Abstract

Enterprise architecture (EA) transforms the structure, culture, and social environment of an enterprise by introducing new processes and technologies into the workplace altering the roles, duties, responsibilities and organizational position of stakeholders. This transformation frequently affects stakeholder behavior and leads to either acceptance or rejection of an EA. Existing EA frameworks fail to recognize the significance of human behavior and its effect on EA. Therefore, a more holistic approach that includes sociologically-oriented provisions is needed. This paper advances our earlier work by exploring three factors that influence EA: organizational transformation, stakeholder resistance to change, and elicitation/use of erroneous EA requirements. Each of these issues can be addressed by implementing a sociologically-oriented approach designed to remove barriers that limit stakeholder action. The proposed approach focuses on a socio-communicative process that establishes an environment where stakeholder involvement in the decision-making aspects of EA is central.

Keywords: Enterprise architecture, organizational change, stakeholder behavior.

1. Introduction

Enterprise architecture (EA) embodies the business objectives, processes and technology infrastructure reflecting the desired incorporation and standardization requirements of an enterprise’s operating environment [9]. In today’s business climate, an EA represents a continuously evolving architecture aimed at improving operational efficiency and effectiveness. In the development of an EA, an EA Plan (EAP), documents the requirements that drive EA focusing on the architectural design, alignment, implementation, and deployment of new and/or enhanced technology [13][20]. EA requirements are predicated on gathering, analyzing, and validating explicit and tacit organizational knowledge. Thus, the EA focuses on the information technology (IT) processes, related artifacts, platforms, software applications, and business and strategy to support and accomplish IT operations [12][20][28].

However, the implementation of an EA poses several potential problems requiring organizational management and an Enterprise Information Architect (EIA) to address and resolve: EA redefines the way and manner in which an enterprise functions [22] and, therefore, affects either positively or negatively stakeholder behavior.

First, EA changes the enterprise’s structure, characteristics, culture and political climate of the workplace [1][22]. As a result of this transformation process, two outcomes for the EA are possible:

- It can be accepted as the new norm for the enterprise, in which case the enterprise simply moves on.
- It can have a negative effect on stakeholders and be rejected and/or modified to meet their personal goals and objectives. In this situation, the behavior of all involved in the process may be altered, and in some cases, it may literally tear the enterprise apart influencing the potential life of the enterprise by introducing factors into business operations that management may or may not be able to cope [14][15].

Second, the impact of these outcomes can produce behavioral patterns that can jeopardize the viability of the EA ending with the EA being improperly aligned with the enterprise’s strategic business plan and operating model to either being partially implemented or completely abandoned [22]. The question then becomes: why didn’t the changes brought about by EA work?

Answering this question is difficult as causal factors differ. For example, in our previous work [19], we identified several causes for failed EA, such as insufficient top management support, and which states that between 60% and 84% of all EA projects fail in one manner or another. This paper adds to that list by including other sources and statistics which cite causal factors such as [11]:

- Sixty-six percent of project failures are attributed to poorly defined applications (i.e.,
miscommunication between stakeholders and IT technical staff).

- Sixty to eighty percent fail because of poor requirements gathering, analysis, and management.

An analysis of these failures found that [11]:

- Fifty percent of the projects had to be rolled back out of production.
- Forty percent of the problems were identified by end-users.
- Twenty-five to forty percent of project cost was wasted on re-work.
- Up to eighty percent of budgets were consumed on fixing self-inflicted problems.

This latter group of statistics is supported by other literature attributing failure directly to erroneous requirements (i.e., organizational knowledge) [5][6][7][25], which we will collectively label hereafter as simply “poor architecture.” However, we look at the problem and resolution from a different point of view: human behavior and the impact technology has on that behavior. From this position, EA can be defined as being influenced by two separate and distinct perspectives which we will categorize as: 1) the context or environment in which EA functions; and, 2) the processes it symbolizes.

EA context is made up of sociological, organizational, and psychological elements such as stakeholder attitudes and behavior, and organizational norms, policies, politics, standards, and resources. EA frameworks (EAF), on the other hand, take on the more techno-centric aspects of EA design that consist of methods for developing the EA [5][20]. Yet, the interactions between the context of EA and its process are dependent. However, if not properly managed, they can pose a conflict in EA design in deciding the weight that should be apportioned to either context or process, potentially jeopardizing the success of the EA.

