Enterprise Architecture: A strategic specialism[α]

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Abstract—In this paper we are not so much concerned with enterprise architecture as a *product* or *process*, but rather with the competencies of the professionals who are responsible for the creation of an enterprise architecture, i.e. the *enterprise architects* themselves.

We present the integrated result of three surveys held in the Netherlands, on the competencies required from enterprise architects. The surveys were also used to clarify the distinction between the competencies needed from *enterprise architects*, and the ones needed from *information architects*. The surveys indeed indicated there to be a fundamental difference in the competencies required from these two roles.

The reported research is part of the larger research programme *General Enterprise Architecting* (GEA) on the governance of coherence in enterprises by means of enterprise architecture.

Keywords-enterprise coherence governance, enterprise architecture, enterprise architecture competencies, information architecture competencies.

I. Introduction

The field of *enterprise architecture* aims to provide management with the insight and overview needed to harness the complexities involved in the evolution and development of enterprises [1], [2]. Where classical approaches will handle problems on a one by one base, *enterprise architecture* aims to deal with these issues in a coherent and integral fashion. At the same time it offers a medium to achieve a shared understanding and conceptualisation among all stakeholders involved and govern the enterprise's evolution and development based on this conceptualisation. In this paper, we are concerned with the people who needs to execute these tasks; the *enterprise architects*.

In the past, we were already involved in a survey on the competencies of enterprise, information and IT architects. The results of this earlier work, conducted between 2005 and 2006, has been reported on in e.g. [1], [3], [4]. This earlier work was also based on inputs from standardization efforts by e.g. The Open Group [2] and the Netherlands Architecture Forum [5], [6], as well as internal certification programmes developed by consultancy companies such as IBM, HP and Capgemini.

More recently, the results of the GEA (*General Enterprise Architecting*) research programme on enterprise architecture [7], [8], [9], provided us with clear indications that the role of enterprise architects was changing. The role was seen to move away from the role of information and IT architects, as studied in [1], [3], [4], towards the more business strategic level. Even more, as also suggested in [4], it is necessary to not only look at the competencies of an enterprise architect as a single person, but rather as a *function* in the organization. This triggered a new series of surveys, with the aim of obtaining a more refined view on the competencies needed from both individual enterprise architects and information architects, as well as the functions as a whole. This paper reports on the results of these surveys.

The GEA research programme was initiated in 2006 by the consultancy firm Ordina (www.ordina.nl). Ordina's initiation of the GEA programme originated from their observation that large scale enterprise transformations fail more often than not, while existing methods and frameworks for enterprise architecture were found to fall short in contributing to the success of enterprise transformation efforts [10], [7]. A survey [10] held at the start of the GEA research programme showed that these experiences were not limited to Ordina only, but were shared among a broad range of client organizations participating in the programme[1]. The initial GEA survey also resulted in the driving hypothesis of the programme: *the overall performance of an enterprise is positively influenced by a strong coherence among the key aspects of the enterprise, including business processes, organizational culture, product portfolio, human resources, information systems, IT support, etc.* GEA refers to the latter coherence as enterprise coherence [10], [7]. The term 'coherence' is used rather than the more commonly used term 'alignment', since the latter is generally associated with

bringing two concepts in line; typically 'Business' and 'IT'. The underlying issues were also considered grave enough for the participating client organizations to indeed co-invest, in terms of time and money, in the GEA research programme.

The core result of the GEA programme is an, iteratively developed, enterprise architecture method to govern the coherence in enterprises. In its current form, the GEA method comprises three core ingredients [7]: ECA, ECF and ECG. Next to an Enterprise Coherence Assessment (ECA) [8] that allows organizations to assess their ability to govern coherence during enterprise transformation, it comprises of an Enterprise Coherence Framework (ECF) [9] and a (situational) Enterprise Coherence Governance (ECG) [7] approach. The latter includes the identification of specific deliverables/results to be produced, the processes needed to produce these deliverables/results, as well as an articulation of the responsibilities and competences of the people involved. Each iteration of the GEA method is based on the experiences of using GEA in the participating client organizations. See [11] for a report on such a case study.

