Design of an E-Procurement Adoption Model (EPAM)

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Summary

This paper describes an exploratory study to design an E-Procurement Adoption Model (EPAM). A taxonomy of issues influencing individual adoption is extracted from literature. Based on triangulation of expert interviews, case studies, and focus group discussions, the EPAM is designed by identifying issues confirmed in practice per role and change phase.

Keywords: E-Procurement, Technology Adoption, Innovation Adoption

Introduction

Since the introduction of internet technology in the purchasing function a wide proliferation has taken place of different E-Procurement (EP) tools. EP can be defined as network-based information systems intended to facilitate the procurement process. Only five years ago, EP only referred to e-ordering systems based on catalogs. Nowadays, the pallet of tools has extended to a wider application domain, for instance e-tendering, e-auction, ERP integration, sourcing catalogs and collaborative tools.

The potential benefits of these EP tools are attractive to many companies, as they can contribute to the professionalization and development of the purchasing function by realizing procurement processes in a more efficient and effective way. Attracted by these potential advantages, many companies have made conceivable investments in EP, only to discover a varying degree of success.

Various recent studies have explored the benefits and applicability of EP tools in different situations (e.g. Harink, 2003; Hartmann, 2002). On the other hand, a major aspect in the successful EP application has remains largely unexplored: in order to reap the potential benefits of EP, adoption of the EP tool and the corresponding change of tasks and responsibilities, by all members of the intended user group is crucial. This adoption is not self-evident. On the contrary, some people might demonstrate open resistance towards the change process; especially when their job is ‘facilitated’ in such a way that it has becomes obsolete.

Several aspects of adoption have already been researched quite extensively. For instance, in the social and psychological discipline, cognitive (innovation) adoption of individuals has received a great deal of attention. On an organizational level, research has primarily focused on different approaches towards change management and organizing the prerequisites for EP. However, only very limited research focuses on the interplay between individual adoption and

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organizational adoption, although the importance of managing the adoption process is recognized by several academia (Hartmann 2002).

Brainstorm sessions with fifteen representatives of leading Dutch buying organizations showed that insights into the ‘soft’ human factors in EP implementation are missed. These concerns of large purchasing organizations combined with the identified gap in current literature have led to this research project with the objective to design an organizational adoption model for EP in which ‘issues’ of individual adoption are identified. This model will be referred to as the E-Procurement Adoption Model (EPAM).

This paper describes the research performed within the Purchasing & Business Marketing group at the Eindhoven University of Technology, resulting in the EPAM. First of all, the research design is briefly described. Next, the data collection process is explained, followed by the data analysis and design. Finally, the findings are discussed.

Research Design

The objective of this study is to develop an EP adoption model (EPAM), which provides the answer to the main research question: ‘What are the major issues influencing EP adoption?’.

The construct that is used in this research project is simply ‘issues’ as independent variables and ‘adoption’ as a dependant variable. Adoption takes place on an individual level and is defined as the behavior contributing towards organizational adoption and is expected to differ per type of role.

Some researchers also propose intermediating variables for the effects of variables on adoption (e.g. Davis et al. 1987). The complex interaction and mediation of external variables provide the basis for a great deal of adoption research. Here, a simple construct is used, to facilitate the exploration of issues. See Figure 1.

Figure 1 - Construct

![Issues to Adoption Diagram]

The organizational adoption process is viewed as a sequence of individual adoption processes and passing through the change phases of Kotter (1996). The interplay between individual and organizational adoption is dealt with by researching seven different roles. These elements are included in this study by structuring the empirical data finding process during in a matrix with the eight change phases from Kotter (1996) horizontally and the seven roles that show individual adoption vertically. The matrix is referred to as the EPAM Matrix, as it provide the basis for the design of the EPAM (Figure 2).

First of all, ‘issues’ are extracted from theory, clustered, and codified in a taxonomy. Then, method-triangulation of the following three empirical research methods is performed: expert interviews, case studies and focus group discussions (FGDs) to elicit issues in practice. Confirmation of the issues from theory by the findings from the triangulation are searched for by narrative analysis and using the taxonomy as a coding scheme. A frequency analysis is conducted to find the occurrence and distribution of major issues in general and specific for the different roles and change phases.

The EPAM is designed by a cluster analysis of the identified issues, yielding a revised taxonomy of issues based on theory and triangulation, and filling the EPAM matrix with this new taxonomy. The research design is shown graphically in Figure 3.
Data Collection

Theoretical Exploration

A review of adoption literature shows the following important models that are widely used in the discussion about (IT) adoption: the Theory of Reasoned Action (TRA) (Fishbein & Ajzen 1975), the Theory of Planned Behavior (TPB) (Ajzen 1991), the Technology Acceptance Model (TAM) (Davis 1989), The Task-Technology Fit model (TTF) (Goodhue & Thompson 1995) and the Expectation-Confirmation Theory (ECT) (Oliver 1980). Of these approaches, the TAM is the most widely cited explaining model for individual adoption. Many follow-up studies have taken place researching TAM for specific information technologies and gathering further empirical evidence for the model (e.g. Davis et al. 1989; Adams et al., 1992).

