Enterprise Architecture: What Discipline is that?

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Abstract. This paper analyzes Enterprise Architecture (EA) as a discipline of study. Current EA foundations, theories and practices are discussed using an epistemological framework. Strengths and weaknesses of current approaches are discussed. Immaturity of EA as a discipline and practice Is identified. The main causes of immaturity are analyzed. A research agenda is proposed to provide maturity in EA foundations, theories and practice.

1 Introduction

noindent Current enterprise environment is characterized by complexity. There are many elements to control and change is constant. Enterprise Architecture (EA) is considered an instrument to help organizations to act effectively in this scenario by providing a blueprint of organizational elements and their relationships. The big picture provided by EA helps decision-making and change management.

Enterprise architecture is a promise for organizations efficiency, but it is still a confusing concept [28]. Since its beginning, many heterogeneous EA proposals have been developed. The approaches often overlap theories and practices with other enterprise disciplines. Proposals are often complex and their benefits cannot be perceived by users, creating obstacles for its correct understanding, affecting its acceptance and use. The lack of a generally agreed terminology in this domain is also a bottleneck for its efficient application. This is the Reason why kappelman [14] considers EA at its beginning despite the concept be known for at least 25 years.

The aim of this paper is to analyze the state of the art of EA as a discipline, identifying and evaluating its foundations, theories and practice. It also proposes a theoretical framework and a research agenda to clarify EA foundations, concepts, scope and practice. Section 2 presents the main definitions, concepts and approaches found in the literature. Section 3 proposes a epistemological framework to assess EA as a discipline of study. Section 4 details the main theoretical approaches. Section 5 analyzes the intersection of EA with other disciplines. Issues of clarity in the boundaries of the EA as a discipline are discussed in session 6. A research Conclusions and agenda to EA are presented in Section 7.

2   A Framework to Assess EA as a Discipline

In order to assess EA as a discipline we use a framework, proposed by [8], shown in figure 1. This framework comprises three levels of inquiry in a discipline: epistemology, science and practice.
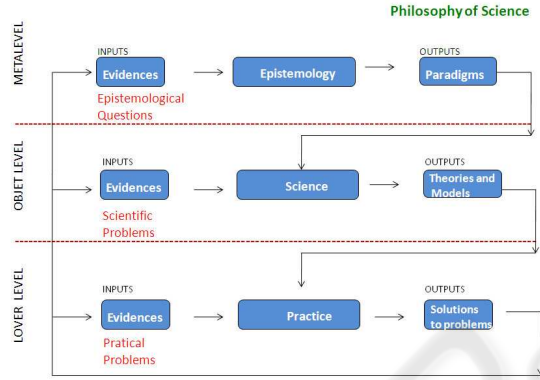

Fig. 1. Hierarchy of Inquiry Systems with their Respective Inputs and Outputs [8].

Epistemology, according to [8] is that portion of the philosophy of science that enquires into the sources of knowledge of a scientific discipline. The outputs of epistemological level are science paradigms. According to Thomas Kuhn [16], a paradigm represents the way problems are conceptualized. It is made up of commitments shared by a scientific community, to accept certain theories, methods and models. A paradigm reflects the values by which the scientists judge how to configure or to define a problem as well as their attitude towards any likely answer(s) or solution(s).

The second part of the model is science. Science is a body of knowledge about a particular object, obtained with certain criteria in a methodical and systematic body logically constructed. It is also considered as a set of methods and procedures used to elucidate issues of reality [29]. Science outputs are theories and models.

The last part of the model, practice, applies theories and models to solve specific real word problems.

3   ENTERPRISE ARCHITECTURE PARADIGMS

This section presents an review of main epistemological approaches and makes an assessment of EA foundations.

3.1   Epistemological Apprroaches

According to Hirschheim [11], there are several philosophical approaches that help establish the paradigms of knowledge of a discipline. The main difference between them is how knowledge is obtained: By reasoning, by experience and by mutual influence between reasoning and experience.

The Rationalist Paradigm. The rationalism is a epistemological approach which argues that knowledge is formed by reasoning, so it is mental. Based on Descartes, [4], this epistemological theory see elements of the world functioning as a clock. Once man interact with the world, he can module the reality in a scientific method and everything will work as drawn in the module.

