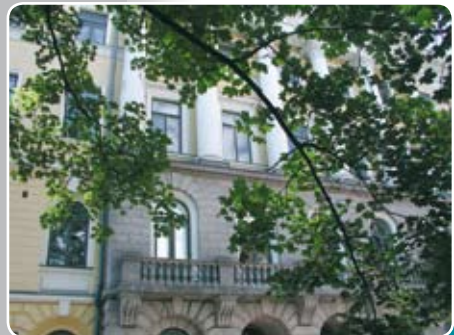# Overview of Enterprise Architecture work in 15 countries

Finnish Enterprise
Architecture
Research Project

FEAR-project

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MINISTRY OF FINANCE

Overview of Enterprose Architecture work in 15 countries

Finnish Enterprise Architecture Research Project

Fact sheet

Abstract

This research report is an overview of enterprise architecture work in 15 countries. The report supports the ongoing enterprise architecture work of Finnish government done by the Ministry of Finance in the Interoperability Development Programme.

Enterprise architecture describes how organisations´ information systems, processes, organisational units and people work as a whole. In state administration the ultimate goal of enterprise architecture is to produce better services for the citizens by rearranging separately developed information reserves and systems. At the same time enterprise architecture increases possibilities for cross public sector reuse, as well as reduces duplication and costs. For these reasons many countries have started to develop their enterprise architecture.

Enterprise architecture is developed in various ways. For the time being, holistic enterprise architecture work at the national level is a new approach. There are only a few countries that have proceeded into concrete enterprise architecture implementations. Some recommendations for the Finnish development work emerge from the review of enterprise architecture work in different countries. Key challenges in Finland are the successful commencement of enterprise architecture work and the introduction of a governance model. In the future it is important to specify the goals of the work and start measuring the benefits. Enterprise architecture is not only a tool for developing IT; it aims at comprehensive development of operations. For this reason, it is important to get the management and personnel to commit to the development work.

ACKNOWLEDGEMENTS

Contents

1 INTRODUCTION

Modernisation of public administration has often been initiated by launching projects to develop e-Government. These are often only partially coherent and cross-project coordination tends to remain lacking[1]. In order to enhance interoperability, to eliminate overlapping projects, and to support reuse, several governments around the world have established Enterprise Architecture programmes. According to one study, as many as 67 percent of governments have an EA programme and when adding countries that are planning on launching a programme within a year or two, the percentage increases to 93,3.[2]

An Enterprise Architecture (EA) explains how the information systems, processes, organisational units and people in an organisation function as a whole[3]. By identifying, structuring and categorising elements, Enterprise Architecture can increase the potential for cross-public sector reuse, reduce duplication, and thus lead to reduced costs[4]. Enterprise Architecture can function as an umbrella, which describes and explains the relationships between projects and helps in both system acquisitions and change management. Architecture models, principles and standards form the content of an Enterprise Architecture[5].

The field of enterprise architecture goes under various terms. Businesses often use the term enterprise architecture. In the governmental context, the same is referred to as national enterprise architecture (NEA)[6]. In the United States, the term is federal enterprise architecture (FEA)[7]. National enterprise architectures have also been called Governance enterprise architecture (GEA)[8]. In the enterprise architecture approach, public administration is viewed as a collection of heterogeneous organisations that have different business processes and information systems[9]. An enterprise architecture serves above all in ensuring systems' interoperability even if administrative branch-specific information systems are maintained. The need for an enterprise architecture becomes obvious when the number of information systems increases and service processes begin to require information exchange between authorities.

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1   Hjort-Madsen (2006)
2   Christiansen and Gotze (2007)
3   Morganwalp and Sage (2004)
4   Ministry of Government administration and reform (2006)
5   Janssen and Hjort-Madsen (2007)
6   Janssen and Hjort-Madsen (2007)
7   FEA (2002)
8   Peristeras and Tarabanis (2004)
9   Janssen and Hjort-Madsen (2007)

Policymakers initiate EA programs often to enhance productivity and the standard of service. Enterprise architecture programmes face challenges related to integration and interoperability within and between public agencies. Overcoming these challenges in government is difficult.10 Government structures often impede EA programmes from succeeding11. EA is irrelevant if it has not been implemented and used in public agencies12.

This overview describes and compares different countries' enterprise architecture programmes on an evaluation framework which helps to evaluate the contents, focus areas and perspectives of the enterprise architecture programmes in different countries. The goal is to support the development of the Finnish state IT function and, in particular, the enterprise architecture work of public administration carried out in the Interoperability Development Programme by evaluating this work in relation to foreign development.

E-government has been studied from several perspectives. The OECD[13] has published evaluations of different countries' e-government, and there are also reports that compare countries with each other[14]. Research on actual enterprise architecture activities has been scattered. Schekkerman[15] has studied the progress of EA usage in various organisations around the world. His surveys address both governmental and private organisations. However, Schekkerman's reports fail to specify whether respondents work, for instance, on the national, municipal, or agency level[16]. NASCIO[17] has published a report that gives an overview of the EA status in the United States. Since the year 2002, the United States Government Accountability Office (GAO) has published several reports on the assessment of agencies' EA maturity. In the year 2002, they gathered benchmark data on 116 departments, component agencies, and independent agencies in the United States[18]. Reports have shown that the progress in EA is slow in the majority of the agencies[19]. Perhaps the most comprehensive study on international EA activities has been conducted by Christiansen and Gotze[20]. The objective of their survey was to obtain a comprehensive overview of EA activities. They collected data on how EA work is being done on a national level. Unfortunately, they do not report their results by country. This report complements the studies presented above by reporting on different countries' enterprise architecture work through an extensive evaluation framework.

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10   Hjort-Madsen and Burkard (2006)
11   Hjort-Madsen and Gotze (2004)
12   Janssen and Hjort-Madsen (2007)
13   see e.g. OECD, 2003, 2005a, 2005b
14   Accenture (2006), Cap Gemini Ernst & Young (2003), Dalziel (2004), Ronaghan (2002), United Nations (2003, 2005)
15   Schekkerman (2005)
16   Christiansen and Gotze (2007)
17   NASCIO (2004)
18   GAO (2002)
19   GAO (2004) and GAO (2006)
20   Christiansen and Gotze (2007, first reported in Christiansen (2006) and Christiansen and Gotze (2006)

International studies on national enterprise architectures and general knowledge on the EA activities of different countries is scarce. Nevertheless, there are countries with noted EA programmes. These include, for example, the Great Britain, Canada, Germany and the United States.[21] The United Nations (UN) has done an extensive comparative study in 2005 on the readiness of its 191 member states to e-government. According to this study, the United States ranks first, Denmark second, Sweden third, and the Great Britain fourth.[22] Readiness for e-government seems to be connected to the potential to adopt a national enterprise architecture. This is why the 15 countries in this report rank among the top 20 in the UN study. Australia, Ireland, Iceland, the Republic of Korea and Singapore have been excluded to prevent the report from expanding excessively. However, including 15 countries from around the world is intended to assure sufficient geographical scope.

Christiansen has divided countries based on the maturity of their EA programmes. According to him, out of the countries covered in this report, Sweden, Finland and New Zealand have low maturity. Low maturity means that the countries have only just realized the potential of EA work. The intermediate group consists of the Netherlands, Great Britain, Japan, Canada, Switzerland, Denmark and Estonia. The United States have been defined high maturity. This means that the country's EA programme is in extensive use and several set objectives have been met.[23] Christiansen's study is missing Belgium, Austria, Norway and Germany out of the countries included in this report.

The report is organised as follows. Chapter two presents the comparative framework which is used in evaluating the enterprise architecture programmes of different countries. Chapter three presents enterprise architecture work in Scandinavian countries and chapter four the rest of Europe. Chapter five discusses North American enterprise architecture work and chapter six other non-European countries. Chapter seven presents conclusions based on a comparison of different countries' enterprise architecture programmes. The eighth and final chapter gives recommendations for Finnish enterprise architecture work.

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21 Christiansen (2006)
22 United Nations (2005)
23 Christiansen (2006)

2   EVALUATION FRAMEWORK

An evaluation framework is used in this report to compare the enterprise architecture work in different countries. The framework is based on Janssen and Hjort-Madsen's[24] framework of five viewpoints: 1) policies, actors and structures, 2) governance, 3) architecture frameworks and methodologies, 4) architecture principles and standards, and 5) implementations. We specified the content of the viewpoints and added two new ones, which are 1) reported benefits of NEA work and 2) evaluation of national EA work based on observations. The extended framework used in the report is presented in Table 1 In the following, we describe the framework in more detail.

Table 1. The evaluation framework (adapted from Janssen and Hjort-Madsen, 2007)

Viewpoint	Explanation
1. Policies, actors and structures	Political and environmental drivers for NEA. The strategic objectives for architecture are provided by political actors and constrained by democratic structures.
2. Governance	NEA's governance model and practices that are needed for keeping the architecture up-to-date. Governance guidelines also encourage desired behavior.
3. Architecture frameworks and methodologies	Definition of the NEA, framework used and architecture process.
4. Architecture principles and standards	Standards, principles and guidelines used for implementation, and change management. Compatibility with international models (e.g. EIF and FEA)
5. Implementations	NEA implementations and cross-public sector projects.
6. Benefits	Benefits of the NEA work and their measurement, experiences from NEA work and its usefulness.
7. Evaluation	Special characteristics and advantages/disadvantages of the NEA work.

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24   Janssen and Hjort-Madsen (2007)

2.1   Policies, actors and structures

This viewpoint encompasses the environmental and political drivers for an EA. The strategic objectives for architecture are provided by political actors and constrained by democratic structures.[25] Governments have different goals for their EAs. According to one study, as many as over 90 percent of the governments report that their motivation for EA work is improving cross-governmental interoperability. On the other hand, very few governments have corresponding operational or financial objectives.[26] Only 30 percent of the governments with NEA programs are able to report clear quantitative goals in relation to their NEA effort[27].

The advantage of an NEA programme is that it can be built according to the strategic goals of the government, but this requires for both short term and, in particular, long term goals to be defined[28]. The key to a successful NEA programme is a road-map describing the steps to achieve the short term goals[29]. NEAs can be guided and promoted at the political level or by public managers. In practice the structures, resources, and readiness for change of public administration determine the way NEA programs can be designed, disseminated and adopted.[30]

2.2   Governance

Architectures evolve over time and consequently governance structures and mechanisms are needed to guide and encourage desired development. According to Christiansen and Gotze, 18 percent of governments have legislation to mandate their NEA programs and thus form the premise for governance. Altogether 46 percent have reported that their NEA programs produce best practices[31].

If the EA lacks governance, it will fail to keep up with, for instance, the development of information systems. Many of the barriers hindering the achievement of NEA goals are the same as in traditional systems development. These barriers are often related to top management support, planning issues, or technical and technological problems etc.[32] Governance models have a central role in managing this kind of risks.

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25   Janssen and Hjort-Madsen (2007)
26   Christiansen and Gotze (2007)
27   Christiansen (2006)
28   Christiansen (2006
29   Ashmore et al. (2004)
30   Janssen and Hjort-Madsen (2007)
31   Christiansen and Gotze (2007)
32   Christiansen (2006)

2.3   Architecture frameworks and methodologies

An architecture framework helps to organise descriptions and interrelations of the structural components, information and information systems as well as technical platforms of an architecture. The architecture method includes the framework, the process, ways of modelling, definitions and the governance model. Architecture models have been discussed in greater detail in the Architecture model report published by the Ministry of Finance.[33]

According to one study, 82 percent of the governments have published NEA frameworks and 72 percent have formulated NEA processes, but the level of detail varies substantially[34]. The chosen models determine what aspects can be captured in the NEA and what level of abstraction is used[35]. Common architecture frameworks include, for instance, the Zachman[36] framework, FEA[37], TOGAF[38], E2AF[39] and EA Grid[40].

In this viewpoint, it is important to take into account the definition of enterprise architecture used, as different countries may have very different kinds of views on the content of a NEA. Some governments use the term NEA for dispersed e-government projects and some might have a narrow view of NEA by focusing on, for example, technology architecture.

