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Decision Processes in Enterprise Architecture: Descriptive Study

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ABSTRACT
This is a progress report to describe the processes by which enterprise architects make decisions in practice. Decisions regarding enterprise architecture are among the most complex decisions in the IT domain. Architectural recommendations such as choice of an enterprise system are strategic decisions in the sense that they influence and constrain corporate decisions. Formal and informal methodologies have been discussed regarding how enterprise architecture decisions ought to be made in an ideal situation (i.e., normatively or prescriptively). However, the processes by which enterprise architects make decisions in practice have not been rigorously studied (i.e., descriptively). Drawing on concepts from complex decision-making (e.g., heuristics) and sociology (e.g., mimetic isomorphism), this paper seeks to understand architectural decision-making processes in practice from the descriptive view. Using a grounded theory approach, the data were collected systematically to clarify and refine concepts.

Keywords
Architect, Enterprise architecture, Decision-making process, Enterprise systems, Descriptive study, Grounded theory

INTRODUCTION
The Enterprise Architecture function within an organization is often assigned responsibility for strategic IT investments such as selection of common IT infrastructure, buy-versus-build enterprise applications, selection of a packaged system, and choice of an enterprise system. Those early decisions are among the most complex decisions in the Information Technology (IT) domain. The goal of enterprise systems, in general, is to integrate the core corporate activities of an organization, such as logistics, finance, and human resources (Newell, et al., 2001). The responsibility of an Enterprise Architect (“EA”) includes creating technology designs aligned with business goals, while keeping up with technology trends. Current and future choices of IT are highly uncertain because of fast technology changes, market direction, or IT innovation (Choi, 1994; Rogers, 1995, Grinter, 1999; Tingling & Parent, 2002; Mumford, 2003). Overall, enterprise architects face a difficult and challenging task of providing evaluations and recommendations to their organizations in environments facing a high degree of uncertainty.

The purpose of this descriptive study is to examine how practicing enterprise architects make decisions in diverse and uncertain environments. Architecture is a result of technical, business, and social influences (Bass, et al., 1998). While much of the research in software architecture has focused on the outcome of the process – the architecture itself - there is increasing concern being shown for understanding how architecture work happens in practice (Grinter, 1999). Existing literature largely takes either: 1) a normative view, as to what architecture ought to be, or, 2) a prescriptive view, often seen in best practices literature. Much less attention has been paid to the issue of how architects actually make decisions in practice (i.e., a descriptive view of EA decision-making). Current architecture research does not provide systematic empirical observations that could clearly explain architecture processes (Smolander, 2003)

Cyert & March (1963, 1992) argued that the descriptive study was relevant to construct a theory of decision-making behavior. They researched descriptive analysis (how they do) compared with normative analysis (what ought to be) on decision strategies in actual organizations. By using retail store pricing as an example, they described normative study (e.g., antecedent firm and organization theories), and descriptive study (e.g., actual organizational decision process). Many important aspects of decision strategies turn on the distinction made by the firm between decision variables and parameters. They examined what characterizes authoritative decision makers under different conditions, how their prior experience and reference group identifications affect their decisions, and how executive expectations are determined. They observed cases where the normative view of economic theory did not apply to real world decision-making processes. The problems of how businesses ought to make decisions are contrasted with how they do.
In a recent paper, Tingling and Parent (2002) analyzed early technology selection decisions by applying institutional theory to decision and cognitive models. Early evaluation is fraught with high uncertainty because choosing technologies that do not survive in the marketplace is expensive and can affect a firm’s competitive premise and economic viability. They observed that IT managers make decisions, not solely through a rational calculation of costs and benefits, but also through a form of imitation. This imitation (called mimetic isomorphism as a part of institutional theory in sociology literature) suggests that the network of ties among enterprise architects may have an independent effect on decision processes and outcomes.

By drawing insights from these studies, this research aims to understand how architects make decisions in practice. It illustrates descriptive views by interviewing enterprise architects and IT managers who closely work with architects. The next section, Research Methods, introduces Grounded theory in the qualitative research methods used to collect and analyze the data and the background information. The following section discusses the Preliminary Findings of the results in the first phase.

