

3 Schools of Enterprise Architecture

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You are probably thinking to yourself “why 3?” 3 is the number of schools of thought on enterprise architecture (EA) which emerge for me when I reflect on my experiences, readings and peer discussions. Each school differs from the others in subtle and not-so-subtle ways. The belief systems underlying these schools of thought are at the heart of a number of challenges, such as fragmentation and misunderstanding, in the EA community because they are often implicitly held by people but not often explicitly discussed. Consequently, it can be very difficult to navigate the EA literature and community discussions without sometimes feeling loss and confused. This article will try to shed some light on the situation by sharing a new taxonomy of EA schools of thought in order to foster understanding and awareness. Fostering the previous is essential in order to establish EA as a discipline and profession because the current lack of shared meaning in the community seems to be a significant barrier for such an establishment.

Currently, it is very difficult to gain deep insights from the literature on EA because there is a lack of shared vocabulary. The same term is used with different meanings and different terms are used with the same meaning. An example of the former case is the term “systems”. The term may be used for multiple ideas such as: (a) software applications, (b) complexes composed of interrelated people and technological tools, (c) complexes composed only of interrelated people or even yet (d) complexes composed of a large variety of interrelated elements (economical, social, technological, etc.). These variations on the meaning of “systems” pertains to scope; in other words, they differ in the types of complexes in question from simple homogenous complexes that have relatively small and well defined boundaries (e.g. software application) to very heterogeneous complexes that have very broad and ill-defined boundaries such socio-cultural—techno-economic systems (e.g. enterprises). An example of the second case is the use of the terms “enterprise architecting”, “enterprise engineering” and “organization design”. All these terms seems to be referring to activities with the same possible concerns and outcomes. The consequences of this plethora of terminology and lack of shared meaning are: (a) varying degrees of difficulty in understand the messages conveyed by authors and (b) a difficulty to easily gather relevant literature on enterprise architecture. Consequently, it is challenging to answer key questions such as “what is enterprise architecture?”, “what literature is relevant?”, “when did enterprise architecture first emerge?” and “is enterprise architecture a mature discipline?”

There seems to be considerable interest in the community in establishing an enterprise architecture discipline. The evidence that supports this perception is the recent creation of a number of professional associations and association federations. Moreover, the recent literature on enterprise architecture also explicitly states the need. If a discipline is to be founded, the terminological challenges of the domain must be resolved in order to foster shared meaning: a key cornerstone to the establishment of a discipline or community of practice.

From a review of the key literature related to “enterprise architecture”, there are 3 schools of thought that emerge. Each one of these schools defines enterprise architecture differently; each has different concerns as well as different assumptions. Furthermore, each school brings insights and limitations when approaching enterprise architecture. The objective of this paper is to present a novel taxonomy of schools of thought. The taxonomy and its discussion is not

meant to be exhaustive but rather a starting point for creating shared meaning. In time, as more commentators contribute to the body of literature created, the taxonomy and its understanding will evolve.

Schools of Thought

Current literature offers many different definitions of the term “enterprise architecture”. Many of these definitions are variations on the theme of “a description (and/or the process of achieving a description) of the interrelated components of an enterprise in order to guide their evolution”. These types of definitions are unclear on two key elements which make them ambiguous: (a) scope and (b) purpose. The first is the scope of the term “enterprise”. The term enterprise could mean anything from the IT platform to the whole “socio-econo-techno (and all the other prefixes) Shebang” which is an enterprise. The other element is purpose. Often, the definitions have some sort of a purpose included in them but it is not directly related to a clear set of enterprise objectives or outcomes. For example, managing the evolution of “the interrelated components of an enterprise” is typically not an enterprise objective or outcome but rather a means for an outcome such as market agility. Despite the ambiguity present in the definitions proposed by many authors, their books and articles are generally clear about the authors stance related to scope and purpose.

In the literature, for both scope and purpose, there are 3 major beliefs which can be found. These beliefs are summarized in Table 1.

