Factors Influencing End-User Intention to use Expert Systems:  
A Theoretical Model

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ABSTRACT  
This paper examined factors that influenced end-user intention to use expert systems (ES). It proposed a theoretical research model to predict end-user intention to use ES. The proposed research model extended the technology acceptance model (TAM) by including additional factors such as perceived reliability of ES and perceived quality of ES. Additionally, external factors that directly and indirectly influence end-user intention such as end-user participation, top management support, and liability were considered in the proposed model. Finally, an instrument for measuring the variables of the model was developed.

INTRODUCTION  
Expert systems are computer programs that are capable of performing specialized tasks based on an understanding of how human experts perform the same tasks (Ye and Johnson, 1995). An expert system may include a knowledge base, an inference engine, an explanation module, and a user interface. These components are used to mimic expert decision making (Yoon et al, 1995). Expert systems are unique in that they are often developed to make unstructured decisions. These real world decisions have financial, legal, political, and social implications (Ye and Johnson, 1995). Over the years, expert systems have been successfully implemented throughout a wide range of institutions. As businesses invest larger amounts of money on technology, the need for the business to evaluate the payback will also increase. Because of this, it has become even more important for information technology personnel to gain a better understanding of the factors that influence the success or failure of a technology project (Yoon et. al, 1995). If users are going to
remain responsible for the decisions made by the expert system and are to feel comfortable with that responsibility, they will need to understand the reasoning processes behind the system (Ye and Johnson, 1995). Even though businesses invest significant amounts of money to design and build expert systems, there is no guarantee that a system will be accepted and used by the end-user. Many factors contribute to the success or failure of expert systems, including the end-users perception of the system’s ease of use, the system’s usefulness, the quality of the system, and the reliability of the system. There are also some of external factors that play a role in the end-user intention to use the expert system. These include the role that senior level management plays in the project, the involvement of end-user in the project, and the liabilities from using expert systems. The main objective of this paper was to propose a theoretical model to predict end-user intention to use expert systems.

LITERATURE REVIEW

A great deal of research has been conducted in the past on the topic of end-users’ acceptance of new computer systems and applications, however; there is insufficient information available on this issue relating to expert systems. The lack of current information available on the topic of expert systems inspired us to explore this subject further. We have focused our study on factors that influence end-users’ intention to use expert systems. The primary model used in this study was the Technology Acceptance Model adapted from Davis (1989). The paper is organized as follows: In the next section, we briefly review related literature, present the hypotheses to be tested, propose a theoretical model for factors that influence end-user intention to use ES, and develop the instrument to measure the factors in the model (Appendix A).

Attitude

Attitude has been used as antecedent of intention to perform behavior (Ajzen and Fishbein, 1980). It was found that a person with a positive attitude toward a particular technology most likely will use that technology (Chang, 1998; Johnson et al., 1999; Lapczynski, 2004). For example, Harrison et al. (1997) found that attitude was a significant predictor of the intention to adopt information technology among small-business executives. Executives with a positive attitude toward information technology had the intention to adopt it. We hypothesized that attitude would affect the individual intention to use expert systems. Thus, the following hypothesis was proposed:

H1: Attitude toward expert systems has a significant effect on end-user intention to use expert systems.

Perceived Usefulness and Perceived Ease of Use

The overall attitude of a prospective end-user toward the use of a new computer program, such as an expert system, was defined as a function of the belief constructs shown in the Technology Acceptance Model (Davis, 1989). This model was used to predict end-users’ acceptance of a system based on two factors: perceived usefulness and perceived ease of use. Perceived
usefulness was defined as the degree to which a person believed that using a system would enhance his or her job performance. Perceived usefulness was the degree to which a person believed that using a particular system would be free from effort (Fenech, 2005).

End-users tend to use or ignore an application based on their perception of its usefulness, which is the belief of whether or not the program will help them to perform their job better? If users believe that a system will help them perform better, but also believe that the system is too hard to use, they are less likely to use the system. The opportunity costs, in terms of time and effort, of using the system outweigh the benefits provided by the system (Davis, 1989).