RESEARCH METHODS

Grounded theory allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations or data. It is a research method that is grounded in data systematically gathered and analyzed (Myers, 2003). The basic idea of the grounded theory is to read a textual database (such as a corpus of field notes) and “discover” or label variables (called categories, concepts and properties) and their interrelationships (Strauss and Corbin, 1997). Using the grounded theory, this research aims to build a theory. Once the theory is developed, it can be operationalized for large sample testing in a later step.

The general steps in the approach may be summarized as follows: 1) observe real world users, 2) induct some general principles, 3) observe again to test general principles, and 4) induct again to further generate new principles. The first phase was completed and the findings are summarized below.

Data

Data for this research is obtained from enterprise architects and executives who work with architects closely. Data collected is qualitative (e.g., verbal descriptions of situations, heuristics, scripts etc.) by using both a list of pre-mediated or “canned” questions as well as free form questions. This study has a phased approach, in which the sample of respondents is subdivided into several sub-samples. The four steps listed above are conducted with a sub-sample and the set of pre-mediated questions will change from sub-sample to sub-sample, based on analysis of existing data. We expect to have a total of N subjects in the sample who will be divided into x sub-samples, each with N/x subjects. For example, N=30 subjects will be broken into 3 sub-samples of 10 subject each.

In the first phase, ten enterprise architects were interviewed from three organizations. Firm A is a Fortune 100 international financial services company with a global architecture group, that leads the technology direction and selects enterprise systems for the corporation. The subjects interviewed have worked on at least one large enterprise system with an evaluation budget of several million dollars. Firm B is a Fortune 100 insurance company with substantial international operations in Europe and Asia. The budget for one of their enterprise systems was approximately $40 M. Firm C is a Fortune 500 manufacturing company with international operations in several countries. The company is working on upgrading one of their enterprise systems. These firms were chosen because they are large, international companies, and have enterprise systems and enterprise architecture departments. The subjects were selected because they played important roles as enterprise architects in corporate level projects. Each has fifteen years or more professional experience with extended knowledge in different areas of technology and business. The interviews lasted from sixty to ninety minutes each. The interviewees shared their opinions and situations much more openly than the researcher expected.

The objectives of the interviews were to understand the processes by which enterprise architect’s work in their organizations and the factors that influence their decision-making processes. The questionnaire outline, which included a set of questions, was used to guide the researcher’s interview process, however, the interviewees were encouraged to freely discuss their work.

PRELIMINARY FINDINGS

The answers showed the gaps between how EAs ought to function and how EAs function in practice. The researcher often needed to ask the participants whether they were talking about their EA practice (descriptive view) or an idealization (normative view). The answers were categorized into organizational environment and decision-making processes. Each aspect is sub-categorized into its influential factors. The following numbers are associated with the table.

Organizational environment:
1. EA’s Role in their organizations,
2. EA’s Organizational positions,
3. EA’s Communication flow with stakeholders,

Decision-making process:
4. EA’s Knowledge source which influences on information gathering processes and decision-making,
5. Sources of EA’s Information gathering, and
6. EA’s underlying philosophy and influential factors for Design decisions.