EA focuses on engineering principles and practices as a means to synchronize organizational activities and engineering modeling schemes to develop and test the architecture. The reality here lies in the fact that stakeholder requirements drive EA design [5][20][26][28]. However, the EAFs used to do the work are formulated around highly techno-centric processes and procedures based on the modalities of traditional computer oriented and computer science theories [10][12][24]. Existing EAFs aim at solving business problems from a purely technical perspective and do not include stakeholder behavior as a significant influence on EA design.

Given this perspective, each enterprise has its own characteristics, culture, and social structure which the enterprise information architect (EIA) must understand and include in the development of an EA. For example, stakeholders are expected to adapt to new environmental conditions imposed by the EA. This influences stakeholder behavior with the assignment of new roles, duties, and responsibilities which, in some cases, they are expected to assimilate unquestioningly [2][3][22]. This works well in enterprises that routinely function in a tightly controlled environment, it will not in others. [8][14][15]. In most cases however, stakeholders typically perceive these changes as a diminution of influence within the enterprise.

Therefore, the lack of continuity between EA context and process has the potential to cause conflicting views of the EA, altering the previously known stable state most enterprises and stakeholders strive for in the workplace. From this, the integration of sociologically-oriented principle with the existing techno-centric EAFs becomes a viable solution to EA design. Failure to implement such an approach leads to negative stakeholder behavior which may be observed in one of two ways [2][8]:

- They may resist the EA either overtly or covertly by exhibiting their reluctance to follow new norms, rules, and policies established by the enterprise.
- They may intentionally or unintentionally miscommunicate, mislead, and/or provide erroneous requirements as input to and thus sabotage the EA.

In either case, the EA may be jeopardized such that the enterprise reverts to the previous architecture. Reversion to the previous state is detrimental in that more efficient and effective technology is subverted and therefore enterprise growth is inhibited.

In earlier work, [17][18][19], we described several of the causal factors leading to EA failure. In this paper, we address two additional factors leading to failure: stakeholder resistance to change and “poor architecture.” These issues can be directly tied to the organizational transformation that takes place as a result of EA and the new technology it introduces. This work raises the level and significance of the impact of human behavior as a major input to EA and how that behavior is affected by technology. We examine Giddens’ Theory of Structuration and its application to this process [8][22].

The remainder of this paper is organized as follows. Section 2 assesses the activities used in existing EAF methodologies, their approach to and contribution to EA design, and their relationship to stakeholder behavior. Section 3 examines EA, organizational theory, human behavior, and the Theory of Structuration and their relationship to EA. Section 4 discusses the ramifications of not properly coordinating and controlling EA effort and concludes with some remarks.
2. Enterprise Architecture Frameworks and Stakeholder Behavior

The adoption and use of EA in large enterprises and development of complex, large-scale systems now places it at the forefront of IT and organizational business strategy [5][12]. The process aspect of EA is inclusive in its approach for formulating a design and implementation plan for the project. The methodologies used in existing EAFs to describe the EA typically propose ontology for both viewing and analyzing the enterprise’s current information architecture and operating environment. The focus of this effort is on how best to use technology and align it with the enterprise’s strategic business plan and operating model [20].

The responsibility for developing the EA design has been that of an EIA. Until now, the requisite skill set for the EIA typically consists of a practical knowledge of technology and business practices [20]. Today, possessing just these skills alone are not enough to address a workplace environment where stakeholders no longer accept change without question but more routinely question the need for EA and the organizational transformation it brings about.

Of the many EAFs used since EA’s inception, four stand out as de facto standards within the industry: the Zachman Enterprise Architecture Framework (Z|FA) [30], The Open Group Architecture Framework (TOGAF) [21], the Federal Enterprise Architecture Framework (FEAF) [4], and the Department of Defense Architecture Framework (DoDAF) [1]. Each of these EAFs feature distinct and unique approaches to EA design embodied with their own set of processes and procedures. In some cases, taxonomy defines the EAF (e.g., Z|FA) process while in the others listed above ontology describes the process [27]. Regardless of their methodologies, the strengths of the frameworks are that each imposes a disciplined regimen of processes and procedures guiding documentation of the EAP [19]. However, the weaknesses of current EAFs are that they fail to take into account [2][8][14][15]:

- The cultural effects on human behavior caused by the environment of the enterprise and the cognitive aspects of stakeholder behavior.
- The behavior and influence an individual has singularly or on and within a group.
- The social change within the enterprise resulting from the EA.
- The changes to the enterprise’s political and economic systems caused by the EA.
- The social conflict that might result from the EA.