As mentioned above, the results (and experiences) of the GEA programme indicated a shift in the role of the enterprise architecture function, and the competencies needed from the involved architects, moving it closer to the strategic level of an enterprise. This triggered a series of three group based surveys:

1) Among the members of Ordina's Enterprise Architecture centre of excellence.
2) Among the members of the GEA programme.
3) Among the members of the Architecture working group of the Dutch Society for Informatics (NGI).

These group based surveys indeed confirm the shift in the role/function of enterprise architect. The overview of the competencies of enterprise architects and information architects, in conjunction with a mapping to the key areas, can be used to:

1) select the right mix of people needed to develop an enterprise architecture function,
2) support potential candidates in their development process into a role within this function and
3) identify and scope the roles within the enterprise architecture function.

The remainder of this paper is structured as follows. In Section II we discuss the perspective we take on competences and the role of enterprise architects. Sections III, IV and V then report briefly on the three surveys. Before concluding, Section VI presents the combined results.

II. A COMPETENCE MATRIX FOR EA

In literature, a wealth of information, approaches, models and definitions available on competencies is available. As the competence surveys took place in a Dutch context, we preferred to use definitions that are commonly used in the Dutch[2] speaking community.

In earlier work on the competencies of IT architects, Steghuis et al. [3], [5], [6], [12] applied the 'competence iceberg' (see Figure 1) from Bergenhenegouwen [13] to the field of IT architecture. At the top of the iceberg, we find the observable professional competences that are typically required to exercise a profession. For example, an IT architect would be required to have knowledge of the business domain as well as the IT domain. Professionals typically acquire this sort of knowledge and skills by formal schooling and on the job training. The presence/absence of these competences can be observed relatively easily. Lower down the iceberg, we find more knowledge, skills and attitudes, that are increasingly harder to teach and increasingly difficult to observe. This is also what lends the 'iceberg' model its name, as a large part of the required competences may actually be hard to observe and/or train, and as such remains 'below the surface'.
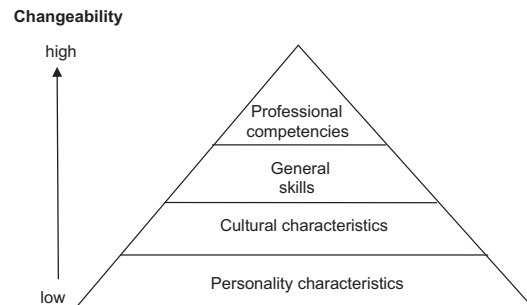

Figure 1. The competence iceberg (based on [13])

The use of the iceberg model for IT architects indeed provided valuable insights, as summarized in [3]. However, the iceberg model does not make an explicit connection between the various tasks that are to be performed by an architect, and the personal characteristics that are a prerequisite for conducting those tasks. This makes it difficult to make the various roles within the enterprise architecture function explicit. This is where we turn to the competence matrix from Luken [14].

The competence matrix model was developed by the NOA (www.noa-vu.nl) group from the Free University of Amsterdam. It is used in the development of several training/schooling programmes in the Dutch speaking community (including MSc and BSc programmes). It identifies two dimensions:

Task areas – identifying the task (domains) of the role for which the competencies are to be described.
Competences – The competences needed to (successfully) perform the tasks.

[2]The Netherlands, and the Flemish part of Belgium.

The competence matrix model is actually based on the more general purpose/resource matrix suggested by Weijers [15]. The competence matrix model fits well with our needs: architects in the enterprise architecture function should not only have the right knowledge, insights, attitudes and behavioural skills, but they also have to be able to apply these to the tasks needed in an enterprise architecture function. In this way, variations can be identified in terms of the relative importance of knowledge and understanding, attitude and skills for the different tasks.

To "fill" the competence matrix of the enterprise architecture function, the following three surveys were carried out and/or used:

1) A survey conducted by the GEA core team among eleven enterprise architects of Ordina's Enterprise Architecture centre of excellence.
2) A survey conducted by the GEA core team among nine members of the GEA research programme.
3) A survey on "*the characteristics of the good architect*" conducted by the Architecture Working Group of the Dutch Society for Informatics (NGI).

