. **Routinisation**: The process indicates that the IT solution is a business operations task. In terms of product, the IT solution becomes an institution’s solution.
3. **Infusion**: The process indicates that the IT solution has improved the organization’s effectiveness at all levels. In terms of product, the IT solution is applied as a competitive advantage.

3.4. **Research questions and hypotheses**

To further examine IT adoption and its components, the following questions are asked:

- What are the critical factors in IT planning?
- What are the critical factors in IT implementation?
- What are the critical factors in IT diffusion?
- What are the relationships among planning, implementation and diffusion?
- What are the differences among different managers in their view of the critical factors?
The following set of hypotheses were derived as a result of the research questions:

**Hypothesis 1.** There are significant factors in IT planning.

**Hypothesis 2.** There are significant factors in IT implementation.

**Hypothesis 3.** There are significant factors in IT diffusion.

**Hypothesis 4.** There are significant relationships among IT planning, implementation, and diffusion.

**Hypothesis 5.** There are differences between managers and employees vis-à-vis the perceived issues of IT planning, implementation, and diffusion.

4. Results

IT managers and employees at PCC were asked to complete a survey questionnaire (76 were distributed) that included questions concerning IT planning, IT implementation, and IT diffusion. These issues were derived from results associated with prior studies [8,29,30]. Each IT issue was rated on a five-point Likert scale, where 1 indicated the process was considered non-problematic, and 5 indicated the process was highly problematic. A total of 44 completed questionnaires were returned (58% response rate). Responses were analyzed, and the findings are presented here.

Data were collected to identify the respondent’s current level (management/employee) and the number of years with PCC. Of the 44 respondents, 68% were employees; approximately 27% were managers (note: 5% of the respondents did not answer these questions). The average number of years with employer was 8, with a range from 1 to 25 years.

The survey responses were entered into MS Excel and transferred into SPSS for statistical analysis. This section presents the findings accompanied by critical reviews. Other discussions cover the implications of the major significant findings and some recommendations.

For ease of presentation and interpretation, the analysis was divided into three classification groups:

1. IT planning in the organization.
2. IT implementation in the organization.
3. IT diffusion in the organization.

For simplicity, the important questions (see Appendix B) focus on determining the most problematic issues with regard to IT planning, implementation, and diffusion in PCC. The mean scores for each IT issue were computed to evaluate how frequently each one was rated. For ease of representation, the scale responses have been grouped into one category where “Highly Problematic” represents scales 4 and 5.

4.1. IT planning

PCC staff evaluated 11 separate IT planning issues, shown in Fig. 4. Of these, the major ones were *adequate training* and *resistance to change*, perceived by 55.4% and 47.7% of participants, respectively. Other significant concerns were rapidly changing technology (43.2%) and existing systems (40.9%), which reflect the dilemma facing planning managers: how to get the most out of current IT investment while keeping pace with innovations. Since PCC is a non-profit organization, the results confirm that timeframes and scheduling are not considered high priorities.

4.2. IT implementation

IT implementation issues are shown in Fig. 5. PCC staff evaluated nine separate issues. Of these, the major one was *quick solutions*, perceived by 52.3% of participants. Other significant concerns were politics, internal/external (45.4%) and emerging technologies (45.4%). These results illustrate that IT support at PCC encounters conflicting needs within the IT planning decisions.
4.3. IT diffusion

IT diffusion issues are shown in Fig. 6. PCC staff evaluated 10 separate issues. Of these, the major ones were technology challenges and attitude to change, perceived equally by 61.4% of participants. Another significant concern is security (54.5%). PCC employees adopt new technology solutions rapidly after they receive adequate training. Since the majority of the technical staff have worked for PCC more than 5 years, the rapid appearance of new technologies aggravates their attitude toward change. It also explains why they rated security their third highest concern when adopting a new technology solution.

In order to understand the underlying factors, factor analyses were conducted, and the results are shown in Tables 1–3.

