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Executive Summary

The state of play report at hand reflects eGovernment research in Europe and globally by providing an overview about the current eGovernment research themes, currently running research programs and policies as well as the existing eGovernment projects on foresight studies and trend analysis.

To investigate the state of play in eGovernment research, the eGovRTD2020 partners scanned literature and documents available in order to identify: current research programs in eGovernment, eGovernment research strategies of the different countries and sources of funds; current eGovernment policies and strategies in Europe, America and Asia-pacific region relevant for eGovernment research; and main relevant (running and finalized) research projects on eGovernment research roadmapping and forecasting running around the world.

Analysis was carried out along four dimensions: ICT related research, Government modernization research, Research in legal groundings and economic issues in Government modernization based on ICT diffusion, and Research in society evolution. The relationships and interaction among ICT usage, Government modernization, economic and efficiency as well as the society were also studied.

The methodology chosen elicited that the level of research programs, strategies and policies vary tremendously: some countries have very focused and detailed research programs; in other countries no one was identified. In the synthesis, the different countries are compared on this aspect.

Resuming from the results, the European Community's strategies are primarily oriented towards the Lisbon strategy and the new i2010 initiative. Focus lies on more investment and innovation, particular in increasing the speed of innovation development and productivity. Further catchwords from the i2010 document are to set up a single European information space and to promote an inclusive European information society. These strategies are reflected in many European member state strategies to modernize Governments by implementing eGovernment. Yet, most countries in Europe do not have own research programmes for eGovernment related research. A country that invests a lot of money in eGovernment research is the USA.

In several foresight studies carried out by FISTERA, within a project of DTI and EIPA for the EC, and Gartner, a series of themes of eGovernment research and investigations have been identified. In most cases, eServices provision in general and with specific focus of pan-European services (in the case of EC-related programs), eInclusion, accessibility, interoperability and standards, trust and security, knowledge management and semantic web technologies, understanding user needs, eParticipation and eVoting (yet still on an early stage) are among these topics.

Next step is the scenario building workshops. Details for the methodology and the results will be available in Deliverable D 2.1. A first version of the approach for the scenario building methodology and a test scenario are described here.

1. Introduction

The report at hand describes the state of play of eGovernment research in Europe and globally. It gives an overview about the current eGovernment research themes, currently running research programs and policies as well as the existing eGovernment projects. With existing eGovernment projects, research projects and research programs, strategies and foresight projects are meant here. These need not to be mixed up with running eGovernment implementation projects in countries or specific public organizations. Here, the focus is on research, i.e. what kind of projects do exist to investigate future trends and foresight on the next topics of eGovernment research.

As stated in the description of work, a consolidation of paradigms is needed in order to establish a clear baseline and wide consensus on concepts and terminology for eGovernment research in the next 15 years and beyond. During the last decade, and in parallel with the development and spreading of Internet technologies, government agencies leveraged tools and new collaboration between agencies emerged. Although there are a large number of initiatives, no clear vision and no overview of dependencies between initiatives and developments of eGovernment research exist. Most of the developments in this area are still technology-driven. The involvement of different agencies at all government levels is a rather difficult process. It requires proper planning and clear identification of the actors and their potential roles.

In recent evolution, a growing awareness can be recognized that eGovernment should be based on contributions of a multidisciplinary nature, namely from the IT, socio-economic, organizational, business management, legal, social, security, political and ethical areas. New collaboration forms, which include new ways of working and even new moral and ethical attitudes, new cooperation agreements and social contracts, new liability agreements and risk negotiation practices, new ways of exchanging knowledge, and correspondingly new challenges on equality, digital divide and ownership are among major trends. There are also several initial developments in terms of definition of adequate management models and policies, integrating the socio-organizational, human and psychological factors, and definition of identity mechanism. Furthermore, mechanisms to empower citizens are required as a way to induce creativity, to strengthen cohesion and sustainability and to reach responsiveness to turbulence.

The overall objectives of workpackage 1 are to collect information about the main eGovernment research programs and policies as well as about existing (running, finalized) relevant research projects of eGovernment all around the world that address foresight and trend analysis. Consequently, the following chapters describe the eGovernment initiatives, projects, strategies and policies of the EU and its member states, as well as of America, Australia and Asia. Next chapter details the methodology and structure of analysis. Following, the research themes, programs and policies are described by country investigated. Overall it should be noted that, besides the technical point of view, a focus on organizational and social influence of eGovernment has been the point of interest.

2. Introduction to eGovRTD2020 and the overall methodology

eGovRTD2020 is a specific support action under the sixth framework program of IST¹. The vision of eGovRTD2020 is to transform the EC government landscape into a coherent community, which anticipates customer needs and leverages the potential of the diversity and innovativeness of public agencies. The project objective is to develop future scenarios of eGovernment 2020. The approach is to go beyond the traditional foresight studies that address the next couple of years. Instead, eGovRTD2020 focuses on future governments by 2020. With the identification and recommendation of key research in the next future, eGovRTD2020 shall contribute to the development of an eGovernment research that helps develop the EC to become the world leading knowledge society.

In order to reach these challenging goals to shape the future of eGovernment research, a proper methodology needs to be adapted and applied. Figure 1 gives an overview of the overall methodology used in eGovRTD2020 in order to develop an eGovernment research roadmap. A first activity reviewed the current status of eGovernment research programs and policies in Europe and worldwide. For this purpose, national ICT implementation plans, national eGovernment programs as well as international initiatives have been investigated. The analysis of the state of play was based on desk research. Research programs and strategic eGovernment ICT implementation plans have been investigated along the dimensions ICT research and innovative developments, public sector modernisation (organisational change, networked governments, management of change and new service offers, adaptation and flexibility of laws, etc.), economics, effectiveness and efficiency of government activity in respect to ICT immersion in the public sector, and the evolution and impact of ICT in the society in relation to the society's interaction with governments. This report will provide more detailed insights into the results of the state of play.

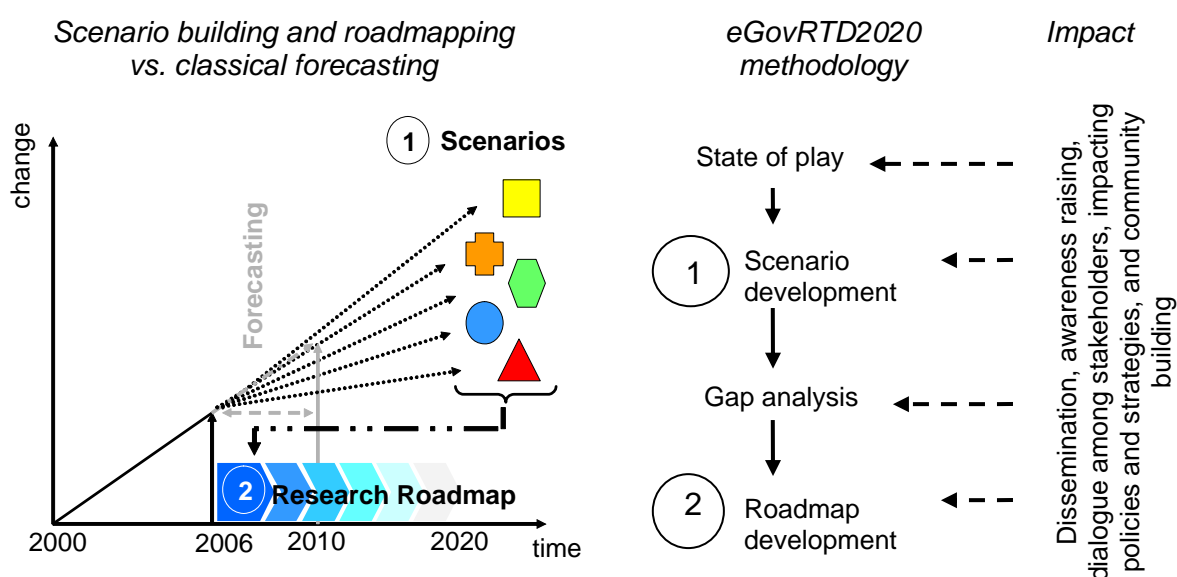


Figure 1: eGovRTD2020 overall methodology to develop an eGovernment research roadmap for innovative Governments in 2020

¹ For further details see the project's website at <http://www.egovrtd2020.org/>

Based on the state of play in eGovernment research, and on national ICT strategies and policies, a series of regional scenario-building workshops take place, in which government, academic, and other participants will collaborate to describe possible futures of Governments in 2020. The approach used thereby is the scenario-building methodology, which is briefly sketched in section 8. Further details will be delivered in the next workpackage report.

