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Articles

Case Study

Trends in Governmental Enterprise Architecture: Reviewing National EA Programs

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Abstract
The article is the first in a series of three, where we will analyze and evaluate governmental enterprise architecture policies and practices in an international perspective. This first article presents the overall findings from an international study, we have made about governmental EA, and introduces an evaluation and assessment methodology. In the forthcoming articles, we will present an evaluation of selected government's EA maturity in a comparative perspective, and discuss the usage of maturity models in policy assessment. The third article will present the findings from a 2007 international benchmarking study of more than 20 governments around the world.

INTRODUCTION

More and more governments around the world are working with enterprise architecture (EA) on a national/federal level to promote cross governmental collaboration, strengthening business and IT alignment, and making their e-government efforts more valuable to citizens, business and the administration itself.

This trend reflects that more and more processes in the modernizing public administration are supported by information technology. Where information technology in the early days mostly was a supporting tool, information technology has now emerged to be an important strategic tool for most public and private enterprises. This can be seen by the fact that almost 50% of the capital expenditures in companies in the US are investments in information technology (Carr, 2003), and governments around the world are also investing heavily in information technology.

Information technology is a success, but as every success, it has a downside. A myriad of classic problems relating to the use of information technology have through the years been responsible for headaches at all levels of the enterprises. We have seen many failed or less successful technology investments, but fortunately, also seen how information technology used right can help transform government and help unlocking public value (Cole & Parston, 2006). Some of the challenges of today's enterprise are to make the right decisions in an environment paralyzed by the lack of coherence between the business and its supporting information technology. Information technology is an integrated part of the business, and it is obvious that it has to be managed as such (Herzum, 2003).

According to the Institute for Enterprise Architecture Developments, EA has been ranked among the most important issues considered by CIOs and CTOs in a consecutive surveys conducted over several years (Schekkerman, 2003, 2004, 2005).

FOCUSING IN ON EA

One of the earliest efforts to establish awareness about the EA concept was done through the frameworks, which described the generic elements of an enterprise. One of the originators was Zachman and his framework

introduced in its first version in 1987. Other frameworks have been described by e.g. Schekkerman (2004) and Bernard (2005). Since 1987 a number of different literature categories relating to EA have seen the light, e.g. EA process literature, often described by the governments, e.g. by the CIO council (2001), The Danish Ministry of Science, IT and Innovation (2003, 2004), by academics e.g. Bernard (2005), Carbone (2004), Armour, Kaisler, Liu (1999) and commercially, e.g. by the Object management Group (2003).

As a consequence of the rather large number of processes and frameworks, a part of the EA literature addresses measurement theory, both covering maturity models, e.g. as described by the US Office of Management and Budget (2005), the US General Accounting Office (2003), Herzum (2003) and tool for applying value measures, e.g. as described by Rico (2005).

Very few of the established EA processes and frameworks provide guidelines addressing specific techniques to describe an EA, e.g. how to describe processes, information, functional requirements etc. Hence this subject is often handled in separate literature not specific to EA, but more focused on, as an example, actual systems development or business process reengineering. This includes descriptions of the Unified Modeling Language (UML) (e.g. by Booch, Rumbaugh & Jacobsen, 1998; Cheesman & Daniels, 2001), descriptions of the Business Process Modeling Notation (BPMN) (e.g. by Owen & Raj, 2003; White, 2004) and several other techniques, as an example older structured techniques (e.g. described by Yourdon, 1989; Demarco, 1979) and specific techniques to model information e.g. Entity-/relation diagrams and resource description language (Jensen, 2004) just to mention a few. An effort has been done to describe a language for describing EA, e.g. by Jonkers, Buuren & Lankhorst et. al. (2003) and Armour, Kaisler, Getter & Pippin (2003).

Probably due to the absence of one single agreed-upon definition of the EA concept (Schekkerman, 2004; Ross, 2003; Rood, 1994), a number of authors have done an attempt to explain which elements the EA concept consist of, e.g. Mayo & Tiemann (2005), Hoogervorst (2004), Baker & Janiszewski (2005), Stevenson (1996), Kaisler et. al. (2005) and Herzum (2003).

