Towards a Common Terminology in the Discipline of Enterprise Architecture

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Abstract. This paper presents a literature analysis considering 126 references to support a common terminology in the discipline of Enterprise Architecture (EA). In a first step, it surveys EA-Drivers, addressed architectural layers and the differentiation of contributions focusing on architectural descriptions and architectural development.

Keywords: Enterprise Architecture, Terminology, Drivers, Architecture Layers.

1 Motivation

An increasing number of publications refer to the term or even the discipline of Enterprise Architecture (EA). Some authors point out that there is no common understanding of the term [28, 66, 82]. Especially in science, an un-reflected usage of buzzwords hinders experts to discuss relevant issues in an appropriate way. This contribution will deliver dimensions to differentiate approaches based on a literature analysis. The following sections will show results of a neutral comparative survey to find possible dimensions to describe the focus of an EA-contribution. The paper starts with some basic facts as timeline of the chosen literature, the authors backgrounds, main issues focused in the contributions and the handling of definitions and terminology. Afterwards three dimensions are described: EA-Drivers, addressed architectural layers and the differentiation between architectural descriptions and architectural development. It closes with a conclusion.

2 Research Methodology

The following thoughts are based on a literature analysis using 126 references from academic and pragmatic sources. This includes research publications (journals, conference proceedings), books and websites. The considered references have been surveyed via the internet.[1] Primer search-criteria have been the explicit usage of the term *Enterprise Architecture*. After a brief survey of the identified contributions, many non-research references needed to be excluded because they are marketing material. Furthermore, a next search covering aspects as Business-IT-Alignment,

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[1] Google Scholar, SpringerLink, Google Web Search.

IT-Architecture Management, Enterprise Modeling and Interoperability was performed to include work that is relevant but not explicitly labeled as EA-literature. After choosing the contributions to be considered the paper differentiates simple facts as time of publication, background of the author and how the authors deal with terminology and definitions of EA which are collected by reading the papers and summarizing the content without interpretation of implicit issues. In a second step the main points of interest as drivers for EA-considerations, addressed architectural layers and whether the focus is more on architectural description or architectural development will be surveyed with a little more effort. First, the contributions that explicitly mention an aspect (e.g. driver) have been evaluated and as a result, a scale of the dimension has been derived (e.g. internal vs. external drivers). Using the result from the first step the rest of the contributions were interpreted in the context of the deeper understanding of the dimension.

3   Literature Analysis

This chapter starts with the basic facts mentioned in the research methodology followed by examinations of EA-drivers, addressed architectural layers and the differentiation between aspects of architectural description and development.

3.1   Basic Facts, Distributions and Correlations

Since 2003, more and more authors are using the term EA explicitly in their publications. Most of the newer contributions are coming from an academic background. Especially after 2005, a lot of consultancies and IT-companies are adopting their products and strategies to an extended architectural understanding hence Enterprise Architecture. Based on the data sample there is no significant correlation between the time of a publication and the background of the author(s). There is a notion that papers from non-academic authors published before 2000 often fulfill at least basic academic or even scientific requirements. Considering that after 2004-2005 a lot of companies started to use the term EA and since then have connected it somehow to their products and strategies a huge amount of superficial marketing material has been distributed. Table 1 and Table 2 show the distribution of all references.

Considering the maturity and the focus of the contributions there is no core topic or even a theory in the discipline of EA. Almost half of the approaches discussed in the papers are still coming with a low maturity level (Concept Phase) in the context of readiness to be used in an organization. Only a third of the authors are delivering some kind of best practice (Implementation/Adoption). Differentiating the focus of EA-authors there are two specific topics only (EA-Frameworks and Enterprise Modeling) the majority is dealing with rather general aspects. A correlation between early maturity levels (Concept Phase) and modeling approaches is existing, mainly delivered by researchers. Many authors from the Public Sector are addressing EA-Frameworks in a descriptive way, but on an academic standard (e.g. FEAF, DoDAF etc.) – see Table 3 and 4.