The state of play and the scenarios of governments and society in 2020 are the main input for the gap analysis, which assesses the differences between today and possible future outlooks for eGovernment research. Thereby, the problems and weaknesses of current research are being investigated. At the same time, challenges and opportunities of research in the various areas are being identified. The future scenarios are also the basis to find out the needs for future research. Likewise, the gap analysis deepens risks and potential threats if research and governments themselves will not take up and investigate the research needed to face the expected change till 2020.

The results of the gap analysis serve as starting point for another round of workshops with leading experts from distinct stakeholders. The purpose thereof is to develop and detail a research roadmap for the transformation process, i.e. a) which topics of eGovernment research will have to be addressed and investigated in the years to come b) with which intensity and c) what kind of results. The research roadmap shall address research challenges and actions to take in emerging technical, organizational, social, economic, and political trends. In this way, key research challenges and the required constituency shall be identified and characterized. Also, possible implementation models for holistic and dynamic governments in 2020 and beyond shall be developed.

Along this process of scanning current activities in eGovernment research and national strategic policies in regards to eGovernment implementations, awareness rising for the need of a stronger dialogue between ICT industry, governments and the academia shall facilitate stronger community building as well. Such a continuous dialogue is required to facilitate the transfer of research results to the application and vice versa to identify research needs in governments that academia can take up. With the methodology of regional workshops along the definition of future eGovernment research, a stronger impact shall be reached as well on this level of regional stakeholders to initiate a community dialogue and to establish common research programs to bring forward eGovernment research and implementation in a common effort of the relevant stakeholders.

3. Methodology to investigate the state of play

Current scientific discussions share the fact that eGovernment is multidisciplinary in nature. Already in 2002, Wimmer has developed and published a holistic reference model for developing eGovernment [120], [121], [119]. The growing awareness that eGovernment should be based on considerations from technology, socio-economic, organizational, business management, legal, social security, political and ethical areas guided also the investigations of the state of play analysis.

The overall methodology to investigate the state of play in eGovernment research was desk research. The partners of eGovRTD2020 analyzed research initiatives, research activities, as well as research programs and strategies in their countries and neighborhoods. The objective of the analysis of relevant material was to identify:

- current research programs in eGovernment, eGovernment research strategies of the different countries and sources of funds
- current eGovernment policies and strategies in Europe, America and Asia-pacific region relevant for eGovernment research
- main relevant (running and finalized) research projects running around the world.

The analysis of the state of play investigated the materials along the four dimensions, which are depicted in Figure 2 indicating as well their relationships:

- ICT related research, including new and innovative technologies that might be of interest in future eGovernment applications.
- Government modernization research, including organizational change, networked governments, new business models, new public management, citizen integration, customer orientation, etc.
- Research in legal groundings and economic issues in Government modernization based on ICT diffusion
- Research in society evolution, people using ICT as a daily support tool, people rejecting ICT, people expecting governments to serve in traditional mode, society change, problems of societal change such as digital divide, ICT illiteracy, ICT addiction, etc.

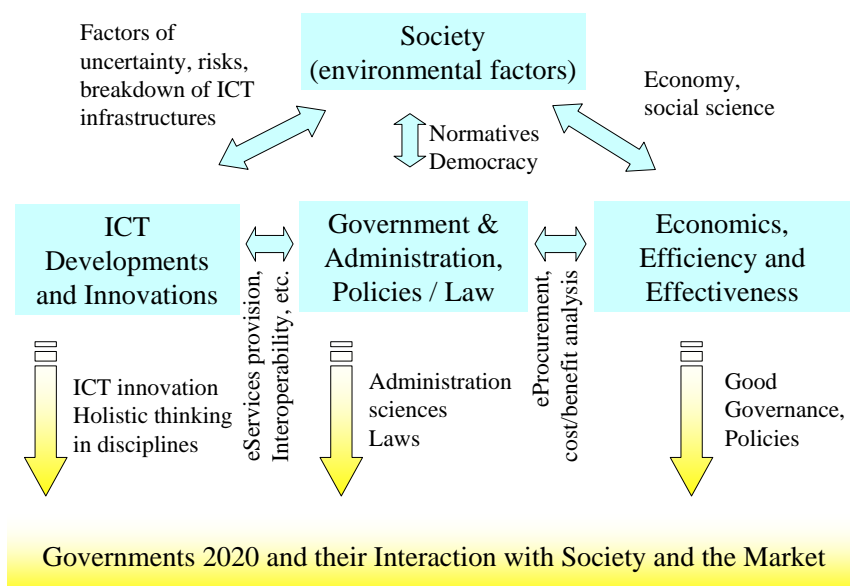


Figure 2: Identification of research areas and competencies along certain relations of areas (arrows): the overall methodology used to investigate the state of play in eGovernment research

A concluding reflection of the overall overview of programs, themes, and future trends in the distinct dimensions of eGovernment research assessed the future needs and weaknesses of current research.

In summary, the state of play represents a collection and review of information about the main research programs, research strategies and research projects of eGovernment in Europe and all around the world. Based on this state of play, a first draft of indications for the visions and measures for the roadmap of eGovernment 2020 were developed.

The methodology chosen elicited that the level of research programs, strategies and policies may vary tremendously (some countries may have very focused and detailed research programs; others may have none at all). This issue will be reflected in the report at hand by looking at the way eGovernment is organized in each country (area of responsibility). In the synthesis, the different countries were compared on this aspect.

4. eGovernment research initiatives and strategies

The following chapters describe the eGovernment research landscape in Europe, North-America and Australia. Statements and recommendations to requirements of future eGovernment research from several studies covering the current eGovernment research are explained in this report. The results of these studies draw a picture of eGovernment research topics both, old and new ones, which are important for the future and should be further funded. Moreover, topics which no longer require research yet are still funded are named, too.

4.1 EC related programs and initiatives

The EC frequently publishes strategic documents that build the ground for the short- to medium-term developments and research programs. The i2010 initiative [42] is such a key document for the current period. Its predecessors are eEurope 2005 [35] and eEurope 2002. i2010 has to be seen in close relation to the Lisbon agenda which consists of making Europe the most dynamic and competitive, knowledge-based economy by 2010. Through improving citizens' quality of life, supporting single markets, and reducing administrative burden on enterprises the vision of the Lisbon agenda shall be realized [113]. Last named measurement is seen in respect to bureaucratic rigidity on that part of service organizations which is a main issue in Europe and a big challenge for the member states to change [102].

As a result, the EC recommends three priorities for Europe's Information Society policy within the i2010 document [42]:

1. Single European Information Space
2. Innovation and Investment
3. Inclusive European Information Society.

The Lisbon agenda, the eEurope 2005 and the i2010 initiative goals were the basic guideline underlying the 5th and 6th Framework Programs of IST. Within the 5th Framework Program, the EC funded eGovernment projects related to a 'user-friendly information society' [69]. The research priorities of the 6th Framework Program of IST are addressing research priorities with the labels "ICT research for innovative Government" and "Strengthening the Integration of the ICT research effort in an Enlarged Europe" [71]. The strategic objectives covered aspects such as:

- Innovative ICTs for democratic involvement, in particular eParticipation
- Intelligent, inclusive and personalized eGovernment service
- Adaptive and proactive eGovernment support systems

- Secure pan-European eGovernment.

Other programs related to the i2010 strategy and the eEurope Action Plans are for example the MODINIS program [89], Interchange of Data (IDA) and Interoperable Delivery of Pan-European eGovernment Services to Public Administrations, Business and Citizens (IDABC) programs [66] and eTEN (Trans-European Networks) [38]. The following paragraphs will give a short overview about these programs and their objectives.