SURVEYING EA

Research based upon collecting and analyzing information about actual EA activities has been very meager. One of the few studies that have been conducted addressing international EA activities is Schekkerman in 2003, 2004 and 2005 (Schekkerman, 2003/2004/2005). He collected information about EA activities, addressing tools, branches, geographical aspects etc. The surveys address both governmental- and non-governmental organizations with the majority of the respondents being represented by private organizations. However, the mentioned surveys ignore the *level aspect*; it is unclear whether the governmental respondents are answering from a national-, regional-, municipal-, departmental- or agency level.

Schekkerman's surveys are, seen from an academic point of view, insufficient with regards to documentation. In light of the unsatisfactory documentation it is impossible to state anything conclusive about the surveys' reliability as well as validity. This academic imperfection however, is believed to be very common in commercial studies.

In 2005, Infosys conducted a survey among 45 CIO's, Enterprise Architects and Heads of EA, about the key concerns, focus areas, approaches etc. in EA (Infosys, 2005). The survey is not as full as Schekkerman's and it is unclear whether the respondents are from governmental or private organizations.

In 2004, Nascio publicized a report describing the result of the NASCIO EA Readiness Assessment Program (Nascio, 2004). The objective of the Assessment Tour was to facilitate the evaluation of US enterprise architecture programs and through this create opportunities for collaboration among the states in the US. The information was collected through, primarily, on-site visits in the twelve participating states. The result is a short summarization of the on-site recordings, which gives a good overview of the EA status in the U.S..

In 2002 the United States General Accounting Office (GAO, 2002) publicized a report describing the EA maturity of 116 US government agencies. The analysis was based on the agencies self-reported management

information, and concluded that the EA, at an agency level, was a work in progress and limited according to the introduced five-step maturity model (GAO, p. 14 -15, 2002). One of the factors indicating the overall maturity of the agencies was the agency leaders that have failed to understand the purpose and value of EA. GAO has subsequently followed up with more maturity assessments, which shows a steady but rather slow progress in the majority of agencies (GAO, 2004, 2006).

For our purposes, it is noted that none of the mentioned studies does an effort to create a comprehensive overview of the international EA activities on a national level. However, we are aware of prior work in this area. Recognizing that a single comprehensive overview of the international developments in EA did not exist, at least not within the governmental domain, an international study group was founded in 2003 by The International Council for Information Technology in Government Administration, ICA (http:/www.ica-it.org). The study group consisted of EA competencies from ten ICA member countries, and one of the present authors (John

Gøtze) acted as the group's chairman. Through 2003 and 2004, the study group gathered and shared with the ICA community a lot of information about the national EA activities in the ICA member countries.

We are grateful for the fruitful collaboration with many ICA members in conducting this survey, which in many ways follows-up on the ICA work. However, this survey is not limited to ICA-member countries, nor is it formally endorsed by ICA.

THE SURVEY

The objective of the survey was to obtain a comprehensive overview of the EA activities through a collection of data on how governments are working with EA on a national level.

Sixteen governments participated in the survey, which was conducted in January-April 2006. The governments, reporting organizations and the ministries responsible for the governmental EA programs, are listed alphabetically in Table 1.

Table 1: The participating governments

Govern-ment	Answering organisation	Responsible ministry
Canada	Enterprise Architecture and Standards Division, Chief Information Officer Branch,	Treasury Board of Canada Secretariat
Denmark	IT and Telecom Agency	Ministry of Science, technology and innovation
Estonia	Ministry of Economic Affairs and Communications, Department of State Information Systems	Ministry of Economic Affairs and Communications
Finland	State IT Management Office	Ministry of Finance
Hungary	Prime Minister's Office	Prime Minister's Office e-Gov. centre
Japan	Government Information Systems Planning Division, Administrative Management Bureau	The Cabinet Office and Ministry of Internal Affairs and Communications
Korea	National Computerization Agency	Ministry of Information & Communications - public organizations Ministry of Government Administration & Home Affairs - Central & local Government
Netherlands	Ministry of Interior	Ministry of the Interior
New Zealand	State Services Commission	State Services Commission and Ministry of Economic Development have complementary leadership roles
Northern Ireland	Northern Ireland eGovernment Unit	Department of Finance & Personnel
Singapore	Infocom Development Authority of Singapore	Ministry of Information, Communication and the Arts (MICA)
Sweden	Swedish Administrative Development Agency	Ministry of Finance
Switzerland	Swiss Federal Unit for IT	Department of Finance
Taiwan	Research, Development and Evaluation Commission, The Executive Yuan	Research, Development and Evaluation Commission, The Executive Yuan
United Kingdom	Cabinet Office	None
USA	General Services Administration	Office of Management and Budget