Table 1 Scopes and Purposes

Scopes	Purposes
Enterprise wide IT platform (EIT). All components (software, hardware, etc.) of the enterprise IT assets.	Effective enterprise strategy execution and operation through IT-Business alignment. The purpose is to enhance business strategy execution and operations. The primary means to this end is the aligning of the business and IT strategies so that the proper IT capabilities are developed to support current and future business needs.
Enterprise (E). The enterprise as a socio-cultural—techno-economic system; hence ALL the facets of the enterprise are considered – the enterprise IT assets being one facet.	Effective enterprise strategy implementation through execution coherency. The purpose is effective enterprise strategy implement. The primary means to this end is designing the various facets of the enterprise (governance structures, IT capabilities, remuneration policies, work design, etc.) to maximize coherency between them and minimize contradictions.
Enterprise-in-environment (EiE). Includes the previous scope but adds the environment of the enterprise as a key component as well as the bidirectional relationship and transactions between the latter and its environment.	Innovation and adaption through organizational learning. The purpose is organizational innovation and adaption. The primary means is the fostering of organizational learning by designing the various facets of the enterprise (governance structures, IT capabilities, remuneration policies, work design, etc.) as to maximize organizational learning throughout the enterprise.

Despite the 9 possible scope and purpose combinations, most of the literature falls within 3 combinations: EIT-alignment, E-coherency and EiE-learning. Respectively, for the purposes of this discussion, let us name the schools of thoughts embodying EIT-alignment, E-coherency and EiE-learning: Enterprise IT Architecting, Enterprise Integrating and Enterprise Ecological Adaptation. These schools of thought should be viewed as “ideal” types insofar that authors typically do not fit perfectly in one school but rather gravitate towards one. Table 2 gives a summary of the schools.

Enterprise IT Architecting School

For this school, enterprise architecture is about aligning the IT assets of the enterprise (through strategy, design and management) to achieve effective business strategy execution and operations by developing the proper IT capabilities. This school is very techno-economic centric in that it is particularly concerned with achieving IT cost reduction through technology reuse and de-duplication. IT strategic planning and business enablement are also high in the priority list of the advocates of this school. Its members often describe enterprise architecture as “the glue between business and IT”, a statement which could be considered this school’s motto.

This school is guided by the practices of software engineering which promotes a reductionist approach through mantras such as “divide-and-conquer” and “separation of concerns”. Consequently, its process of architecting, through the use of models and views, often tries to neatly separate the IT assets of the enterprise into components and sub-components which are designed and assembled according to software engineering best practices. As inputs to the design process, key items are: business strategies and business objectives. Often, the latter are exactly that, nothing more than inputs to the process; hence not subject to question or review. The implicit assumptions of the school are that the business strategies and objectives which have been provided by the business portion of the organization are correct and not to be questioned. In addition, it is often assumed that IT planning is a rational, deterministic and economic process which if done correctly will achieve the “correct” results. Challenges with the implementation of the strategy are a consequence of inadequate skills and management. The introduction of new technologies is seen as mostly independent of work design and organization design; consequently solutions are often selected without consideration of the latter. Moreover, since the scope of this school is on IT, aspects such as remuneration policies, work design, etc. are of no concern insofar that they are inputs to the design process.

Because of its grounding in engineering, this school is capable of designing robust and complex technological solutions. Moreover, because much importance is given to “proper” analysis and planning, practitioners of this school often produce high quality models and planning scenarios. On the downside, its reductionist stance rarely allows for the design of technological solutions which are either inadequate or unfeasible in the larger organizational context. Complex organizational dynamics driven by remuneration policies, politics and socio-cultural forces often mount considerable barriers to solution acceptance and implementation. Moreover, its disinterest in the process of generating business strategy makes this school vulnerable to the syndrome of creating “perfect” designs for unsustainable strategies.