In the context of these surveys, enterprise architecture and information architecture were defined in line with definitions as can be found in e.g. [1], [7]. More specifically, enterprise architecture was considered as indeed being the architecture of the enterprise, ranging from the products/services offered, via the business processes and supporting information systems, to the IT needed to support/implement these information systems. The information architecture was treated as focusing on the information systems ('information provisioning') needed to support the business processes of the enterprise and the IT support needed for these information systems. This makes it natural for enterprise architecture to be more broadly oriented, and closer to enterprise strategy, whereas information architecture has a more in depth focus towards the actual design of the information systems. This is illustrated in Figure 2 and 3 respectively.

Given these 'orthogonal' definitions of enterprise architecture and information architecture, one would indeed suspect there to be a difference between the competencies needed from the different architects. The three surveys therefore considered both the competencies of an information architecture function and ones from an enterprise architecture function.

III. Survey 1 – Ordina's EA centre of excellence

The first survey was held among the architects of Ordina's architecture community of practice (Dutch: Vakgroep). It should be noted that even though Ordina was the initiator the GEA programme, this certainly does not mean that all of Ordina's enterprise, information, or IT architects, are "GEA architects". Ordina, being the result of several take-overs of smaller consultancy firms, represents a rich variety of architecture approaches and associated experience.
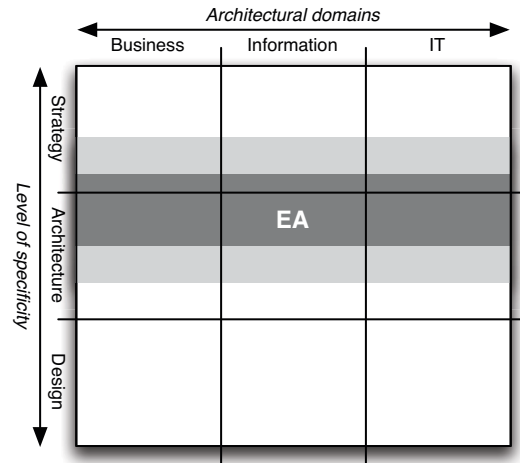

Figure 2.   Enterprise architecture focus area
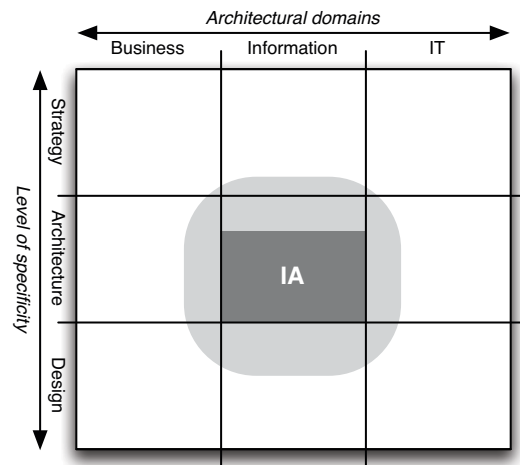
Figure 3.   Enterprise architecture focus area

This survey was organized as a plenary session involving *eleven* participants. It involved two steps. First, the participants collaboratively gathered (and clustered) the competencies they considered as relevant to enterprise architects and information architects. Then they prioritized the resulting competence cluster. For both the enterprise architect and information architect function, the participants were asked to distribute *four* points over the clustered competences based on the importance of the competency to the function. The two prioritizations indeed yielded significant differences for the two different functions. The resulting competence clusters are shown in Table I.

Note that a score of zero points for a competence cluster does not imply that this competence was not relevant. All competency clusters are indeed considered relevant by the group as they were listed by the group in the first place. The table only shows the relative priority of the clusters.