RESEARCH METHOD

The survey was performed through collaboration between the IT University of Copenhagen, Copenhagen Business School and the Association of Enterprise Architects (a|EA) and conducted through the following five phases:

    Phase 1: Literature Review

    Phase 2: Instrument Preparation & Pre-Test

    Phase 3: Instrument Distribution

    Phase 4: Interviews

    Phase 5: Data Analysis

In Phase One, a comprehensive literature review was performed to identify the generic elements of the EA concept. The result of the review was a list of seven generic EA elements that was used as the dimensions of relevance to this survey. Subsequent to identifying the dimensions of relevance, a survey instrument was designed and formally pre-tested by three test respondents, and revised accordingly (cf. the second phase). In Phase Three, the survey instrument was distributed by mail to twenty-seven governments, of which 16 (59.2%) replied. In Phase Four, twelve governments (75%) were contacted by mail with further questions relating to the reported survey answers. The national representatives, contacted in phase four, were offered to answer the questions via an interview by phone or via e-mail. Eight governments (50%) responded in the fourth phase. In phase five the collected data was analyzed and summarized.

RELIABILITY AND VALIDITY

Factorial- and criterion validity was not calculated due to the small sample-size of this study. However, the content validity was optimized via the first and second phase of this study: A comprehensive literature study and a pre-test of the instrument, securing the coverage of the relevant domain of construct. The reliability of the distributed instrument was not calculated either, as the sample-size was too small for accurate measures.

SURVEY LIMITATIONS

One of the major barriers to the success of this study was the lack of agreed-upon definitions of the EA concept and a known discrepancy among governmental EA practices. Through an extensive literature study, we established a model of the generic elements of EA, which should enable respondents to "map" their understanding of and practice with EA into the survey model. We find that the survey instrument had a high standard, where the majority of variables were clearly formulated. Based on reported answers, the few imperfections have not had any consequences regarding the reliability of survey results.

FINDINGS

The survey documented that EA is an established discipline within the governmental domain at the national level. 67% of governments already have national EA programs, and with those that plans to have one within one or two years it sums up to 93.3% of the governments. In fact, only one government does not have any future plans incorporating a national EA program, which indicates that the participating governments have a huge focus on EA from the national level. This survey was documented in a scientific report as well as a presentation report (see easurvey.org).

EA GOVERNANCE

Eighteen percent of the governments have chosen to mandate their EA programs via legislation. Forty-six percent of the responding governments reported that their EA programs, and related guidelines, are populated as a proposed practice. Thirty-six percent of the governments reported 'Other', e.g. "The technical architecture is mandated by policy", "The program is not enforced", "Government act, government resolution, and "standing order".
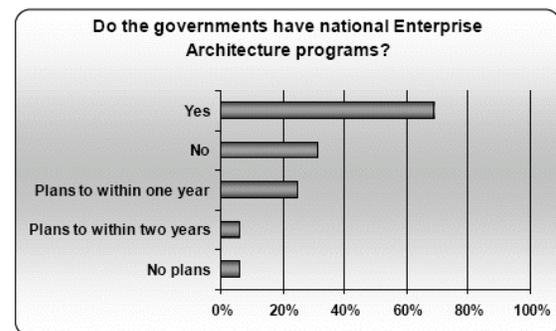

Figure 1. Status of Government EA Programs

With regard to the governance arrangements, a majority of the governments (62%) reported that they applied governance mechanisms on both centralized and decentralized levels, as is shown in Figure 2 below.

