Enterprise architecture: beyond business and IT alignment

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Abstract IT has always embodied both a huge opportunity and a misunderstood asset in most enterprises. Today, pressure has never been so hard on IT executives to reduce cost and complexity while bringing value. Enterprise architecture was born in an attempt to address this very challenge. But while serving its original purpose, it usually focuses on business and IT, overlooking other aspects potentially required for envisioning enterprise transformation. The latter is becoming more and more compulsory and IT has never been so pervasive in today's enterprises. In this context, approaching transformation through a business/IT duality as in most enterprise architecture methodologies proves to be insufficient. Pervasive IT infers the consideration of other aspects, all intermingled one another. One possible way to deal with this reality is to model the enterprise as a graph of aspects, beyond business and IT. By putting weight on the relationships between those aspects, one can delineate a Minimal Spanning Tree that would constitute a pragmatic yet complete frame of analysis. Applied to an imaginary business case, the aforementioned approach proves to be relevant for enterprise analysis in a holistic yet pragmatic way. It can also be integrated in existing frameworks, either as an extension, or as an overarching frame for a hypothetic *enterprise transformation practice*. Yet, many additional works need to be achieved before envisaging such a practice in the future.

1 Searching for alignment

1.1 Original purpose of enterprise architecture

IT has always been perceived as both a huge opportunity and an immense burden by organisations. When cleverly used, it can greatly improve performance and foster innovation. In many ways, it also embodies an intangible and mostly misunderstood asset whose value is always to be proven, complexity to be tamed and cost to be put under control.

In the early days, organisations have rushed into IT to take advantage of its potential: process automation, digital desktop, etc. All these advances have been devised and implemented through most of the time an unplanned and rather opportunistic way. This led to a rather chaotic IT landscape without a solid foundation to enable reuse and homogenisation. Over time, the cost and complexity of IT systems have exponentially increased while the additional business value to be derived from those systems has constantly decreased. Organisations have found themselves facing the following challenge: how can I derive more value from IT and at the same time reduce cost and complexity? This question has been addressed by several areas of expertise, among which, enterprise architecture.

1.2 Serving the business and aligning IT

If one cannot find a unique commonly agreed definition for enterprise architecture, practitioners usually do agree on the benefits it can bring to an organisation: it facilitates the reduction of complexity through better interoperability and promotes cost reduction, through better return on investments and flexibility of business capabilities. Practitioners also do usually agree that enterprise architecture should "enable the process of translating business vision and strategy into effective enterprise change" [1]. The exact modalities of how to proceed differ from one methodology to another but most of them are usually applied with the following commonality: a *business/IT duality*, with a strong emphasis on the necessity for *IT to be aligned with the business*. Let's examine in detail the practices mostly in use in organisations today to confirm this statement.

Enterprise architecture is usually applied in a top-down approach. It operates with a strong support from the top management in an environment where the vision statement is clear. In this configuration, all the analysis is conducted so that the target state of the organisation is in line with the business vision. This is usually conducted using the "separation of concerns" [2] principle, the concerns in study differing according to the methodology in effect.

For example, in TOGAF (The Open Group Architecture Framework [3]), the concerns in question are the Business Architecture, Information Systems and the Technology Architecture. There is a clear business/IT duality in the way architecture is envisaged and IT is supposed to support the target state of the Business Architecture, which should itself be directly aligned with the strategic objectives.

In the Zachman framework [4], even though the separation between business and IT is less formal, the first two audience perspectives (executive and business management) represent the business aspect whereas the three following audience perspectives (architect, engineer, and technician) represent the IT aspect. The alignment notion is clearly represented as a link to be made alongside the audience perspectives. Like in TOGAF, little or no attention is turned to other concerns than business and IT.

This business/IT duality is even more striking when adopting a "city planning" layered approach to enterprise architecture. It organises enterprise into a layered hierarchy, from the business layer to the technical layer. This methodology, while aligning IT with the business by essence, gives however few or no room for the study of other concerns than business and IT.

Now that we have examined the usual practices in effect in enterprise architecture, it becomes apparent that there is usually a strong common emphasis on business/IT alignment which permits to prioritize initiatives according to the value they can bring. Moreover, there is systematically a strong emphasis on reuse and the building of a foundation architecture. Therefore, enterprise architecture as practised today is serving well its main original purpose: reducing cost and complexity while deriving more value from IT.