The models are predominantly designed to explain individual adoption of technologies in a B2C setting, corresponding with a limited change, and using mediating variables. Although a high level of explanation of individual adoption is attained in specific situations, no study concentrates on classifying external issues. Therefore a taxonomy of issues is developed by reviewing both adoption and change management literature. Issues identified in the existing approaches adoption are included in this taxonomy.

A total of 61 issues were identified from adoption literature and clustered in 18 categories and five super-categories: individual, EP, project, organizational, and environmental
characteristics. Next, the taxonomy of issues is revised and extended using change management literature. Twenty-three issues were added based on literature dealing with change strategy, a management tool-box, other perspectives towards adoption, other IT adoption processes and practitioners information. This resulted in a taxonomy of 84 issues in 18 categories and five super-categories. The taxonomy is codified to use as a coding scheme in the analysis of the data gathered in the triangulation.

**Triangulation Method I: Expert Interviews**

The first empirical method that has been applied, is conducting semi-structured interviews focused on extracting issues based on expertise (knowledge and opinions) or experiences (actual events). During the interviews the focus is directed towards the latter in order to be as fact-based as possible. A critical incident technique is used to focus on the effectiveness of experiences (issues). Open questions about why and lessons-learned revealed more issues. Nearly all interviewees have drawn from more than one adoption experience; although some interviews dealt with one specific EP case.

The EPAM matrix is used as a guideline and structure for the interviews. It was not detailed into a list of questions to leave some freedom to elaborate on certain issues and shift focus during the course of the interview depending on a specific expertise of the interviewee. After a short introduction about the background of the interviewee, individual adoption of the different roles during the organizational adoption of EP is discussed using the EPAM matrix.

The selection of interviewees covered a broad array of different experts: consultants with relevant experience in supporting EP implementation, suppliers that have developed, sold, and/or implemented EP solutions, and scientists who have conducted research related to EP. For both consultants and suppliers the selection was based on including the opinions of major players in The Netherlands. The scientists were identified by their affiliation with NEVI.

A total of twelve different people were interviewed, either face-to-face or by telephone and the emphasis was different in every interview due to the specific expertise of the interviewee. A total of 382 issues were extracted from the twelve interviewees.

**Triangulation Method II: Case Studies**

Yin (1994) states the following three conditions to assess the applicability of case studies as research strategy: the type of research question, the control of the investigator over the actual behavioral events, and the focus on contemporary phenomena. In general, case studies are recommended when ‘how’ or ‘why’ questions are being posed, when the investigator has little control, and when the focus is a contemporary phenomenon in a real-life context. The study of adoption of EP adheres to all of these criteria.

In the definition of a case study Yin (1994) describes that it copes with situations with more variables of interest than data-points and that it relies on multiple sources of evidence. The following different data sources were used in the case research in this study: documentation, to speed up the comprehension of the case and provide background information., Hands-on experience, to get the ‘look & feel’ of the EP system, and interviews. The interviews were the primary data source for the case studies. A comparable method was applied as for the expert interviews, using the EPAM matrix as interview guideline and also adopting a critical incidence technique. The major difference between expert interviews and case-interviews is that the latter deals with real-life experiences of the interviewee.

The selection of cases focused on including cross industry cases and different types of EP. In addition, the interviewees in a case are selected to include as much diversity of functional background as possible. The potential cases were limited by the availability and willingness of companies to actively participate in this research project. Although Yin (1994) suggests a
process where each case leads to the selection of the next case, a more parallel approach was
applied, due to the relatively long lead time from case identification till the confirmation of a
case report and the time constraint for this project.

A multiple case study replication design (Yin 1994) is used to perform eight case studies
of EP adoption across five different companies in eight different industries. The cases cover
the different types of EP and all cases deal with an EP adoption case that has already taken
place or is in such a stage that discussion can take place about past experiences. A total of 565
issues have been extracted from the cases.

Triangulation Method III: Focus Group Discussions

A focus group discussion (FGD) is a guided, in-depth exploration in which six to twelve
members of the target population discuss their feelings, beliefs and behaviors relative to a
research topic. The discussion shows how people behave and why they behave as they do. In
order to facilitate a free discussion, the group members should be able to relate towards each
other, as to the moderator, and be familiar with the research topic. Sharing personal or
demographic characteristics could help in this respect.