If an end-user is faced with two expert systems that offer the same functionality, the user should identify the system that they perceive to be easier to use and to be more useful. User perceptions of a system are formed after minimal exposure to the new system. These initial perceptions have a direct affect on whether the user will actually want to use the system in the future (Morris and Dillon, 1997). It has been reported that PEU had a direct impact on intention and indirect impact via PU (Davis et al., 1989; Toe et al., 1999; Venkatesh and Morris, 2000). Therefore, the following hypotheses were proposed:

\[ H2: \text{ Perceived Ease of Use has a significant effect on end-user attitude toward expert systems.} \]
\[ H3: \text{ Perceived Usefulness has a significant effect on end-user attitude toward expert systems.} \]
\[ H4: \text{ Perceived Ease of Use has a significant effect on PU of Expert Systems.} \]

**Perceived Reliability of the Expert System**

Reliability refers to the ability to ensure continuous and smooth operation of a system. Reliability is represented by the availability of the technology in its normal operational mode (Applegate et al., 2003). The reliability of a technology is measured by its competence in providing up-to-date information, as well as reducing errors and system breakdowns. It should also generate an output of information that is meaningful and unambiguous (Liao and Landry, 2005). The acceptance of advice provided by an expert system is determined more by its reasonableness than by its correctness. It was pointed out by Ye and Johnson (1995), that the belief of end-users’ in the reliability of the system’s conclusions was increased after the users were able to review the explanations provided by the system (Ye and Johnson, 1995). Thus, in this paper, we posit the following hypothesis:

\[ H5: \text{ Perceived Reliability has a significant effect on end-user attitude toward expert systems.} \]

**Perceived Quality of the Expert System**

The Planned Behaviour in Context (PBiC) model was developed by Klobas and Clyde (2005) as a way to explain resource use as a function of intention to use the information resource. The attitudes held by end-users reflect the perceived quality of the information system and influence their intentions to use the system. Intentions are formed from attitudes which reflect the context of use and the perceived quality of the information system (Klobas and Clyde, 2005). In this
paper, we measure quality construct by a set of items that reflect end-user perception about the quality of expert systems. The following hypothesis was proposed:

*H6: Perceived Quality has a significant effect on end-user attitude toward expert systems.*

**EXTERNAL VARIABLES**

Davis (1989) suggested that his original model could be extend by adding external variables that may directly or indirectly impact ease of use, usefulness, and user acceptance. For example, Venkatesh and Davis (2000) included external variables in their study. In this study, the authors included end-user participation, top management support, and liability of expert systems as external variables that might have direct and indirect impact on end-user intention to use expert systems.

**End-user Participation**

The introduction of a new system into an organization represented a period of significant, and often involuntary, change for employees. End-users often experience a threat of reduced control over their work. A decrease in personal control resulted in an increased level of stress, withdrawal, sabotage, depression, and reduced performance. Personal control over an unpleasant stimulation, such as the introduction of a new system, reduced employee stress and led to greater endurance throughout the implementation process (Baronas and Louis, 1988).

The type of user participation included no involvement, symbolic involvement (user input was requested but then ignored), involvement by advice, involvement by weak control (the user had sign-off responsibility), involvement by doing (the user was an actual team member), and involvement by strong control (Tait and Vessey, 1988). Ignoring the role of potential users in the expert systems development process led to end-user dissatisfaction. When end-users received a system that they did not request and did not have input into, they were found to be very critical of the system and avoided its use. In the worst case, even a direct command from senior management was not able to make users change their attitudes, and any use of the system was done grudgingly. The most common complaints heard from end-users included difficulty in understanding the system and incompatibility with current methods and procedures (Wong, 1996).

System users, especially managers, were motivated by a desire to preserve their discretion in decision making. Expert systems represented a threat to the manager’s professional discretion. When introducing a new expert system, it should be presented as an important source of expertise that managers can rely on to supplement their knowledge. It should be stressed that the system will not replace the managers own judgment. Managers were more likely to use the expert system when they were encouraged to view it as a tool to help them make appropriate decisions in complex, unstructured areas (Berry, 1997).