Information Architect		Enterprise Architect	
Competence cluster	Points	Competence cluster	Points
Has a large Analytical capacity	12	High Organizational sensitivity	8
Has a strong Thinking ability	9	Is a Networker	7
Is a good Listener	5	Has a strong Thinking ability	6
Knowledgeable	5	Has an eye for Effects	5
Is a good Communicator	3	Has Empathy	5
Has an eye for Effects	2	Has Management Skills	4
Is a Facilitator	2	Is a Negotiator	3
Has useful/meaningful Instruments	2	Has a large Analytical capacity	1
Has Empathy	1	Is a good Listener	1
Monitors the Structure	1	Is a good Communicator	1
Is Steadfast	1	Is a Facilitator	1
Is Creative	1	Is Critical	1
High Organizational sensitivity	0	Is a Generalist	1
Is a Networker	0	Knowledgeable	0
Has Management Skills	0	Useful/meaningful Instruments	0
Is a Negotiator	0	Monitors the Structure	0
Is Critical	0	Is Steadfast	0
Is a Generalist	0	Is Creative	0
Total	44	Total	44

Table I
COMPETENCE CLUSTERS IN ORDER OF IMPORTANCE

Figure 4 highlights the differences between the two functions in terms of the difference is score for the required competences. It indicates that the architects of Ordina's centre of excellence indeed see a significant difference between the two functions/roles.
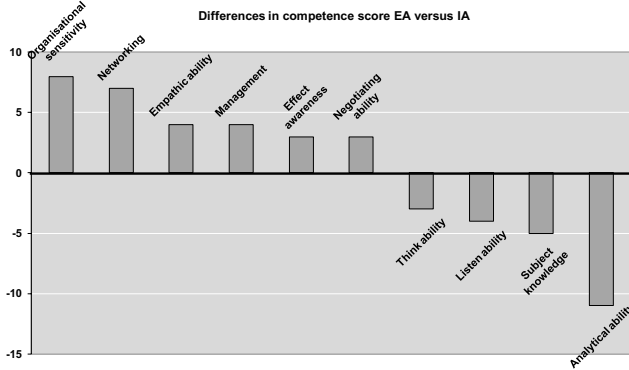

Figure 4. Survey 1: Differences in competence score

IV. SURVEY 2 – GEA MEMBERS

The second survey was held among members of the GEA research programme. More specifically this involved the following *nine* members: ANWB, Dienst Justitiële Inrichtingen van het Ministerie van Justitie, Politie Nederland, PGGM, ICTU, Rijkswaterstaat, Ordina, UWV and Nederlandse Spoorwegen.

The second survey involved three major steps. First, the participating GEA members were asked (bi-laterally) to list the important competencies of enterprise/information architects. Then a plenary session, involving *twelve* representatives of the participating GEA members, was organized to cluster the identified competences. This produced a total of twenty-three competence clusters. As a third step, the clusters were prioritized by the twelve representatives. Each representative was asked to divide *seven* points over the twenty-three clusters. Once for the enterprise architecture function, and once for the information architecture function. With *twelve* representatives for *nine* GEA members, some GEA members had a stronger 'vote'. However, each of the participants participated as a professional, rather than the representative of the member's own specific interest.

As a fourth step, *eighteen* members of Ordina's Enterprise Architecture centre of excellence were also asked to provide a prioritization. This involved again the division of *seven* points over the clusters as identified by the GEA team members, for both the enterprise architecture and information architecture functions. As this centre of excellence represents a broad range of architecture approaches, their prioritization provides a "non GEA programme" perspective.

To ensure that the prioritization of the *eighteen* members of the centre of excellence would not "outnumber" the prioritization of the *twelve* GEA representatives, a weighing factor was used when aggregating the different prioritizations. In doing so, the number of involved organizations was used, leading to a 90 to 10 ratio. In other words, the votes from GEA participants received a 90% weight while the votes from the centre of excellence received a 10% weight. A total of: $12 \times 7 \times 90\% + 18 \times 7 \times 10\% = 88.2$ points have been divided, per enterprise/information architecture function.

The results of the second survey are as shown in Figure 5. The results show a strong differences in the priorities with regards to the competences of enterprise architects versus those of information architects. The top-10 score for enterprise architecture competences is shown in Table II, while the top-10 score for information architecture is shown in Table III.