2.4   Architecture principles and standards

Architectural principles and standards guide decisions that concern the governance model and the architecture. For instance, distinguishing general and common architecture from administrative branch-specific architecture is a principled decision of this kind, which also takes international standardisation into consideration. Correspondingly, current descriptions can serve as foundations for the implementation and transformation of existing NEA into the desired architecture.[41]

In this viewpoint, we want to emphasise compatibility with the international standards, such as the European Interoperability Framework (EIF)42 and the United States Federal Enterprise Architecture (FEA)43. International standards guide NEA programs, and for example EU member states should

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33   Pulkkinen, Valtonen, Heikkilä and Liimatainen (2007)
34   Christiansen and Gotze (2007)
35   Janssen and Hjort-Madsen (2007)
36   Zachman (1987)
37   FEA (2002)
38   TOGAF (2003)
39   E2AF (2005)
40   Hirvonen (2005)
41   Janssen and Hjort-Madsen (2007)
42   IDABC (2004a)
43   FEA (2002)

follow instructions given in the EIF in their own NEA work. International standardisation is in its infancy. International EA standards are developed by, for instance, the Object Management Group and the Open Group, and confirmed by ANSI and ISO.

2.5   Implementations

The objectives of NEA programmes cannot be achieved through mere planning, but through implementing the visions identified in the planning effort. Implementation, whether this includes business process reengineering, system implementation or both, is an essential part of the implementation of NEA.[44]

This viewpoint provides indications for how the NEA is adopted, used and updated. It covers change support to enable the adoption and diffusion of the NEA, and includes the development and use of central facilities and infrastructures.[45]

2.6   Benefits of NEA work

Through positive effects of NEA efforts, governments can justify the costs and resources it incurs[46]. According to one study, 45 percent of governments that have a NEA programme are measuring their programme's performance. The same percentage is using key performance indicators (KPIs) in their NEA work. Only 18 percent of governments with NEA programmes measure its total expenditure, the total amount gained from the NEA and the benefits to cost ratio. This indicates low maturity of NEAs and difficulty of evaluating benefits.[47]

When total expenditure and benefits of NEA work have been evaluated/measured, the positive effects of NEA have included decrease in the number of used platforms and systems, and cost savings through shared infrastructure and services[48]. It is challenging to identify, measure and calculate the financial benefits of NEA[49]. NEA programmes offer many types of benefits to a government, and they can be divided into five main categories[50]: 1) financial, 2) economic development, 3) reduced redundancy, 4) fostering democratic principles, and 5) improved service. Financial improvement means reducing the costs of organisations and

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44   Christiansen (2006)
45   Janssen and Hjort-Madsen (2007)
46   Morganwalp and Sage (2004)
47   Christiansen and Gotze (2007)
48   Christiansen (2006)
49   Rico (2005)
50   IAB (2003, 1)

enhancing revenue collection. Economic development signifies the growth of local, state, and federal economies. Reduced redundancy means consolidating, reducing, and integrating government systems. Fostering democracy means offering a consistent level of customer service to all stakeholders, regardless of political affiliation. Finally, improved services are needed for citizens, customers, and all other key stakeholders. A successful NEA programme should cover at least one of the mentioned areas, but the most successful will probably deliver benefits in multiple areas[51].

2.7   Evaluation

The final viewpoint for comparing NEAs is evaluation of the programmes for continuous development. In addition to measuring the benefits, NEA programmes often lack the evaluation, comparison and reflection of the NEA effort itself. Evaluating different countries' NEA programmes can be helpful when a government is developing or establishing its own NEA program. In EA work, just as in all development activities, continuous evaluation is the prerequisite for improvements. It enables transforming what has been learned during EA work into more efficient and high-quality practices.

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51   Rico (2005) and IAB (2003)

3   SCANDINAVIA

In this section, we evaluate the NEA programmes of the Scandinavian countries. Scandinavian countries have been considered forerunners in the development of e-government. The use of information systems in public administration is extensive and is a part of citizens' lives in many ways. In addition, the Scandinavian model for participation entails including citizens and enterprises actively in decision-making at all levels of government from initiatives to implementation and evaluation. This has led to the utilization of ICT as a part of the democratic process.[52] In this chapter, we determine whether the same is true for NEA programs. We evaluate the countries in alphabetical order.

3.1   Norway

Norway has long been actively using ICT in the public sector, through which it has improved the quality of public services and modernised government. Nevertheless, Norway is average among the EU countries in developing electronic services for citizens. Even though Norway is not an EU member state, its e-government development has been strongly influenced by EU initiatives.[53]

The government's information society policy focuses on 1) strengthening Norway's leadership in ICT development, 2) using ICT to promote economic and social development and 3) making the benefits of the information society available to all[54]. In Norway, the Ministry of Government Administration and Reform is responsible for the national policy for the development and coordination of ICT use, and measures to make government more efficient and service-oriented.[55] However, the Ministry's coordinating mandate is limited[56].

In Norway, each governmental organisation is responsible for its own procurements and development of ICT solutions. This has resulted in poorly

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52   Andersen et al. (2005)
53   OECD (2005b, 1-2)
54   OECD (2005b, 2)
55   Ministry of Government Administration and Reform (2007)
56   Ministry of Government administration and reform (2006)

coordinated e-services.[57] Interaction between different actors in the public sector should be improved, but there are no general requirements for e-government planning within individual ministries and agencies, and it is up to each ministry and agency to translate the common vision into concrete plans of action. Broad national e-government objectives have not been sufficiently translated into clear targets and goals for ministries and agencies.

The Norwegian government has been successful in developing the necessary online frameworks, which enhance cross-public sector collaboration and exchange of e-government implementation experiences. With the eNorway project, the government has been successful in setting up a framework for measuring progress in the development of the information society, but there is no government-wide framework for monitoring progress and assessing the impact of e-government initiatives.[58]

The Norwegian e-government project strives for an open, accessible and coherent public sector offering integrated and fully digital services, which are aimed at rationalising and freeing up resources through the use of ICT. The government's software policy is based on open standards and more extensive use of open source software.[59] The Ministry has set a NEA as its goal. The NEA will be layered, consisting at least of a presentation layer, a common component layer and an enterprise layer. The presentation layer is what citizens and enterprises see for instance in the form of centralised service portals. The component layer includes the government's shared ICT components for the realisation of efficient self-service solutions, the rationalisation of electronic services and the reduction of the number of complex applications (so-called infrastructure components)[60]. The enterprise layer contains technical solutions, registers, and maintenance systems. Before the end of 2007, a more detailed description of the architectural principles with associated strategies and guidelines will be prepared. When the NEA is in operation, major public ICT projects must be based on and support the NEA.[61]

The Norwegian NEA will include various kinds of ICT standards. It will involve technical standards, which make it possible for different systems to exchange data. Conceptual (semantic) standards will ensure that the data is always interpreted in the same way. Organisational and procedural standards will serve to ensure that interacting parties have explicit divisions of responsibility and process descriptions. Standards may be, for instance, either recommended or mandatory for use in the public sector. The government will formulate a governance model that instructs, for example, in the organisation, management and finance of the development of shared components and future administrative

57   Ministry of Government administration and reform (2006)
58   OECD (2005b, 3-8)
59   Ministry of Government administration and reform (2006)
60   Ministry of Government administration and reform (2006)
61   Ministry of Government administration and reform (2006)

standards.[62]

Norway seems to be on the way to establishing a NEA. The work has begun only recently and this makes evaluation fairly fruitless. Analysis of the Norwegian approach is summarised in Table 2.

Table 2. The Norwegian approach to NEA work

	Norway
1. Policies, actors and structures	The Ministry of Government Administration and Reform is responsible for ICT development and strategy.
2. Governance	NEA will include a governance model.
3. Architecture frameworks and methodologies	NEA will be based on a layered model comprised of a presentation layer, a common component layer and an enterprise layer). The NEA model will be ready by the end of the year 2007.
4. Architecture principles and standards	Heavy emphasis on open standards and open software. NEA includes technical, conceptual, organisational and procedural standards. NEA will include a shared component library.
5. Implementations	NEA work has recently begun.
6. Benefits	NEA work has recently begun.
7. Evaluation	NEA work has recently begun.

3.2   Sweden

Swedish public administration is currently undergoing a change towards a dynamic model of governance. It aims at a high level of interoperability between governmental organisations, and quality of the services offered for citizens and companies. The Swedish vision[63] of a 24-hour government will be realised through the application of web-service based technology, resulting in a a Service Oriented Architecture (SOA).[64]

Verva, the Swedish Administrative Development Agency, is responsible for coordinating the development of central government in Sweden and is one of the government's central advisory agencies[65]. Verva has assumed the responsibility for promoting e-government services[66]. Thus far, only limited coordination of ICT projects has existed between different ministries and governmental

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62   Ministry of Government administration and reform (2006)
63   Statskontoret (2005)
64   Magnusson and Nilsson (2006
65   Verva (2006)
66   ICA (2006b)

bodies[67]. In Sweden, e-government projects are seen as parts of normal service and administrative development. Therefore, each administrative body has been responsible for its own e-government projects. Furthermore, there is no e-government specific legislation.[68]

In June 2006, the Swedish government presented its new strategy for the development of e-government. It aims at greater efficiency and effectiveness in public administration, and improvement of services for citizens and businesses. Four main objectives have been set in the strategy: 1) a more efficient and effective information management by 2010, 2) a quicker and more secure administrative process through ICT use by 2010, 3) electronic processes for public purchases by 2010, and 4) a common government policy for secure electronic communication.[69] Through this strategy, the government is strengthening its governance of the development of public administration based on ICT. Rationalisation is the dominating goal, although better services and the development of democracy have also been frequently on the Swedish e-government agenda[70].

In an international study on the EA activities of sixteen governments, Christiansen[71] found out that Sweden is the only country that does not have any plans for incorporating a national EA programme. Also Ilshammar, Bjurström and Grönlund[72] state that Sweden has chosen an unstructured form of development. However, the Swedish government has expressed that the old ways in which agencies act as isolated silos will have to change. The Swedish Administrative Development Agency, Verva, has done a feasibility study of architecture and frameworks for interoperability. The study discusses the development of common specification, and ongoing architecture initiatives in Sweden and other countries. The study proposes goals for the Swedish NEA reference model, and suggests three matters to be defined: 1) main operations, 2) requirements and prerequisites from EU for Swedish national work, and 3) architectural model, framework and strategy.[73] Thus, it seems that Sweden is considering the possibility of introducing a NEA program, but has not yet initiated one.

Analysis of the Swedish e-government work is summarised in Table 3, although Sweden currently does not have a NEA. The evaluation is made in order to enable comparison between Sweden and other countries.

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67   Ilshammar, Bjurström and Grönlund (2005)
68   ICA (2006b)
69   ICA (2006b)
70   Ilshammar, Bjurström and Grönlund (2005)
71   Christiansen (2006)
72   Ilshammar, Bjurström and Grönlund (2005)
73   Wessbrandt (2006)

Table 3. Evaluation of the Swedish e-government

	Sweden
1. Policies, actors and structures	Verva, the Swedish Administrative Development Agency, is responsible for coordinating the development of central government.
2. Governance	Governance is decentralised and each administrative body is responsible for its own e-government projects.
3. Architecture frameworks and methodologies	A feasibility study has been made to survey the possibilities of a NEA programme, but there is no concrete NEA initiative.
4. Architecture principles and standards	A feasibility study has been made to survey the possibilities of a NEA programme, but there is no concrete NEA initiative.
5. Implementations	
6. Benefits	There are not concrete measurements for the success of e-government projects.
7. Evaluation	Currently, there are disconnected e-government projects without a central governance facility. The possible benefits of a NEA have not been achieved.

3.3   Finland

Since the 1990s, Finland has been a leader in exploiting ICT to renew its economy and to reform its public administration. Finland's reputation as the provider of successful proactive e-government services and information has brought officials from around the world to learn from Finnish experiences.[74]

Finland's Information Society Programme crosses the administrative branches. It aims at: 1) boosting competitiveness and productivity, 2) promoting social and regional equality, and 3) improving citizens' well-being and quality of life through effective utilisation of information and communications technologies in the entire society.[75] One of the programme's goals is fostering the development of information society and, if necessary, creating reusable models and standards. The technologies and new systems used by Finnish public administration should be interoperable. This aims at cutting costs through harmonisation and using the savings for the overall development of the information society.[76] National and international cooperation is a crucial part of the Information society

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74   OECD (2003)
75   Information Society Programme (2007)
76   Information Society Programme (2005)

programme[77]. The first part of the programme, Information Society Programme ended in April 2007[78].