Characterisation of the governance arrangements in the governments

Centralised

Decentralised

Both decentralised and centralised

Other

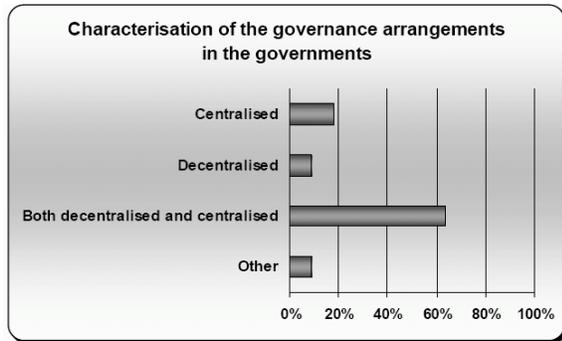0% 20% 40% 60% 80% 100%

Figure 2. EA Governance Characterization

EA GOALS

Even though more than half the respondents already have national EA programs the business drivers towards EA differs enormously; while over 90% of the governments can agree on that the high-level motivation for attending an EA effort on a national level is to "Improve cross governmental interoperability"; very few have similar operational business goals. Some of the reported business goals were planning government IT strategies; eliminate redundancy and reduce the number of systems and platforms; and to reduce public sector IT expenses through a wide use of centrally developed solutions.

This indicates that the EA concept supports the achievement of a broad range of strategic goals and not only "an effort that leads to the definition of future projects" (Carbone, 2004) or "a management process for understanding the business" (Tuker & Aron, 2005).

BARRIERS IN ACHIEVING EA GOALS

The main barriers in achieving EA goals was reported to be "Lack of skilled staff and lack of top management support". 36% of the respondents reported other barriers, e.g. "Difficulties in getting agencies to collaborate and share across" and "There are only very few mandatory requirements to IT projects".

A large proportion of the reported barriers against the achievement of EA goals were well known barriers towards the success in, e.g. traditional systems development, identified 15 to 20 years ago. Barriers relating to top management support, difficulties in finding skilled staff, the need of specific guidelines, issues regarding integration, planning issues, proprietary technologies etc. are known as areas of great risk and have been so for many years, e.g. identified by Wallace (1999), Schmidt et. al. (1996 & 2001), Barki et. al. (1993), Wallace & Keil (2004), Moynihan (1997), Boehm (1991).

Main barriers in achieving national EA goals

Lack of top management support

Lack of skilled staff

Funding

Lack of resources

Political barriers

Lack of proper guidelines (e.g. EA process and framework)

Cultural barriers

Other

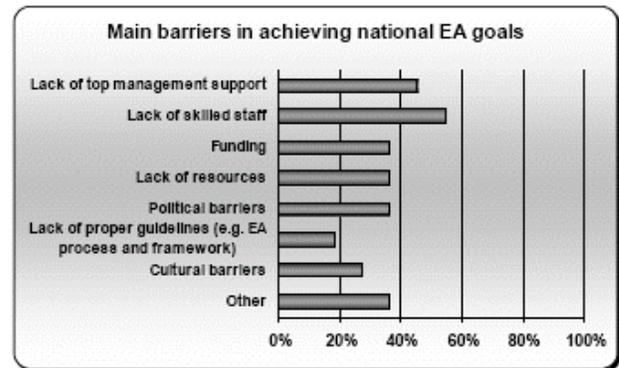0% 20% 40% 60% 80% 100%

Figure 3. Barriers to Achieving EA Goals

The fact that a prerequisite for conducting EA successfully requires skilled staff should not come as a surprise to anybody. However, based on reported answers, it seems it does.

MEASUREMENT

Figure 4 below shows that forty-five percent of the governments with national EA programs are measuring EA program performance. Similarly, forty-five percent report that they have (and use) key performance indicators (KPI's) in their work with the national EA programs.

Do the governments measure EA performance
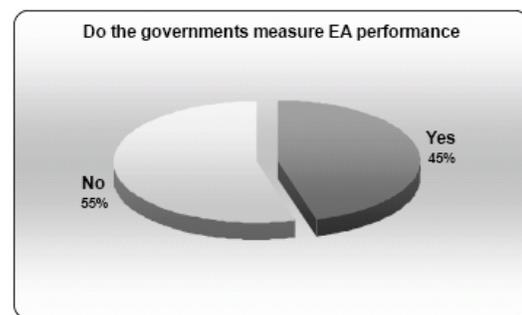
Yes
45%

No
55%

Figure 4. Government's Measuring EA

Being able to measure, in the meaning of having the skills and capability to measure, is essential at all stages of the EA adoption. To measure EA program performance is a capability that is rated as maturity-level two, according to the EAMMF maturity model (GAO, 2003).