The MODINIS program [89] aims to follow up the eEurope Action Plan by disseminating good practices, monitoring and comparing performances of the European member states, and supporting actions to increase awareness and to enhance the security of networks and information. In order to support the efforts made by the European member states in the framework of eEurope at national, regional or local level, MODINIS covers four key branches of research [89]:

- analyzing good practices
 - study on exchange of good practices in eHealth
 - study on content for mobile broadband services
 - study on importance of free and open source software on the development of the information society
 - study on security challenges in the deployment and use of disruptive technologies
 - study on interoperability
- establishing a mechanism of exchange of experiences
- analyzing the economic and societal consequences of the information society in terms of social inclusion
- preparing the establishment of the future structure for network and information security issues

The IDABC program [66] succeeds the former IDA program and was set up for the period 2005 – 2009. It aims to support and promote the development of pan-European eGovernment services and the underlying interoperable telematic networks. Therefore IDABC focuses on [66]:

- enabling the interchange of information between public administrations
- facilitating the delivery of pan-European user-centric services
- getting interoperability across different policy areas, particularly on the basis of a European Interoperability Framework
- promoting the spread of good practice
- encouraging the development of innovative telematic solutions in public administrations

The eTEN (Trans-European Networks) Program [38] aims to support the interconnection of telecommunication infrastructure networks, the establishment and development of interoperable services and applications and access to them. In detail eTEN focuses on the following topics:

- facilitating the transition to the information society
- eInclusion by strengthening economic and social cohesion
- eGovernment services
- eHealth services
- eInclusion by encouraging the participation of older people and people with disabilities in the information society
- eLearning
- increasing trust and security of services available
- Value chain
- Interoperability

- Services of common interest
- Generic services.

The distinctions of the programs IST, MODINIS, and eTEN can be seen as follows: while IST focuses on research from the very beginning and in its core interest, eTEN tries to take up the research results from IST in order to support the further development of findings towards products ready to immerse in the market. MODINIS tries to provide a ground for knowledge transfer by providing measurement guidelines and frameworks as well as good practice cases all over Europe, from where one could learn. IDABC, instead, focuses the interoperability of processes and services among various stakeholders in eGovernment. So, it can be considered a basic principle.

To look beyond core eGovernment research, we investigated several foresight studies of the EC carried out by the EC institute FISTERA in Seville. The following aspects have repeatedly reached our attention:

- ICT research priorities towards nano-electronics, photonics and integrated micro-nano-systems, as well as ubiquitously and unlimited capacity communication networks, embedded systems, and computing and control [82].
- Advanced software development, Grid research and development, as well as security improvements and dependability; integration of technologies in personal and home environments, as well as robotic systems, and intelligent infrastructures;
- ICT related to societal challenges in areas like health [92], mobility [10], environment, sustainable development, and government.

To sum up the key recommendations in research issues provided by EC related programs and initiatives, Table 1 provides an overview of the topics identified in a series of studies and strategic documents available at EC level. Most often named topics are trust and security followed by the three topics a) understanding the user needs, b) interoperability and harmonization, and c) Inclusive European information Space.

Table 1: Summary of future research recommendations and topics identified by EC related initiatives

Research topic	Named by study / strategic document from EC	Number of occurrences of listing the priority	Framework program (FP)
trust and security	[107] [5] [88] [36] [82] [102] [101] [89] [38]	9	FP 5, FP 6, MODINIS
understanding individual user needs	[88] [36] [82] [113] [99] [89] [66] [38]	8	FP 6
harmonization and interoperability	[5] [88] [36] [40] [82] [89] [66] [38]	8	FP 6, IDABC, MODINIS
Inclusive European Information Society	[42] [36] [40] [56] [62] [89] [38]	7	FP 5, FP 6
socio-economic inclusion	[88] [36] [113] [89] [38]	5	FP 5, FP 6
access for all to	[88] [36][82] [62]	4	FP 6, MODINIS

government services			
Health	[82] [92] [89] [38]	4	FP 5, FP 6
knowledge management	[5] [88] [82]	3	FP 5
Investment	[42] [36][40]	3	
value chains	[88] [17] [38]	3	
Innovation	[42] [62] [66]	3	
change in public sector	[88] [82]	2	FP 5
new government delivery models	[88] [78]	2	FP 6
more user friendly systems	[88] [102]	2	FP 6, FP 5
eDemocracy	[88] [17]	2	FP 5, FP 6
cross-sectoral public services	[88] [17]	2	FP 5
change towards front-office and service use	[26] [88]	2	FP 5
Mobility	[82] [10]	2	
Single European Information Space	[42] [89]	2	
Environment	[82]	1	FP 6
sustainable development	[82]	1	FP 5
Government	[82]	1	FP 5, FP 6

Besides, within the 5th framework program of the EC, the Danish Technological Institute (DTI) together with the European Institute of Public Administration (EIPA) elaborated a key forward-looking study which resulted in a report towards the eGovernment vision for EU in 2010 [88]. This report extracted the major current and future research areas of interest in Europe via a questionnaire and expert workshops. It concluded with a suggestion of the ICT research policy challenges that should be addressed in the next five years.

The stakeholders of the questionnaires and workshops were academics and consultants, public sector strategic managers, ICT industry, users and media, European Commission, and non-European experts. These stakeholders had to assess the eGovernment research area and to rank the topics to its perceived importance. A general agreement of all stakeholders by 50% or more of respondents identified the following research areas as very important [88]:

1. harmonization and interoperability with 76 %
2. trust and security with 72 %
3. access for all to government services with 67%
4. knowledge management for data with 63 %
5. understanding individual user needs with 62 %
6. change in public sector with 56 %
7. new government delivery models with 62 %

From the investigations and results of the study, DTI and EIPA have elaborated a holistic reference framework for eGovernment research depicted in Figure 3. The smaller lined circle indicates current eGovernment research, which focuses intensely on back-office and interfaces between back- and front-office. Particularly, attention is given to technology aspects including data and knowledge management, as well as to technical aspects of interoperability, service design and production, and trust and security. Accordingly, current eGovernment research focus is clear set up on technology use and exploitation of these solutions.

However the study also recommended that eGovernment research should not only implement existing technology but it should require its own basic technology research, adapt and develop technologies appropriate to eGovernment in relation with monitoring and cooperating with other domains. There is much less focus on the user-centered issues, or on the benefits of eGovernment applications for public agencies or users.

The dotted line (bigger) circle in the figure identifies the expected future developments that head for more research activities in the field of user needs and more user friendly systems, as well as socio-economic inclusion, eDemocracy, value chains, and cross-sector public services. This implies that the focus shifts away from back-office and inward facing research towards wider organizational aspects of service design and delivery. We seem to return to the front-office view of the earlier research focus of FP 5. However, the future focus should be to include both views: front-office view with back-office and inward-looking research that should lead to overall management of change in a comprehensive way in order to reach networked governments by large.

As a concluding recommendation, the study of DTI and EIPA stresses that future research shall be more linked to European and national policy in regard to social and inclusion policies, as well as to economic and cross public sector policies [88]. The first named policies were emphasized mostly by academia, the public sector and users, the latter by consultants, industry and non-Europeans.