This business/IT duality actually reflects quite well the usual state of mind of C-level executives regarding IT, namely its contribution to the business vision and strategy in a context where IT is mostly seen as a utility or as a service provider to the business. But only very few methodologies approach the enterprise in a context of overall transformation [5], embracing concerns out of the business and IT scope, like culture, skills or behaviour. Only in the Praxeme framework can we see a more global approach, as enterprise architecture is defined as the place "where the effort is made to consider all the aspects together" [6]. But are all these other concerns of primary importance when dealing with enterprise change? And if so, how can we cope with them?

2 Intertwining aspects

2.1 Ubiquitous IT: a reality

Technology has never been so present in our everyday's life. With social network, mobility, and new media all in play, our relation with technology has been reshaped for good. This trend is also increasingly spreading in organisations. While confined in the early days in a limited number of functions, technology is now omnipresent: we use applications to develop customer relationship, we use mobile devices and digital signature to deliver parcels, and we use social networks to develop new forms of marketing. In a sense, IT has become ubiquitous in most organisations.

2.2 Transforming the enterprise beyond business and IT

But ubiquitous IT is not all. Organisations have never faced such a shifting and unstable environment. With the advent of new regulatory policies and the ever harder pressure of the competition, organisations are constrained to transform constantly.

In this context of ubiquitous IT and compulsory transformation, is enterprise architecture as practised today relevant for an effective translation of business vision and strategy into effective enterprise change? As discussed in the first chapter of the present paper, enterprise architecture usually addresses transformation by approaching business and IT, the main concern being the alignment of IT with the business. This approach is suitable in a vision where the business is the most important driving force of the enterprise and where IT represents an asset whose main function is to serve the business. But when IT is ubiquitous and when interactions exist between all aspects, this simple approach may be inadequate for practical purposes. Indeed, how many times have we witnessed a transformation fail because some critical aspects like culture or behaviour were overlooked? And yet, in those cases, enterprise architecture was quite practised as defined by the state of the art methodology.

2.3 Embracing other subjects

Let's now examine the disciplines involved with transformation in a context where *IT is ubiquitous* in the organisation. Most often, the organisation proceeds

through an association of disciplines such as strategy, business analysis, innovation, enterprise architecture, change management, and talent management. People all work together to enable the transition into the desired state of the organisation and to find the right interaction that delivers added value.

Needless to say, there are other disciplines involved in the transformation process and a strong "organic" interaction between them. These disciplines imply quite a number of aspects beyond business and IT as well as interactions in both directions. For example, the organisational behaviour influences the way people interact within business processes which in turn influence the target state of the IT landscape. Conversely, the latter influences skills and competencies. This illustration calls for two observations:

   a) All aspects are intertwined and to be considered when transforming an organisation, beyond the separation wall of business and IT
   b) Enterprise architecture is not the only discipline at stake when transforming the organisation

Given this, can enterprise architecture take up the challenge of mingling different aspects of the organisation beyond business and IT and act as more than a catalyst for transformation?

2.4 Enterprise as a network of aspects: a holistic approach

In order to answer the latter question, let us formalise architecture in the context of an enterprise. Architecture can be defined as the "structure of components, their **inter-relationships**, and the principles and guidelines governing their design and evolution over time" [7]. An enterprise can be defined as an "organisation engaged in the trade of goods, services, or both to consumers" [8] and viewed as a complex system of socio-technical aspects including people, culture, information, technology, business operations, and intellectual property. Enterprise architecture is usually focused on the business and IT aspects of the organisation. This scope is surrounded by a context, which includes all other aspects. Enterprise architecture is normally responsible for the articulation between the scope and the context as described in the following figure, while making the necessary alignment between business and IT.
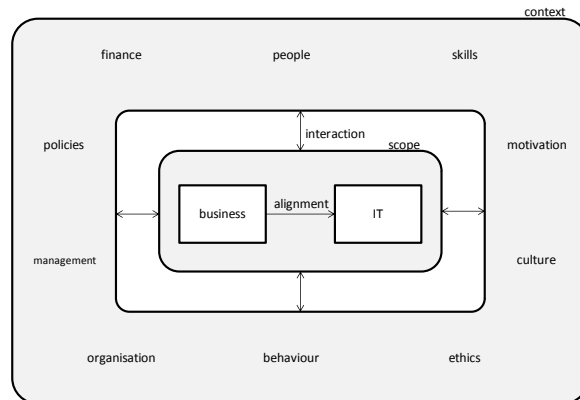
Fig. 2.1. Usual scope and context of enterprise architecture