Within this school of thought, the role of the enterprise architect is above all one of master planning and designer. With the aid of technical competence, engineering knowledge and rigorous data collection and analysis, the enterprise architect creates models of the present and future in order to guide transformation. His perceived key challenges are communication and buy-in; the difficulty for an enterprise architect lies mostly in getting the members of organization to understand and accept his “expertly designed plans” so that enterprise initiatives which require IT capabilities may be aligned to his master designs. It is not rare to see uses of “urban planning” as a metaphor for enterprise architecture in this school, hence the role of an enterprise architect would be compared to that of an urban planner.

Enterprise Integrating School

For this school, enterprise architecture is about designing all the facets of the enterprise so that enterprise strategy may be executed by maximizing the overall coherency (concerning the strategy) between all its facets, IT being one of them. This school is grounded in systems thinking, hence approaches the design of enterprises holistically or systemically. Consequently, high on the list of concerns for this school is the elimination of contradictions between various policies and structures of the enterprise as well as those that are contradictory to desired outcomes. Its members often describe

enterprise architecture as “the link between strategy and execution”, a statement which could be considered this school’s motto.

The guiding principle of the school is that a reductionist approach to enterprise design and strategy execution is not adequate; hence all aspects of the organization, aspects which form a complex fabric of reinforcing and attenuating dynamics, must be globally optimized and designed. By designing the enterprise in such a manner as to reinforce wanted dynamics and attenuate unwanted ones, an enterprise may achieve its desired outcomes. Similarly to the enterprise IT architecting school, key input items to the design process are business strategies and objectives. Here also, the implicit assumptions are that the business strategies and objectives, which have being provided by the business portion of the organization, are correct and not to be questioned. In addition, this school also views the environment as a generator of forces which the enterprise is subject to and managed. Challenges with the implementation of the strategy are a consequence of an incomplete understanding of the systemic dynamics of the organization. The introduction of new technologies is seen as dependant on work design and organization design; consequently all aspects are jointly designed.

Because of its grounding in systems thinking; this school is capable of designing comprehensive solutions taking into account all the various known aspects of enterprises. Organizations designed according to this school may gain significant efficiency by eliminating unnecessary contradictions and paradoxes. On the downside, similar to the enterprise IT architecting school, this school is vulnerable to the syndrome of creating “perfect” designs for unsustainable strategies.

Within this school of thought, the role of the enterprise architect is above all one of inquiring facilitator. Since the dynamics present within an enterprise surpasses the cognitive capabilities of a single person, the enterprise architect becomes a facilitator to multi-functional team inquiry processes in order to surface and map systemic dynamics. Consequently, facilitation skills and systems thinking acumen are essential for this role. Other important skills are illustration skills in order to capture systemic dynamics so that they may be communicated and understood across the organization for design purposes. Because the enterprise “beast” is complex, designs are achieved through team-based processes; hence collaboration and enterprise-wide commitment are essential. The perceived key challenges are understanding and collaboration; the difficulty for an enterprise architect lies mostly in emerging all the systemic dynamics which are at play in order to identify contradictions. Moreover, because of the nature of systems, typically multiple elements which may be mistakenly perceived as independent must be redesigned; with this comes the challenge of achieving understanding and collaboration between the members impacted by redesigns. This school is often subject to the same resistance barriers as the enterprise IT architecting school, for often, the enterprise designs are created by “expert” teams that struggle with the same acceptance issues as the rest of the organization

Enterprise Ecological Adaptation School

For this school, enterprise architecture is about fostering organizational learning by designing all the facets of the enterprise as well as its relationship to its environment to enable innovation and enterprise-in-environment adaption. Enterprise strategy creation and organization design are high on the concerns list of this school. Also, similar to the enterprise integration school, this school is concerned with contradictions but not only within the organization; it also looks for incoherency in the bidirectional relationship between the enterprise and its environment. Its members often describe enterprise architecture “the means for organizational innovation and sustainability”, a statement which could be considered this school’s motto.