Finland has made two changes in legislation to support its government-wide efforts. The new amendments to the law on the openness of government state that government organisations must make sure that their ICT systems comply with the technical requirements for interoperability, and must participate in a shared customer service system if required in a statute. According to the new amendments of the budget, the Ministry of Finance can order government organisations to use the joint procurement contracts negotiated by the state central procurement unit.[79]

The government's ICT development programmes are placed under the Information Society Programme. A programme to reform state information management was launched and the state IT management unit was established in the Ministry of Finance in spring 2005[80]. The development of ICT operations aims at producing customer-oriented flexible services and strengthening the transparency of administration. The government's decision in principle includes the long term objectives of the government's ICT operations, development strategies of ICT functions, the common governance model, and the development programmes for the years 2006-2011.[81] One of the five programmes covers interoperability.

The interoperability programme strives to develop the interoperability of the ICT systems of state administration, decrease overlap in information collection and maintenance as well as the number of overlapping ICT systems. The main goal is to increase flexibility. The programme aims at creating a common state ICT architecture (the Finnish NEA), which will be used as a tool to develop functions and ICT systems at all levels of state administration. A governance model will be introduced for maintaining the architecture and utilising the descriptions of the architecture in the steering of projects and systems design.[82] Planning of the architecture will be finished by the end of the year 2007. After that the NEA with its governance model will be implemented and spread in the government agencies. The interoperability programme will continue until the year 2011. The State IT Management Unit is responsible for the organisation of the programme.[83]

Several government organisations have already started to work on the EA, but the big picture is still missing at the level of state government. This makes it necessary to aggregate and standardise the information in the information systems, technological solutions and existing architectural and operational

77   Information Society Programme (2006)
78   Information Society Programme (2007)
79   Terho (2006)
80   Information Society Programme (2007)
81   Ministry of Finance (2006b)
82   Ministry of Finance (2006a)
83   Ministry of Finance (2006c)

descriptions. The focus is on shared information systems, common basic technology, shared services and cross-public sector processes.[84] Currently, government on state, regional, and municipal levels have their own development programmes for ICT functions but these will be united in 2009[85].

Finnish NEA consists of the descriptions of the business, information, application and technology architectures realised with a common description language and methods. The NEA method is in accordance with the TOGAF process and the NEA utilises known frameworks (such as EIF, FEAF, TOGAF and NAF) in its reference model and architecture descriptions[86]. At the governmental level, the NEA is in accordance with EIF[87] and its cost-benefit analysis model adapts the FEA's Performance reference model and the Finnish government's profitability framework (Tulosprisma)[88]. Descriptions of the current state, target state and the road-map are included in the NEA method. A maturity model is used for the evaluation of the current state. This model is based on the common CMM (capability maturity model) and NASCIO models[89]. It is essential to form an overall picture of the architecture at all levels of state government (e.g. state, administrative branch and agency), and to depict the architecture of every agency[90]. Hence, the governance model will include process and organisation descriptions and the maintenance model for the NEA. In sum, the Finnish NEA includes an EA framework, EA descriptions, and the governance model.

The Finnish NEA programme is in the planning phase and the first results will be approved during the year 2007. Pilot implementations started in the spring of 2007. Currently, there is no comprehensive model for the analysis of the benefits of the whole NEA programme. One of the main challenges is the ownership of the NEA and its processes. This issue is thus far unsolved. The key to a successful NEA programme is in a well-planned and executed implementation. On the positive side, the Finnish NEA approach is holistic. Analysis of the Finnish NEA is summarised in Table 4.

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84   Ministry of Finance (2006d)
85   Terho (2006)
86   EA Method Project (2007a)
87   EA Method Project (2007b)
88   EA governance model project (2007a)
89   EA governance model project (2007b)
90   Ministry of Finance (2006d)

Table 4. Summary of Finnish NEA work

	Finland
1. Policies, actors and structures	NEA is developed by the Ministry of Finance. The project is formed as a cross-public sector project. The Council of State has recognised shared information systems, common basic technology, shared services, and cross-public sector processes as the key focus areas.
2. Governance	The NEA contains a governance model.
3. Architecture frameworks and methodologies	The framework covers four common viewpoints (business, information, application and technology), which are supported in several widely used frameworks (FEA, TOGAF, IEF and E2AF). The NEA method is in accordance with the TOGAF process. NEA utilises known frameworks (such as EIF, FEAF, TOGAF and NAF) in refence models and descriptions.
4. Architecture principles and standards	The NEA includes a maturity model that is based on the CMM and NASCIO models. At the governmental level the NEA is in accordance with the EIF. The FEA's Performance reference model is adapted to the public administration's profitability framework (Tulosprisma) in cost-benefit analysis.
5. Implementations	The implementation plan will be ready in October 2007. The first pilot projects will be initiated in spring 2007.
6. Benefits	A cost-benefit analysis model is included in the NEA.
7. Evaluation	At this point the main challenge is defining the ownership of the NEA and its processes. For the NEA to be successful the implementation phase needs to be successful.

3.4   Denmark

The Danish government is pursuing a vigorous e-government programme spanning the entire public sector. Many international assessments of countries' e-government achievements have consistently ranked Denmark as one of the leading e-government nations.[91] In the early 21st, century Denmark was one of the few governments with a NEA programme[92]. The Danish NEA work is intended to improve the basic conditions for efficient and coherent public ICT use. The NEA is expected to enable optimisation of the value of the government's ICT investments, reduce the risks of individual projects, and make it possible to create a more flexible and competitive ICT market[93]. The work includes the drafting of general guidelines and principles for building ICT systems in the public sector (common enterprise architecture), and the

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91   OECD (2005a)
92   Schekkerman (2003)
93   OECD (2005a)

dissemination of standards for data interchange. EA work is carried out in close cooperation between the public sector and enterprises. Transmitting expert knowledge is key in this cooperation.[94]

The Danish NEA has been developed in the Ministry of Science, Technology and Innovation in close collaboration with Danish municipalities and the Ministry of Finance[95]. The white paper of the Ministry of Science, Technology and Innovation[96] proposes five core architectural principles: 1) interoperability, 2) security, 3) openness, 4) flexibility, and 5) scalability. To carry these principles into effect, it was recommended based on various international standards that the government adopt a service-oriented architecture (SOA) model. The SOA model treats individual ICT solutions as modularly designed services with well-defined interfaces.[97] The NEA governance model is based on incentives, and there is no legislation or regulations dictating NEA adoption. Hence, agencies are free to design their own architecture.[98]

In the year 2006 the Danish parliament decided upon advancing the use of open standards (so-called Parliamentary decision B103). It imposes on the government a duty to ensure that the public sector's use of ICT, including the use of software, is based on open standards. The government should adopt and maintain a set of open standards by the beginning of the year 2008, or as soon as technically possible. Open standards should be part of the basis for the public sector's development and procurement of ICT software. The government will ensure that all digital information and data that the public sector exchanges with citizens, companies and institutions, is available in open standard-based formats.[99]

The Danish Interoperability Framework has been compiled in accordance with the EIF's preliminary requirements, and offers a set of policies, technical standards and guidelines that outline the government's policy on achieving interoperability. The Danish framework is targeted at any authority that wishes to interoperate with other national authorities or abroad with the EU and its member countries.[100]

The Danish NEA is called OIO (Offentlig Information Online) Architecture and it covers the joint public administration work with e-government architecture and standardisation. The OIO Architecture is a common framework that contains overall principals, methods, tools, and control frameworks. In addition, it is the embodiment of a concrete architecture including a collection of standards, a reference model design, and the establishment of common infrastructure

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94   ICA (2006a)
95   Janssen and Hjort-Madsen (2007)
96   Ministry of Science, Technology and Innovation (2003)
97   OECD (2005a)
98   Janssen and Hjort-Madsen (2007)
99   ICA (2006a)
100   Danish e-Government Interoperability Framework (2005)

elements, etc.[101] The NEA model is based on the Zachman framework, but the primary focus is on the planning process[102]. Denmark has a standardisation guide that documents the government's common ICT, technical, data and process standards[103].

According to an OECD[104] report, the Danish e-government has faced a range of challenges. These include: 1) maintaining momentum during a time of major restructuring of responsibilities across levels of government, 2) increasing governmental organisations' awareness and understanding of the purpose and scope of the e-government programme, 3) developing more collaboration over e-government between agencies and across levels of government, and 4) striking the right balance between centralised coordination and decentralised implementation of e-government. Denmark has reported conceptual goals and publicised guidelines describing the EA process. It is also developing an EA tool for storing and sharing NEA knowledge. However, Denmark has not been able to report any achieved goals and only carries out limited measurement of its EA effort, and does not, for example, give information on the method's actual use ratio.[105] Judging by the lack of results and the publicly discussed difficulties, the incentives are not working as hoped.

The Danish NEA focuses mainly on interoperability. This requires a strong governance model that is lacking in Denmark according to our analysis. Danish NEA is facing the risk of failure in the implementation phase. There have also been problems in rendering the NEA comprehensive and understandable. The architectural models are perceived difficult, too abstract and therefore only used to provide structure to the NEA efforts[106]. Analysis of the Danish NEA is summarised in Table 5.

101   Ministry of Science, Technology and Innovation (2006)
102   Janssen and Hjort-Madsen (2007)
103   ICA (2006a)
104   OECD (2005a)
105   Christiansen (2006)
106   Janssen and Hjort-Madsen (2007)

Table 5. Summary of Danish NEA work

	Denmark
1. Policies, actors and structures	The Ministry of Science, Technology and Innovation is responsible for the NEA initiatives in close collaboration with Danish Municipalities and the Ministry of Finance. The focus is on interoperability as well as security, openness, flexibility and scalability.
2. Governance	The NEA governance model is based on incentives. Agencies are free to plan their own architecture. NEA adoption is not dictated by law or regulations.
3. Architecture frameworks and methodologies	NEA includes principles, methods, tools, and control frameworks The NEA model is based on the Zachman framework.
4. Architecture principles and standards	NEA includes a selection of standards, a reference model design and principles for the establishment of common infrastructure elements. Strong emphasis is on open standards and a set of open standards will be available in 2008. The interoperability framework has been compiled in accordance with the EIF.
5. Implementations	Dominant SOA orientation. Development and implementation of standardised software components is incidental.
6. Benefits	Conceptual goals have been reported, but no reports on achieved goals. Only a limited set of indicators used.
7. Evaluation	An advanced NEA programme that takes interoperability as a starting point. Unfortunately, a strong governance model is missing. Problems in the implementation of the NEA.

4 OTHER EUROPEAN COUNTRIES

This chapter presents the enterprise architecture programmes of European countries. The countries are discussed in alphabetical order.

4.1 The Netherlands

In the beginning of this decade, the Netherlands was a forerunner in e-government, but today it has fallen behind more ambitious countries. In 2004, the Government Reforms ministry initiated a NEA programme. The aim of the programme is to decrease bureaucracy since, according to calculations, this should increase long-term economic growth, employment and income.[107]

As a result of current Dutch legislation, local government has extensive autonomy in decision-making. This means they are responsible for their own budgets and can make independent ICT investments. The purpose of the NEA programme has been to capitalise best practices. The basic idea is to establish several decentralised, heterogeneous projects at different levels of government. After a while, a project may become successful, after which similar projects will no longer receive support. The results of a successful project are included in the NEA and disseminated as a best practice.[108] The NEA is intended to guide the operations of administrative branches and agencies. The policies and laws focus on stimulating the provisioning of electronic services, data reuse, and the creation of a one-stop shop. The NEA programme is based on a service-oriented architecture paradigm and the complete reference application architecture is also service-oriented.[109]

The NEA programme is based on adopting one part of the Zachman model. The programme has been criticised for not covering the whole picture, for being too abstract, and not supporting communication. The architecture is driven by requirements made by the EU, Dutch government, businesses and citizens. Control, maintenance and security are given special attention. The model is primarily used as a way to structure architecture principles and best practices. The web-based version contains hyperlinks to these principles and practices. The NEA contains over 160 principles. However, some are overlapping, some are

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107   Janssen and Hjort-Madsen (2007)
108   Janssen and Hjort-Madsen (2007), and Janssen and Kuk (2006)
109   Janssen and Hjort-Madsen (2007)

vague (such as "60% of the services should be provided online") and too abstract. Nevertheless, it is very useful that all principles are collected, maintained and disseminated by one department.[110] The architecture efforts are fragmented and, except for documentation, there is no focal point[111]. A complete picture is currently lacking, but a programme has been initiated to clarify the relationships between projects.