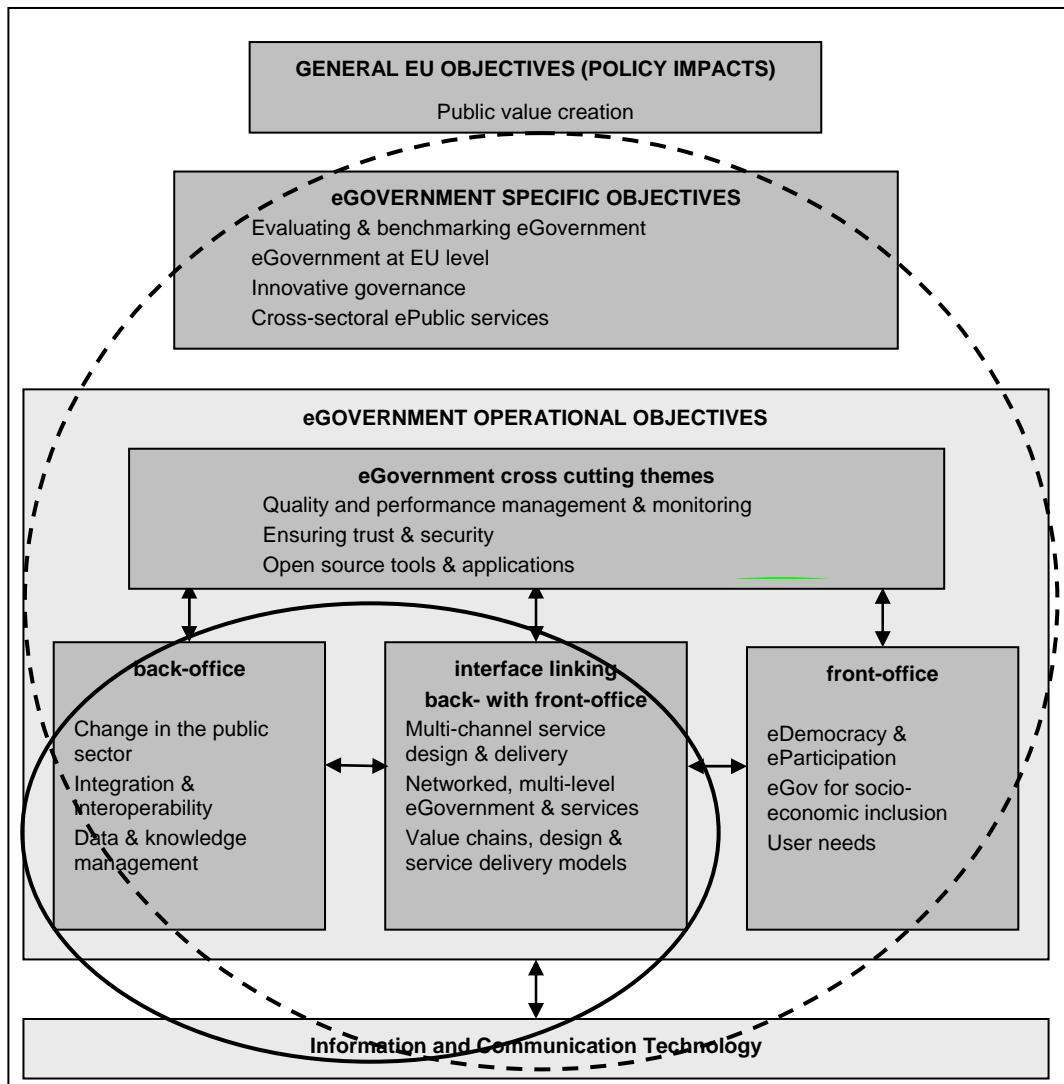


Figure 3: Proposed holistic conceptual research framework for eGovernment [88]

4.1.1 ICT related research programs and strategies

4.1.1.1 Harmonization and interoperability

Within its eGovernment activities, the European Commission has declared interoperability as a primary topic for the next period. In its working document [44], the EC (European Commission) defines interoperability as “*the means by which the inter-linking of systems, information and ways of working, whether within or between administrations, nationally or across Europe, or with the enterprise sector, occurs*”. As can be recognized, interoperability is to be addressed on several levels. Summing up current discussions on interoperability (cf. [6], [7], [44], [68], [58], [73], [111]), the following levels are key to enable communication and cooperation among systems and services:

- *technical interoperability*: Linking computer services and systems together so that the systems and applications are able to communicate with each others based on

standardized interfaces and commonly used standardized metadata, document formats, communication protocols, technologies and open standards.

- *semantic interoperability*: Establishing a unique meaning of exchanged data, information and procedures. Only through such commonly agreed unique understanding, the information can be processed in a meaningful manner. Thereby, standardized data definitions, process models and object description frameworks are being used.
- *organizational interoperability*: This level of interoperability – the most complex one – is concerned with aligning business processes and information architectures with organizational goals. Furthermore, overall agreements are settled on organizational and legal level to enable processes to co-operate beyond organizational and state borders.

All three levels of interoperability deserve equal attention in order to make systems communicate with each other and to link up governmental systems and services beyond organizational and national borders. To reach comprehensive interoperability, a series of problems have to be resolved.

The EC has launched a series of programs, where interoperability research and development gets substantial funding. Such examples are the IST framework program 6, IDA and IDABC, eContent and eTEN (see [35]). Within the EC MODINIS good practices framework, one project is dedicated to localize good practices in interoperable public service provision [90]. The European Commissions eGovernment subgroup also addresses interoperability issues in its strategic-political agenda.

As has been recognized, seamless communication and integration of data and information, as well as synchronized inter-organizational business processes are hindered by the absence of common standards [99]. The current fragmented and isolated developments hinder the networking and exchange of data due to e.g. proprietary systems and lack of common open standards. Currently, the EC invests much into ICT related developments to secure exchange of data and information among distinct legacy systems and different organizations. The visions are to interconnect all ICT systems [37]. Enhanced interoperability is a crucial factor to solve these problems. Research in the development of standards has to concentrate on both, basic infrastructure technologies [107] and domain specific technologies [78].

In a recent workshop organized by the EC, the following policy areas and research challenges have been identified in regards to interoperability [78]:

- the dissemination of information about existing legislation and regulation to ensure security and trust
- the harmonization of national implementation of EU directives supporting eCommerce for instance eSignatures
- the adoption of the IPv6 or research should be promoted to ensure the availability of Internet addresses for all devices (also identified as important in [77])
- the development of new software licenses which will be based on on-demand computing usage

- the introduction of a regular framework for trusted certified authorities with regard to globally harmonization
- the free exchange of data across national borders with emphasis on Europe
- a trans-European limited liability inclusion.

The overall conclusion of the workshop report was that research should concentrate on developing a specific technology roadmap of interoperability [78].

4.1.1.2 Developing interoperable security infrastructures

High priority is given to research actions that focus on security and flexibility of large, complex, open and interrelated infrastructures [26], as well as on methods for mapping and modeling the infrastructure underlying processes. This is related to secure platforms [37], networks and software ensuring interoperability and competition, and cryptographic techniques [26]. Furthermore, methods for network security inspections, forensics and tracings have to develop, above all new methods for acquisition of highly charged data with tools not based on the operating system. Especially attention in regard to eSecurity is given to research of identification and authentication [40] matters with focus on biometrics [43]. Besides, research activities also concentrating on guaranteeing reliability and security of software-intensive systems [26].

Furthermore, innovative identity management [82] [37] systems shall empower the user and include technologies that authorize users to handle their identification themselves or choose to leave it to the service provider. For identity management across heterogeneous systems, interoperability and some minimum standards are essential. Legal, technical and organizational barriers must be identified before the electronic identity is applicable. Besides, security industry should switch emphasis from “managing ownership for users” to “empowering users” to manage their own data.

The strategy of a secure information strategy published in the i2010 strategy for the Information Society requires improvements of eSecurity, particularly for the Internet [101]. Therefore, research shall address risk management, identity management and privacy enhancing, certification and standardization, regulation and general policy strategies, authentication, trusted computing, network security, as well as technologies to support law enforcement activities [43]. Further research is required for secure fundamental protocols, secure software engineering and software assurance, as well as a holistic system security approach for complex and multi-layered global infrastructures [37].

ICT systems are susceptible to attacks. Research shall focus on monitoring capacities enabling rapid recovery, and it should develop protection models that automatically distinguish between “normal” behavior and cases of threats. The vision is to reach out to automated protection and repair operations. In addition, these models shall support real-time data collection, storage, mining and analysis during crisis, too [37].

4.1.1.3 Further key technology and socio-technological development requests

Currently public organizations emphasize the development of smart environments, in particular communication-related technologies which are crucial for future intelligent environments. This research focus has arisen through the ongoing convergence of high-quality multimedia services with high-speed data communication. Research and

development of multimedia data and multimedia information processing is also a priority topic of those organizations [26].

Socio-technical research should be undertaken to identify socially useful technologies based on the principle “design for all”, and assistive technologies [82].

Research should promote where Europe’s performance in ICT is weak in comparison with other global regions particularly in the area of storage and processing [28].