Rk	Competence	Score	Rk	Competence	Score
1	Organizational sensitivity	14.6%	6	Visionary	5.5%
2	Communicative	8.5%	7	Networking	5.5%
3	Persuasiveness	8.3%	8	Professional integrity	4.9%
4	Analytical ability	7.1%	9	Decisiveness	4.7%
5	Branche knowledge	5.9%	10	Effective judgement	4.2%

Table II
TOP-10 SCORE FOR ENTERPRISE ARCHITECTURE COMPETENCES

To better highlight the differences between enterprise architects and information architects, the top-10 scores are combined in the spider-diagram as shown in Figure 6. This diagram provides an overall picture of *fourteen* competences comprising of both of the top-10 scores. It shows that an overall enterprise architect can be qualified as a *visionary*
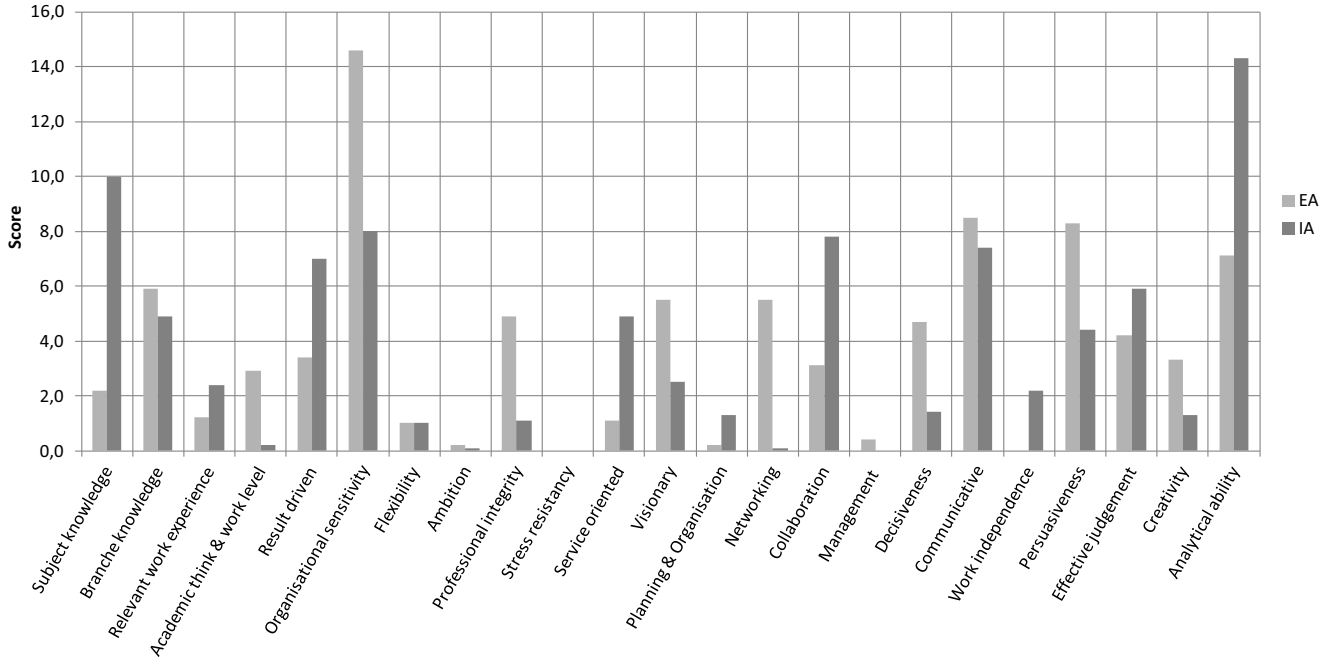
Figure 5.   Comparison competences EA function & IA function

Rk	Competence	Score	Rk	Competence	Score
1	Analytical ability	14.3%	6	Result driven	7.0%
2	Subject knowledge	10.0%	7	Effective judgement	5.9%
3	Organizational sensitivity	8.0%	8	Branche knowledge	4.9%
4	Collaboration	7.8%	9	Service oriented	4.9%
5	Communicative	7.4%	10	Persuasiveness	4.4%

Table III
TOP-10 SCORE FOR INFORMATION ARCHITECTURE COMPETENCES

networker and an information architect as an *analysis oriented knowledge worker*.