It was noted by Gill (1996) that there was a pattern that emerged in his research. When a new system was proposed, everyone got excited about the system; it was used for a few years, and then its use slowly declined. Expert systems that continue to thrive five years after they were
implemented had a common ground. Instead of focusing the system on replicating or incrementally improving pre-system task performance, they changed the tasks in ways that motivated its use. They offered the end-user a greater sense of control and increased variety. They also made it easier for users to assess the impact of their tasks on the rest of the organization. By enhancing the intrinsic motivators of control, arousal, and achievement, end-user commitment to the systems use was ensured (Gill, 1996). Therefore, end-user participation was considered in this paper as external variable, and it was measured as dummy variable that takes a value of 0 if the end-user participated in the process of developing expert systems, and 1 if the end-user did not participated. We proposed the following hypotheses:

**H7a:** End-User Participation has a significant effect on end-user intention to use expert system.  
**H8a:** End-User Participation has a significant effect on perceived ease of use of an expert system.  
**H9a:** End-User Participation has a significant effect on the perceived usefulness of an expert system.  
**H10a:** End-User Participation has a significant effect on the perceived reliability of an expert system.  
**H11a:** End-User Participation has a significant effect on the perceived quality of an expert system.

**Top Management Support**

Top-management support included providing sufficient time and money for the expert systems project, showing confidence in the project’s leadership, and through direct involvement in all stages of the expert systems development process. Failure to provide sufficient support was found to have an adverse effect on the project and contributed to project failure (Wong, 1996).

The role of the CEO in information technology development projects was to create a climate of support for the system. This was done by endorsing the IT manager’s initiatives, signaling the importance of the project throughout management, and providing general business direction. However, the CEO did not personally participate in decision making and other activities related to IT (Jarvenpaa and Ives, 1991).

The essential factor to ensure end-users acceptance of a system was through top management involvement in all stages of the project. Management support was able to ensure sufficient allocation of resources and act as a change agent to create a more conducive environment for the project. It was important for the leaders of the company to inspire the rest of the company by sharing with them the vision for the future. This included the role that technology would play within the organization (Liao and Landry, 2005). Top management support was included in this paper as an external variable, and it was measured as a dummy variable that takes a value of 0 if top management support was present and 1 if it was absent. We proposed the following hypotheses:

**H7b:** Management Support has a significant effect on end-user intention to use expert system.  
**H8b:** Management Support has a significant effect on perceived ease of use of an expert system.

492
H9b: Management support has a significant effect on the perceived usefulness of an expert system.

H10b: Management support has a significant effect on the perceived reliability of an expert system.

H11b: Management support has a significant effect on the perceived quality of an expert system.

**Liability**

The liability issue has been one of the main concerns that could hinder the usage of expert systems, especially, when the outcome of the expert systems related to human lives. According to Mykytyn et al., (1990) Liabilities could include product liability and negligence. Additionally, all individuals involved in the process of developing expert systems (such as knowledge engineers, domain experts, and end-users) could be subject to legal inquiry (Lynn and Bockanic, 1994; Mykytyn et al., 1990). Therefore, companies as well as individuals should investigate such potential legal consequences of using expert systems. In a similar line of inquiry, Bordoloi et al., (1996) examined in detail how computer-based systems developers could be threatened as a result of defective systems, and proposed a framework for injury assessment and reduction of legal liability that might resulted from development flaws. In another study, Dillard and Yuthas (2001) proposed a framework for the responsibility ethic implementation in the audit expert systems domain. It is clear that the liability issue could influence the usage of expert systems, since by their nature expert systems are designed to mimic human expertise by playing the role of consultants and advisors who could be subject to accountability for bad recommendations. Thus, we proposed that liability would influence individual intention to use expert systems. Therefore, the following hypotheses were proposed:

H7c: Liability has a significant effect end-user intention to use expert system.

H8c: Liability has an effect on perceived ease of use of an expert system.

H9c: Liability has an effect on the perceived usefulness of an expert system.

H10c: Liability has an effect on the perceived reliability of an expert system.

H11c: Liability has an effect on the perceived quality of an expert system.