Each of these forces plays a significant role in stakeholder behavior and thus influences their capacity to contribute to the EA. For example, if we examine the cultural environment of an enterprise, stakeholder behavior mirrors organizational behavior learned over time and manifests itself based on their past and present work experiences within the enterprise [8][14]. Continuing, group behavior cannot be understood solely as the aggregate behavior of an individual though an individual may significantly influence the group’s behavior or be influenced by the group [2][15]. Social change, on the other hand, is evolutionary and can occur in two opposing fashions: opened or constrained and is internally the by-product of technology and/or change in the political structure of the enterprise. External forces can also induce social change but are beyond the scope of this paper.

In an EA, the forces that affect social change are twofold: technology including the new processes introduced by the technology, and the new roles, duties, and responsibilities assigned to stakeholders [22]. These forces alone usually result in the transformation of the enterprise’s political and economic structure. This force singularly can produce one salient, potent and counter-productive possibility in that it can evoke conflict within the enterprise [8][14][15].

As can be seen, EA alters stakeholder perceptions of the enterprise and as such changes their behavior which can seriously jeopardize the EA. Given this perspective, we can conclude that the techno-centric methodologies espoused by existing EAFs are deficient in neither providing mechanisms that recognize human behavior in their approach to EA nor contain any tools or processes that would mitigate adverse behavior in EA implementation [17][18][22]. Thus, the aggregation of these forces on EA elicits behavior that constricts, discourages, and limits stakeholder action and, at the same time, stifle their capacity to offer more innovative and creative approaches to problem-solving [17].

Though comprehensive from a technical point-of-view, the EAFs fail to provide for the kinds of humanistic based principles and practices such as communication, education, and training programs we believe essential to deal with stakeholder relationships, interactions, and behavior.

3. Enterprise Architecture and Human Behavior

Top-management behavior permeates through all layers of an enterprise influencing the enterprise’s work environment and social structure [1][14][15].
Stakeholders, on the other hand, are purposeful systems which exhibit will which may act in concert with or oppose organizational goals and objectives and that the addition of technology to this equation [2][14][15][22]:

- Forces stakeholder to accept and adapt to new EA processes and procedures.
- Diminishes their influence and position within the enterprise.
- Alters the way in which they function within the enterprise from a consistent pattern of individual and social behavior to new ones that are less desirable.

However, enterprises must respond to competitive and shifting environmental demands by changing their existing operating environment and altering it to one focused on the use of technology to take advantage of the economic benefits to be derived from a project such as EA [12][20]. The resultant organizational transformation requires stakeholders to willingly or unwillingly accept and adapt to new ways of doing work which in turn changes their perception of the environment in which they function [2]. New rules, policies, standards, processes and procedures dictated by management to be followed and used by stakeholders typically results in new stakeholder behavioral patterns [14][15]. In many situations, organizational transformation is difficult to achieve because of these new behavioral tendencies. From a negative point of view, we can explore the effect of two candidates that can seriously affect and influence the success or failure of change, including stress and the need for EA stakeholders to learn, adapt and accept something new [14]. Stress is nothing new in any organizational setting to either stakeholders or the enterprise. However, it can take on a life of its own where technology is the prime motivation for change.

Stress caused by change is evident and easily recognized in stakeholders by their actions and behavior. Both stakeholder and organizational behavior tends toward a point where inputs, processes, and outputs remain stable with change viewed as a potential threat to the equilibrium and known state of the enterprise. Stakeholder resistance to accept change typically follows any movement away from this known state. In some cases, the stakeholder may even resort to sabotage to revert to the previous known state of equilibrium [13].

The rationale for this behavior traces to varying views of technology by people reacting to it accordingly, and for several legitimate reasons [8][14][15]:

- Low tolerance for change – the stakeholder believes the new is worse than the known.
- Misunderstanding - the stakeholder doesn’t understand the reason for change.
- Power – the stakeholder has the power to ignore, obstruct, and avoid the new.
- Distrust – the stakeholder doesn’t trust the enterprise’s motivation for the change.

The transition to something new forces stakeholders to learn new ways to do work: processes, procedures, software, and other IT artifacts [3][22]. In most situations, this is accompanied with assignment of new roles, duties, and responsibilities [2][22]. This relearning process, in many cases, is simply beyond the day-to-day ability of some stakeholders to accept and adapt. Their tolerance level and threshold for change is limited. This results in a loss of productivity and, more importantly, negative changes in their behavioral patterns. When the change is involuntary, and imposed by internal and/or external forces (i.e., management), the change becomes emotional with stakeholders feeling a sense of disempowerment and loss of control, all adding to their feeling of stress [14][15]. Thus, these factors must be addressed by incorporating a dynamic and behavior driven approach to EA.