There is a NEA at the central level, and several relatively large agencies have their own EA. Often the latter do not comply with the centralised EA. Moreover, agencies have started to implement new initiatives without considering the NEA. Lack of sufficient attention on interoperability is considered the problem of the Dutch NEA programme. To some extent, Denmark is a role model for the Dutch NEA, as several of its building blocks are based on the best practices found in Denmark.[112]

The Dutch national policy declares the following on open standards: "to use open standards as far as possible for data interchange between government agencies, members of the public and businesses, and to agree how data are to be used by multiple users." In 2006, the Netherlands have established a Government Standards Board and a Standardization Forum to promote the use and adoption of standards.[113]

The Dutch NEA work is problematic because the EA is primarily built on best practices. If no best practices can be found for a certain area, many small projects are stimulated which should result in the creation of new best practices or even breakthrough reforms. This can be seen largely as a risk-avoiding strategy, which makes NEA development slow. The Dutch NEA is consensus-based and strives to avoid conflict. This is why it only contains elements which have been decided upon through consensus among all actors. Consequently, the enterprise architecture rarely involves innovative projects, and the added value is limited for the early adopters in the local governments. In the Netherlands, the present NEA efforts tend to be designed primarily to solve current problems, whereas the longer-term goals remain abstract. The lack of a centrally implemented EA model is also a problem. This is one reason for problems in EA governance and implementation.[114] Dutch EA work is summarised in Table 6.

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110   Janssen and Hjort-Madsen (2007)
111   Janssen and Cresswell (2005)
112   Janssen and Hjort-Madsen (2007)
113   ICA Summary (2006)
114   Janssen and Hjort-Madsen (2007)

Table 6. Summary of Dutch NEA work.

	The Netherlands
1. Policies, actors and structures	The Ministry of Government Modernization and Innovation is in charge of NEA work. The main goal is reducing bureaucracy for companies and agencies.
2. Governance	Use of NEA is not mandatory and agencies are free to design their own architecture. Change support teams have been created to help agencies in EA adoption.
3. Architecture frameworks and methodologies	A simplified version of the Zachman model is used to structure the architectural principles. The NEA programme uses no architectural models, but at the local level public agencies have adopted a variety of architecture models.
4. Architecture principles and standards	The NEA contains a set of high-level principles and guidelines. NEA efforts are primarily consensus based. The use of open standards is promoted in some areas.
5. Implementations	Service-oriented architecture is the dominant paradigm. Standardised software components are developed and used in NEA work.
6. Benefits	
7. Evaluation	No comprehensive NEA programme. NEA does not take long-term objectives into consideration.

4.2   Belgium

Belgium started the establishment of e-government late compared to many other countries. This presented the possibility to learn from other countries and understand that e-government does not only signify information and communication technology. Therefore, the basic principles of the e-government strategy formulated in 2002 are information sharing and business process re-engineering. Belgium started back-office integration and began to develop a national enterprise architecture.[115]

The Belgian e-government strategy aims at creating a single virtual public administration. It involves deference to the privacy of users and to the special characteristics and know-how of all parts of government. This is understandable when considering the complexity of Belgian government; both states and linguistic

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115   Vanvelthoven (2005)

communities have their own governments. However, the goals of e-government are similar as elsewhere: enhancing the services public administration offers to citizens and enterprises by making processes faster and more usable, by reducing limitations and enhancing openness. The strategy has four strategic objectives. These are: 1) re-design and integration of service channels, 2) cooperation between all parts of public administration, 3) simplification of administrative procedures, and 4) back-office integration of and protection of private data.[116]

The essential content of the Belgian strategy remains interoperability and promotion of the use of open standards[117]. In Belgium, using open standards and/or common specifications in new applications is mandatory when they are used for receiving or transmitting electronic data. The use of open source software is not declared mandatory, but all new government software should be owned or co-owned by the administration. This means that it must be possible to provide their source code to other units of Belgian federal administration as free software.[118]

Key players for eGovernment in Belgium at Federal level are FEDICT (FEDeral public service of Information Technology and Communication), Ministry of Interior (National Register) and Secretary of State for Administrative simplification. FEDICT has a coordinating role in relation to other public authorities. FEDICT has three objectives: 1) state computerisation, 2) society computerisation and 3) Belgium as an ICT knowledge region. In the year 2006 FEDICT published the first service catalogue. It is a list of products and services that FEDICT can deliver to other Ministries, municipalities, etc. The service catalogue provides information, for example, about formats used, service level agreements and costs. An adapted version of this service catalogue for companies and another one for citizens will be issued at a later time. Belgium is a federal state, which means that several people decide upon the same topic. This brings on a need for more coordination, which has been met by creating a meeting for all chief information officers from all ministries held every six weeks.

Belgium has also created a Strategic Coordination Team, which assembles representatives from all regions and communities to disseminate information and discuss eGovernment matters. In addition, temporary associations are formed around specific topics when necessary. These include, for example, the Belgian portal website and the eGov Awards. [119]

Belgium has set up a framework to measure e-government progress that will assess the degree of strategic contribution, potential benefits and degree of urgency for ICT investments.[120] In addition, a tool for measuring the state of computerisation in the federal ministries is used. It includes a barometer of

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116   IDABC (2007c)
117   IDABC (2007c)
118   IDABC (2004b)
119   ICA (2006e)
120   ICA Summary (2006)

120 indicators based on the answers of ministries' chief information officers. The federal barometer combines evaluations of ministries and it includes 21 global indicators. Analysis is done around five perspectives: strategic, financial, personnel-related, organisational, and technological.[121]

Belgium does not use an enterprise architecture. The development of e-government is widely decentralised and controlling the entire effort may be challenging, but, as shown above, it has been given particular attention. The Belgian approach is summarised in Table 7.

Table 7. Development of Belgian e-government

	Belgium
1. Policies, actors and structures	Key actors in e-government are: FEDICT, the Ministry of Interior and Secretary of State for Administrative simplification. FEDICT has a coordinating role. The e-government strategy aims at creating a single virtual public administration. The objectives are the dissemination of information and redefinition of business processes.
2. Governance	The federal governance model is decentralised.
3. Architecture frameworks and methodologies	
4. Architecture principles and standards	A service catalogue, which is a list of FEDICT products and services, is in use. The use of open standards and/or common specifications is mandatory and use of open-source software is advised in government.
5. Implementations	Implementation through individual projects of e-government.
6. Benefits	A framework for the evaluation of e-government progress is used. It enables evaluating the degree of strategic contribution, potential benefits and degree of urgency for ICT investments.
7. Evaluation	There is no NEA programme. Evaluation of e-government development is difficult since little information is available.

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121   ICA (2006e)

4.3   The United Kingdom

Commissioned by the Prime Minister, in 2005 a new strategy was published concerning the opportunities provided by technology for transforming the business of government. It is inspired by the major challenges which globalisation is setting modern governments: combining economic productivity, social justice and public service reform. The strategy addresses three key changes that will be achieved through technology. According to the first, services enabled by IT must be designed around the citizen or business, not the provider. Secondly, government must move to a shared services culture and release efficiencies by standardisation, simplification and sharing. Thirdly, government's professionalism in terms of the planning, delivery, management, skills and governance of IT must be broadened and deepened.[122] To support the change strategy, an implementation plan has been formulated which draws upon best practices in the public and private sector.[123]

The UK has established an eGovernment Unit (eGU), which has the primary role of leading the implementation and development of the strategy. The eGU supports the business transformation of government and its role includes delivering both common infrastructure and services for government, and providing ICT support to the Cabinet Office's own business and transformation. The Transformational Government Strategy is closely allied to the Comprehensive Spending Review process and governed at the ministerial level by a goverment sub-committee.[124] The Chief Technical Officers Council is the cross–government body responsible for increasing cooperation at a technological level. The council has started its own procedures related to the planning, interoperability, development, modernisation, use, reuse, sharing, performance, and efficiency of IT resources in order to enhance governmental practices.[125]

Better public services tailored to the needs of the citizen and business require the seamless flow of information across government. The e-Government Interoperability Framework (e-GIF) was first published in 2001. The e-GIF sets out the government's technical policies and specifications for achieving interoperability and Information and Communication Technology (ICT) systems coherence across the public sector. The e-GIF architecture contains a framework and a register. Adherence to the e-GIF policies and specifications is mandatory. The main thrust of the e-GIF is to adopt the Internet and World Wide Web specifications for all government systems. There is a strategic decision to adopt XML and XSL as the core standards for data integration and management. The e-GIF also sets out policies for establishing and implementing metadata across

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122   CabinetOffice (2005a)
123   CabinetOffice (2007a)
124   ICA (2006h)
125   CabinetOffice (2007b)

the public sector.[126] The Technical Standards Catalogue defines the minimum set of specifications that conform to the technical policies as defined in e-GIF[127]. Excellent achievements and investments into projects distinctly in accordance with the interoperability standards are rewarded with e-GIF Awards[128].

The e-GIF is an interesting framework, as the Commonwealth is adopting architectures based on it. Scotland is using the Open Scotland Information Age Framework (OSIAF)[129], which expands the e-GIF by making Scottish public sector services interoperable with UK government services. Also Northern Ireland has shown its commitment to the e-GIF and the Welsh Assembly Government is a voluntary partner of the e-GIF.[130] In addition, New Zealand's own e-GIF is based on the British framework[131].

Previously in the UK, different administrative branches have had their own architectures which have included common features, but none of which has been sufficiently comprehensive[132]. Now, a new cross-Government Enterprise Architecture (xGEA) has been introduced. It is an essential part of the strategy of governmental transformation. The benefit of xGEA is that it will offer a business and IT blueprint for government. In addition to this, the xGEA's benefits include, for instance, promotion of the development of common architecture, improved management of risk, sustainable alignment of business and IT functions, and better inter-working between agencies through the agreement of shared standards. The first release of the xGEA has been published. This contains the xGEA Reference Model (xGEARM), as well as a repository with Enterprise Architecture assets captured for all government to use, an opportunity portfolio of potential exemplars, a set of processes based on industry practices for describing the exemplars and the EA models.[133]

Research findings have suggested that the e-Government implementation process underway in the UK does not embody the principles of widening democracy and increasing social inclusion. Citizen engagement in the design, development and implementation process has been limited, which has led to some failures.[134] Even though the xGEA as a new approach would not increase citizen engagement, it will improve projects' possibility of success by taking governmental entities into account better than before. The xGEA is only the first step after which administrative branches and agencies must take EA down to an organisational level and several levels down in detail, to departmental EAs[135] Table 8 below summarises the British approach.

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126   CabinetOffice (2005b)
127   CabinetOffice (2005c)
128   CabinetOffice (2006)
129   Scottish Executive (2006)
130   CabinetOffice (2005b)
131   State Services Commission (2006)
132   IBM (2007)
133   CabinetOffice (2007c)
134   Damodaran, Nicholls, Henney et al. (2005)
135   IBM (2007)

Table 8. Summary of the British approach

	The United Kingdom
1. Policies, actors and structures	The eGovernment Unit (eGU) is responsible for the implementation and development of the strategy. The Chief Technical Officers Council is the cross–government organisation responsible for increasing cooperation at a technological level.
2. Governance	Following e-GIF practices and specifications is mandatory.
3. Architecture frameworks and methodologies	The e-GIF defines the government's technical policies and specifications for achieving interoperability and ICT systems coherence across the public sector. It contains a framework and a register. The first version of a cross-Government Enterprise Architecture (xGEA) has been published.
4. Architectural principles and standards	The Technical Standards Catalogue defines the minimum set of specifications that conform to the technical policies as defined in the e-GIF.
5. Implementations	The e-GIF is in use, but the adoption of xGEA is only starting. Administrative branches have their own EA programmes that are partly compatible.
6. Benefits	Some objectives have not been reached (in participation, democracy and increasing social inclusion).
7. Evaluation	The e-GIF has spread to several other countries. Comprehensive EA work is only beginning.

4.4   Austria

The first activities to establish e-governance in Austria have been carried out in 1995-1996 within the Information Society initiative.[136] Since then Austria has managed to achieve a comparably good state of e-government through several further activities, such as the electronic signature and identification for citizens. In 2003, the Federal Government launched an eGovernment Offensive, which set priorities for a rapid development of e-government in Austria and aimed at achieving a leading position in the European Union. The basis for achieving this aim was support for and cooperation with the political decision-makers of the Federal Government, the provinces, local authorities, municipalities, social insurance bodies, and the private sector. An eGovernment Platform was set up under the chairmanship of the Federal

136   IDABC (2007a)

Chancellor. The short-term goals of the eGovernment Offensive were achieved as Austria ranked 4th in a European ranking of e-government leaders in the annual e-government benchmarking survey published by the European Commission[137].