Rico (2005) stresses that many organisations are irresponsible when it comes to keeping track of EA expenses. Generally, Rico argues, measuring return on investment is necessary for enterprise architecture, and establishing measurable goals and objectives is necessary for measuring return on investment, and in that way successfully applying enterprise architecture *and* return on investment is necessary to get payback from enterprise architecture (Rico, 2005).

We found that only 18% of the governments with national EA programs are doing an effort to measure the total expenditures in EA, the total amount gained from EA and the ratio EA benefits to cost. This fact is a clear indication of low maturity in the EA work at a national level.

EA PROCESSES, FRAMEWORKS & TOOLS

The development and publication of formally defined EA frameworks and -processes is happening at the national level. In this survey EA frameworks and –processes was defined in the following way: An EA framework is an instrument that, either very concretely or more conceptually, can be used to categorize and relate information that needs to be captured about an organization to understand relevant aspects of it. An EA process describes, either in very concrete or conceptual terms, how an organization already are, or potentially could, create and maintain an EA. The EA process has two main goals: to describe a baseline EA; and-/or to describe a target EA (Bernard, 2005).

We found that 82% of the governments have publicized EA frameworks at the national level and 73% have publicized EA processes. However the level of detail is varying; some governments have delivered processes and frameworks that are described at a high level whilst other have published detailed material covering different aspects.

The one-to-one adoption of formally described frameworks and processes have been meager, instead more than one third of the respondents have based their publicized processes and frameworks on existing and well-known material, e.g. TOGAF, Zachman, FEAF and approaches developed by different vendors.

An EA tool is seen as a tool that helps the enterprise in modeling, storing, managing and sharing information about the enterprise. EA tools can be segregated in two main categories: (1) EA repositories; and (2) EA modeling suites. We found that 36% of the governments are suggesting the use of specific EA tools (e.g. from Telelogic, Adaptive, and Troux). Other non-EA specific tools are also suggested by the governments, e.g. presentation, word-processing, spreadsheets, project management tools and so forth.

CONCLUSIONS FROM THE SURVEY

We found in this study that EA is a fast emerging discipline within the governmental domain, but generally, not very mature.

-*EA is a fast emerging discipline* because 93.3% (15) of the respondents are already having - or is planning to have - a national EA program within the next two years. Only one of the participating governments reported not having any future plans incorporating a national EA program.

-*The international maturity level is found to be on the early stages* because the majority of the governments lack clearly defined and measurable goals, and furthermore a very limited effort is done to measure EA progress and value.

The national EA maturity on the governmental level is found to be on the very early stages compared to common maturity frameworks. We do acknowledge that much can have changed since we collected our data about a year ago, and do plan to collect fresh data, but we also think that the progress made does not radically change the overall picture. That is why we will conclude this article with a set of general recommendations to governments about their EA work.

Principles for Better EA

The following eight principles mirror pretty much the harsh truth of the national EA programs; the governments need to adopt some "common-sense" principles as part of their EA work to achieve a higher degree of maturity, and through that achieve a higher degree of EA goal realization.

1. Define clear and measurable EA goals
The EA programs around the world, and the authors of EA literature for that matter, are not good enough at defining EA goals. There is a tendency towards the establishment of an unwritten rule describing, when an EA goal is mentioned is has to be pre- or post-fixed by the word "interoperability", and furthermore be utterly unclear and open to interpretation by anybody.

Lesson: If you do not want to waste your companies, or even worse, the money paid by honest citizens and companies in a country, define clear and measurable goals.

2. Do not uncritically buy the vendors "Ten steps to successful EA" and expect the world to change in any advantageous direction
No individual, organization or government have ever been exactly alike, which is why one size seldom fits them all. The same principle applies to the EA work; no such thing as "Ten steps to successful EA" fitting all purposes, exists. To blindly believe that completing the same ten steps as a company to which you have no similarities, automatically will generate value, is at best optimistic. Organizations are different, and have different needs. Accordingly, the different needs of an organization have to be taken care of with different tools. A prerequisite for the solution of any kind of challenge will always be to identify the challenge prior to the solution.