The Empirical Paradigm. A second approach, empirical, claims that knowledge only happens in experience. The mind can construct models but only the interaction with the world will give the true knowledge. This is the materialist approach of Locke [18] and Hume [12].

The Phenomenological Paradigm. A third approach says that knowledge is a phenomenon that occurs in the interaction between mind and experience. The Phenomenology approach, created by Husserl [13] and contributions of Heidegger [10], Gadamer [7] and others analyzes the essence of the phenomenon in a humanist perspective. The word influences the world and man also designs the world, and perceptions and designes are made in collaboration with others.

3.2 Assessing EA Paradigms

We did not find a research specifically about EA epistemology, but is it possible ti identify some paradigms analyzing EA approaches. EA approaches, detailed in next sections, have focus in organizational domain modeling, providing mainly technical aspects os models. Current EA approaches see the world, its elements and relations and assume that everything will work as a clock. Approaches also consider that we have many visions of the same subject, depending on the perspective of the user. But these models and visions are not updated dynamically. Once developed and approved they are considered as a truth for everyone. No approach considers that in a dynamic situation changes may occur everyday in the interaction of man with te reality. So we can consider that current approaches use a rationalist perspective. Once modeled and approved models predominate over reality.

We conclude, analyzing EA features, that the rationalist perspective is insufficient as paradigm to the discipline. The humanist approach of phenomenology, in our opinion is more suitable as a foundation for EA and so approaches must consider human interaction with the architecture. In other words, models must be accessible to everyone and approaches must give conditions for update information in dynamic and custom bases.

4 Enterprise Architecture Science

This section presents a review of the literature and makes an assessment of EA theories.

4.1 Enterprise Architecture Definitions

There are many definitions for EA. The name of discipline, itself, may vary, being referred to as Enterprise Architecture (EA) [31] or Enterprise Information Architecture

(EIA) [3]. Examples of EA definitions found in literature: An abstraction of the main elements of the organization and their relationships [26]; Define the various elements that make up an organization and how they relate and establish the principles and guidelines governing their design and evolution over time [20]; A coherent set of principles, methods and models used in the design and construction of the structure, processes, systems and infrastructure of an organization [17]; Blueprints which define a complete and systematic position of the current and desired organizational environment [24]; A description of a complex system (the enterprise) at a point in time [2]; The structure of components, their relationships, and the principles and guidelines governing their design and evolution over time [5]

4.2 Enterprise Architecture Objectives

Some examples of EA objectives found in the literature: EA intends to model, analyze and communicate the organization. The benefits of EA are the knowledge infrastructure for reporting and analysis by all stakeholders and the possibility of designing new conditions in an organized manner [17]. EA is not only an instrument for strategic planning of IS/IT planning but also other business functions, such as compliance control, continuity planning and risk management [30]. The objectives of the EA are risk and compliance control, project and organizational programs management, portfolios of IT management and integration between business and IT [24]. According to [21] an EA, as a whole, is used in a number of different ways to guide, direct, and manage an enterprise: Is a basis for decision making and planning; Governs the identification, selection and development of standards; is the mechanism for managing change within the enterprise; Enables effective communication about the enterprise.

4.3 Enterprise Architecture Users

According to John Wu[1], Enterprise Architecture is for every one. The senior management need EA to support decision making on capital investment, The project manager need EA to reuse common resources. The security engineers need EA to know what to secure about. Service Oriented Architecture depends on EA to select the proper service. A important factor for EA utilization is the capability to access the EA artifact in time for need.

4.4 Enterprise Architecture Approaches

Since middle of the 1980s several proposals for EA appear. The diverse proposals have different approaches aiming different objectives. Table 1 shows a classification of proposals in five approaches: Strategic EA, enterprise modeling, enterprise modeling methods and standards, enterprise architecture language and Information Architecture.

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[1] http://it.toolbox.com/blogs/lea-blog/enterprise-architecture-disciplines-15651

Table 1. Evolution of Technology and System Applications.