The main goals of the Austrian e-government work are[138]:

- Businesses effect their administrative transactions with the authorities electronically
- The citizens process their administrative issues with the authorities electronically
- Development of secure communication infrastructure for citizens, businesses and public administrations
- Development of electronic identification concepts, e.g. electronic signature
- Cooperation with the political decision-makers of the Federal Government, the provinces, local authorities, municipalities, social insurance bodies and the private sector

The responsibility for Austria's e-government strategy lies directly with the State Secretary, who was entrusted with this task by the Federal Chancellor[139]. The secretary is supported by the ICT-Board that embodies the Federal Chief Information Officer and the ICT Strategy Unit. The Federal Chief Information Officer advises the Federal Government at the strategic and technical level, supports the formulation of its e-government policies, and promotes Austrian e-government solutions in the European and international arena. The Federal Chief Information Officer regularly reports to the State Secretary on ongoing activities. The ICT Strategy Unit is responsible at the federal level for legal and organisational issues of e-government, coordination of technical infrastructure, programme and project management, budget control and procurement, and international issues in the area of e-government and security.

Although Austria does not apply the concept of National Enterprise Architecture, the work done fulfills the characteristics of NEA work. Therefore, in this report we call Austrian e-government efforts NEA work. The Austrian NEA is described in the ICT Strategy Unit's guide[140]. The Austrian architecture is based on three fundamental pillars: 1) a clear legal framework which can be easily understood and can thus rapidly become part of public awareness, 2) secure and thus sustainable systems and services as a precondition for nationwide implementation, and increasing confidence of citizens in electronic

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137   IDABC (2007a)
138   Bundeskanzleramt (2003)
139   IDABC (2007b)
140   ICT Strategy Unit of the Federal Government (2004)

administrative services, 3) the use of sustainable technology on the basis of open standards and defined interfaces in order to ensure continuous adaptation to new technology.

The legal Framework is given by the e-government law from 2004[141], which serves as the legal basis for the instruments used to provide a system of e-government and for closer cooperation between all authorities providing e-government services. The most important principles are: 1) freedom of choice between means of communication for submissions to the public administration, 2) security for the purpose of improving legal protection by creating appropriate technical means, and 3) unhindered access to information and services provided by the public administration for people with special needs (already by the end of 2007).

The modernisation of e-government is divided into three areas: organisational implementation, technical coordination, and structural measures[142]. Organisational implementation embodies the administration's processes, such as finances, voting, and recording systems. Technical coordination includes the technological means and software components for the realisation of these processes, such as infrastructure specification, specification of software services, protocols, policies, and tools. The service-oriented paradigm is suggested for the realisation of e-government applications. Finally, the structural measures include issues relevant to projects, such as human resources, funding, knowledge, skills, and assistance tools.

Neither the NEA benefits nor their evaluation are defined. An evaluation only exists for e-government applications. The Federal Chancellery awards applications and procedures that are in conformance with the three Austrian e-government pillars and the technological requirements for applications defined in the NEA. The award is called the E-Government Quality Mark. The Austrian NEA is summarised in Table 9 below.

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141   Bundesgesetzblatt (2004)
142   ICT Strategy Unit of the Federal Government (2004)

Table 9. Summary of the Austrian approach

	Austria
1. Policies, actors and structures	The e-government work was triggered by the Federal Chancellery. The responsibility for e-government strategy lies directly with the State Secretary who is supported by the ICT-Board. The NEA primarily aims at making the administrative process electronically available for all citizens.
2. Governance	The State Secretary is principally responsible for the NEA. The NEA is utilised nation-wide.
3. Architecture frameworks and methodologies	E-government is guided by law. E-government is divided into three elements: organisational implementation, technical coordination and structural measures.
4. Architecture principles and standards	The EA is based on three fundamental pillars for a national architecture: a clear legal framework, secure and thus sustainable systems, and the use of sustainable technology on the basis of open standards and defined interfaces. Use of open standards and software is emphasised. Requirements of EIF are met.
5. Implementations	A service-oriented architecture paradigm is suggested for the implementation of e-government applications. Several existing open source tools are suggested for different purposes.
6. Benefits	NEA work is not evaluated. Applications and procedures that are in conformance with the NEA are awarded with the Quality Mark.
7. Evaluation	Austria does not apply the term NEA, although the work done is similar to NEA efforts in other countries. Instead, the term e-government is used.

4.5   Germany

The first intensive and co-ordinated ICT-enabled change in the German public administration started in 2000 with the BundOnline 2005 campaign[143]. During this programme, in 2000-2005, over 440 administrative services have been provided as online services for businesses and citizens. However, most of these services have been provided by the departments of the Federal States and by the local authority districts and not by the Federal Government. Therefore, the main aim was the creation of unitary standards for the German federal and local administrations. Regarding this aim, the German Federal Government

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143   Bundesministerium des Innern (2005)

and the governments of the Federal States initiated the Deutschland-Online initiative in 2003[144].

In September 2006, the federal cabinet adopted a comprehensive strategy aiming at the modernisation of the Federal State Administration by downsizing bureaucracy and by improving the quality and efficiency of public sector services[145]. The E-Government 2.0 Programme forms an integral part of the strategy. The programme has been developed in compliance with the European action plan i2010 and utilises already existing knowledge in the area of e-government originating from earlier projects. The Federal Ministry of the Interior is responsible for Germany's e-government strategy. The Ministry has set up an Office of the IT Director in 2002. This office pools the tasks of the Federal Ministry of the Interior relating to IT policy and strategy. It brings together, for example, the unit responsible for the coordination of the Information Society, the Federal Information Security Agency (BSI), and the team in charge of the biometry projects for identification and travel documents.

The E-Government 2.0 programme aims at achieving the following four major objectives in the area of e-government by the year 2010:

- Portfolio: Enhancement of the federal e-government services for businesses and citizens in terms of quantity and quality.
- Process chains: Establishing electronic collaboration between the public administration and the business community by utilising common business process chains.
- Identification: Introduction of an electronic Identity Card (eID Card) and development of electronic identification concepts.
- Communication: Development of secure communication infrastructure for citizens, businesses and public administration.

To realise the e-government goals, the Advisory Agency for IT in the Federal Administration (KBSt) published guidelines for e-government applications, which contain architecture models and standards. These guidelines are called SAGA (Standards and Architectures for eGovernment Applications) and they serve as the basis for the German National Enterprise Architecture (NEA)[146]. The first version was published in 2002 and served as the basis for the initiative BundOnline 2005. Since then SAGA has been enhanced continuously and at the moment it is used to realise the E-Government 2.0 and the Deutschland-Online programmes. The German NEA pursues the following aims[147]:

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144   Bundesministerium des Innern (2003)
145   Bundesministerium des Innern (2006a)
146   KBSt (2002)
147   KBSt (2002)

- Interoperability: Warranting a media-consistent flow of information between citizens, business, the Federal Government and its partners
- Reusability: Establishing process and data models for similar procedures when providing services and defining data structures
- Openness: Integrating open standards into applications
- Reduction of costs and risks: Standardising and outsourcing investment implementations
- Scalability: Ensuring the usability of applications as requirements change in terms of volume and transaction frequency

The NEA programme is based on the ISO reference model for systems for open distributed processing (RM-ODP) and is applied from five viewpoints: enterprise, information, computation, engineering, and technology[148]. The business view, for example, defines the goals of German e-government, stakeholders' roles, frames of reference, guidelines and forms of interaction as well as the aims with regard to standardised processes. The service-oriented architecture and component-based architecture paradigms are suggested as software architectures for the implementation of e-government applications[149]. In the future, Germany wants to focus more on the use of open ICT standards in both public administration and businesses. The government intends to make a plan for the introduction of open documentation standards into German Federal administration. [150]

In addition to the NEA program, the Federal Ministry of the Interior will develop a cost-benefit-calculation in the beginning of 2007. So far the government has published the cost-benefit-ratio for the realised services. Since 2002, the Federal Government has invested 650 million euros into e-government activities. The benefits to the government were 350 million euros per year and to the clients (businesses and citizens) 430 million euros per year[151]. Germany has also reported that by making central governmental processes electronic costs can be reduced up to 40 percent[152].

The modernisation of public administration is one of the major goals of the German government and since the year 2000 much effort has been put into achieving this long-term goal. Nevertheless, Germany is still far behind other European countries in the ranking for ICT utilisation in the public sector, placing eleventh in the third Waseda University World ranking on E-Government[153]. This ranking indicates that most of the implemented services are information services and there is still a lack of transaction services[154]. The German SAGA enterprise

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148 KBSt (2002)
149 KBSt (2002)
150 IDABC (2007d)
151 Bundesministerium des Innern (2006b)
152 IDABC (2007e)
153 Institute of e-Government at the University of Waseda (2007)
154 Deutsche Bank Research (2005)

architecture focuses to a great extent on the technical side of architecture and less on making wider definitions of policy[155]. Table 10 summarises the German NEA programme.

Table 10. Summary of German NEA work

	Germany
1. Policies, actors and structures	The responsibility for Germany's e-government strategy lies with the Federal Ministry of the Interior. The Ministry has set up an Office of the IT Director in 2002. The NEA programme focuses on cost reduction and efficiency improvement. Enhancement of federal e-government services for businesses and citizens in terms of quantity and quality is pursued.
2. Governance	The NEA programme is centrally initiated and coordinated by the Federal Ministry of the Interior. NEA is a mandatory guideline for the federal agencies.
3. Architecture frameworks and methodologies	The NEA programme is based on the ISO reference model for systems for open distributed processing (RM-ODP) and considers enterprise, information, computation, engineering, and technology perspectives.
4. Architecture principles and standards	NEA guides the use of conceptual and technical standards in design and implementation. The aims are interoperability, reusability, openness, scalability, and reduction of cost and risks. Use of open standards and software is emphasised. The NEA fulfils the requirements of the EIF.
5. Implementations	SAGA suggests the use of component-based and service-oriented architectrure paradigms.
6. Benefits	The goals are documented and benefits will be calculated in 2007. Benefits from previous NEA work are known.
7. Evaluation	Cost-benefit-calculation is currently the only evaluation method. The goal is to calculate financial benefits annually. The NEA focuses particularly on technical architecture.

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155   Christiansen (2006)

4.6   Switzerland

The goal of the e-government strategy in Switzerland is to use information and communication technologies (ICT) to make administrative activities as efficient, economical and close to the people as possible throughout Switzerland[156]. With the national e-government strategy approved by the Federal Council in January 2007, the Confederation and the cantons are focusing their efforts on joint achievement of their e-government goals. These goals are[157]: 1) Businesses effect their administrative transactions electronically with the authorities, 2) The authorities modernise their processes and also interact electronically with each other, and 3) The citizens process their administrative issues with the authorities electronically. The Swiss e-government strategy is coordinated and carried out in co-operation with other international programmes and projects, for example, the European i2010 program[158].

The Federal Council mandated the Federal Department of Finance in January 2006 to work with the cantons on drafting an e-government strategy for Switzerland. The national e-government strategy is one of the Federal Council's priority programs for promoting the information society in Switzerland. The Federal IT Council (FITC) bears overall strategic responsibility for ICT use in the Federal Administration. Specifically, the FITC defines the ICT requirements for the Federal Administration and supervises implementation in the various departments and the Federal Chancellery. The Federal Strategy Unit for IT (FSUIT) proves the administrative force of the FITC. It creates the strategy, programmes, architectures and standards for information technology in the Federal Administration and ensures implementation through appropriate control measures. To promote standards that advance e-government in Switzerland, the eCH association under public law was created. Members of FSUIT staff lead several eCH expert groups, helping to promote standardisation at all administrative levels.

The Swiss NEA is called eGovCH[159]. The NEA model is based on the TOGAF framework[160]. TOGAF was adopted by the Federal IT Council (FITC) in October 2006 as the standard framework and toolset at the federal level. In this way, the Federal Administration underscores its philosophy of using open-source, vendor-neutral and freely available tools. Furthermore the Open Source Software Strategy has already been approved by the IT Council in 2004. Basically, the Swiss NEA considers two different views: the process view and the structural view. The process view describes all processes that have to be executed within the administration to perform their tasks. Several processes demand interaction

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156   EFD (2007)
157   EFD (2007)
158   ICTswitzerland (2006)
159   Müller (2005)
160   TOGAF (2006)

between several regional and federal agencies. The structural view describes the necessary elements and components to enable and support process execution. Therefore, the structural view defines service levels, which include: technical services, infrastructure services, data services, and specific services (the specific services provided by an agency for citizens and businesses).