Based on the above-mentioned literature review and hypotheses, we proposed the following research model depicted in Figure 1. This Model would be validated and tested by collecting data through a survey questionnaire in a future study.
Figure 1: The Proposed Research Model
### APPENDIX: LIST OF ITEMS

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intention</strong>&lt;sup&gt;b&lt;/sup&gt;</td>
<td>IN1</td>
<td>How certain is your plan to use an expert system</td>
</tr>
<tr>
<td></td>
<td>IN2</td>
<td>How confident is your plan to use expert systems</td>
</tr>
<tr>
<td><strong>Attitude</strong>&lt;sup&gt;c&lt;/sup&gt;</td>
<td>AT1</td>
<td>The thought of using expert systems frights me</td>
</tr>
<tr>
<td></td>
<td>AT2</td>
<td>I do not see how expert systems will be useful to me in the future</td>
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<tr>
<td></td>
<td>AT3</td>
<td>Having to use expert systems could make my work less enjoyable</td>
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<tr>
<td></td>
<td>AT4</td>
<td>I avoid using expert systems whenever I can</td>
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<tr>
<td></td>
<td>AT5</td>
<td>I feel very negative about expert systems in general</td>
</tr>
<tr>
<td><strong>Perceived Ease of Use</strong>&lt;sup&gt;d&lt;/sup&gt;</td>
<td>PEU1</td>
<td>Learning to use the expert system would be easy</td>
</tr>
<tr>
<td></td>
<td>PEU2</td>
<td>I would find it easy to fully utilize the expert system</td>
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<tr>
<td></td>
<td>PEU3</td>
<td>It would be easy to become skillful at using the expert system</td>
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<tr>
<td></td>
<td>PEU4</td>
<td>I would find the expert system to be easy to use</td>
</tr>
<tr>
<td><strong>Perceived Usefulness</strong>&lt;sup&gt;d&lt;/sup&gt;</td>
<td>PU1</td>
<td>An expert system would enhance my job process</td>
</tr>
<tr>
<td></td>
<td>PU2</td>
<td>An expert system would increase my job performance</td>
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<tr>
<td></td>
<td>PU3</td>
<td>An expert system would advance my career</td>
</tr>
<tr>
<td></td>
<td>PU4</td>
<td>An expert system would improve my skills to complete my duties at work</td>
</tr>
<tr>
<td><strong>Perceived Reliability</strong>&lt;sup&gt;e&lt;/sup&gt;</td>
<td>PRI1</td>
<td>I would assume that the result (outcome) of expert systems are reliable</td>
</tr>
<tr>
<td></td>
<td>PRI2</td>
<td>I would be confident in the result (outcome) of expert systems</td>
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<tr>
<td></td>
<td>PRI3</td>
<td>I would use the result (outcome) of expert systems without hesitant</td>
</tr>
<tr>
<td></td>
<td>PRI4</td>
<td>I would be confident about the availability of expert systems in its normal operational mode</td>
</tr>
<tr>
<td><strong>Perceived Quality</strong>&lt;sup&gt;e&lt;/sup&gt;</td>
<td>PQU1</td>
<td>I would be satisfied with the quality of the result (outcome) of expert systems</td>
</tr>
<tr>
<td></td>
<td>PQU2</td>
<td>The result (outcome) of expert systems would be consistent all times.</td>
</tr>
<tr>
<td></td>
<td>PQU3</td>
<td>The result (outcome) of expert systems would improve the quality of my work</td>
</tr>
<tr>
<td></td>
<td>PQU4</td>
<td>The explanation feature of expert systems would add value to the quality of its result (outcome)</td>
</tr>
</tbody>
</table>

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a. All statements will be measured using a 5-point Likert scale, ranging from strongly disagree to strongly agree, with the exception of intention items. The scale will range from extremely uncertain (unconfident) to extremely certain (confident).
b. The items for measuring intention were adapted from Ajzen’s (1991) study.
c. The items for measuring attitude toward expert systems were adapted from (Delcourt and Kinzie, 1993 and Maurer and Simonson, 1984).
d. The items for measuring PEU and PU were adapted from Davis’ (1989) study.
e. These items were created by the authors.
REFERENCES