The European Commission research furthers also personalization of services and service platforms, which will be different from today’s physical platforms, whereby Internet and mobile platforms will start playing a central role. According to Dachs et al [28] at the moment Europe is a leader in terms of mobile applications and infrastructure. To maintain and perhaps upgrade its leading position in future it still must concentrate on the development of mobile infrastructures and applications with attention to Asia’s development [32].

4.1.2 Programs and strategies to support government modernization research based on ICT developments

According to a FISTERA study [82], research needs to concentrate on the integration of front office, back office and processes.

The Lisbon agenda as well as the i2020 strategy claim for single access points to reach all public agencies. Therefore, the different ICT systems need to seamlessly networked together [99], in particular new innovative systems shall exchange data interoperable with older ICT systems and applications. ICT research shall emphasize new forms of dynamic networked co-operative business processes and optimized work organizations [82]. Research activity will consist in creating a business interoperability framework in regards to short-, middle- and long-term change to prevent over- and under-investments in interoperability technology. Besides, a holistic approach of interoperability within a socio-economic context shall also be investigated. For the individual public agency, business models shall be developed which can be incorporated into Grid-middleware, and evaluated to indicate those circumstances under which they provide the most benefit. Research must also be undertaken in the field of analyzing and developing features to manage the gap between decentralized resources, aims and restrictions. Furthermore, changes in models of a public agency [42] can affect processes, decisions and aspects in other agencies. Therefore, research activities are necessary in the field of synchronization. According to [78], a model-based aggregation is necessary, especially in regards to cross-organizational workflows.

To promote ICT enabled public services, both, technical and organizational needs have to be considered [42], [120], [119], [121]. Technically common interfaces, portability of identity and authentication systems are needed. Organizational changes will require new practices, new skills and different legal grounds.

In particular, research in the field of process models and tool interoperability shall allow connectivity between process models and reusability in the future [78]. According to [42], an action plan on eGovernment and strategic orientations on ICT enabled services is required. In the past focus was on ICT support of the development of large scale communications but in the future attention will shift to individuals and therefore the communication systems will develop to support the interaction between human beings and institutions at local level [75].

Furthermore, research in the field of identity management [37] in particular permanent document identity and identifiers shall intensify; especially attention is given to policies, practices and possibly standards, to set up a legally authentic electronic certification. In addition practical use of steady electronic document formats is not that wide used as expected, and this is a negative development because electronic documents are a basic requirement for many eGovernment services. Therefore, intensification of electronic document research is necessary to ensure its legal validation at European scale. In regards to the administration of electronic documents, also the issue of long-term archiving has to be solved with proper maintenance models [5].

Existing mechanisms for knowledge management which shall support the share of eGovernment experiences, good practices, lessons learnt and information are still not efficient enough and are limited in their effectiveness by being project-based. Common specifications for semantic interoperability are claimed in [78] as being needed for instance through a regular eGovernment service terminology and service information model.

Fontela et al [47] state that structural changes in business and government require reinforced research capabilities for the analysis of economic and technological interdependencies.

Government can be supported through eGovernment by providing effective inputs to society and in particular to economy. Public sector purchases in Europe account for 15-20% of GDP that is why eProcurement benefits are potentially very high and research in eProcurement activities should be promoted [113]. The European Commissions Action Plan on electronic procurement provides for reducing bureaucracy, creating an EU wide consistent legal framework and ensuring interoperability between the different national IT systems by 2010 [67]. To exploit market potential, the flexibility of the ICT market must be enlarged. Besides, if the EU objectives for economic growth and jobs shall reach out, research focus has still to focus on trust and security, as well as on value chain partnerships and service delivery models, networked governments, and understanding user needs but much more appropriate than it is at the moment. Especially, the four internal market freedoms of movement including persons, good, capital and services need to be supported by eGovernment. Consequently, a more widespread cooperation across Europe is required. How ICT can support these non-technical requirements should be clarified through intensive research [42]. Other sources stress that for more efficient transactions between the public sector and its customers particular attention should be on eCommerce applications and secure payment online [77], as well as on the development of reputation systems [43].

4.1.3 Research programs and strategies to investigate society evolution

The European Commission aims at realizing the vision of an inclusive European Information Society, which provides high quality public services and promotes quality of life. Therefore, social, economic and territorial cohesion shall be reinforced by making ICT products and services more accessible [9], and in particular, by including regions lagging behind. Governments in Europe are encouraged by the European Commission to direct their eGovernment policies to provide eAccessibility [82] [95] including the offering of multimedia data and information [26] through multiple channels and broadband penetration [40]. Broadband research related to telecommunication infrastructure and applications is an important enabler of the Information Society [37]. To improve quality of life, the Commission has set up three quality of life ICT flagship initiatives:

1. caring for people in an ageing society [62]

2. needs for safe and clean transport solved by intelligent cars
3. needs of cultural diversity solved through digital libraries.

Digital convergence leads to new challenges for eInclusion. Thereby, socio-economic research regarding ICT and other skills are needed. Particular attention should be paid to the inclusion aspect and to overcome barriers for elderly, women, immigrants and ethnic groups. Further research is needed into what is driving people out of the Information Society, for instance poverty and social exclusion, digital illiteracy, access gap, personal factors and so on [102]. To avoid digital divide, ICT systems have to be easier to use for a wider range of people. Research addressing product innovation and development especially for elderly in fields like smart environments and eHealth [107] [92] are very important for eInclusion. Europe's public servants are a crucial competitive factor, which leads to the fact that these actors in society have to be equipped with skills and competencies necessary to adapt and manage change. ICT research shall focus on technology-enhanced learning [84]. Therefore, a European initiative on eInclusion is proposed which investigates such requirements [42]. Currently, there is an increasing trend to focus on social and economic implications of ICT [82].

To reach the EU policy aims for 2010 in regard to social inclusion and regional cohesion, research has to concentrate more on outward-facing aspects of eGovernment and the interface between government and citizens. The focus shall be on the development and delivery of appropriate content and services, and networked, coordinated and joined-up government. Besides, trust and security of electronic data transmission and storage are also important in regard to eGovernment acceptance and utilization [107] and social inclusion [40].

The EU policy in regards to eGovernment in the field of social welfare requires improved usability of interfaces between public agencies and citizens. Particular attention in developing the usability of interfaces is given to the operational level including service design and back-office developments. Whereby back-office improvements shall take place on integration and interoperability. Research into the change of the public sector can help to face legal and regulatory challenges in the back-office change. Emphasis must lie on the understanding of user needs [40] [99]. The emphasis of user needs leads directly to users expectations and requirements concerning secure information system infrastructures [59] which must be build in relation to usability models therewith users accept the system and interact with it [5].

For the development of an Information Society citizens should be encouraged and empowered both, to use existing ICT as well as to continuously learn the usage of new ICT [40] [83] [19] [102]. Such motivation should lead to high-quality IT education at all education levels [107]. Therefore, research in the field of eLearning [83] [107] is required, as well as privacy enhancing technologies [82] [59] [99] which provide both anonymity and identification, and thereby accountability for online transactions.

The further development of human computer interface design (HCI Design), which is engaged in configuring the interface between human beings and computers particularly with regard to human abilities and technological possibilities, is also an important research topic concerning eInclusion. In the special field of software development above all user abilities, skills, needs and interests play a major role and therefore research should focus on understanding the psychology of dealing with motivators and incentives of using ICT as well as of trust in the digital world [43].

Currently, there is a shortage of skilled networking professionals, application skills, skills around host-based computing, and technology neutral skills. Industry and academic should

closer and more regularly cooperate to improve the transformation process at the higher education level. Future research should focus on flexibility in education, lifelong learning, labor market information systems, industrial and business delocalization processes, new and emerging working life styles and cycles, as well as interdisciplinary professions, and incentives and conditions for increasing inter-regional and inter-sector mobility [102] [83].

Another point to take into account is the improvement of eParticipation [42] and opinion forming, which are central topics of eGovernment regarding eDemocracy. The development of eParticipation depends on the degree of formality a certain action has to fulfill. The more informal political participation is the higher is the probability to transform it electronically. Informal information exchange at forums or chat rooms is relatively easy to implement and already partly in action. At that level, the most eParticipation deployment will take place. At the semi-formal level it is more difficult to electronically transform actions.