Table 1. Publication timeline

Year	Contribution	#
1987	[123]	1
1988		0
1989		0
1990		0
1991		0
1992	[103]	1
1993		0
1994	[75], [88]	2
1995	[40]	1
1996	[30], [62], [65], [71], [77], [121], [124]	7
1997	[104]	1
1998	[10]	1
1999	[3], [8], [9], [13], [16], [125]	6
2000	[4], [19], [24], [83]	4
2001	[5], [20], [31], [35], [39], [81], [112], [120]	8
2002	[6], [23], [28], [101], [106], [108], [119]	7
2003	[7], [15], [25], [33], [44], [46], [48], [49], [55], [56], [64], [74], [84], [89], [91], [92], [93], [109], [114], [117]	20
2004	[12], [17], [26], [29], [45], [51], [54], [59], [63], [67], [70], [72], [73], [79], [82], [94], [95], [97], [105], [107], [113], [115]	22
2005	[2], [47], [57], [61], [69], [78], [87], [98], [102], [116]	10
2006	[1], [14], [27], [42], [43], [52], [66], [76], [85], [86], [90], [99], [111], [126]	14
2007	[11], [18], [21], [22], [34], [36], [37], [38], [41], [50], [53], [58], [60], [68], 80], [96], [100], [110], [118], [122]	20
2008	[32]	1

Table 2. Author´s background

Origin	Contribution	#
Academics	[1], [2], [4], [10], [11], [13], [15], [17], [18], [21], [22], [23], [24], [26], [27], [29], [30], [31], [32], [37], [38], [39], [40], [42], [44], [46], [47], [51], [52], [53], [54], [55], [56], [60], [62], [63], [64], [65], [68], [69], [73], [79], [80], [83], [88], [89], [90], [92], [93], [95], [96], [97], [98], [101], [102], [104], [105], [106], [107], [108], [110], [111], [114], [115], [117], [118], [120], [121], [122], [126]	70
Public Sector	[5], [6], [7], [8], [9], [12], [19], [57]	8
Consulting-Company	[16], [20], [28], [33], [35], [36], [48], [50], [58], [59], [67], [70], [71], [75], [76], [78], [82], [85], [87], [91], [94], [99], [109], [112], [113], [124], [125]	27
IT-Company	[3], [34], [41], [49], [66], [81], [103], [119], [123]	9
various	[14], [25], [43], [45], [61], [72], [74], [77], [84], [86], [100], [116]	12

Table 3. Maturity level of contributions focused issues

Maturity	Contribution	#
Concept Phase	[4], [5], [17], [18], [21], [22], [23], [24], [26], [27], [29], [30], [32], [37], [38], [40], [42], [43], [44], [47], [50], [51], [52], [53], [54], [55], [56], [57], [59], [60], [63], [65], [68], [69], [71], [72], [73], [77], [79], [83], [85], [88], [89], [91], [92], [97], [98], [102], [103], [106], [107], [111], [114], [115], [117], [118], [120], [123], [126]	59
Towards some kind of Product	[1], [3], [7], [12], [20], [28], [31], [39], [48], [64], [66], [67], [75], [76], [78], [84], [86], [87], [93], [94], [95], [96], [99], [108], [109], [121]	26
Implementation/Adoption	[2], [6], [8], [9], [10], [11], [13], [14], [15], [16], [19], [25], [33], [34], [35], [36], [41], [45], [46], [49], [58], [61], [62], [70], [74], [80], [81], [82], [90], [100], [101], [104], [105], [110], [112], [113], [116], [119], [122], [124], [125]	41

While the first relevant publications go back to the End of the 1980s and the topic has been heavily discussed for the last ten years, only a third deals with validated best practice. Only 6% of the considered publications do give its own definition of the term EA and at the same time differentiate it to others by referring to their definitions (see Table 5). A small percentage is defining the term *Enterprise* because the term *Architecture* is not being used often in the context of domains as Managerial and Organizational Science (but with a long history in Computer Science- see Table 6).

Table 4. Focused issue of contribution

Adressed Issues	Contribution	#
Overview on EA	[4], [5], [8], [15], [23], [28], [29], [32], [33], [34], [44], [47], [49], [50], [61], [66], [71], [72], [74], [77], [79], [84], [87], [88], [93], [98], [99], [105], [107], [108], [114], [115], [120], [125]	34
Best Practice	[2], [6], [9], [10], [11], [12], [13], [14], [16], [19], [20], [25], [26], [27], [31], [35], [37], [39], [41], [43], [45], [46], [48], [52], [54], [58], [63], [64], [68], [70], [75], [78], [80], [81], [89], [90], [94], [95], [100], [101], [106], [109], [110], [112], [116], [122]	46
EA-Frameworks	[1], [24], [36], [38], [40], [60], [67], [73], [76], [82], [83], [92], [97], [103], [104], [113], [121], [123], [124], [126]	20
Enterprise Modeling	[3], [7], [17], [21], [42], [51], [53], [55], [56], [59], [65], [69], [102], [111], [117], [119]	16
various	[18], [22], [30], [57], [62], [85], [86], [91], [96], [118]	10