The eGovCH programme applies the service-oriented paradigm. The NEA considers political and legal constraints. Concerning the implementation, the technical guideline SAGA.ch (Standards Architectures for eGovernment Applications)[161] defines the technological standards and basic architectures for e-government applications in Switzerland. The utilisation of open standards and open source software is recommended. The NEA defines criteria and measurements for evaluating the quality of e-government solutions. The measures are related to performance, efficiency and costs.[162] These criteria and measures are: accessibility, reduction of effort for administration, waiting times, throughput, cost management, quality, transparency of processes, and people's opinion about administration. The following Table 11 summarises the analysis of the Swiss NEA.

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161   Schmid (2007)
162   Müller (2005)

Table 11. Summary of Swiss NEA work

	Switzerland
1. Policies, actors and structures	The Department of finance is responsible for planning and implementation of the Swiss e-government strategy. The Federal IT Council bears overall strategic responsibility for ICT use in the Federal Administration and the Federal Strategy Unit for IT creates the strategy, programs, architectures and standards. The NEA focuses on making administrative activities as efficient, economical and close to the people as possible throughout Switzerland.
2. Governance	The responsibility for the NEA lies with the Department of Finance. NEA should be used in federal and local administrations.
3. Architecture frameworks and methodologies	The NEA programme is based on the TOGAF framework for the development of the architecture. The NEA contains principles, standards, tools, and evaluation criteria, and considers process and structural views.
4. Architecture principles and standards	The use of open standards and open software is promoted. The NEA fulfils the requirements of the EIF and the principles of the i2010 programme.
5. Implementations	SAGA.CH suggests service-oriented architectrure paradigms for the implementation of e-government applications.
6. Benefits	The NEA defines criteria and measurements for evaluating the quality of e-government solutions. The measures are related to performance, efficiency and costs.
7. Evaluation	A fairly comprehensive NEA programme.

4.7   Estonia

The Estonian Information Society plan was published in January 2007. The plan covers years 2007-2013 and it focuses on the enhancement of the quality of life through IT use. The ultimate goal is completely paper-free public administration. The plan is a continuation of previous plans published in 1998 and 2004. In Estonia, priority is given to developing one-stop shop cross-administrative branch services that consider the needs of different groups of people. In order to enhance societal well-being through IT, changes must be effected in processes and business models with ways

enabled by new technology.[163] The Estonian Information Society Strategy is a sectoral development plan, setting out the general framework, objectives and respective action fields for the broad employment of ICT. Several EU-level policy documents, such as the EU i2010, were taken into consideration when elaborating the strategy. All ministries, the State Chancellery, as well as organisations representing the third sector and scientific circles participated in the elaboration of the strategy[164].

Estonia aims to shift its emphasis from the development of technological solutions to that of information society as a whole. This poses new challenges to the current national ICT co-ordination model according to which agencies primarily proceed from an institution-based or local view. This model is to be abolished in favour of ICT solutions that are based on a horizontal (cross-institutional) and integral view. The wide adoption of ICT is aimed at increasing the efficiency and transparency of the public sector. This will change the way the public administration functions and pose challenges in terms of skills of civil servants. The Information Society Strategy sets the following objectives: 1) development of citizen-centred and inclusive society, 2) development of knowledge-based economy, and 3) development of citizen-centred, transparent and efficient public administration. Development targets, indicators, responsible authorities and planned measures have been defined for each objective. In addition, each objective is analysed and evaluated by an expert group composed of representatives from respective ministries, the third sector as well as academic circles. The strategy is implemented on the basis of annual Information Society Implementation Plans. The implementation plan is realized in the form of projects in accordance with the principles set out in the Estonian IT Architecture and Interoperability Framework. Projects are financed by both the state budget and the EU structural funds.[165]

The main objective of the Estonian IT Interoperability Framework is to ensure that state information systems are citizen-focused and service-based. Information systems must be integrated into a single logical whole that serves the population and various organisations. This requires state-level rules and agreements.[166] The Estonian IT Interoperability Framework is a set of standards and guidelines aimed at ensuring the functionality of services in both national and European contexts. Following the interoperability framework and the related documents is obligatory in order to ensure communication between the information systems of central and local government agencies. However, the framework is not included in the law. The obligatory nature of the framework is based on the related documents going through a consultation round in government agencies, the private sector, third sector organisations as well as

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163   IDABC (2007f)
164   Ministry of Economic Affairs and Communications (2006)
165   Ministry of Economic Affairs and Communications (2006)
166   Vallner (2006)

private persons, who can submit their proposals. Thus, the documents serve as agreements between different stakeholders.[167]

The Estonian IT Interoperability Framework employs three perspectives: organisational, technical and semantic interoperability. Organisational interoperability signifies the ability of organisations to provide services to other organisations or their clients by making use of information systems. Organisational interoperability is ensured by legislation and general agreements. Semantic interoperability refers to the ability of different organisations to understand the exchanged data in the same way. This presumes the creation of a mechanism that can present service data and data definitions. Technical interoperability is based on the interoperability of infrastructure and software. These require common data exchange protocols, the development of software necessary for the management of data connections, and the creation of user interfaces enabling communication between different organisations. In order to ensure interoperability, open standards and specifications are used in information systems. According to possibilities, open source-based solutions are applied in information systems.[168]

The development of Estonian state IT architecture is service-oriented. A data exchange layer called X-Road has been developed and is fully operational. X-Road constitutes the foundation of the so-called common service space. Several e-services have been created with it at both central and local levels.[169] The cornerstones of the state IT architecture are technical interoperability, security, openness, flexibility, and scalability[170]. The X-Road project has been deemed one of the best-practice examples internationally. Estonia is one of the first countries that have had a nationally operational interoperability framework already for several years. Today it only takes some days, or in some cases only some hours, and limited budgets (from 1000 to 10000 USD average) to develop a new e-service in this environment.[171]

In Estonia, the Department of State Information Systems, which functions under the Ministry of Economic Affairs and Communications (MEAC), is responsible for the general coordination of state information systems. The tasks of the department include the coordination of state IT activities and the formulation of development plans. These include, for instance, state IT budgets, IT legislation, IT audits, standardisation, and IT procurement procedures. Also under the jurisdiction of the MEAC is the Estonian Informatics Centre, an implementing body responsible for the coordination and development of state registers, computer networks, and data communication. Estonian ministries and municipalities also have their own IT councils. Furthermore, there is the

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167   Ministry of Economic Affairs and Communications (2005)
168   Ministry of Economic Affairs and Communications (2005)
169   Ministry of Economic Affairs and Communications (2006)
170   Ministry of Economic Affairs and Communications (2005)
171   ICA (2006g)

Estonian Informatics Council, which is a government subordinate committee comprised of experts.[172] The non-hierarchical coordination system enables decision-making as close to the level it affects as possible[173].

Estonia does not apply the term enterprise architecture, but the Interoperability Framework covers many aspects traditionally linked to enterprise architecture. Estonia has invested greatly in building a service-oriented architecture. The non-hierarchical and decentralised coordination system poses challenges to the development of a unitary national architecture. The Estonian approach is summarised in Table 12.

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172   Ministry of Economic Affairs and Communications (2005) ja RISO (2005)
173   ICA (2006g)

Table 12. Summary of the Estonian approach

	Estonia
1. Policies, actors and structures	Principal responsibility is held by the Department of State Information Systems and the Estonian Informatics Centre, which function under the Ministry of Economic Affairs and Communications. Ministries and municipalities have their own IT councils. The Information Society Strategy sets three objectives: 1) development of citizen-centred and inclusive society, 2) development of knowledge-based economy, and 3) development of citizen-centred, transparent and efficient public administration.
2. Governance	Coordination system is non-hierarchical. Following the interoperability framework and the related documents is obligatory, but not enforced by law.
3. Architecture frameworks and methodologies	No actual NEA in use. The Interoperability Framework covers three perspectives: organisational, semantic and technical.
4. Architecture principles and standards	The X-Road, which is based on service-oriented architecture, forms the foundation of the common service space. In order to ensure interoperability, open standards and specifications are used in information systems. According to possibilities, open source-based solutions are applied in information systems.
5. Implementations	The role of X-Road in the development of e-services is significant.
6. Benefits	Indicators have been defined in the strategy for each objective. In addition, each objective is analysed and evaluated annually by an expert group.
7. Evaluation	The non-hierarchical and decentralised coordination system makes it challenging to develop a national-level architecture.

5   NORTH AMERICA

Canada and the United States are often brought up when discussing the forerunners of enterprise architecture work. Next, we present the NEA programmes of these two countries.

5.1   Canada

The Canadian approach is a critical element of the government's strategy in renewing the public sector, governance, and the production of high-quality services to civil servants as well as citizens. Canadians expect affordable, easily accessible and open services. The strategic use f information technology enables responding to these expectations. Canada has adopted a federated architecture approach.[174] The aim of the government's NEA programme is to help in considering the government-wide uniformity perspective in the design, grouping, transformation, governance and interoperability of services and systems. Due to the programme's goals, Canada is changing its ways of governing business, information and technology.[175]

The Canadian government's EA tool-kit[176] is called the Business Transformation Enablement Program (BTEP) and it consists of two parts: 1) the strategic reference models of Canadian government and 2) transformation methodology. The former involves a common language for federal, provincial and municipal government. It allows modelling or mapping how a unit, programme or process of government works. The latter part describes the step-by-step iterative process, which produces usable visions, strategies, plans, standards, use cases and implementation plans. These are needed in every project to move from planning to implementation. These EA tools have been instrumental in supporting key government initiatives, such as the Government of Canada IT Security Program and the Services to Seniors programme. The Canadian government's strategic reference models include an extension, which is the profile of the Government of Canada IT Services.[177] It provides an enterprise view and reference point for the government's IT programmes that support

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174   Treasury Board of Canada Secretariat (2003)
175   ICA (2006c)
176   Treasury Board of Canada Secretariat (2004)
177   Treasury Board of Canada Secretariat (2006a)

the development of consistent IT service descriptions, more detailed service catalogues of IT service providers, as well as the basis for common planning, design and communications around Government of Canada IT services across government. [178]

Canada has an extensive strategy for the use of service-oriented architecture (SOA). The Government of Canada Service-Oriented Architecture Strategy[179] supports a cohesive approach to service delivery across government by introducing the service-oriented approach and the SOA reference model, which help ensure the consistent adoption of SOA in federal departments.[180]

The Canadian Public Sector Service Value Chain approach ties together employee engagement and citizen/client satisfaction with public services and citizen confidence as drivers of e-government performance. The programme aligns internal and external government investments through common architectures, shared business processes and management standards.[181]

Canada has established a separate unit (The Enterprise Architecture and Standards Division), which is responsible for the design, development and implementation of the Government of Canada's enterprise architecture and standards. Furthermore, it is in charge of the framework of principles and practices used to guide the design and implementation of service transformation and information management/IT initiatives. In addition, the unit supports the governance and control functions of the Treasury Board Secretariat by providing architectural reviews of key projects, coordinating the identification of new common components and services within the NEA, and developing migration and implementation plans.[182]

The main problem at present in the Canadian NEA approach remains the absence of more holistic thinking. This is needed in order to create a new federated architecture for collaboration. This architecture should entail an overhaul, and if necessary the transformation, of the existing political arrangements of the federation.[183] Christiansen's[184] extensive study revealed that although Canada has been considered progressive with regard to NEA, in reality it has problems realising its NEA objectives. Canada has not reported measurable goals or key performance indicators. Furthermore, no type of structured measurement is performed, nor is there information available on the degree of NEA use in Canada. According to Christiansen, Canada is not among the leading nations when NEA programmes are compared. The Canadian approach is summarised in Table 14.

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178   Treasury Board of Canada Secretariat (2006a)
179   Treasury Board of Canada Secretariat (2006b)
180   ICA (2006c)
181   ICA Summary (2006)
182   Treasury Board of Canada Secretariat (2006c)
183   Roy (2006)
184   Christiansen (2006)

Table 13. Summary of Canadian NEA work

	Canada
1. Policies, actors and structures	The Enterprise Architecture and Standards Division, which is subordinate to the Treasury Board, is in charge of NEA work. The objective is increasing government unity.
2. Governance	The NEA programme has no mandatory parts.
3. Architecture frameworks and methodologies	Canada applies a SOA reference model. The Enterprise Architecture and Standards Division is responsible for the design, development and implementation of enterprise architecture and standards.
4. Architecture principles and standards	The EA tool-kit consists of two parts: 1) the strategic reference models of Canadian government and 2) transformation methodology
5. Implementations	Heavy emphasis on the use of service-oriented architecture.
6. Benefits	No indicators for the evaluation of NEA work are used.
7. Evaluation	The problem in NEA work is lack of authorisation, and the absence of a holistic view on collaboration between different governmental organisations.