The guiding principle of the school is that a systemic approach alone is not sufficient to enterprise design; it is necessary to achieve environment and enterprise coevolution by purposefully changing the environment, designing the enterprise systemically as well as its relationship to its environment. Coevolution is achieved by three means. Firstly, by making the environment friendlier for the enterprise’s desired goal. This is achieved by reinforcing pockets of desired futures within the environment and by attenuating unwanted forces. The second means is by adapting the desired goals of the enterprise to what is compatible with the enterprises environment. Through environmental learning, the enterprise may learn from the environment and determine desired goals based on existing desirable futures which already exist in the environment. The third means, similar to the enterprise integrating school, is through intra-organizational coherency. By designing the enterprise to reinforce wanted intra-dynamics and attenuate unwanted ones, it is possible to make the organization conducive to ecological learning, environmental influencing and coherent strategy execution. The key assumptions of this school are that the environment can be changed, enterprise-in-environment coevolution is essential for strategy elaboration and organizational coherency is necessary for effective strategy execution.

Because of its grounding in systems-in-environment thinking; this school of thought is capable of fostering enterprise-in-environment coevolution as well as enterprise coherency. Enterprises designed by this school are conducive for innovation and sustainability. On the downside, as a pre-condition, this school requires enterprises which are prepared to accept multiple paradigm shifts of management and strategy creation as well as environment which may be purposefully influenced.

Within this school of thought, the role of the enterprise architect is above all one of nurturer. Extracting knowledge from the environment as well as searching for desirable futures requires a great deal of “sense-making”. “Sense-making” is required because of the vast complexity of the environment as well as the subjective nature of human perception. The enterprise architect must be capable of fostering “sense-making” processes within the organization which then leads to learning. Consequently, dialogue fostering skills and system-in-environment thinking acumen are essential for this role. Other important skills are larger group intervention competency in order to facilitate enterprise strategy elaboration. For the same reasons as the enterprise integrating school, team-based processes and enterprise-wide commitment are essential. The perceived greatest challenges of enterprise architect of this school are sense-making and transformation; the difficulty for him lies mostly in fostering “sense-making” with regards to system-in-environment dynamics as well as getting the organization to accept the paradigm shifts which are necessary foundations on which to build the enterprise.

Table 2 Summary of Schools of Thought

	Enterprise IT Architecting School	Enterprise Integrating School	Enterprise Ecological Adaptation School
Motto	“EA as the glue between business and IT”	“EA as the link between strategy and execution”	“EA as the means for organizational innovation and sustainability”
Objectives & Concerns	<ul style="list-style-type: none"> • Effective enterprise strategy execution and operations • IT Planning & Cost reduction • Business Enablement 	<ul style="list-style-type: none"> • Effective enterprise strategy implementation • Organizational coherence 	<ul style="list-style-type: none"> • Innovation & adaption • Organizational coherence • System-in-environment coevolution
Principles & Assumptions	<ul style="list-style-type: none"> • Reductionism • Business strategies and objectives are provided by the business and are correct. • Independent design of organizational dimensions. 	<ul style="list-style-type: none"> • Holism • Business strategies and objectives are provided by the business and are correct. • Environment as something to manage 	<ul style="list-style-type: none"> • Holism • System-in-environment coevolution • Environment can be changed • Joint design of all