Lesson: Define your EA goals before you choose your tools.

3. Do not isolate an EA team and expect them to generate value-adding EA
An EA effort, regardless of purpose, is an endeavor affecting whole organizations and governments. An EA effort might be governed centrally, but an EA can seldom be created centrally. An EA effort is recognized by effecting organizations, where existing processes are adjusted to accommodate the achievement of new goals. Thus, the success of an EA effort is dependent on people who are not in the EA team, and that has to be taken into consideration, because often, they are the value-creating elements.

Lesson: Be visible and ready to document that participating in an EA effort is worth the effort. Secure strong stakeholder commitment through workshops, education, road-shows, reporting, etc.

4. Measure EA performance to ensure progress and ultimately EA success
Alarmingly, less than half of the participating governments in this survey are measuring EA program performance. This is a tendency that is expected to apply to many local EA initiatives as well. The EA practitioners have to understand, that EA will, at its best, provide a minimum of incidental value, if measures are not used. Most EA efforts are considerable efforts with many man-years of resources involved. It is our duty, as EA practitioners, to ensure that these resources are used in an efficient manner, which can only be done via the use of measurement.

Lesson: If the EA discipline is going to be confirmed as an established discipline, we all have to document its value. Consequently, if we want enterprise architects to be a part of the future landscape, we should start measuring the value of EA and communicate it.

5. Calculate EA expenses-/earnings; it becomes necessary
The time will come, also within the field of EA, where it is required to document the results of an effort. The top management will not just be satisfied with trivial reports telling that something abstract in relation to "interoperability" have been achieved; they want reports in a terminology they understand, the monetary terminology.

Lesson: Focus on the "bottom line".

6. Do not make the mistakes of the past....
Looking at the barriers against the achievement of EA success collected in this study, it is clear that organizations are having many of the same

major challenges as projects in the past. We have found that many organizations are attending EA efforts almost single handed, as they all think that they are doing something unique that has never been done before, which seldom is the entire truth:

1. EA programs can be seen as ongoing projects, hence the piles of best practices that applies to project completion does apply to EA efforts as well.

2. EA is a fast emerging discipline, especially on the national level, but also at the local level. There are no reasonable arguments promoting the reinvention of the wheel or reasons to make the same expensive mistakes already made by others.

Lesson: International experiences are being made within the field of EA. Learn from them; in the long run it will save you time and money. Remember: You are not a pioneer when attending an EA effort!

7. Use an EA tool, but remember: The most expensive might not be the best suitable

Basically, EA is about handling knowledge, in the sense of registering, accessing, managing and searching knowledge. But knowledge is complex, and the use of text editing and presentation tools alone have proven to have limitations with regards to their abilities to structure knowledge in an efficient manner. In any larger EA effort, with the purpose of describing a target architecture or document a slice of the *real world*, an EA specific tool is highly recommended.

Lesson: Use a suitable EA tool, to avoid ending up with 10.000 pages of EA no one can use, because no configuration management has been applied, no relations exist between the different documents, 20% of the documents are located at local clients, no consistency exists, etc. However, remember the most expensive might not be the best suitable.

8. Focus your EA governance

To ensure the optimal use of EA resources, we have to acknowledge the dissimilarities in the different local entities that are part of a national EA effort. As illustrated in fig xx**Error! Reference source not found.**, there are different segments of governmental entities, and each segment will have their prerequisites for participating in a national EA effort and should be treated accordingly. A number of questions must be answered: Why use resources on entities that are willing to do EA and capable of it? Why bother controlling entities that are willing, but just need some guidance? Why guide entities that are not interested in parting in any EA effort, when enforcement is needed?