In this research project five parallel FGDs are held during a conference. In these
discussions a specific case of an EP adoption is dealt with in a group of approximately eight
participants. A case representative explained the case during a short presentation and then the
focus group members were asked to participate in the discussion as one of the roles in the
project. The discussion is set up as a ‘role play’. The moderator used the EPAM matrix to
explore the issues of the different roles in the different change phases in the case at hand. The
FGD method and the EPAM matrix were discussed at forehand with both the case
representatives and the moderators to ensure a proper usage of the EPAM matrix as
discussion format.

The moderator has an important role in stimulating the discussion. The moderator should
be comfortable in the group, familiar with the background, and able to structure the
discussion. This was attained by having every group chaired by a NEVI-purchasing
professor. The findings of the FGD were recorded and the moderator checked the minutes
afterwards.

The participants of the conference were predominantly purchasing managers of large
Dutch purchasing organizations, in addition to several consultants and scientists. The
participants were all familiar with purchasing and EP from a management perspective and
were able to engage in an open discussion. The group composition and roles of the
participants, initial background information about the discussion format, and a brief
theoretical basis were provided at forehand.

A total of 422 issues were extracted from the FGDs.

Data Analysis

The method employed for data analysis is a ‘narrative analysis using a coding scheme’. Data
point were extracted from the findings of the expert interviews, case studies, and focus group
discussions and placed in the EPAM Matrix. The data point can be seen as ‘narrations’ from
the research participants. Then, all data points are categorized according to the taxonomy of
issues found in theory, which is used as a coding scheme.

The following data analysis process has been performed for every one of the three
triangulation data sources. Data points (narrations) are extracted from the interview, case and
focus group discussion reports that broadly represent one discrete issue influencing individual
adoption. The points are placed in the EPAM matrix, primarily based on were the respondents
in the interview, case, and FGDs placed the points, and revised by the researcher according to
the theory of Kotter (1996). Then, they were given a code. The coding scheme includes super categories, categories and subcategories and a data point is ascribed to the ‘smallest’ possible category. Every interviewee, case or FGD can only lead to one ‘score’ per code per cell in the EPAM matrix. Therefore, the maximum count of a specific code in a certain cell is the amount of interviews, cases or FGDs triangulation data source (N=25). The result is a filled EPAM matrix with codified issues.

The data analysis has been performed for the total of 1396 data points.

Results

Analysis for the different methods shows that they show a different distribution across the EPAM matrix, which indicates a complementariness of the applied empirical methods. The distribution of issues across the EPAM matrix is as follows: 30.2% in the matrix, 9.3% for the roles, 34% for the change phases and 26.4% in general.

The most Issues in the EPAM matrix are found in the ‘Create Buy-in phase’ for the ‘Operational Purchaser’ and ‘Business User’. The most frequently found issues in the EPAM matrix are: ‘Communication’; ‘Usefulness’; ‘Need for Security’; and ‘Threat to Power’. The roles with the most issues are ‘Management’ and ‘Project Team’. The most frequently mentioned issues in the different roles are: ‘Competencies’; ‘Link Business, Purchasing and Project’; and ‘Alignment of Purchasing and Business Strategy’. The distribution of issues across the change phases shows an increase, peaking at the ‘create buy-in phase’, followed by a decrease in frequency. The most frequently mentioned issues in the different change phases are: ‘Communication’; ‘Multifunctional’, ‘Involvement’; and ‘Link Business, Purchasing and Project’. The issues that could not be attributed towards specific roles, change phases or combinations, generally refer to the business and its context.

For the overall findings, 90% of the taxonomy of issues from theory was confirmed, at least once by the issues from practice and 56.6% by all three empirical methods. The most frequent issues overall are: ‘Communication’; ‘Involvement’; ‘Link of business, purchasing and project’; ‘Usefulness / Relative Advantage’; and ‘Change Strategy: Organizational Development’. Communication is mentioned most often (6.5% of all issues from practice) and can be split up into communication strategy and execution. The distribution across the EPAM matrix shows that the majority is found in the ‘communicate vision’ phase and for the ‘operational purchaser’ and ‘business user’.

Designing the EPAM

The EPAM consists of the following parts: a revised taxonomy of issue and the filled EPAM matrix. A cluster analysis is performed to develop a revised taxonomy of issues based on theory and practice. This is originally a mathematical method to group variables with a related characteristics, e.g. effect on the end-variable. Here, the results of the frequency analysis are used to make a new taxonomy that is more concise and divides the frequencies more evenly across the different categories. Only the issues in the original taxonomy are included that are confirmed in all three empirical data sources and have a minimum frequency of over 0.5%.