Three factors were identified for IT planning:

- **Factor 1**—Innovation issues: Emerging technologies, standardization, technology value, timeframes and scheduling, and written procedures/guidelines.
- **Factor 2**—Strategy issues: Timeframes and scheduling, and written procedures/guidelines.
- **Factor 3**—Intra-organizational issues: Interdepartmental coordination.
We identified three factors for IT implementation:

- **Factor 1—Deployment issues:** Adequate training, IT budgeting allocation, interdepartmental coordination, written procedures/guidelines, timeframes and scheduling, and standardization.
**Factor 2—Skills update issues:** Rapidly changing technology, individual IT expertise, and resistance to change.

**Factor 3—Business analysis issues:** Adequate IT staffing and interdepartmental coordination.

This time we had two factors for IT diffusion:

- **Factor 1—Ease of use issues:** Perceived benefits, compatibility with systems, security concerns, management participation, attitude to change, effort required, previous experience, risk taking, and technology challenges.
- **Factor 2—Learning period issues:** Time investment.

Once data reduction was accomplished, the objective was to determine correlations, if any, among IT planning, implementation, and diffusion issues. Regression analyses were performed to explore the nature of these correlations. The tests showed a few significant associations between the planning (innovation issues) and implementation (deployment issues) factors (see Table 4). Also, IT planning issues were found to be significantly correlated ($p<0.000$) with IT diffusion issues (see Table 5). Similarly, IT implementation issues were found to be significantly correlated ($p<0.000$) with IT diffusion issues (see Table 6). The results suggested that more attention is required in the case of new technologies and this will help the deployment and diffusion of the technology (Fig. 7).

Chi square tests did not show any significant association between the respondents’ educational background with OC (organizational culture) styles, OC orientations or Dominant OC factors.

### 4.4. Hypothesis testing results

**Hypothesis 1.** There are significant factors in IT planning.

**Hypothesis 2.** There are significant factors in IT implementation.

**Hypothesis 3.** There are significant factors in IT diffusion.

**Hypothesis 4.** There are significant relationships among IT planning, implementation and diffusion.

The first four hypotheses were confirmed through factor analyses and regression tests.

**Hypothesis 5.** There are differences between managers and employees in the perceived issues of the IT planning, implementation and diffusion.

The last hypothesis could not be confirmed.

### 5. Discussion and conclusion

This study proposed a conceptual framework (refer back to Fig. 1) based on models suggested in reviewed books and papers. An integrated, three-stage framework involved IT planning, actual IT implementation, and
IT diffusion. The first stage, IT planning, aligns business strategies to current and future operations. Clear and concise priorities for investing in technology solutions increase the overall performance of an organization. The second stage, IT implementation, focuses on selecting and implementing new technology solutions, developing necessary skills, and measuring the effectiveness of new systems. The third stage, IT diffusion, manages change and the adoption of new technology solutions by the organization and its members.

Our case study revealed that the issues of greatest concerns were adequate training and resistance to change when considering IT deployment. Since the proposed framework was tested with only one organization survey, future research that involves many organizations needs to be conducted to examine and evaluate issues related to how IT planning and implementation contribute to diffusing a new technology solution. Future

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Table 4
Regression analysis—implementation as a function of planning

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>$R$</th>
<th>$R^2$</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployment issues</td>
<td>0.705</td>
<td>0.498</td>
<td>41.6</td>
</tr>
<tr>
<td>Innovation issues</td>
<td>0.717</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

Table 5
Regression analysis—diffusion as a function of planning

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>$R$</th>
<th>$R^2$</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployment issues</td>
<td>0.735</td>
<td>0.541</td>
<td>49.4</td>
</tr>
<tr>
<td>Innovation issues</td>
<td>1.156</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

Table 6
Regression analysis—diffusion as a function of implementation

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>$R$</th>
<th>$R^2$</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ease of use issues</td>
<td>0.702</td>
<td>0.492</td>
<td>40.7</td>
</tr>
<tr>
<td>Innovation issues</td>
<td>1.086</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

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Fig. 7. Results of the framework.
work could include formulation of new hypotheses about the impacts of IT planning and IT implementation on IT diffusion in other parts of the service industry.