Table 5. Proprietary EA-definitions and references to other authors definitions

EA-Definition	Contribution	#
Proprietary Definition, no further References	[4], [5], [6], [8], [9], [15], [16], [20], [23], [25], [28], [30], [33], [39], [41], [43], [45], [47], [48], [53], [65], [66], [67], [68], [72], [74], [76], [77], [78], [80], [81], [84], [86], [88], [89], [90], [94], [95], [101], [105], [119], [124]	42
Proprietary Definition in the context of further defining References	[1], [44], [58], [93], [99], [116], [126]	7
Definition by References, no proprietary Definition	[2], [14], [17], [19], [26], [32], [34], [37], [38], [42], [46], [49], [50], [51], [52], [54], [57], [60], [61], [63], [69], [82], [87], [92], [96], [97], [98], [102], [108], [113], [114], [115], [117]	33
No Definition at all	[3], [7], [10], [11], [12], [13], [18], [21], [22], [24], [27], [29], [31], [35], [36], [40], [55], [56], [59], [62], [64], [70], [71], [73], [75], [79], [83], [85], [91], [100], [103], [104], [106], [107], [109], [110], [111], [112], [118], [120], [121], [122], [123], [125]	44

Table 6. Including the term *Enterprise* to an extended architectural understanding

Defining the term *Enterprise*	Contribution	#
yes	[1], [3], [5], [9], [15], [44], [47], [65], [68], [79], [81], [88], [91], [93], [94], [108], [117], [119]	18
no	Rest of 126 considered References	108

50% of the authors are technology-driven. 36% are following a systemic approach towards a wider and integrated architectural understanding, which includes at least another architectural layer apart from the IT-Architecture. 14% tend to use a method-driven terminology. Some of the authors even combine the three main directions (see Table 7 and Table 8). To summarize the first section: there is a lack of theoretical foundation, stringent definitions or a common understanding within the authors, who publish in the context of EA. The majority of authors are publishing with a research background, they are technology-oriented and most of the introduced approaches are still in a concept phase and have not proven neither their real world value nor their feasibility.

Table 7. Term-Definitions main focus

Term-definitions main focus	Contribution	#
systemic	[1], [4], [8], [9], [25], [30], [66], [67], [72], [74], [76], [80], [81], [88], [90], [94], [95], [99], [105], [119], [126]	21
technology-driven	[1], [5], [8], [9], [20], [23], [28], [33], [39], [43], [44], [45], [48], [53], [58], [65], [68], [74], [78], [80], [84], [86], [89], [93], [101], [116], [119], [124], [126]	29
method-driven	[1], [6], [15], [16], [41], [47], [77], [116]	8

Table 8. Combinations of focused issues

Combinations	Contribution	#
systemic	[4], [25], [30], [66], [67], [72], [76], [81], [88], [90], [94], [95], [99], [105]	14
technology-driven	[5], [20], [23], [28], [33], [39], [43], [44], [45], [48], [53], [58], [65], [68], [78], [84], [86], [89], [93], [101], [124]	21
method-driven	[6], [15], [16], [41], [47], [77]	6
systemic & techn.-driven	[8], [9], [74], [80], [119], [126]	6
systemic & method-driven		0
techn.- & method-driven	[116]	1
sys. & techn.- & meth.-driven	[1]	1

3.2   Drivers for Enterprise Architecture Approaches

A central part of a common understanding could be the reasons why organizations are supposed to gain advantages from EA-approaches. Therefore, the drivers mentioned in the considered contributions have been surveyed. Just a small minority of authors are discussing drivers, why organizations are interested in EA. They differentiate internal and external drivers (see details in Table 9). In the category of internal drivers *Business-IT-Alignment* (by far) and *Cost-Reduction* are the most common entries. External drivers are legal requirements that push organizations to improve their Business-IT-Alignment.