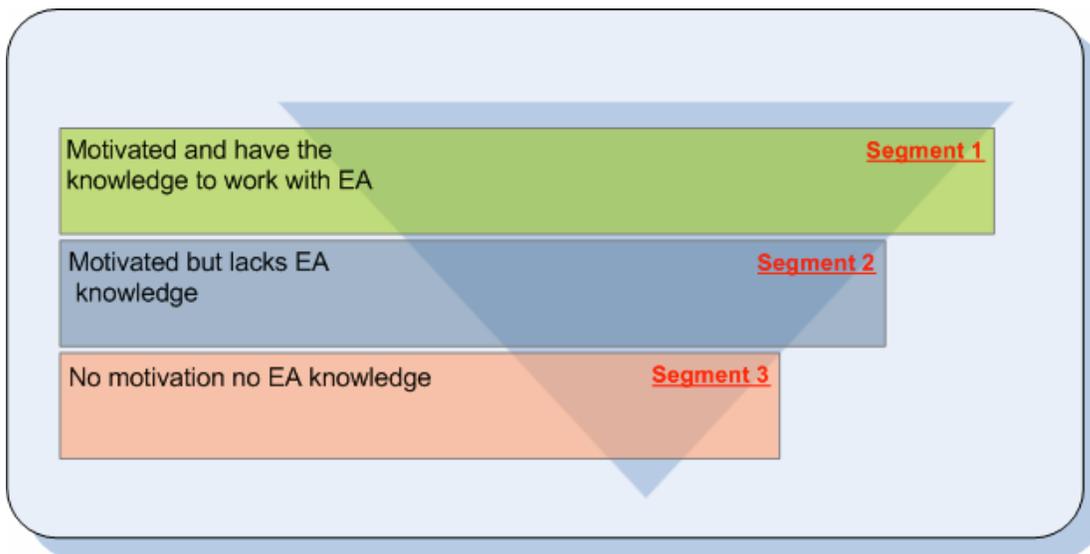*Lesson: Focus your governance effort where it gives the most value.*

Figure 6. The Relationship of Motivation and EA Knowledge

CONCLUDING REMARKS

In this article we have presented the overall findings from an international study about governmental EA. Our aim with the survey has not only been to gain insight into the international development in governmental EA, but also to develop and use an evaluation and assessment methodology for international benchmarking.

In two forthcoming articles, we will expand on this. In the next article, we will present an evaluation of selected government's EA maturity in a comparative perspective, and discuss the usage of maturity models in policy assessment. The third article will present the findings from a 2007 international benchmarking study of more than 20 governments around the world, which is being carried out over the coming months.

We are convinced that there is much to gain from comparing and benchmarking governments' work with EA. In the same way that our societies and technologies go through a globalization process these years, so must governmental EA. The discipline of EA knows no boundaries, and neither should those that work with EA in government.

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REFERENCES

Armour, F., Kaisler, S., Getter, J., and Pippin, D. (2003). A UML-driven Enterprise Architecture Case Study. IEEE Proceedings of the 36th Hawaii International Conference on System Sciences.

Armour, F.J.; Kaisler, S.H., Liu, S.Y. (1999). Building an Enterprise Architecture Step by Step. *IT Professional*, Vol.1 Issue.4, pp. 31-39, IEEE.

Baker, D., C. & Janiszewski, M (2005). 7 Essential Elements of EA, DiamondCluster International, Inc.

Barki, H.; Rivardi, S.; Talbot, J., (1993). Toward an Assessment of Software Development Risk. Journal of Management Information-Systems (Fall vol 10., No 2) pp. 203 – 225.

Bernard, S (2005). Introduction to Enterprise Architecture. Author House, Bloomington, IL.

Boehm, B. (1991). Software Risk Management Principles and Practices. IEEE (January)

Booch, G., Rumbaugh, J. and Jacobsen, I. (1998). Unified Modelling Language User Guide. Addison Wesley

Carbone, J. (2004). IT Architecture Toolkit. Enterprise Computing Series. Upper Saddle River, NJ, Prentice Hall PTR

Carr, N. (2003). IT Doesn't Matter, Havard Business School Publishing Corporation

Cheesman, J., & Daniels, J. (2001). UML components – A simple process for specifying component-based software, Addison Wesley

Chief Information Officer Council (2001). Federal Enterprise Architecture Version 1.0, Chief Information Officer Council

Cole, M. and Parston, G. (2006) Unlocking Public Value: A New Model For Achieving High Performance In Public Service Organization. Wiley

Danish Ministry of Science, Technology and Innovation (2003). Hvidbog om IT-arkitktur [Whitebook on Enterprise Architecture], Danish ministry of Science, Technology and Innovation