Although we could not confirm in a statistically significant manner the hypothesis that stated there were differences between managers and employees with regard to perceived issues of IT planning, implementation, and diffusion, our observations and discussions with managers and employees lead us to believe that there are some differences. Managers claim they understand the users and interpret the technological needs into cost/benefit solutions with respect to the organization’s strategic plan. However, employees who directly interact with their users identify genuine shortcomings in the project objectives. Regarding implementation issues, managers try to centralize IT deployment, which inadvertently reduces the employee’s job involvement and job satisfaction. These different perspectives on the IT planning and IT implementation issues lead end users to believe that a technology solution is challenging and likely to decrease technology diffusion. These observations can be confirmed statistically with additional data collection in other institutes.

Appendix A. PCC tiered architecture model

See Fig. A1.
### Appendix B. Important questions

<table>
<thead>
<tr>
<th>Question (Q)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interdepartmental coordination</td>
<td>Gathering specific IT needs across departments</td>
</tr>
<tr>
<td>Emerging technologies</td>
<td>Considering relevant emerging technologies</td>
</tr>
<tr>
<td>Quick solutions</td>
<td>Pressure for quick solutions to very complex IT problems</td>
</tr>
<tr>
<td>Standardization</td>
<td>Standardizing planning models</td>
</tr>
<tr>
<td>Technology value</td>
<td>Defining and measuring the possible benefits of technologies for budget</td>
</tr>
<tr>
<td>Politics, internal/external</td>
<td>Addressing political, internal/external environment concerns</td>
</tr>
<tr>
<td>Timeframes and scheduling</td>
<td>Coordinating the timeframes and scheduling all projects</td>
</tr>
<tr>
<td>Written procedures/guidelines</td>
<td>Developing guidelines for usage of the new technologies</td>
</tr>
<tr>
<td>Organizational culture</td>
<td>Defining the organizational culture</td>
</tr>
<tr>
<td>Rapidly changing technology</td>
<td>Managing systems with regard to the rapidly changing technology</td>
</tr>
<tr>
<td>Individual IT expertise</td>
<td>Individual IT competence and adaptation to new technologies</td>
</tr>
<tr>
<td>Adequate training</td>
<td>Adequate training is provided for all employees</td>
</tr>
<tr>
<td>Resistance to change</td>
<td>Resistance to change due to fear of the unfamiliar</td>
</tr>
<tr>
<td>IT budgeting allocation</td>
<td>The institution has focused resources to enhance IT ability</td>
</tr>
<tr>
<td>Existing systems</td>
<td>Compatibility of systems and software is addressed early on the planning</td>
</tr>
<tr>
<td>Adequate IT staffing</td>
<td>The number of qualified IT support staff is adequate</td>
</tr>
<tr>
<td>Interdepartmental coordination</td>
<td>Coordinating IT implementation across departments</td>
</tr>
<tr>
<td>Written procedures/guidelines</td>
<td>Developing general procedures to implement IT</td>
</tr>
<tr>
<td>Timeframes and scheduling</td>
<td>Developing the timeframes and scheduling effectively</td>
</tr>
<tr>
<td>Standardization</td>
<td>Setting standards for consistency and efficiency</td>
</tr>
<tr>
<td>Perceived benefits</td>
<td>Perceived benefits (ease of use, usefulness) to adopt a technology solution</td>
</tr>
<tr>
<td>Compatibility with systems</td>
<td>Level of interactions of other processes to adopt a technology solution</td>
</tr>
<tr>
<td>Time investment</td>
<td>Time consuming to adopt a technology solution</td>
</tr>
<tr>
<td>Security concerns</td>
<td>Security problems associated with using a technology solution</td>
</tr>
<tr>
<td>Management participation</td>
<td>Management participation to adopt a technology solution</td>
</tr>
<tr>
<td>Attitude to change</td>
<td>Attitude of end users to change the way to complete their work</td>
</tr>
<tr>
<td>Effort required</td>
<td>Effort toward mastering tasks required to use a technology solution</td>
</tr>
<tr>
<td>Previous experience</td>
<td>Success rate of previous IT adoptions</td>
</tr>
<tr>
<td>Risk taking</td>
<td>Willingness to accept high risk from untried technologies</td>
</tr>
<tr>
<td>Technology challenges</td>
<td>Extent that employees are aware of requirements and obstacles</td>
</tr>
</tbody>
</table>

References


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