Table 9. Distribution on internal and external EA-Drivers

Driver		Contribution	#
Internal	Business-IT Alignment	[5], [18], [42], [49], [57], [60], [61], [87], [115], [118], [122]	11
	Cost Reduction	[19], [20], [84], [86]	4
	Standardization/Consolidation	[84], [86]	2
	Management/Governance	[32], [84]	2
	various	[5], [14], [37], [46], [57], [84]	6
External	Clinger-Cohen Act	[5], [47], [18], [57], [58], [61], [99], [119]	8
	Sarbanes-Oxley Act	[34], [37], [58], [61], [78], [118]	6
	Basel II	[37], [58], [61], [118]	4
	Solvency II	[37], [58], [78]	3
	various	[5], [34], [42], [58]	4

3.3   Architectural Layers Addressed in EA-Contributions

An extended architectural understanding should consider elements apart from IT-Architectures. The authors are naming their layers on many different ways. The used categorization (Strategy, Organization, Information, Integration/Interoperability, Application/Appl.-Landscape and Infrastructure) has been derived considering all contributions that explicitly name an architectural layer concept and their generalization. Just counting the layers described, more papers deal with non-technical layers (Strategy, Organization and Information) than technical layers (the others). More than half of the authors are not addressing some kind of architectural layer or just one single layer

hence not even half of the authors are dealing with two or more architectural layers, which would be expected in the context of an EA-approach (see Table 10 and 11).

Differentiating the focused layer within the contributions that address one layer only, by far most of the authors are dealing with organizational issues. The architectural layer *Organization* can be divided into business processes, organizational structures and a mixture of both. More than half of the authors speak about business processes in the context of Organization. Hence a majority addresses business process aspects. Second common is the issue *Applications* and/or *Application Landscape* (see Table 12 and 13).

Table 10. Distribution of addressed architectural layers

EA-Layer	Contribution	#
Strategy	[14], [15], [16], [19], [28], [35], [53], [54], [58], [70], [78], [84], [89], [90], [112], [116]	16
Organization	[3], [6], [7], [11], [14], [15], [17], [18], [20], [25], [26], [32], [39], [40], [42], [44], [48], [49], [50], [53], [55], [58], [59], [60], [61], [63], [65], [68], [69], [73], [74], [75], [78], [82], [83], [87], [90], [91], [93], [94], [96], [98], [99], [101], [105], [110], [115], [116], [118], [120], [121], [122]	52
Information	[6], [7], [20], [34], [39], [46], [48], [49], [50], [53], [56], [59], [60], [61], [62], [68], [69], [73], [74], [82], [83], [94], [102], [106], [115], [117], [121], [122], [123]	29
Integration	[2], [20], [26], [31], [46], [63], [101], [113]	8
Applications/Appl.-Landscape	[4], [10], [16], [21], [24], [25], [26], [27], [33], [40], [43], [44], [45], [48], [49], [51], [56], [58], [61], [70], [74], [79], [87], [93], [98], [104], [105], [106], [111], [113], [114], [122], [124]	33
Infrastructure	[10], [12], [16], [25], [33], [34], [43], [44], [62], [75], [84], [87], [104], [108], [109], [110], [123], [124]	18

Table 11. Distribution on the overall number of considered layers

# of adressed Layers	Contribution	#
0	[1], [5], [8], [9], [13], [22], [23], [29], [30], [36], [37], [38], [41], [47], [52], [57], [64], [66], [67], [71], [72], [76], [77], [80], [81], [85], [86], [88], [92], [95], [97], [100], [103], [107], [119], [125], [126]	37
1	[2], [3], [4], [11], [12], [17], [18], [19], [21], [24], [27], [28], [31], [32], [35], [42], [45], [51], [54], [55], [65], [79], [89], [91], [96], [99], [102], [108], [109], [111], [112], [114], [117], [118], [120]	35
2	[6], [7], [10], [14], [15], [33], [34], [39], [40], [43], [46], [50], [56], [59], [60], [62], [63], [68], [69], [70], [73], [75], [78], [82], [83], [84], [90], [93], [94], [98], [101], [104], [105], [106], [110], [113], [115], [116], [121], [123], [124]	41
3	[16], [20], [25], [26], [44], [48], [49], [53], [58], [61], [74], [87], [122]	13

Table 12. Distribution of addressed architectural layers (one layer addressed only)

Single layer adressed	Contribution	#
Strategy	[19], [28], [35], [54], [89], [112]	6
Organization	[3], [11], [17], [18], [32], [42], [55], [65], [91], [96], [99], [118], [120]	13
Information	[102], [117]	2
Integration/Interoperability	[2], [31]	2
Application/Appl.-Landscape	[4], [21], [24], [27], [45], [51], [79], [111], [114]	9
Infrastructure	[12], [108], [109]	3

Table 13. Distribution of architectural layer *Organization*

Organizational issues	Contribution	#
Organizational Structures	[68], [91], [94], [122]	4
Business Processes	[19], [28], [35], [54], [89], [112] , [3], [7], [11], [17], [20], [26], [39], [40], [42], [48], [49], [50], [55], [59], [63], [65], [69], [78], [87], [93], [96], [98], [99], [105], [115], [116], [120]	27
Structures & Processes	[6], [14], [15], [18], [25], [32], [44], [53], [58], [60], [61], [73], [74], [75], [82], [83], [90], [101], [110], [118], [121]	21

After a deeper look on the combined architectural layers (when two layers are addressed), by far most approaches do combine organizational issues with the information layer. The information layer includes all aspects towards business and technology matter of information systems as well as data models.