While simple in its conception, this way of separating concerns may be out of phase with reality. We indeed observed that in a context of transformation, all aspects are to be considered and are linked with one another. This would imply an overlay of the scope and context as well as links between all aspects as follows.
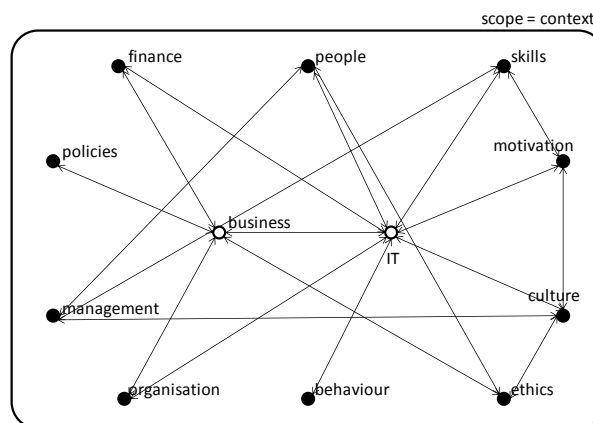

Fig 2.2. The enterprise: a network of intertwined aspects

In graph theory, the above representation is an undirected and unweighted graph. Each aspect in consideration can be represented by a "vertex", and each link between two aspects can be represented by an "edge". Using a **holistic approach**, approaching enterprise architecture would theoretically imply studying n "vertices" and $n(n-1)/2$ unique "edges", in two temporal states (baseline and target).

One matter yet to consider is that depending on the case, interactions between aspects are in reality not equivalent one another. For example, while in most enterprises there is a strong mutual influence between "business" and "behaviour",

there can be very few interactions between "IT" and "ethics". This can be modelled by putting a weight on each "edge" of the graph inversely proportional to the importance of the interaction between the two aspects. The business/IT "edge" would be weighted at 0 by default as it obviously owns a particular position. Conversely, there could be no interaction between two aspects, leading us to simply delete those "edges" from the graph.

Given this, and because all aspects have to be at least analysed separately, we are compelled to select all "vertices" in the graph and in theory, all "edges". Studying the $n(n-1)/2$ "edges" would however not be efficient from an executive point of view and one would be enticed to select the most important remaining "edges". This problem can be solved in two ways. One is to arbitrarily select the most important "edges". Another is to have recourse to a formal method, such as for example finding the Minimal Spanning Tree (MST) of the given graph. A spanning tree is "a subset of edges forming a tree connecting all vertices" and the MST is "the smallest connected graph in terms of edge weight" [9]. Among the possible algorithms to find the MST, stand the Prim's and the Kruskal's algorithm [9]. We consider the Kruskal's algorithm since it will automatically by principle select the business / IT "edge" whose weight is 0 by default. The following figure illustrates this algorithm on a graph representing the interconnected aspects of the organisation in one given temporal state.
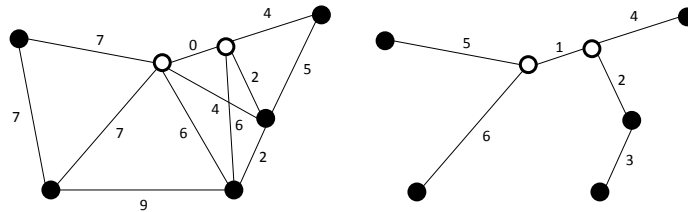

Fig 2.3. Illustration of the Kruskal's algorithm. The numbers in the original graph represent weights. The numbers in the MST represent the order of insertion.

This example illustrates that it may be conceivable to reduce the number of interactions to study while at the same time address the most important ones using a formal graph algorithm. Consequently, one could envisage tackling the analysis part of enterprise architecture in its entirety and not uniquely on business and IT aspects. This holistic approach may have the benefit of broadening the scope of enterprise architecture and revive its purpose in today's environment. It could thereby have the potential to become one day the practice to consider when dealing with enterprise transformation as a whole.

In the next chapter, we make an attempt to use this approach on an imaginary business case before giving hints for new perspectives.

3 Bringing it into reality

3.1 Framing the analysis

In order to illustrate the approach described above, we now imagine a business case with an enterprise named Buy-A-Lot, a major player in the electronics retail sector. In 2012, Bob Casey, the CEO of the company, in response to a harsh competing environment, decides to launch the "Back on Track" program based on three major strategic orientations: cooperation, interoperability and agility.

In order to plan the transformation, we define the target state of the company using first a traditional business/IT dual framework, leading to the following high-level vision statement.