It is interesting to see that both survey 1 and 2 indicate similar distinctions between the competencies required from the enterprise architecture function and the information architecture function. See Figure 4 and 7. Of course it is the case that Ordina's centre of excellence played a role in both surveys. However, in the second survey they only determined 10% of the weight of the prioritization. It suggests that the distinction between the enterprise architecture function and information architecture function is shared among the GEA members and the broad community of architects within Ordina.

V.   SURVEY 3 – NGI

The third survey involved the members of the Architecture working group of the Dutch Society for Informatics (NGI). This survey was conducted by the NGI to better understand
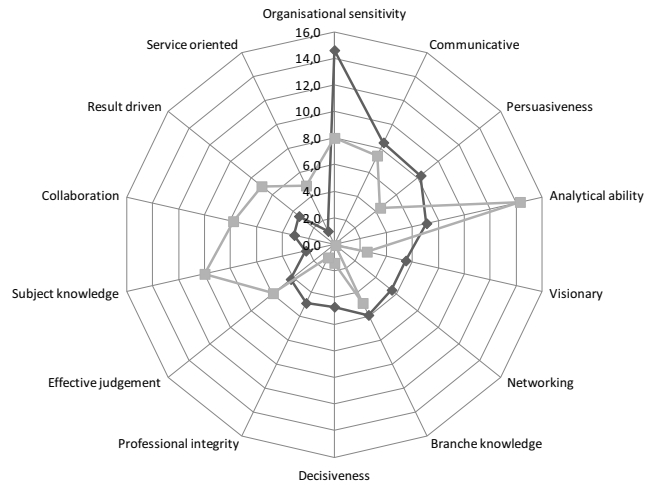
Figure 6.   Top 10 competences compared (dark = EA; light = IA)

and develop the competences of information architects. Even though this survey was not conducted as part of the GEA programme, the GEA team did have an involvement in the survey. From the perspective of our purposes, this third review was used as an 'extra' to cross check some of the results of the earlier two reviews. Regretfully, this survey focussed only on the competencies of information architects.

The actual survey followed a similar pattern as survey 1 and 2. In other words, as a first step, the potential

Figure 7. Survey 2: Differences in competence score

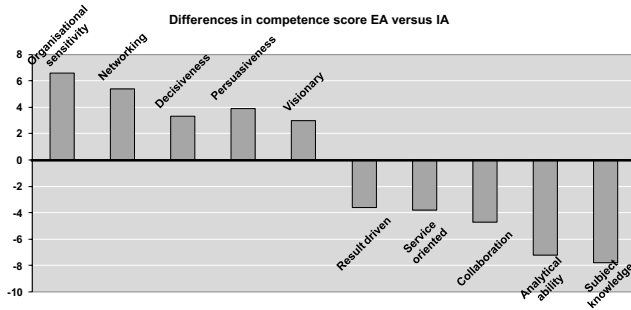| Survey 3 – NGI		Survey 2 – GEA members		Survey 1 – Ordina	
Competence	Rank	Competence	Rank	Competence	Rank
Interacting	1	Persuasiveness	3	Good listener	3
		Organizational sensitivity	1	Facilitator	7
Structuring	2	Analytical ability	4	Analytical capacity	1
				Thinking ability	2
Vision development	3	Visionary	6	Eye for Effects	6
Communicating	4	Communicative	2	Communicator	5
Knowledge	5	Branche knowledge	5	Knowledgeable	4

Table V
CORRESPONDENCE OF SCORES

competencies were clustered by the organizers of this survey. As a second step the clusters were prioritized at a plenary session of the working group, involving nineteen members. Each member was allowed to divide three points over the competences according to their priority. This resulted in the scores as shown in Table IV

Competence	Points	Competence	Points
Interacting	18	Knowledge	4
Structuring	12	Sense of proportions	1
Vision development	12	Experience	1
Communicating	8	Creativity	1

Table IV
PRIORITIZATION OF COMPETENCIES

As the NGI survey used a slightly different clustering, it is difficult to compare the results of this survey with the two earlier ones. However, when taking the five top priorities of the NGI survey as a starting point, and interpreting these clusters in terms of the clusters from the GEA survey, one can observe the correspondence as shown in Table V. This comparison shows that, for information architects, the three surveys provide similar top five competency clusters, albeit with a differing order of importance. We do believe this also indicates the stability of the overall results of the first two surveys, including the results for the enterprise architecture function.