Approach	Objective	Proposal
Strategic EA	Blueprints showing enterprise and technical infrastructure	[23]
Enterprise Modeling	Framework of organizational models	[31]
Enterprise modeling methods and standards	Framework, methods and standards for organizational models	[20, 5]
Enterprise architecture language	Framework and language to model architectural models	[17]
Enterprise Information Architecture Approach	Infrastructure for modeling the enterprise information	[19]

4.5 Assessing EA Theories

EA definitions are comprehensive and clear, considering the architecture as covering all organizational domains. Its goals are also clear because they consider architecture as capable of enabling organizational knowledge and manage change. The problem in the theories of EA is in the methods proposed to achieve its objectives. Available approaches vary in detailing architecture levels. There is no consensus on the best strategy. EA must model only strategies? must models all elements? who makes the models? Current approaches do not make clear the boundaries of architecture modeling in relation to other areas of enterprise modeling, such as processes and applications. So is not clear yet what subjects are exclusive to EA discipline.

5 Enterprise Architecture Practice

This section presents a review of the literature about EA practice, and makes an assessment of tools, organizational structures and strategies.

5.1 Enterprise Architecture Tools

Schekkerman (2009) publishes an extensive annual survey of the various EA tools in the market. It is important to note that following Zachman proposal, the architecture can consist of models from various domains which can lead to the conclusion that any modeling tool can be considered as a tool for EA. This is the focus of Schekkerman analyzes. The study shows most of the tools meet only part of architecture domains and no tool is specialized in EA, They provide resources to make many other things such systems or processes modeling. There also other reviews of EA market analyzing Strengths and Weakness of theirs resources [6]. Research institutes, such as Gartner and Forrester, also publish annual reports assessing the tools to EA. Both consider that only six or seven companies meet the requirements for an EA tool. These requirements are: resources to model the various domains, specific resources to model architecture and identify relations between models, support for the main frameworks, resources for managing projects, resources for publishing on the Web, collaboration resources and a repository for storing and retrieving models. The main companies that offer tools with

these requirements are: IBM (System Architect and Rational) [2], IDS Scheer (ARIS tools) [3], Metastorm [4], Troux Technologies [5] and Alphabet [6].

5.2 Enterprise Architeture Strategies

Many EA programs do not succeed because they are not well implemented. It is recommended to implement an EA program in five steps: Initiate the effort; Describe where we are; Identify where we would like to be ;Plan how to get there; Implement the architecture [1].

Initiate the Effort. Develop an architecture framework;Create readiness for architecture Build the architecture team; Identify and influence stakeholders; Encourage open participation and involvement; Reveal discrepancies between current and desired state.

Describe where we are. Characterize the baseline architecture; Make it clear to everyone why change is needed.

Identify where we would Like to Be. Develop the target architecture; Communicate valued features; Energize commitment; Create a plan for transition activities

Plan how to Get there. Develop the transition plan; Execute the target architecture Communicate the transition plan; Establish sound management structure; Build support for the architect.

Implement the Architecture. Maintain/enhance the target architecture; Develop new competencies and skills; Reinforce architectural practices

5.3 Organizational Structures for Enterprise Architeture

To reach its goals EA must have an organizational structure with a group responsible for it [9]. [22] proposes a structure with an EA board and an EA operational management team. This team must have a central staff and also specialists distributed in local departments that contributes to EA contents. The central staff does not generate content. The central staff must implement and manage an infrastructure to EA and identify and publish EA policies and guidelines. As Rosenfeld states, EA is a mix of users, context and context [22]. EA community is composed by users and content generators that are also users. Each user needs a specific vision of architectural elements. Each content contributor deals with a specific content level. It is a function of EA staff to know who does content and who needs information. The enterprise Architect is the main professional for EA. Given the interdisciplinary nature of EA, the enterprise Architect must have a general knowledge of various discipline [25]. These discipline, among others, are business strategy, financial management, organizational dynamics, business process design, and information technology.

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[2] http://www-01.ibm.com/software/rational/
[3] http://www.ids-scheer.com/index.html
[4] http://www.metastorm.com/
[5] http://www.troux.com/
[6] http://www.alfabet.com/

5.4 Assessing EA Practice

Current Research on EA practice does not present a positive situation. A survey published by Gartner [2] identifies that only 25% of EA initiatives can be considered active and mature. 50% of them take 2 steps forward and 1 step back and 25% have failed repeatedly. An investigation of perception and practice of EA found that IT professionals still do not perceive EA as an organizational effort, but an IT initiative which indicates that EA is not properly implemented [15]. The same survey shows that the identification of requirements is still a great challenge in information systems development which shows the necessity of change in systems development processes. Another study identified that only 6% of organizations have an appropriate degree of maturity in the modularization of its information systems [23]. The literature is plentiful in perceptions that EA, though admittedly to be an important tool, it is not a standard practice in organizations, mainly considering medium and small ones [27].