4.1.4 Research programs and strategies addressing crime prevention and safe life

A societal debate is needed to find a balance between security, freedom and protection of human rights. The role of software producers and Internet service providers must also be examined. Test beds shall be used to study psychological, organizational and economic aspects of trust in different areas for instance data retention [43].

Over the last years, eCrime increases. Government duties have increased to provide proper protection mechanisms. Effective research is needed to develop concepts, methods and tools to detect and counteract corruption, crime and terrorism activities taking e.g. place via the Internet or being prepared via the Internet. Secure core infrastructures and Internet security protocols, as well as monitoring concepts for managing emerging risks and increased complexity shall be developed by corresponding research. Need for cooperation and networking information security policies on at least EU level is necessary. Research should focus on related domains like psychological, societal, institutional, legal or economic aspects which can prevent eCrime [37].

4.1.5 Research issues related to eHealth

Because of an increasing aging society, research in the area of eHealth becomes more and more a central topic of policy [82] [26] [92] [107]. More research should be undertaken to understand the social characteristics of the health domain in relation to ICT usage. Technology application research shall help to develop more efficient and economic practices for long-term care through tele-assistance systems, home telemedicine oriented systems, Internet based systems, and mobile pervasive systems [92]. Another point of view is promoting research and deployment of grid computing to share computing, application, data, storage, and network resources across dynamic and geographically dispersed organizations for medical care and research [57].

4.1.6 Research related to EU enlargement

In the European environment, particularly EU enlargement eGovernment research face a lot of complexity and interoperability needs [40]. Sharing and disseminating information are key success factors for EU wide government. Therefore, a correlative infrastructure, cooperative research and education in the EU to harmonize quality at a certain level is necessary [42].

4.1.7 New strategies and programs to spur innovation and change

In the field of economic growth, competitiveness and innovation, current research is not linked closely enough to EU policy, which implies the need for a more policy-driven and top-down research policy [42]. Solution coverage of at least the EU level is also necessary for developing competitive standards and authentication [5]. For the promotion of innovation and investment it is crucial to concentrate on closing the gap with Europe's leading competitors, and delivering world class performance in research and innovation in ICT. Investment in research and development normally leads to invention and innovation, and both are essential for the ICT sector to continue delivering jobs and economic growth. The innovative exploitation of ICT is very important. In the field of deployment and adaptation of ICT, enterprises face a lack of interoperability, reliability and security. In particular, small and medium sized enterprises (SMEs) have difficulties to adopt ICT. Therefore, the EC has identified the need of research and deployment initiatives to overcome key bottlenecks that require both technological and organizational solutions. Some of the strategic research priorities have already been identified as technology pillars for the Seventh Research Framework Program [82]:

- Technologies for knowledge, content and creativity
- Advanced and open communication networks
- Secure and dependable software
- Embedded systems
- Nano-electronics

These research priorities cover also the trend of technology convergence, which requires that ICT research must be coupled to other different scientific domains like biological and chemical sciences [82] [102].

Moreover, complementary measures to encourage private investments in ICT research and innovation need to be set [42]. Businesses and academia should work closer together in creating innovative ICT products and services. Furthermore, research and development should be coordinated on a European scale and not separated from each other [30]. Special attention and promotion shall be given to SMEs because they are the main drivers in innovation production.

In general there is still a growing gap between Europe and the US which is the reason why European telecommunications should invest more effort in innovation [106]. In addition, research should aim at discovering "attractor" technologies, which influence the future development of related technologies and spur innovation within these areas. Batteries, embedded systems, bandwidth, micro and ad-hoc protocols, storage, radio propagation and information semantics could be such potential attractors to name but a few examples [17]. Special attention should also be given to new technologies and their interoperability to existing legacy systems. Therefore, related models and test-beds should be developed to exercise such potentials [37].

4.2 eGovernment Research Programs in USA

4.2.1 Research Program of the US National Science Foundation

The US National Science Foundation (NSF) is the major source of support for eGovernment research in the United States. Under the term “Digital Government Research,” NSF has supported more than 200 individual investigations since the mid 1990s. Digital government (DG) research funded by NSF lies at the intersections of computer and information sciences, related social, political, and behavioral sciences, and the problems and missions of government agencies. Multidisciplinary approaches are encouraged and partnerships with government agencies are a required element for most projects. Funded projects range in size from small exploratory research grants or workshops of less than \$50,000 to large projects that exceed \$1 million. Investigations vary in length from a few months to 2-3 years. The DG program partners with other programs at NSF (such as Information Technology Research and Digital Libraries programs) to share funding for proposals that meet the requirements of more than one program. In addition, some federal agencies, such as the Library of Congress, share in the funding of DG research that addresses that agency’s research needs.

The Digital Government research agenda is not directive, that is, it does not specify questions, methods, or outcomes (beyond the expectation of generating new knowledge useful to government). Instead, the DG research agenda has been built over time by the topics of interest to proposers as well as by NSF-funded workshops organized by researchers in a variety of fields. Workshop grants help to identify key issues within the domains of government that could benefit from formal research partnerships between universities and government agencies at the national, state, and local levels. Examples of such workshops include:

- Towards the Digital Government of the 21st Century (IT research)
- Some Assembly Required: Building a Digital Government for the 21st Century (multidisciplinary research)
- Information, Institutions and Governance (social science research)
- National Workshop on Internet Voting
- Responding to the Unexpected
- It’s About Time - Research Challenges In Digital Archiving And Long-Term Preservation
- E-Rulemaking: Information Technology and Regulatory Policy

The intent of these workshops is to identify a broad array of possibilities and to encourage innovative scientific proposals to address them. Consequently DG research grants cover a variety of public sector topics including:

- Communication
- Digital divide

- Education
- Government records, libraries, and archives
- Government statistics and surveys
- International problems and comparative studies
- Intra- and intergovernmental relations
- Law and regulation
- Natural resources management
- Organizational and institutional analysis
- Political processes
- Preparedness and national security
- Privacy
- Public management and administration
- Service delivery

The DG program welcomes research that involves many different methods and approaches to information technology, use, and management, including any appropriate combination of frameworks and methods that suit the questions to be studied, such as:

- Data sharing and integration
- Digital libraries and archives
- Geographic information systems
- Human computer interaction
- Information architecture and management
- Knowledge systems
- Metadata
- Modeling and simulation
- Natural language processing
- Security
- Semantic Web
- Visualization

- Wireless and mobile communications
- Experiments and prototypes
- Surveys
- Case studies

Some examples of NSF-funded Digital Government research projects are summarized below:

Connecting to Congress: The Adoption & Use of Web Technologies Among Congressional Offices (research on how Members of Congress use or should use the Internet to provide information to and interact with their constituents).

Policy Made Public: Technologies of Deliberation and Representation in Rebuilding Lower Manhattan (examines how old and new advocacy groups are adapting to new deliberative technologies that may challenge traditional mechanisms of citizen participation in public policy decisions).

COPLINK Center: Information and Knowledge Management for Law Enforcement (develops knowledge management technologies and methods for capturing, analyzing, visualizing and sharing law enforcement information and studies the organizational, social, cultural and methodological impacts and changes needed to maximize and leverage in information and knowledge management investments.)

Modeling Uncertainty in Land Use and Transportation Policy Impacts: Statistical Methods, Computational Algorithms, and Stakeholder Interaction (based on a sophisticated simulation system that models urban development, this project studies issues associated with assessing and representing uncertainty as well as presenting results and supporting interaction with the simulation for a wide range of stakeholders).

Information Discovery in Digital Government: Self-extending Topic Maps and Ontologies (GrowOnto) (explores the automated construction of domain ontologies across governmental datasets where the number of terms or variables is so large that manual efforts are not possible). Research programs, activities and strategies at national level

Digital Government: Collaborative Research: Quality Graphics for Federal Statistics (focuses on developing and assessing quality graphics for federal statistical summaries considering perceptual and cognitive factors in reading, interacting with and interpreting statistical graphs, maps and metadata).