This group of issues from the taxonomy, makes up approximately half of the total amount, while corresponding with a total confirmation frequency of over 90%. This leads to a revised taxonomy of issues from theory with eight categories and three super-categories. Relating this back to the original research construct, this yield a revised construct as shown in Figure 4.
The EPAM matrix filled with the issues from triangulation and codified with the taxonomy from theory, is converted to the new taxonomy from theory and triangulation. This provides a more practical overview of the categories of issues in general and specific to roles, change phases, and their combination. The frequency distribution across the EPAM matrix is shown as different shades of gray (figure 5).

Discussion

The EPAM can be used by practitioners as a management tool to facilitate the adoption process of EP. The EPAM matrix shows the possible issues that can influence individual adoption. If practitioners would like to influence the intra-organizational adoption processes, the EPAM matrix provides a guideline as to when (in which change phase) and where (with which roles) potential issues occur that influence the adoption. Only when these are known, effective measures or directed efforts can be designed and executed to intervene in these influences. These are not covered in the EPAM. Practitioner that are in charge or responsible for an EP adoption process are recommended to use the EPAM to identify the relevant issues in this specific process. Instead of employing random methods to manage the adoption, they should develop methods that effectively address the specific issues at hand. The focus of their interventions or actions can then be increased.

Limitations & Future Research

This research is an exploratory study identifying issues that influence individual adoption of EP. The issues identified in this research are treated as independent variables, however, a complex interaction of these variables and mediating or moderating variables might approach reality in a better way. Still, for unraveling this complexity, this research provides the first step by identifying different relevant issues.
Some points of internal validity can be made, that are embedded in the research design. For instance, the use of the change phases (Kotter 1996) and the seven roles has some methodological concerns. Both in the case studies as in the FGDs, the change phases in the EPAM matrix (Kotter 1996) were not dealt with in consecutive order, but rather in a more parallel and iterative way. Another point of critique of using Kotter (1996) is that the exact transition between the phases is difficult to determine. On the other hand, the research base was familiar with Kotter (1996), which facilitated the empirical data gathering process. More roles could have been identified for this research, however, these capture the most relevant during a change process of implementing EP.

Besides points referring to using the EPAM in the data gathering and analysis, a lot of discussion takes place among scholars about triangulation as a research method. Especially, the comparability is a major issue. In this research, this is addressed by using a coding scheme for data analysis. Still, points of interpretation of converging results remain.

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<th>Figure 5 – EPAM</th>
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<tr>
<td><strong>Operational Purchaser</strong></td>
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<td><strong>Tactical Purchaser</strong></td>
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<td><strong>Strategic Purchaser</strong></td>
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<td><strong>Management</strong></td>
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<td><strong>Support: IT</strong></td>
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<td><strong>Project Team</strong></td>
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<td><strong>Business User</strong></td>
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<td><strong>General</strong></td>
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**Shade Frequency**

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<th>Shade Frequency in the Matrix</th>
<th>Frequency in the Roles</th>
<th>Frequency in the Change Phases</th>
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<tbody>
<tr>
<td>&gt; 10%</td>
<td>&gt; 25%</td>
<td>&gt; 20%</td>
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<tr>
<td>5 – 9.9%</td>
<td>10 – 24.9%</td>
<td>15 – 19.9%</td>
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<td>2.5 – 4.9%</td>
<td>9 – 9.9%</td>
<td>10 – 14.9%</td>
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<tr>
<td>0.5 – 2.4%</td>
<td>&lt; 9%</td>
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The major issues were identified by the frequency of their occurrence. However, this does not imply exhaustiveness and only gives an indication of the importance of the issue in explaining adoption. In addition, using a critical incident technique might leave obvious points or prerequisites unmentioned. For instance, having internet access was never mentioned, but is surely required to engage in EP.

There is an implicit assumption in researching a multitude of individual adoption that it can capture the complexity of organizational adoption. However, the interplay between organizational and individual adoption is likely to be more complex, as different roles influence each other in their adoption behavior. Other approaches, for instance Social Network Theory, could further assist in addressing this interplay.

Academia are recommended to focus on the possibilities for more formal research. These include several options for hypothesis testing, for instance using the revised construct. In addition, a replication study can be performed to refine and further develop the EPAM. The EPAM is widely applicable as it is a general EP adoption model. However, deviated or more precise models could be developed showing the issues for specific EP tools or applied for different situations.

Besides (re-)testing the issues and their influence on individual adoption, future research can also focus on the interventions that a leading coalition can manage the organizational adoption process. This research provides the basis for developing an effective portfolio of interventions, as knowledge about the relevant issues is required. However, the effectiveness of different measures on one or more issues remains unclear.

This paper merely presents a starting point for the discussion about intra-organizational adoption processes for EP or IT tools. Academia are recommended to join this discussion, as it might present interesting leads for future research. Within PBM future research will address the interaction between different roles with respect to the intra-organizational EP adoption, aiming for a proven model of interventions for managing the intra-organizational dissemination of EP adoption.

References