An appropriate theoretical lens that would enable an EA to be aligned with such an objective is Giddens’ Theory of Structuration (ST) [8]. In ST, structure is understood to be an abstract property of social systems and in this context is not something concrete, situated in time and space, but lacks material characteristics. Structure does not and cannot exist apart from the human actors who enact and interpret its dimensions existing only in a virtual state. People, however, readily allow their actions to be constrained and limited by these shared abstractions of social structure suggesting that behavior can be strongly influenced and sometimes induced even by vague simulations of authority relationships and other organizational settings. The ability of organizational structures to elicit compliance and conformity in the absence of material constraints attests to the power of those socially constructed abstractions.

Given this perspective, structuration articulates a process-oriented theory that treats enterprises as both a product of, and a constraint on, human action. Giddens attempts to bridge the gap between the deterministic, objective and static notions of structure, on one hand, and voluntary, two realms of social order and focusing attentions on the subjective and dynamic views on the other, by positing points of intersection between these two realms. Giddens termed these as the Institutional Realm and Realm of Human Action [8]. The former represents the existing framework of rules in an enterprise derived from a
cumulative history of actions and interactions. Such a framework of rules is characterized by dimensions of signification, domination and legitimization. Signification schemes are modalities for communication within an organization and constitute organizational structures of signification. Structures of signification represent organization rules that define and inform interaction. Resources are modalities through which power is exercised in an organization and may be authoritative (i.e., extending over people) or allocative (i.e., extending over material/property). Norms are modalities that define appropriate behavior and constitute organizational structures of legitimization using which a “moral order within an organization is articulated and sustained through rituals, socialization practices and tradition” [8].

On the other hand, the Realm of Human Action refers to the social interaction of the humans under the aegis of the institutions. The institutions’ properties are encoded into the human actor’s stock of knowledge through the modalities of interpretive schemes, resources and norms, and influence how people communicate, enact power and determine what behavior to sanction and reward. The crux of Giddens’ theory is that this relationship is not directional but recursive. Organizational structural properties (i.e., the Institutional Realm) are drawn on by humans in their on-going interactions even as such use in turn reinforces or modifies the institutionalized structures. Such a recursive relation is termed as the duality of structure.

ST does not merely provide a means to understand the nature of an organization but can be applied to understand the impact of the use of technology. Orlikowski proposed the Structurational Model of Technology (SMT) to provide a more complete model of understanding of how technology affects organizations [22]. This theory is based on the perceptions of the Duality of Technology and the Interpretive Flexibility of technology. The former posits that the socially created view and the objective view of technology is not exclusive but rather intertwined and are differentiated because of the temporal distance between the creation of technology and usage of the same. Interpretive Flexibility defines the degree to which users of a technology are engaged in its constitution (physically and/or socially) during its development. SMT has three components – the Human Agents, Technology and Institutional Properties of Organization. The model specifies an interactive relationship among these components that are essentially recursive in that each of these components influences and is at the same time influenced by the others. Technology is proposed to be the product of human action in that it is created and exists through ongoing human action. Humans constitute technology by using it, while at same time making it an outcome of human actions such as design, development, appropriation and modification. However, once technology is implemented it facilitates and constrains human action through the provision of interpretive schemes, facilities and norms.

From the organizational perspective, institutional properties influence humans in their interaction with technology through: professional norms; rules of use – design standards and available resources. There is, however, a consequence of the institutional interaction with technology. They are manifested by impacting the institutional properties of an organization through reinforcing or transforming structures of signification, domination and legitimization that characterize the Institutional Realm.

In summary, the theoretical premise of these two theories is an acknowledgement that organizational structures, technology and human action are not distinct but are intertwined such that each is continually reinforced and transformed by the other [8][22]. A logical conclusion can therefore be made that an initiative such as the formulation of EA remains incomplete if it does not explicitly take into account human action. ST provides a framework, which if adopted could form a basis of a behavioral and inclusive approach towards formulating an EA. Specifically these theories provide a lens for the EIA to understand the dynamics of an enterprise and use that information to formulate an EA that is contextualized to that particular enterprise and advocated by its stakeholders.