Digital Government: Harvesting Information to Sustain Our Forests (an initiative to design and prototype an "Adaptive Management Portal" to make information available in an open, natural and useful way to all parties interested in forest lands, using thematic organization based on common forest management terminology and allowing users to augment the system with their own annotations, linkages and collations that might be of use to others).

Knowledge Management Over Time-Varying Geospatial Datasets (focuses on integration of spatial data collected by many government agencies in various formats and for various uses, thus providing for new uses; includes development of a knowledge management framework to provide syntax, context, and semantics, and explores the introduction of time-varying data).

Modeling the Social and Technical Processes of Interorganizational Information Integration (develops and tests dynamic models of information integration in multi-organizational government settings in law enforcement and public health, combining organizational behavior, computer and information science, and political science perspectives; uses both system dynamics and social process modeling).

4.2.2 United States (other than NSF)

eGovernment research is sponsored by several government and nonprofit programs in addition to the National Science Foundation program described in Section 4.2.1. The research is conducted mostly by university-based researchers and some nonprofit professional associations such as the National Association of State Chief Information Officers (NASCIO).

4.2.2.1 ICT related research programs and strategies

US Department of Commerce, National Institute of Standards and Technology (NIST). NIST's Information Technology Laboratory conducts IT research that contributes to national and industry standards for such topics as computer security, personal identity, digital information access, software development, and networking.

Research sponsored by the branches of the Armed Forces as well as by the US Department of Defense conduct and support a wide variety of research programs aimed at improving national defense. Some of these projects have value for advancing civilian eGovernment. Examples include work on natural language processing and sensor technology.

US Department of Homeland Security. US DHS sponsors technology research focused on the ability to detect and deter attacks on information systems and critical infrastructures. This research program supports university-based centers of excellence and examines issues related to security systems and to the security-related elements of the Internet, data bases, information systems, and telecommunications networks.

4.2.2.2 Programs and strategies to support government modernization research

US Department of Justice. US DOJ sponsors research projects that address improvements in law enforcement and criminal justice. Interagency and intergovernmental information sharing is a strong theme in much of this work. Projects are carried out by university-based investigators as well as by professional law enforcement and information technology management associations. The National Institute of Justice (NIJ), the research arm of US DOJ, sponsors technology research in several areas pertaining to law enforcement including crime mapping and communications technologies.

The National Institutes of Health (NIH) are part of the US Department of Health and Human Services (US DHHS) which is responsible for many programs that address public health, social services, and related areas. NIH is primarily concerned with bio-medical research, but it also sponsors work that pertains to the use of technology in the management of health care services and records.

IBM Endowment for the Business of Government. The IBM endowment sponsors and publishes research that pertains to improving government operations, including eGovernment themes. Several small grants (approximately \$20,000 each) are awarded

twice a year on a competitive basis. Funded projects are published and disseminated in print and on the web. Recent eGovernment research projects include studies of government use of RFID technology and data transmission standards for elections administration, electronic signatures, and e-government performance measurement.

4.2.2.3 Research programs and strategies to investigate society evolution

Pew Charitable Trusts. Pew is a nonprofit foundation that sponsors the Internet and American Life Program which explores the impact of the Internet on Americans and disseminates research-based information on the Internet's growth and societal impact. Recent work has addressed broadband adoption, on-line activities, social networks, and the demographics of Internet use.

Markle Foundation. The nonprofit Markle Foundation focuses on the impacts and potential of information and communication technologies to change people's lives. The Foundation conducts research and social change projects in partnership with selected collaborators from the public, private, and civic sectors. Its current priorities are health care and national security.

4.2.2.4 Research programs and strategies addressing several dimensions

National Academies of Science (NAS). The National Academies are chartered by Congress to serve as an independent advisor on scientific topics of importance to the nation. Study panels made up of leading scientists assess various topics and issue reports, usually at the request of a federal government agency. The Computer Science and Telecommunications Board (CSTB) of NAS has issued reports on information technology research for crisis management, federal statistics, and innovation and eGovernment.

National Historical Publications and Records Commission (NHPRC). The research arm of the National Archives and Records Administration, NHPRC supports a research program aimed at improving archival and records management theory and practice. Examples of research grants include work on geo-archives, persistent archives, preservation of interactive information, improved tools and practices for state archives, and frameworks for secondary use of electronic government records.

4.3 Activities in Australia

For about 10 years the Federal Government of Australia has been implementing strategies for the use of ICT for government applications. The latest was released in March 2006, by the Australian Government Information Management Office (AGIMO), a business group in the Department of Finance and Administration. AGIMO provides strategic advice, activities and representation relating to the application of ICT to government administration, information and services.

The latest strategy is called "Responsive Government – A New Service Agenda" [94] and it describes the way to achieve the vision of "a connected and responsive government by 2010". There are four main areas of activities, and these, together with the strategic priorities for each activity are as follows:

- **meeting users' needs;**

- security and privacy
- measuring user needs and preferences
- the Australian Government entry point
- user accounts and personalized services
- visible and traceable services
- increasing user awareness of service delivery options
- online engagement with Government
- **establishing connected service delivery;**
 - reform and transformation
 - technology enablement
- **achieving value for money;**
 - a robust investment framework
 - project management capability
 - inter and intra-agency re-use and sharing of systems
- **enhancing public sector capability;**
 - Service capability and maturity
 - Skills development
 - ICT procurement
 - Australian Public Service (APS) employee identity management
 - Enable the legislative framework where necessary.

To implement this strategy, the following approaches will be taken:

- **use innovative technology**
 - exploit emerging mobile technology
 - smart cards
 - develop existing innovative infrastructure
 - assess other emerging innovative technology
- **partner with industry**
- **manage the vision**
 - governance structures
 - international context
- **measure the impact**
 - develop a set of service delivery metrics.

The strategy contains detail on the activities and implementation approach, and examples of the achievements of agencies in implementing eGovernment applications and technology. An Appendix describes a Service Oriented Architecture (SOA), based on the following components:

- the **existing foundations**, including
 - a Service Delivery Capability Model
 - multiple channels management
 - a number of interoperability frameworks
 - an eAuthentication framework
 - a Demand and Value Assessment Methodology
- a **connected architecture**
 - common SOA elements
 - common standards
- a **capability and maturity stocktake**
- **pathway projects.**

The document, which covers the eGovernment strategy of Australia, contains no reference to “research”.

The main source of research funding is the Australian Research Council (ARC). The ARC's mission is to advance Australia's capacity to undertake quality research that brings economic, social and cultural benefit to the Australian community. In this way it plays a key role in the Australian Government's investment in the future prosperity and well-being of the Australian community.

The ARC is the primary source of advice to the Government on investment in the national research effort. ARC funding programs come under the umbrella of the National Competitive Grants Program. *Discovery* programs fund individual researchers and projects and *Linkage* programs help to broker partnerships between researchers and industry, government and community organizations as well as the international community. Funding is also provided to establish interdisciplinary and inter-university networks with the purpose of promoting innovative research.

There are also government initiatives to develop eGovernment applications in Australia, and both the state and national level, which may not be considered as "research" in the academic sense. In general these initiatives are projects of varying size, funded to develop specific aspects of e-Government, all contributing to a vision or a policy of electronic government.

4.3.1 ICT related research programs and strategies

ARC funded the research project "Create Once, Use Many Times - The Clever Use of Metadata in eGovernment and eBusiness Recordkeeping Processes in Networked Environments". The focus of this project is on descriptive metadata, i.e. structured context-rich information about business processes, agents, and information resources. Descriptive metadata is a vital tool in managing business transactions and related information objects in complex intranet / internet environments to support eBusiness and eGovernment. Implementation of record keeping metadata standards is problematic as metadata generation and deployment are resource intensive and application specific. This project will develop a proof of concept prototype to demonstrate how standards-compliant metadata can be captured *once* in particular application environments, then reused *many* times across business applications and in different environments. Implementation of the prototype in a test-bed site will provide a model for best practice.