5.2   The United States

The long-term NEA work done in the United States can be noted in the good condition of public administration e-services when compared to other nations. The USA has consistently ranked among the top countries, for instance, in the UN e-government readiness index[185]. In the United States, large-scale architecture work was initiated already in the late 1980s with the adoption of the GOSIP[186] standard aiming at the compatibility of data transfer. At that time, the goal was internetworking between administrative branches, which helps reach the administrative objectives and obligations set by law. The second goal was achieving interoperability within government and in governmental areas regarding businesses and citizens. The third goal was universal applicability by promoting portable software and devices, which would enable performing several tasks with the same equipment. Finally, the key goal was reducing administrative costs.

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185   United Nations (2005
186   Government Open Systems Interconnection Profile, Federal Information Processing Standard 146.

Since the term enterprise architecture, more and more attention has been paid to security, privacy protection, standardisation and above all the governance model which guides the process aiming at interoperability. Two major frameworks that are targeting at an enterprise architecture have been introduced in the United States: Federal Enterprise Architecture Framework (FEAF) presented by the Federal Chief Information Officer Council (CIOC) and FEA reference model presented by the Office of Management and Budget (OMB).

The FEA also includes guidelines for carrying out multilateral projects (The Federal Transition Framework, FTF). The FTF aims at modelling the relevant features, implementation and maintenance of the architecture in a simple way which is also compatible with the FEA reference models. The FTF contains government-wide IT policy objectives and cross-agency initiatives. Content related to these initiatives is provided in one place – the FTF Catalog, which is organized into sections. Each section describes a single cross-agency initiative with information organized using a standard series of layers mapped to the Federal Enterprise Architecture (FEA) Reference Models.[187]

In the USA, particular attention has been paid to evaluation models for maturity and costs, as these are highly developed in the United States. Also the CIOC provides recommendations for ways of calculating costs and the cost effects of different techniques and solutions. In practice, the GPRA[188] obliges agencies to formulate strategic five-year plans and annual plans that implement them (including resourcing). The implementation of the plans is reported annually. Today, a three-dimensional framework is used as a performance indicator. This framework considers the adoption of and participation in the initiative, the actual level of use in practical work, and the end-user's approval and satisfaction in services produced.[189] The performance measures and assessed initiatives are publicly available on the www.egov.gov website.

There are several performance measurement indicators in use, such as the PRM[190] (the FEA's Performance Reference Model) and CBAM. For example, the CBAM (Cost Benefit Analysis Method) is a cost-benefit model used by the defence forces and drafted by the CMU/SEI[191], which balances the tasks of agencies and the costs used for them in relation to the quality demands of IT solutions and activities. These assessment models consider, for instance, system capacity, availability, security, modifiability and usability-related quality factors as part of the architecture. The premise of the analysis is the action scenario

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187 U.S. Office of Management and Budget (2007a)
188 Government Performance Results Act of 1993, aiming at better monitoring of the results of government projects with regard to objectives, effects, economic efficiency and performance.
189 OMB (2006)
190 U.S. Office of Management and Budget (2007b)
191 Carnegie Mellon University / Software Engineering Institute is a research institute financed by the federal state and ministries.

that forms the foundations of the architecture. This scenario is expanded by participants in the analysis, starting from the agency's operational goals. The costs and benefits of the planned system are determined by applying the quality factors listed above. Therefore, the CBAM requires an outline of the planned system with specifications derived from operational goals.

Experiences gained from the first administrative unit-specific reference models and implementations are systematically collected to support FEA governance. In practice, this means having a more permanent control organisation in addition to the project organisation. As well as guiding development work, the control organisation manages feedback and change in its sub-organisations. Financial administration is regarded as being furthest along in administrative branch-specific development.[192] The OMB has formulated adoption guidelines for agencies, which enable them to join service centres (four federal-level Centers of Excellence in Financial Management). The guidelines include a framework for shifting from old systems to new services, a model for a project plan, the best practices for change management and a list of available services. Services of financial administration can be produced either in federal agencies or via outsourcing through the orderer-producer-model.

Table 13 below describes the central features of the US standardisation programme. Despite standardisation, the number of government information systems has been increasing steadily at an annual rate of 10-20 percent (10000 was reached in 2005). The uses of ICT also change qualitatively (e.g. through an increased need for security and spatial systems) and require additional services, such as help desks, new telecommunication channels and data centres. The productisation and outsourcing of these services is estimated to achieve annual savings of approximately couple of billion USD in infrastructure costs (annual savings of 16-27 percent).

192   ICA (2006i)

Table 14. US NEA work

	The United States
1. Policies, actors and structures	Policy is defined by congress and implementation is controlled by an operational programme set by the President of the United States. The federal operational programme is implemented by the Office of Management and Budget (OBM). Each ministry implements the programme under the control of the Government Accountability Office (GAO). Local initiatives (in states) come from governors.
2. Governance	The law on public IT acquisitions (the Clinger-Cohen Act) defines acquisitions. The governance model is based on an evaluation framework called EAMMF, used for evaluating the maturity of administrative branches from an architecture perspective. The GAO evaluates the prgress of the architecture programme every two years. The OMB reports on benefits achieved and provides instruction. In addition, the CIOC gives recommendations in the Federal Architecture Working Group (FAWG).
3. Architecture frameworks and methodologies	The NEA is broadly defined to cover technology and business. It contains models which are used to model an organisation's operations. The descriptions include the present state, the target state and a strategy.[193] Frameworks used include e.g. TOGAF, FEAF and FEA. With the Data Reference Model v 2.0, the NIST (National Institute of Standards and Technology) has formulated a standard outline SP 800-80, which combines performance indicators for an agency's target-oriented operations and security. The complete description is in the Consolidated Reference Model (CRM) Version 2.2.
4. Architecture principles and standards	In the United States, legislation controls NEA work. The US Government Performance & Results Act, GPRA (1993) connects the budgeting process of administrative branches and agencies, and obliges them to follow performance indicators. The Clinger-Cohen Act (1995) obliges process reforms to be done before systems acquisition. The E-Gov Act (2002) defines principles of e-government, including agencies' security practice and responsibilities for agencies' reporting and federal control. The www.core.gov webpages define universal components used in architecture, as well as their maintenance responsibilities.

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193   GAO (2006)

5. Implementations	Each administrative branch must carry out their own projects according to NEA models and the principles of the GPRA and Clinger-Cohen Act. Implementation is monitored by the OMB which holds budgetary authority. Administrative branch-specific implementation recommendations come from the OMB. FTF guidelines have been developed for cross-public sector projects.
6. Benefits	Cost-benefit analysis commonly used. Key Performance Indicators show services are becoming more common and saving in costs.
7. Evaluation	NEA work is considered the most advanced. Administrative branch-specific, does not directly encourage cross-public sector projects. On a federal level NEA is in order, but in reality development on local/state levels is slow and scattered.

6 OTHER COUNTRIES

In addition to European and North American EA work, this report considers Japan and New Zealand, which have been included for achieving better geographical scope.

6.1 Japan

The word "e-government" was first used in an official Japanese document in 1997. The Japanese e-government strategy is called e-Japan, and its main target is to make Japan the most advanced IT state in the world. In addition, it aims at improving the quality of public services and the efficiency of administrative work.[194] Both central and local governments have been requested to publish administrative information on the Internet. As the amount of offered information increases, the usability of the websites has deteriorated. Most websites are infrequently updated and it remains difficult for ordinary residents to find the required information.[195]

Japan has also adopted a new 5-year strategic plan for IT modernisation published in the beginning of 2006. This new strategy focuses on the government-level renovation of business processes and systems through the implementation of enterprise architecture. The strategy determines that systems are to be updated or renewed only when 1) they contribute to administrative and financial reform, 2) they are based on an appropriate framework including an optimisation plan, and 3) they expand users' convenience.[196]

As part of the strategic plan, Japan has established a government project management office and a programme control office. The purpose of these offices is to support IT initiatives in order to reach cross-public sector and efficient solutions. In addition, a government evaluation committee comprised of external IT experts was founded. The task of the committee is the thorough evaluation of business processes and optimisation projects of systems in various ministries. The committee performs a cost-benefit evaluation and, if necessary, advices and gives recommendations in the planning, development, use and evaluation of systems.

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194 Shinkai (2005)
195 Orita (2005)
196 ICA Summary (2006)

The Japanese government has marketed computerisation since the time of central computers, but ministries and agencies have been largely autonomous. Central systems have been developed in individual ministries and the interoperability aspect has been neglected, mostly due to the independence and fragmentation of Japanese administrative branches. Therefore, the government has initiated a NEA programme. The programme aims at the evaluation and reform of business processes and systems. Reforms must be accompanied by an optimisation plan, which describes the challenges and goals of IT use. Plans must include an evaluation of the savings in time and costs achieved with the reform. The goals include, for example, transitioning to open systems and outsourcing business processes. The ultimate goal is a compact and cost-efficient public administration.[197] Using the NEA framework and the NEA process is mandatory[198].

197   ICA (2006d)
198   Christiansen (2006)

Table 15. Japanese NEA work

	Japan
1. Policies, actors and structures	The objective of Japan's e-government strategy e-Japan is to make Japan the most advanced IT state in the world. In addition, it aims at improving the quality of public services and the efficiency of administrative work. A five-year strategic plan published in 2006 launches a NEA programme aimed at renovating business processes and systems in public administration.
2. Governance	A government project management office and a programme control office have been established to help governance. The purpose of these offices is to support efficient cross-public sector IT initiatives. Using the NEA framework and process is mandatory.
3. Architecture frameworks and methodologies	The NEA programme contains a NEA framework and process.
4. Architecture principles and standards	Reforms must be accompanied by an optimisation plan, which describes the challenges and goals of IT use, as well as an evaluation of the savings in time and costs achieved with the reform. Goals include, for example, transitioning to open systems and outsourcing business processes.
5. Implementations	
6. Benefits	A government evaluation committee comprised of IT experts evaluates business processes and optimisation projects of ministries' systems. The committee performs cost-benefit evaluations and, if necessary, advices in the planning, development, use and evaluation of systems.
7. Evaluation	Evaluation of NEA work is difficult because little information on the programme is available.

6.2   New Zealand

The New Zealand e-government strategy published in the end of 2006 is a government-wide approach which changes the way agencies use technology in service provision, produce information and interact with people. New Zealand is pursuing the leading position in information and technology usage in reaching financial, social, environmental and cultural goals that benefit all citizens. Three scheduled objectives are set in the strategy. The first aims for the year 2007, by which ICT should be an inseparable part of administrative information, services and processes. The second goal is in 2010 when government has changed so that agencies and their partners are using

technology to provide user-centred information and services, and are reaching joint goals. The third goal is in 2020. By this time, people's commitment to government will have changed, as the possibilities of networked technology are utilised increasingly and innovatively.[199] The broader goals of e-government success are: a) appropriateness and satisfaction, b) integration and efficiency, c) trust and participation. The ICT department operating under the State Services Commission is in charge of the implementation of the e-government strategy[200].