The issue confronting the EIA is that of taking advantage of these circumstances recognizing that stakeholders are able to provide reasons for their activities, including perhaps even lying about them. However, this behavior can be managed by promoting an environment that encourages stakeholder participation in the decision-making process. EIAs are faced with three behavioral issues: the introduction of technology into enterprises, changes in stakeholder behavior resulting from technology and resistance to change with enterprises seeking equilibrium at the same time. The end-result of this behavior may result in “poor architecture”.

Successful implementation of new technology is the product of successfully navigating stakeholder behavior and the resultant influence on organizational change. For example, management practices often negatively influence stakeholder behavior because of inadequate knowledge being passed down and across enterprise boundaries. These issues can be addressed by implementing an open-ended communication’s
system where there are no boundaries, either
diagonally or vertically, for sharing of knowledge, knowhow, ideas, potential problem solutions, and it provides a forum for “brainstorming.” This in effect,

As such, management behavior, attitudes, rules, and policies can avoid maintaining an ingrained mechanistic view of technology and approach EA from a more humanistic venue.

In this context, the actions of management and EIAs lead to changes in the way stakeholders behave. In a business context, stakeholder behavior and organizational factors contribute more to the success or failure of an EA than technical factors. Simply stated, stakeholders can be affected by IT change and are unlikely to be invested in the change if it is forced upon them without warning and input from them.

We envision an approach that highlights the impact of change on an enterprise relative to human behavior that can be utilized to enhance and extend the capabilities of well known architectural framework models used in an EA project. The approach fosters stakeholder ownership of the EA while building relationships through a coupling of EA and structuration.

4. Discussion and Closing Remarks

To manage and govern the complexity of an enterprise requires the coordination and control of activities embedded in the complex networks of techno-centric relations and boundary spanning exchanges. EA and the introduction of new and/or enhanced technology into an enterprise often results in a sociological and a political change in the hierarchical structure of the enterprise. This is evidenced by a dynamic shift in internal and perhaps external perceptions of the enterprise. Stakeholder roles, responsibilities, and duties invariably change because of new rules, policies, procedures and processes introduced by new technology. Therefore, the manner in which the EA design takes place can seriously affect acceptance and alignment of the EA by different stakeholders.

Among the many factors associated with EA failure are:

- Poor communication
- Lack of leadership
- Lack of top-management support and sponsorship
- Underestimating the importance of change and change management
- Lack of technical and business knowledge
- Poor project management

These factors are counter-productive yet they can be minimized and mitigated by providing an environment where stakeholders are involved with and are active participants in and are receptive to change. Such an environment fosters collaboration and information-sharing where stakeholders communicate both horizontally (i.e., peer-to-peer) and vertically (i.e., up and down the hierarchical organization chart) whenever and however they need to do in order to solve problems and exchange knowhow and knowledge. The possibility and prospect becomes realizable if an enhanced working environment where participation in the design, decision-making, and implementation of new EA technology is welcomed and not perceived as a threat to stakeholder well-being. The benefits from such an environment can only improve workforce morale and productivity. In our increasingly digitally encoded environment, EIAs hold the potential to become major players who can assist enterprises achieve their respective goals and objectives.

In conclusion, the Theory of Structuration provides a means of understanding human behavior and its relationship to organizational change. SMT, on the other hand, addresses the effects of technology on human behavior [14]. Taken together, they conceptualize the unique opportunities for an EIA to implement an EA.

This paper progresses our earlier work [17][18][19] by expanding our exploration into the possibilities extant and the potential contribution gained as the result of using the Theory of Structuration along with SMT and thus improve on and enhance the EAF process. We consider a communication process based on human behavior the prime motivational element in behavior modification and offer it as a means to augment existing EAFs. Coupled with the communication process, future work includes expanding our research into two areas:

- To obtain a better understanding of human behavior and the influence it has on EA so as to provide a better platform to manage and govern the design process.
- To explore EA modeling schemes to assess their ability to cope with human behavior in their respective approach to requirements modeling. The focus of this effort is to better ensure the quality and reliability of design requirements input to EA.

Modifying human behavior to more readily accept organizational change represents a major component requiring design and implementation of tools and
mechanisms that facilitate stakeholder willingness to share knowledge. Quality requirements are essential to EA success. Therefore, we plan to expand our research and explore EA modeling schemes to assess and better ensure EA quality through the requirement elicitation, analysis, and specification phases of EA.

5. References