VI. THE TASK AREAS OF THE EA FUNCTION

Finally, to indeed fill in a competence matrix for enterprise architects, as discussed in Section II, the results of the second Survey were used on the *Competence* axis of the matrix (see Figure 8). In a workshop with the participants of the GEA programme, the task areas of the enterprise architecture function were identified. The processes and products as already identified in the GEA results [7] formed the basis for this identification. During the workshop, the GEA processes and products were clustered using the

Metaplan technique [16]. This resulted in five key task areas: *initializing & mobilizing*, *advisory*, *frameworking*, *maintaining* and *governance*. These task areas are illustrated in Table VI. These results are used to fill in the *task areas* of the competence matrix (see Figure 8).

TASK AREAS	
PROCESSES	PRODUCTS
Initializing & mobilizing	
Organising sessions	Enough sessions and a high attendance for realizing enterprise coherence framework
Inventory of cohesive elements	All cohesive elements with appropriate depth
Set up enterprise coherence framework	Coherent enterprise coherence framework, consistent, supported
Advisory	
Integral coherence analyses	Relevant relationships between perspectives, core concepts, etc.
Integral solutions major business issues	Integral solutions including choices of approach
Strategy fit analyses	Strategy impacts
Frame working	
Programme start architectures	Programme Start Architectures and affiliation with derived Project Start Architectures
Aspect and domain architectures	Relevant sub, domain and aspect architectures
Programme- and project evaluation	Assessment Reports regarding Program Start Architectures
Grant permission	Start Licenses Programme phases
Maintaining	
Enterprise coherence framework actualisation	Releases enterprise coherence framework
Governance	
EA-plan	Enterprise Coherence Development plan, EC annual plan and EC detailed plans
EA-check	Enterprise Coherence Progress reports, Enterprise Coherence Audit reports
EA-act	Decision Enterprise Coherence Change report

Table VI
TASK AREAS

With the two dimensions of the competence matrix in place, we are now ready to indeed fill in the matrix in terms of the relative weight a competence has towards the different tasks. In other words, the extend to which a selected competence is important to a task area. This is why, as can

be seen in Figure 8, the columns in the matrix add up to 100%. A high value indicates a strong correlation between the competence and the task area. Correlations with a score higher than 15% have been highlighted. To arrive at these correlation values, all participants in the workshop were asked to distribute five points per competency to the task areas.

Reading the figure in horizontal direction, the matrix shows for example that the tasks *Organising sessions*, *Integral solutions major business issues* and *Strategy fit analyses* require the most of the high ($\geq$ 15%) scoring competences. In a vertical direction one can for instance be read that 19% of the *Organizational sensitivity* competence is allocated to the task area *Integral coherence analysis*. Other competences, such as collaboration and persuasiveness are more evenly distributed over the task areas.

The resulting enterprise architecture competence profile can among others be used to:

- select the right people to participate in an enterprise architecture function,
- support potential candidates in their development process into a role within this function and
- clearly identify, and scope, different roles within the enterprise architecture function.

With regards to the last point, the GEA programme actually suggests the organization of the enterprise architecture function as shown in Table VII.

Task area	Role	Responsibility
Governance	EA manager	Enterprise architecture function
Advisory	EA strategist	Strategic advice
Initializing & mobilizing	EA Designer	Enterprise Coherence Framework Design
Frameworking	EA Programme-Architect	Architecture compliancy
Maintaining	EA Administrator	Actual Enterprise Coherence Framework

Table VII
ORGANIZATION OF THE EA FUNCTION

VII. CONCLUSION AND RECOMMENDATIONS

In this paper we focused on the competencies needed from enterprise architects, while also relating this to the competencies required from information architect. The results presented in this paper are based on three surveys.

The surveys indeed confirmed there to be a fundamental difference in the competencies required from these two roles, in line with what we expected in terms of Figure 2 and 3. Many of the relevant competences are enclosed at the bottom of the competence iceberg [13] and are therefore not or difficult to learn. Therefore we dare to claim that an information architect with additional training does not necessarily make an enterprise architect.