The strategy published in 2003 introduced the importance of NEA use and the new strategy advances the issue. NEA provides an integrated framework for the development of ICT and is a significant tool in reaching the goals of government. In a networked operations model of government, activities related to planning and implementation must be coordinated. Controlling the existing and future applications as well as data exchange standards is important when improving and promoting interoperability. This requires a comprehensive and coordinated approach for governing ICT, which will form the foundations for the New Zealand EA. The EA will be based on a federated enterprise architecture. New Zealand has adopted a comprehensive view on enterprise architecture. EA is defined as a practice utilising an extensive method for the modelling of current or future structure of an organisation's processes, information systems, personnel, and organisational units in a way that aligns them with the central objectives and strategy of the organisation. Combining business strategy and IT investments is determined as the key goal of the formulation of EA. Federated EA signifies the application of EA practices to a situation in which an integrated organisation comprised entirely or partly of autonomous organisations is formed. The autonomous organisations work together to reach the goals and strategies of the integrated organisation.[201]

The first step towards EA has been the development of an interoperability framework for e-government. The framework is called e-GIF[202] and its first part was based on the British framework published in 2000. The New Zealand framework was adapted by evaluating the British e-GIF in groups made up of representatives of agencies and suppliers. The framework offers a model for the development of a more comprehensive architecture.[203] The e-GIF is a collection of practices, standards and information sources which support New Zealand IT systems[204]. The e-GIF encourages the use of open standards. An open standard is defined with three features: 1) the standard must be accessible to everyone free of charge, 2) the standard must remain accessible to everyone free of charge, and 3) the standard must be documented in all its details. The e-GIF is mandatory

199   State Services Commission (2006)
200   ICA (2006f)
201   State Services Commission (2006)
202   e-GIF (2006a)
203   State Services Commission (2006)
204   ICA (2006f)

for all Public Service departments, the New Zealand Police, the New Zealand Defence Force, the Parliamentary Counsel Office, the Parliamentary Service, the Office of the Clerk, and the New Zealand Security Intelligence Service. Adoption is also encouraged in organisations in the wider state sector and local authorities. Furthermore, the e-GIF is also open for use by enterprises and citizens.[205]

The EA includes a nation-level architecture and agencies' own architectures. The jurisdiction of the national EA covers cross-agency operations which require connectability and interoperability. In addition, the EA contains parts of the agency's internal operations in an area which applies shared data and services. For instance, the log in authentication tool is a shared resource used by agencies. The interfaces of agencies must be compatible with the standards, practices and protocols needed in using the service. The increasing importance of EA will bring on accordingly increasing governance, naming of responsibilities and financial support. Various committees have been set to help cross-administrative branch government.[206]

The New Zealand e-government strategy highlights the role of agencies and local government in the transformation of service provision and strengthens the role of key agencies. The use of information and communication technology has also been given a central position in the transformation of the relationship between government and citizens. Therefore, government must recognise and meet the challenges this creates. Using architecture as a framework to support individual operational and system development projects is becoming advisable. Expanding this kind of thinking as an enterprise architecture to the entire government is a new step in development. The implementation of the NEA approach to New Zealand state services as a whole, while taking into consideration the autonomy of individual agencies and agencies' own architectures, is the result of this development.[207]

New Zealand NEA seems comprehensive and its extensive documentation is publicly available. However, the webpages lack evaluation of the NEA programme. New Zealand has measured the progress of e-government[208]. According to the evaluation report, good progress has been made in accomplishing the goals set in the e-government strategy. New Zealand NEA work is summarised in Table 16.

205   e-GIF (2006b)
206   State Services Commission (2006)
207   ICA (2006f)
208   State Services Commission (2004)

Table 16. New Zealand NEA work

	New Zealand
1. Policies, actors and structures	The ICT department operating under the State Services Commission is in charge of the implementation of the e-government strategy. Goals include: a) appropriateness and satisfaction, b) integration and efficiency, c) trust and participation.
2. Governance	The EA includes a nation-level architecture and agencies' own architectures. In time new responsibilities will be named, and governance and finance increased. Various committees have been set to help cross-administrative branch government. Using the e-GIF is mandatory for some parts of government and recommended for others.
3. Architecture frameworks and methodologies	EA is defined as a practice utilising an extensive method for the modelling of current or future structure of an organisation's processes, information systems, personnel, and organisational units in a way that aligns them with the central objectives and strategy of the organisation. The e-GIF is a collection of practices, standards and information sources which support New Zealand IT systems.
4. Architecture principles and standards	The EA will be based on a federated enterprise architecture. The e-GIF encourages the use of open standards.
5. Implementations	
6. Benefits	Evaluation has only been carried out on the benefits of e-government. These have been discovered to comply with the goals.
7. Evaluation	A comprehensive NEA approach. Extensive documentation also positive.

7 CONCLUSIONS

In this report we have made an overview of the enterprise architecture work in 15 countries. The availability of information on these countries varied and their approaches differ significantly from each other. One of the key observations is that enterprise architecture work is novel as a comprehensive national level activity and advanced countries are few. However, several countries have on-going programmes or intentions to launch one. Key observations of the enterprise architecture work in different countries are summarised in Table 17.

Table 17. Key observations from NEA work in different countries

	Key observations
1. Policies, actors and structures	Usually responsibility of NEA work lies with a ministry or its subordinate organisation. In some countries the governance unit is cross-governmental. Key goals included for instance: interoperability, improving the efficiency of government, cost savings, better services and the reform of business processes.
2. Governance	Several countries use a governance model. Obligatoriness of NEA varies. Few countries have widely mandatory NEA. In addition, NEA use may, for example, be mandatory in government, or some parts of it may be mandatory for all. Only few countries have NEA legislation. The governance model has a crucial role in ensuring the success of an NEA programme.
3. Architecture frameworks and methodologies	Nowhere near all countries use a NEA framework. The background of the used frameworks used is not always revealed. E-government interoperability frameworks are used in several countries.
4. Architecture principles and standards	Several countries say their principles fulfil EIF requirements. Over half of the countries focus on openness (of standards, systems, source code). Some countries even oblige open solutions. Unification of standards used in e-government is a common premiss.

5. Implementations	Few countries have thus far truly implemented NEA. Several countries report emphasis on service-oriented architecture (SOA). Some use or are setting up a component collection.
6. Benefits	Measurement of the benefits of NEA work is rare. Indicators may be defined, but measurements are not available. Describing and measuring benefits would be important for securing the development and continuity of NEA work.
7. Evaluation	Development of e-government is already advanced, but the implementation of actual NEA programmes is only beginning. Not all countries have NEA programmes. Ongoing NEA programmes are different from each other. Few countries' programmes have congruent parts, but e.g. the British e-GIF is used elsewhere as well. The most influential NEA programme has most likely been the United States programme. Often the technical aspect is emphasised. Focus is on e.g. the creation of common standards. Comprehensive NEA work is only beginning in many countries.

It is important to notice that dissimilar programmes have reached good results. A legally binding governance model in the United States has led to extensive enterprise architecture work in government. In contrast for example, Estonia's X-Road has enabled a fast and cost-efficient way of developing services. In order to put forward successful EA programmes, the analysis should focus more extensively on the goals set for the programmes and their related governance models.

A service-oriented architecture as the method of implementation and investment in the use of open standards and software emerged in many countries. These are indeed necessary considerations when the goal is increasing interoperability and cost savings.

One crucial deficiency is shortage in measuring advantages and lack of self-evaluation in NEA work. These are needed since continuous evaluation is a prerequisite of improvement, which entails formulating lessons learned from work into more efficient and high-quality practices. It would be essential also for the continuity of EA work to be able to demonstrate advantages gained from this work.

In most countries, Enterprise Architecture work is only starting and therefore it was difficult to find examples or experiences from implementation. Several countries have set increasing interoperability both between administrative branches and with suppliers a central goal. This requires cooperation across administrative branches, which is often a new and different kind of work practice for hierarchically organised administration. This causes certain kinds of challenges in the implementation phase and particularly the role of governance models becomes salient.

8 SUMMARY AND RECOMMENDATIONS FOR FINNISH ENTERPRISE ARCHITECTURE WORK

The recommendations presented in this chapter are premised on conclusions drawn based on the comparison of the enterprise architecture work performed in the countries presented above. In addition, the steering group of the FEAR project[209] discussed the report and adduced objects of development important for Finland, which were included in this report.

8.1 The process of Enterprise Architecture work

Enterprise Architecture work has proceeded in different countries usually by following a pattern in which, first, a national framework and its reference models are developed. The next phase is the creation of a governance model for the integration and implementation of enterprise architecture. After this, features focused on ensuring interoperability are added to the governance model. In the most advanced countries, organisational change management and capability development have become highlighted.

In practice, this entails firstly a need to *predict the readiness of agencies* to participate in Enterprise Architecture work and to be able to participate in cross-public sector services, taking into consideration for instance data protection, security and aspects related to profitability.

Secondly, the development of enterprise architecture seems to require long-term cooperation between different actors. In the EU, public acquisitions must be done through competitive bidding. The problem is whether activities oriented to activity development can be defined so unambiguously that both orderer and

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209 Ministry of Finance, BEA Systems, IBM, Microsoft, Oracle, SAP, SAS Institute, SYSOPENDIGIA Oy, and TietoEnator have ordered the FEAR (Finnish Enterprise Architecture Research) project from the Information Technology Research Institute at the University of Jyväskylä. Additional information on the project: www.jyu.fi/titu/fear

bidder understand in different situations what is being developed. A *strategic alliance* between key actors could be an option worthy of consideration.

8.2   Measurement of advantages and prioritisation of goals

The goals set for enterprise architecture programs differ from each other considerably and, therefore, the success of an enterprise architecture programme is related to the goals set. If no goals have been set, or if they are left overly abstract, evaluating success is nearly impossible. Continuous assessment is a prerequisite for improvement. Evaluation/assessment of advantages is the driving force of enterprise architecture work.

In order to find out the significance of Finnish Enterprise Architecture work, advantages should be measured. The prerequisite for measurement is that clear goals are defined for Enterprise Architecture work. These goals can help in defining indicators that help to gain information on, for instance, the savings brought by EA work and the development of services. It would also be worthwhile to measure the spread of EA into organisations. Through EA work, common indicators for measuring the advantages of projects could be developed for the use of governmental organisations.

The advantages of EA work can also be evaluated by measuring the maturity of organisations' Enterprise Architecture. This measurement should be performed before the development of Enterprise Architecture is started and repeated when the EA has been in use for some time. The initial maturity measurement can help in directing development work into areas that provide results in a reasonable time frame or that have the greatest deficiencies. In this way, it can be determined if EA work has succeeded in developing the organisation's activity.

EA enables many things. Goals should be prioritised at the level of public administration and in organisations that start EA work. It must be decided which issues are taken up immediately in development and which will be taken up later. In the initial phase of EA work, it might be useful to consider what kind of development work provides fast payoff and success stories. These would help in spreading and promoting EA-thinking. Prioritisation of goals should be done from the perspective of business, and this requires cooperation between management, operational personnel and IT function.

8.3 Increasing understandability by developing interaction

A key development need in Finnish EA work is interaction development, which must be carried out in order to ensure the success of implementation. This includes, for example, naming the Finnish national enterprise architecture, communication, developing more understandable documentation and training, in order for the enterprise architecture to become familiar especially for public administration personnel. In the United States, interaction has been enforced through legislative means by, for instance, allowing citizens to follow the realisation of information society projects, and by stipulating discussion and rationalisation across administrative branches as a part of development projects.

Public administration interacts with a number of target groups. Different kinds of communication should be developed for different groups in order for the message to be received and accepted. Thus far communication on EA work is scarce and personnel have no clear picture of what it affects. It would be necessary to communicate both what benefits EA brings and what it does not affect.

8.4 Implementation of the governance model of Enterprise Architecture

Initiating Enterprise Architecture work in agencies and particularly the implementation of the governance model requires standardising procedures. This is challenging because authorisation is often deficient and current decision-making structures require changes. In addition, a governance model will enable controlling the development of national enterprise architecture and, for example, devising control structures that help to decide what kinds of development projects can be launched. Implementing a governance model is also important when EA development is initiated in an organisation. If the governance model is missing, EA will deteriorate in time.

A governance model serves, for instance, in defining standardised description models, which every administrative branch or agency must devise. With a governance model, a national-level permission for launching certain types of projects can be mandated. This ensures that similar development projects are not underway redundantly in several locations at the same time. A governance model is one way of promoting the creation of uniform procedures.

8.5   Enterprise Architecture as a tool for administration

EA handles issues that belong to the tasks of general administration. Therefore, it is vital to make administration commit to EA work. It also enables strategic goals pursued by administration. This is why it is important to include administration in this work. In order to reach this goal, work must be done in public administration through for example communication and training.

For EA work to produce as much benefit as possible, EA should be a part of decision-making. It is not only a tool for information management but also for administration and operational personnel. EA work in various organisations should involve people whose work is being developed. On the other hand, the problem may also be lack of dialogue between general administration and chief information officers. EA is supposed to be one tool for creating this dialogue. However, the fact that the IT function is not always represented in the steering group may become a problem.

In Finland, EA work is carried out under pressures of diminishing budgets, which is why the organisation of this work should be considered. A viable method might be networking between different organisations. This would decrease the need for architectural skills in an individual organisation. Network-like work would also enable interaction, learning and the creation of best practices. It must also be understood that the development of Enterprise Architecture is long-term work that must be done in collaboration with different parties in an organisation.

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