Aspect	Description in the target state
Business	Highly tactical customer services
	Harmonised and end-to-end processes
	Clearly defined business services
IT	Agile development
	Portals and Intranet
	Mutualisation of technical resources
	Usage of standards
	SOA (Service Oriented Architecture)

Table 3.1. High-level vision of the target state of Buy-A-Lot on Business and IT

This first analysis could be satisfying as such and lead to further analysis and modelling. Bob Casey is however warned about common SOA pitfalls, especially those dealing with changes in business habits, including the reduction of overlapping in roles and responsibilities. On that account, he wishes to build analysis on the following aspects as well: behaviour, organisation and skills, making a number of 10 interactions to study. By adopting the MST approach, he hopes that this number and consequently the amount of work to provide could be reduced.

The following table is the weighted adjacency matrix of the aforementioned aspects in the target state of Buy-A-Lot. Weights are attributed based on the assumption that SOA leads to fundamental changes in behaviour and skills while harmonised and end-to-end processes infer changes in behaviour and organisation.

	Business	IT	Behaviour	Organisation	Skills
Business	-	∞	12	10	5
IT	∞	-	15	4	8
Behaviour	12	15	-	3	2
Organisation	10	4	3	-	4

Skills	5	8	2	4	-

Table 3.2.Weighted adjacency matrix of the aspects in the target state of Buy-A-Lot

Using Kruskal's algorithm, we can delineate the MST of the graph that leads us to reduce the number of interactions to study by 60%. The outcome of the discussion on the four remaining interactions is as follows:

Edge	Discussion on the alignment
Business-IT	- Already covered in the first analysis
IT-Behaviour	- SOA calls for responsibility and transparency - People should collaborate in a service oriented fashion between - departments (no more request isolated from predefined services) - Mutualisation of resources and standards mean more strict rules and potential tensions - Agile development infers perimeter and timing strictness
Business-Organisation	- Clearly defined business services and end-to-end processes imply no redundancy in the organisation
IT-Skills	- New skills are needed with agile development, SOA and collaboration through portals and intranet

Table 3.3.Discussion on the main interactions between aspects of Buy-A-Lot

This quick analysis makes it possible to refine the description of the aspects and draw a more consistent vision of the target state of the enterprise.

Aspect	Description in the target state
Business	Highly tactical customer services Harmonised and end-to-end processes Clearly defined business services
IT	Agile development Portals and Intranet Mutualisation of technical resources Usage of standards SOA (Service Oriented Architecture)
Behaviour	Delimitation of responsibilities and transparency Service orientation in working habits Rigor Potential tensions
Organisation	Redundancy free organisation
Skills	New skills correlated to new usages and technology

Table 3.4.Refined high-level vision of the target state of Buy-A-Lot

This example, while simplistic at first sight, shows however that this approach can enable a more consistent and rather fast picture of the enterprise. The next step would consist in defining the baseline state, analysing gaps and defining the transition.

3.2 Integrating with current practices

While defining the transition, Bob Casey main concern lies in the follow-up phases, especially regarding the integration with current practices in the company, for example enterprise architecture, or skills and change management.

One possible way to deal with his concern is to integrate the approach in existing practices, such as TOGAF. It can indeed be seen as an extension of the analysis in B, C and D phases of the ADM (Architecture Development Method). Starting from phase E, practitioners have the choice between:

a) Restraining themselves to the study of the usual business and IT aspects: in that case this approach would just be an *enhancement of the methodology*

b) Including all other aspects in the transition and planning analysis. In that case, this approach could be seen as a *practice of enterprise transformation* that would embrace other practices than enterprise architecture.

Facing those two options, Bob Casey acknowledged the relevancy of an *enterprise transformation practice*, but due the novelty of the idea, decided to mitigate risks and eventually chose the first option.

3.3 New perspectives, new challenges

The approach developed and illustrated previously could be a first step to envisage enterprise transformation in a complete, holistic, yet pragmatic manner. It certainly paves the way for new perspectives more consistent with today's environment, as initiated in certain practices such as Praxeme.

Perhaps one day we will see a more efficient and consistent method for transforming the enterprise. Yet, this also leads to new challenges, such as the modelling of all concerns or the integration of all practices within one single framework. There is undoubtedly much work remaining but the effort may be worthwhile to make progress in this highly potential field of enterprise management.

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Used abbreviations

IT: Information Technology
TOGAF: The Open Group Architecture Framework
MST: Minimal Spanning Tree
CEO: Chief Executive Officer
SOA: Service Oriented Architecture
ADM: Architecture Development Method