The surveys also stressed the fact that *the* all-encompassing enterprise architect does not exist. One should rather think of it as an enterprise architecture function, involving different roles (as suggested in the previous section). When looking at the plethora of required competencies, it is also not reasonable to expect a single person to excel in each of these. We therefore find it more realistic to see an enterprise architect as functioning in a particular role.

The enterprise architecture competency matrix provides starting points to:

1) select the right mix of people needed to develop an enterprise architecture function,
2) support potential candidates in their development process into a role within this function and
3) identify and scope the roles within the enterprise architecture function.

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COMPETENCES / Task areas	Knowledge & Insight	Subject knowledge	Branche knowledge	Relevant work experience	Academic think & work level	Attitude	Result driven	Organisational sensitivity	Flexibility	Ambition	Professional integrity	Stress resistancy	Service oriented	Visionary	Skills	Planning & Organisation	Networking	Collaboration	Management	Decisiveness	Communicative	Work independence	Persuasiveness	Effective judgement	Creativity	Analytical ability
Basis score Enterprise Architect	12,2	2,2	5,9	1,2	2,9	30,7	3,4	14,6	1,0	0,2	4,9	0,0	1,1	5,5	45,3	0,2	5,5	3,1	0,4	4,7	8,5	0,0	8,3	4,2	3,3	7,1
Percentile score	13,8	2,5	6,7	1,4	3,3	34,8	3,9	16,6	1,1	0,2	5,6	0,0	1,2	6,2	51,4	0,2	6,2	3,5	0,5	5,3	9,6	0,0	9,4	4,8	3,7	8,0
Initialising & mobilising																										
Organising sessions		0	0	18	3		10	17	23	10	2	29	18	2		32	32	7	15	3	17	0	10	2	5	0
Inventory of cohesive elements		5	15	2	7		2	5	5	3	7	4	0	5		0	13	12	2	5	15	7	0	8	7	10
Set up enterprise coherence framework		12	7	8	10		7	7	11	14	15	4	0	22		0	7	10	2	13	13	10	3	5	25	8
Advisory																										
Integral coherence analyses		10	22	5	28		0	19	4	5	10	4	7	13		0	7	15	0	0	8	5	15	12	10	20
Integral solutions major business issues		7	18	8	15		8	14	7	5	7	11	15	18		2	5	10	2	5	12	7	12	15	13	18
Strategy fit analyses		7	22	10	17		5	17	7	15	10	9	9	20		0	5	3	2	2	12	7	13	23	12	17
Frameworking																										
Programme start architectures		20	3	5	8		22	5	7	7	11	5	9	5		2	7	13	2	15	8	8	13	5	8	12
Aspect and domain architectures		18	7	10	7		7	2	4	3	3	5	7	7		2	3	12	5	2	2	18	10	7	10	8
Programme- and project evaluation		2	0	5	0		7	0	4	8	7	7	7	2		2	7	3	2	7	5	13	7	10	0	5
Grant permission		2	2	0	0		3	3	4	3	8	5	7	0		2	3	0	5	22	2	0	5	2	0	0
Maintaining																										
Enterprise coherence framework actualisation		13	0	5	0		5	2	5	2	2		18	0		8	0	7	7	2	0	13	2	2	5	0
Governance																										
EA-plan		0	5	10	0		12	5	11	19	2	5	0	7		31	3	3	25	7	2	7	3	0	3	2
EA-check		3	0	5	3		7	0	4	0	7	4	0	0		7	3	2	12	7	3	3	0	8	0	0
EA-act		2	0	8	2		7	5	5	5	11	7	2	0		14	5	3	20	12	2	3	7	2	2	0
		100	100	100	100		100	100	100	100	100	100	100	100		100	100	100	100	100	100	100	100	100	100	100
Number of competence >10%		4	4	1	3		2	4	3	4	3	2	3	4		3	2	4	4	4	5	3	4	3	3	4
Biggest		20	21,7	18,3	28,3		21,7	18,6	23,2	18,6	14,8	28,6	18,2	21,7		32,2	31,7	15	25,4	21,7	16,7	18	15	23,3	25	20

Figure 8.   Enterprise Architecture Competence Profile

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