	<ul style="list-style-type: none"> Disinterest in none IT dimensions. 	<ul style="list-style-type: none"> Joint design of all organizational dimensions. 	organizational dimensions
EA Skills	<ul style="list-style-type: none"> Technical competence Engineering knowledge 	<ul style="list-style-type: none"> Small group facilitation Systems thinking 	<ul style="list-style-type: none"> Dialogue fostering System & System-in-environment thinking Larger group facilitation
Perceived Challenges	<ul style="list-style-type: none"> Organizational understanding and acceptance of designed plans. 	<ul style="list-style-type: none"> Understanding of organizational systemic dynamics Organizational collaboration System thinking paradigm shift 	<ul style="list-style-type: none"> Fostering sense-making System-in-environment paradigm shift
Insights	<ul style="list-style-type: none"> Permits the design of robust and complex technological solutions Fosters the creation of High quality models and planning scenarios 	<ul style="list-style-type: none"> Permits the Design of comprehensive solutions Enables significant organizational efficiency by eliminating unnecessary contradictions and paradoxes 	<ul style="list-style-type: none"> Fosters enterprise-in-environment coevolution and enterprise coherency Fosters organizational innovation and sustainability
Limitations	<ul style="list-style-type: none"> Susceptible to producing inadequate or unfeasible solutions for the larger organizational context Susceptible to considerable solution acceptance and implementation barriers Susceptible to “perfect” designs for unsustainable strategies syndrome 	<ul style="list-style-type: none"> Susceptible to “perfect” designs for unsustainable strategies syndrome Requires a paradigm shift from reductionism to holism 	<ul style="list-style-type: none"> Requires many organizational pre-conditions with regards to management and strategy creation Requires environments that may be influenced

A little mapping

In order to illustrate further the schools of thought, a tentative mapping of items from the literature is offered in Table 3. Tentative, because, as mentioned earlier, the proposed schools of thoughts are conceptual “ideals”, authors typically do not fit perfectly in one school but rather gravitate towards one. Consequently, the mapping presented is for illustrative purposes and not to associate unconditionally various literature elements with rigid “boxed” ways of thinking. Given the limited space available for the article, it is not possible to offer a comprehensive explanation for the mappings. However, the table is offered as both an invitation to explore some of the EA literature with new eyes as well as a first step towards dialogue about EA and belief systems.

Some readers could be surprised to notice that no mapping is proposed for Zachman’s framework despite its popularity in the EA community. The framework has been omitted for two reasons: a) the framework is a “taxonomy” and not a school of thought, and b) the information-centric nature of the framework isn’t representative of Zachman’s stance on EA. In his SIM guide to EA, Leon Kappelmon shares a very interesting interview he conducted with some key EA pioneers including John Zachman. From Zachman’s statements during the interview, he can be positioned in the Enterprise Integration School like most of the interviewees.

Table 3 Schools of Thought Mapping

Enterprise IT Architecting School	Enterprise Integrating School	Enterprise Ecological Adaptation School
Finkelstein (2006) Hanschke (2010) Op’t Land et al. (2009) Perks and Beveridge (2003) Ross et al. (2006)	Bernus <i>et al.</i> (2003) Giachetti (2010) Kappelmon (Eds) (2010)	Gharajedaghi (2006) Graves (2007) Hoogervorst (2009) Martin (1995) Smith (2011)

Conclusion

In the Indian fable of the nine blind men and the elephant, each of the blind men perceives the elephant very differently from the others according to the elephant part they are touching. Mintzberg refers to this fable in his book *Strategy Safari* in order to illustrate that the various schools that he proposes, individually, do not offer a complete view of the strategy “animal” but rather their combination.

With regards to the enterprise architecture schools of thoughts, this fable doesn't hold. Each school builds by adding more context and content, hence offering a more complete image. Consequently, each school inherits the concerns of the other schools with lesser scope but focuses less on their concerns. EI includes and transcends EITA. EEA includes and transcends EI. However, there are fundamental differences in the assumptions and values of the schools, hence the use of the term “transcend”. They are not strictly subset from a system belief perspective, only from a scope perspective!

In conclusion, if organizations are to survive the turbulence of today markets, they must learn to adapt and innovate. Based on a survey by Gartner and Forrester, current enterprise architecture practices, which are mostly based on the EITA school of thought, will not be able to deliver adaption nor innovation; they have not in the past and there is no reason to believe that they will in the future. Enterprises will have to move to more holistic ways of thinking if they wish to survive and flourish.

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