Summarizing the surveyed architectural layers, too few authors are addressing hence integrating multiple layers. When multiple layers are focused on, the most common constellation combines business process artifacts with more conceptional issues of information systems. Hence, the understanding of Business-IT-Alignment does not consider enterprise strategy and technical details from the mostly technical architectural layers (Integration/Interoperability, Applications/Application Landscape and Infrastructure).

Considering similar scientific disciplines, neither Managerial and Behavioral Science nor Computer Science or even Electrical Engineering is suitable for that focus. The only domain that discusses this combination (incl. the topic Enterprise Modeling) is Information Systems Research (ISR).

Furthermore there is no significant accumulation to identify another bundle of topics, hence the EA-Community does not have a common targeted issue.

3.4   Architecture Description vs. Architecture Development

The last considered differentiation between the chosen contributions is based on the ISO 15704 [129]. The norm defines two types of addressing an extended architectural understanding. Type 1 is summarizing all approaches that focus on aspects to describe the state of an AS IS and/or TO BE architecture (incl. static and dynamic issues). Type 2 extends the Type 1 considerations with methodologies how to develop an AS IS state towards a planned TO BE. Many of the EA-Frameworks can be called Type 2 approaches. Type 1 and Type 2 Architectures are complementary. Without the description of AS IS and TO BE, there is no such thing as a meaningful methodology to derive a better TO BE Architecture. ISO 15704 does not define the scope (or layer) of an architectural consideration; therefore, it can be used in the context of EA. It is explicitly addressing Enterprise Reference Architectures.

Within the surveyed contributions there is no majority towards some kind of architectural type. Hence, the authors deal with documenting issues as well as with methodologies (or the combination of both).

Table 14. Distribution architectural description vs. architectural development

Type of Architectural Consideration	Contribution	#
Typ 1	[2], [3], [7], [10], [13], [17], [21], [26], [30], [39], [42], [49], [51], [53], [54], [55], [56], [59], [63], [65], [87], [94], [102], [105], [106], [108], [111], [113], [114], [119], [120]	31
Typ 2	[1], [5], [8], [9], [12], [14], [18], [19], [28], [32], [36], [45], [47], [67], [69], [73], [76], [79], [80], [82], [83], [84], [90], [92], [93], [95], [97], [101], [107], [110], [116], [117], [121], [122], [126]	35
Typ 1+2	[6], [11], [15], [16], [24], [25], [34], [37], [48], [50], [58], [66], [74], [81], [86], [100], [103], [104], [115], [123], [124]	21
No Typ	[4], [20], [22], [23], [27], [29], [31], [33], [35], [38], [40], [41], [43], [44], [46], [52], [57], [60], [61], [62], [64], [68], [70], [71], [72], [75], [77], [78], [85], [88], [89], [91], [96], [98], [99], [109], [112], [118], [125]	39

It is possible to differentiate the contributions along these criteria very well, but except from [15] the explicit usage is not seen in any of the contributions. It seems to be quite a useful differentiation because it is simple and disjunctive.

4   Conclusion

As stated in the introduction: this is not about yet another EA-Definition. It is about a lack of a common terminology. It is not possible to consider all EA-Publications. Many of the results are based on interpretation of implicit statements. That makes it difficult to call this literature analysis scientific.

Nevertheless, there is no doubt about the horrible mess looking at the usage of the term *Enterprise Architecture*! The only way to improve the situation is to start thinking about a common structure, developing a core theory and please: define and differentiate your aims, methods and addressed issues. This paper would like to give some first orientation and maybe start a discussion in the EA-community.

Another result of the survey is the still blur but developing picture, that authors can be differentiated into descriptive and descriptive-normative positions. Descriptive approaches see EA as a result of a planning process. The descriptive-normative authors of contributions consider the planning process as an integrative part of an EA-Approach.

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