The table summarizes the main findings in their normative views and descriptive views for each factor.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>#</th>
<th>Factor</th>
<th>Normative View</th>
<th>Descriptive View</th>
</tr>
</thead>
</table>
| Organizational Environment | 1 | Role                    | • EAs should research and submit their recommendations to executive council for discussion and approval  
• EAs should be involved in enterprise strategic decisions such as buy vs. build, choice of platform, and selection of enterprise systems  
• EAs should be an educator and bring intelligence to the corporate strategic processes  | • EA roles are ambiguous in an organization.                                                                                                           |
| 2 | Organizational Position | • EAs should be an autonomous group reporting to a corporate executive and be facilitators between business and IT units | • EAs often report to the technology unit and lack of involvement in the business process  
• This causes miscommunication with business units  
• Ambiguous reporting structure                                                                                                                                 |
| 3 | Communication          | • EAs should have well-balanced communication with multiple levels of stakeholders (e.g., business and IT executives, development groups, business users) | • Communication with business units is limited  
• Business unit and development think the EA’s approach is too abstract to understand and implement  |                                                                                                                                                     |
| Decision-making Process  | 4 | Knowledge Sources (technology trends, best practices, etc.) | • EAs should have wide range of knowledge, communication is important (e.g., Conferences, User group, Special Interest Group (SIG))  | • EAs use their local network (e.g., ‘social network’) as their main source of knowledge                                                                 |
| 5 | Information Gathering (requirements) | • EAs should collect information from all associated business and technology groups | • Information gathered from limited sources                                                                                                                                                             |
| 6 | Design Decisions       | • EAs should have priority in addressing reusability and quality of the system  
• EAs should develop a high-level abstract design  
• EAs should understand technology trends and apply industry best practices | • Corporate resources limit the selection of technology  
• Influential individuals affect corporate decisions  
• Success stories in other companies influence system choices and design decisions                                                                 |

Table 1. Findings: Architect’s Normative View vs. Descriptive View

Discussion

Organizational environment: Role, Position, & Communication

The role of enterprise architecture should be architectural design work at an enterprise level and contribute IT strategic decisions such as selection of platform and enterprise systems (Bredemeyer, 2003). Architects should facilitate coordination of multiple business and technology units, which have different priorities and agendas (Grinter, 1999, Bass, et al, 1998). In
order to accomplish their role, practicing architects believe that balanced communication in both business and technology functions is imperative. However, in practice, communication is not always well balanced across heterogeneous groups in an organization.

Phase I data indicates that the organizational environment influences EAs communication flow, and their roles in the organization. When an architecture group is structurally a part of IT, their communication with business functions is sometimes limited, and their influence on strategic decisions is restricted. When their reporting structure is ambiguous, information flow across department boundaries is also limited. When the architecture group is positioned in the executive management team, their communication across the organization and their involvement in strategic decisions increases. A positive partnership with business groups seems to help enterprise architects work more effectively.

Architects interact with numerous influential stakeholders such as business and technology executives, development groups, customers, and others. For example, when enterprise architects work on high level, abstract designs, there is a tendency for the development groups to consider their work to be too abstract to implement. However, when the architects have a close relationship with the development group, then the level of conflict is reduced and the level of understanding of the abstract design among the development group increases.

**Decision-Making Processes: Knowledge source, Information gathering, and Design decisions**

Architects gather information from numerous sources. Most of the architects emphasized that understanding of business requirements was critical as well as technology requirements and feasibility. The Internet provides architects various sources of information, including well-known IT professional sites. Social interaction with other architects is also a major source of information, especially when those architects are involved in a similar organization or industry. Experiences of other architects can have a profound influence.

The process of decision-making at the corporate level has a high level of uncertainty. It seems that highly influential individuals have a large affect on corporate decisions, but this influence is sometimes unseen. For example, architects are often puzzled by the corporate final decision. Even when the architect achieved broad acceptance in critical meetings among executives, the final executive decision could be much different from their recommendations with no clear explanation being given.

**CONCLUSION AND FUTURE RESEARCH**

The first phase of the research aimed at understanding the factors influencing EA decision-making processes in practice. This paper observed the considerable gaps between architects’ normative views and descriptive views. Architects typically have firm opinions regarding what enterprise architecture ought to be, but they recognize that the reality is significantly different. Their actual decision-making processes seem to be influenced by the communication flow, powerful stakeholders, and their social contacts. EA’s validity of evaluation seems to have a strong relationship with authenticity in the organization and corporate-wide communication flow.

The second phase of research focuses on a specific aspect of the environment facing enterprise architects – uncertainty. Uncertainty has been conceptualized in a variety of ways in research. The second phase addresses two research questions: a) what kinds of uncertainty do enterprise architects face?, and b) what kind of coping strategies architects use in making decisions? The researcher will clarify and analyze these questions by using the grounded theory approach in the next phase.

**REFERENCES**