Danish Ministry of Science, Technology and Innovation (2004). Arkitektur for digital forvaltning. Håndbog om begreber, rammer og processer [Handbook on Enterprise Architecture], Danish ministry of Science, Technology and Innovation

Demarco, T. (1978). Structured Analysis and System Specification. Yourdon Press, New York

General Accounting Office (2002). OMB Leadership Critical to Making Needed Enterprise Architecture and E– government Progress, GAO

General Accounting Office (2003). A Framework for Assessing and Improving Enterprise Architecture Management (Version 1.1), GAO

General Accounting Office (2004) Information Technology: The Federal Enterprise Architecture and Agencies' Enterprise Architectures Are Still Maturing, GAO-04-798T, May 19, 2004

General Accounting Office (2006) Enterprise Architecture: Leadership Remains Key to Establishing and Leveraging Architectures for Organizational Transformation, GAO-06-831, August 14, 2006

Herzum, P. (2003). Applying Enterprise Architecture. Executive report, Vol. 6, No. 3, Cutter Consortium

Hoogervorst, J., A., P. (2004). Enterprise Architecture: Enabling Integration, Agility and Change, International Journal of Cooperative Information Systems, Date: 2004, Volume: 13 Issue: 3, p. 213 – 233

Infosys (2005). Infosys Enterprise Architecture Survey, Infosys

Jensen, H., (2004). RDF - Resource Description Language, SOA network

Jonkers, H.; Buuren, R.; V, Lankhorst M.M., et al. (2003). "Towards a Language for Coherent Enterprise Architecture Descriptions", 7th IEEE International Enterprise Distributed Object Computing Conference (EDOC 2003), 16-19 September 2003, Brisbane, Australia. IEEE Computer Society

Kaisler, S; Armour, F., and Valivullah, M., U.S. Capitol Police (2005). Enterprise Architecting: Critical Problems, Proceedings of the 38th Annual Hawaii International Conference on System Sciences (HICSS'05) - Track 8, p. 224b

Keil, M. and Wallace, L. (2004). Software Project Risks And Their Effect On Outcomes. Communications of the ACM (April/Vol. 47. No. 4) pp. 68-73

Mayo, D., & Tiemann, M. (2005). EA: IT's Not Just For IT Anymore. *Journal of Enterprise Architecture*. August 2005, Vol. 1, No. 1.

Moynihan, T. (1997). How Experienced Project Managers Assess Risk. IEEE Software, May/June

National Association of State CIOs (2004). NASCIO EA Assessment Tour Site Visit Report October, 2004.

Object Management Group (2003). MDA Guide Version 1.0.1, Object Management Group

Office of Management and Budget (2005). OMB Enterprise Architecture Assessment Framework Version 1.5.

Owen, M. and Raj, J. (2003). BPMN and Business Process Management Introduction to the New Business Process Modelling Standard, Popkin Software

Rico, D. (2005). A Framework for Measuring the ROI of Enterprise Architecture. http://davidfrico.com/rico05a.pdf

Rood, M. (1994). Enterprise Architecture: Definition, Content and Utility, The Mitre Organisation

Schekkerman, J. (2003). Trends in Enterprise Architecture, IFEAD

Schekkerman, J. (2004). Trends in Enterprise Architecture, IFEAD

Schekkerman, J. (2004). How to Survive in the Jungle of Enterprise Architecture Frameworks: Creating or Choosing an Enterprise Architecture Framework, Trafford Publishing

Schekkerman, J. (2005). Trends in Enterprise Architecture, IFEAD

Schmidt, R., Lyytinen, K., Keil, M., and Cule, P. (1996). Identifying SoftwareProject Risks: An International Delphi Study. Paper presented at the Proceedings of the 17th International Conference on Information Systems, Cleveland, OH, December 16-18 1996.

Schmidt, R.; Lyytinen, K.; Keil, K. & Cule, P. (2001). Identifying Software Project Risks: An International Delphi Study

Yourdon, E. (1993). Yourdon Systems Method: Model-Driven Systems Development, Yourdon Press (Prentice Hall)

Wallace, L. (1999). The Development of an Instrument to Measure Software Project Risk. Dissertation Submitted in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy

Zachman, J. A. (1987). A Framework for Information Systems Architecture. *IBM Systems Journal*.