6 Assessing EA as a Discipline

The enterprise architecture discipline touches the same subjects as business process management, information systems and other enterprise disciplines, but from a different perspective and in a distinctly different context. The EA context is holistic and its perspective is organizational, while the other disciplines are implementation-specific.

The enterprise architecture discipline is more than a superset of engineering domains. While the subjects of enterprise domains are meant to be applied to the solution implementation, the EA subjects are largely used for enterprise analysis, planning, and architecture governance.

EA is among enterprise disciplines already consolidated. What specific knowledge we need to enterprise analysis, planning, and architecture governance? When does engineering end and architecture begins? Who models the specific vision of architecture? How to integrate Models? How to find a specific model for a specific need? How to get collaboration of other domains to construct a dynamic architecture? How to reach EA audience? How can be the enterprise architect profession defined? How can he be educated? how to collaborate with who needs to know the architecture in a timely fashion?

Approaches such as Zachman lists a number models that are related to other organizational domains and suggests no method to elaborate the models. So it does not indicate specific theories for a EA discipline. TOGAF suggests specific methods but it has a rationalist view, not considering human aspects. The same happens with the proposal of Archimate. Without considering the human aspects of architectural models and collaboration aspects in developing then the approaches are incomplete with less chance of succeed.

Current EA tools are not specific to EA. They are IT or BPM approaches with some resources to EA. EA needs models from IT and from processes and it sounds logical to evolve them to EA. But these tools do not help to identify the frontiers between domains, so it is not clear to managers and professional who does what. Tools are also rationalist oriented without resources for collaboration. Organization changes everyday and resources to update elements and relation in a collaborative environment is needed.

Education is another big problem to EA. It is hard to find specific formal education to EA. No even a mere discipline in IS, IT or Processes courses can be found. This is, perhaps, the most striking sign of immaturity of EA as a discipline. We do not have a defined body of knowledge in formal education. IT is not easy to find in the literature proposals of a curriculum for the discipline of EA.

Concepts found in literature are clear to define the specific object of EA: Organizational elements and their relations. The objectives also sound clear: To provide organization knowledge and help in planing and change management. The problem here is with current approaches. They have three kind of problems: they do not help to establish a frontier with other disciplines, they do not provide a body of specific methods for the discipline and they do not consider human collaboration aspects. That is the reason why many organizations fail in the implementation of the EA and others not even try.

7 Conclusions and Research Agenda

This paper presented a review of current literature on concepts and approaches to EA, contributing to a better understanding of the state of the art and the challenges of this field of research and practice. It assessed EA as a discipline using a framework with epistemological, theoretical and practical levels. Looking at EA foundations, theories and practice it is easy to see that, even though EA is seen with optimism on a medium and long run, the current reality is not good. Most of the professionals who could be using the existing proposals consider approaches still confusing and complex and tools much expensive. It is not clear for systems analysts the boundary between modeling a system and modeling an application architecture. It is not clear for business analyst the difference between a process model and an a business architecture model. It is not clear to both professionals who should make engineering models and architecture ones.

If EA boundaries are not clear to professionals, they are not clear to executives either. So, EA initiatives are not properly structured. A poorly structured EA initiative is a sure failure. EA is certainly a complex initiative considering the existing approaches. The expectation is that over time it becomes mature to be implemented in a less complex manner. For this to happen it is necessary, above all, better approaches and more specialized and affordable tools.

A new agenda of EA research as a discipline is needed. Research must clarify EA boundaries, and provide unique foundations and theories. EA methods and tools must change of paradigm. The rational paradigm is not sufficient to orient theory and practice of EA. Research is needed to bring human perspective to EA. Research is needed to provide specific tools for EA considering the collaborative paradigm. Research is also needed to set formal education to enterprise architects.

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