Besides ARC Research Networks started the following projects with eGovernment implications:

Australian Nanotechnology Network. The field of nano scale science, engineering and technology (in short nanotechnology) is just emerging and it is predicted to make a major impact in all technologies and areas of society. Australian Nanotechnology Network intends to harness the combined Australian capability to enable Australia to take a leading role in this rapidly growing field.

Enterprise Information Infrastructure (EII). EII targets consolidated research towards the comprehensive development & establishment of advanced information infrastructures. Its prime purpose is to provide a forum for intellectual exchange by diverse yet complementary research groups, to address the fundamental research problems faced by scientific & business communities when dealing with deployment of information technology to globally distributed, and data intensive environments. EII will address 3 tightly coupled research themes: Ability to interoperate across existing heterogeneous platforms & applications; Efficient processing of very large data sets; Technology adoption & impact. Generic results will be applicable to e-science and large business information systems installations.

Intelligent Sensors, Sensor Networks and Information Processing. Sensor networks, a collection of diverse sensors interconnected via an ad-hoc communication network, are identified as one of the key technologies that over the next two decades will change the way we live. This research network brings together an interdisciplinary team of outstanding Australian researchers representing all the key disciplines required to successfully deploy sensor networks and links this team with the foremost international authorities and leading industry players in the area of sensor networks. This research network will guide collaborative research that will ensure Australia to play a world leading role in sensor network development and implementation.

Australian Communications Research Network. Building on a strong platform of existing research excellence, the Aim of the Network is to facilitate nation-wide collaborative research, promoting four intersecting research Themes: Mobile and Wireless Communications, Rural Communications, Broadband and Optical Networks, and Fundamentals of Emerging Media. Each Theme is formulated to drive multidisciplinary, innovative research as well as inspire new collaborative initiatives. Four Programs encapsulate the core activities of the Network: Researcher Mobility, Workshops and Conferences, Postgraduate Education, and Knowledge Management Systems. The Network is expected to add significant value to pre-existing investments and raise the profile of Australian telecommunications research.

4.3.2 Research programs and strategies in legal economic issues

4.3.2.1 The ARC Research Networks with eGovernment implications – projects approved for funding in 2004

Financial Integrity Research Network. The integrity of the financial system is constantly under stress because of the development of ever more complex financial instruments, structures and strategies, and the associated research technologies that continues to accelerate worldwide. FIRN's vision is to harness the considerable strengths of Australia's internationally renowned finance, accounting and economics researchers into a research agenda to address issues concerning the integrity of the financial system. It will enable Australian research in this area to match the scale and impact of similar research in other major international financial centers, and play an essential role in placing Australia among the world's leaders in financial markets related research.

4.3.3 Research programs and strategies to investigate society evolution

Liberal Machines: Information poverty, political culture and the uses of new communications technologies. This project funded by ARC examines two contentious issues in scholarly and policy debate: the nature and consequences of information poverty, and the consequences of new communications technologies for western political culture. Rather than focusing on the emancipatory potential of new technologies, we see these problems through the prism of liberal government, its history and prospects. In particular we are concerned with liberalism's longstanding concerns with security, civil peace, freedom, and disadvantage. We explore contemporary developments in electronic government, digital media, online learning, cyber-democracy and wired communities. The result will contribute to our understanding of the political and intellectual uses of information technology.

Invoking consistency of meaning in data integration and extraction for electronic Health Records. This project is a cooperation between ARC and Partner Organization(s) NSW

Health. Many governments want to implement an Electronic Health Record. Such a Record is a summary of events in an individual's medical history derived from diverse medical databases. Only some summaries are relevant to any medical condition. This project is to address these converse issues of data integration and extraction. Summaries must have variable structure according to event, and must be consistently drawn from datasets which have consistent meaning. We will extend a formal mathematical approach successfully developed for checking conformity of databases. NSW Health Department is partnering us, because the outcomes represent a step toward a practical Electronic Health Record.

4.3.3.1 ARC Research Networks with eGovernment implications – projects approved for funding in 2004

Asia-Pacific Futures Network. The ARC Asia Pacific Futures Network is an international vehicle for building research capacity in the national research system to enhance understanding of Australia, its region, and the world. The Network brings experienced researchers working in identified research areas and themes into dynamic collaboration with government and industry through structured programs, with a view to stimulating new research directions, partnerships and training opportunities. In its 5-year plan, the Network will focus on Governance and Security, Culture and Religion, Media and Communications, Health and Population, and Trade and Industry. APFN will also have the capacity to marshal expertise on pressing issues facing Australia and the region as a whole.

4.3.4 Research programs and strategies addressing several dimensions

4.3.4.1 ARC Research Networks with eGovernment implications – projects approved for funding in 2004

The Economic Design Network: Practical Policy Tools for Industry, Infrastructure, Services and the Environment. The Economic Design Network is a partnership of more than one hundred researchers and over forty international universities and research centers. The Network will support cross disciplinary research and policy innovation using state of the art techniques in economic theory and experimental economics. It will create practical policy tools that can be used to solve complex social and economic problems in industry economics, health economics and environmental policy. By linking Australian mid and early career researchers into multidisciplinary teams based around the world's top experimental economics laboratories, it will create a world class economic design capacity in Australia.

Complex Open Systems Network (COSNet). Complexity is the common frontier in the physical, biological and social sciences. This Network will link specialists in all three sciences through five generic conceptual and mathematical theme activities. It will promote research into how subsystems self-organize into new emergent structures when assembled into an open, non-equilibrium system. Outcomes will include new technologies and software tools and deeper understanding of fundamental questions in science. An essential function of the network will be introducing researchers and end users to new tools and broadening the horizons of graduate students.

Research Network for a Secure Australia (RNSA). The Research Network for a Secure Australia (RNSA) is a multi-disciplinary collaboration established to strengthen Australia's research capacity for protecting critical infrastructure from natural or human-caused disasters including terrorist acts. The RNSA will facilitate a knowledge-sharing network for research Organizations, government and the private sector to develop research tools and

methods to mitigate emerging safety and security issues relating to critical infrastructure. World-leaders with extensive national and international linkages in relevant scientific, engineering and technological research will lead this collaboration. The RNSA will launch various activities to foster research collaboration and nurture young investigators.

The Governance Research Network (GovNet). Institutions and their governance are frequently part of our most pressing problems - not least in our national research priorities. Hence, institutions are invariably a key part of the solutions. GovNet unites three ARC Centers, two existing networks (RegNet, ANZSOG) and several other dynamic centers to create an interdisciplinary network of ethicists, lawyers, political scientists, economists and historians. It will tackle issues of institutional governance, from small firms to global institutions recognizing both common governance issues and radically differing contexts. Together with APSEG and government agencies, it will apply cutting edge cross-disciplinary, theory-driven, evidence-based research to governance issues in the region.

4.3.5 Strategies and programs to spur innovation and change

4.3.5.1 ARC Research Networks with eGovernment implications – projects approved for funding in 2004

Enabling Human Communication: Tough problems in human communication with bold but informed solutions drawing on sound, speech, and language research capabilities. The Human Communication Network promotes interdisciplinary research in speech, language, and sound by and between humans and machines. The network connects leading and emerging researchers across disciplines, exploits previously unrecognized intersections, supports interdisciplinary graduate training and exchanges, provides database storage infrastructure, and consults with industry and government to set, not follow, research agendas. By generating an explosion of new approaches and knowledge, the network will build Australia's reputation as a leader in communication science and technology via advances in automatic speech recognition, distress call monitoring, hearing prostheses, web interfaces, and data retrieval and data mining systems.

4.4 Other initiatives fostering eGovernment related research

Besides the European Commission and the governments of the European Union member states, a range of worldwide acting organizations are promoting eGovernment and eGovernment related research. The following sections will give an overview about specific targeted research programs of OECD and UN.

4.4.1 OECD focused research strategies and programs

The Organization for Economic Co-operation and Development (OECD) promoted the project WiMAX (Worldwide Interoperability for Microwave Access), which is related to support long-distance wireless connectivity of broadband access and interoperability [105]. The digital divide shall be overcome through that project. An important point according to digital divide is the try to reduce costs and therewith prices that citizens can afford it. For example the Massachusetts Institute of Technology (MIT) Media Lab has initiated the development of a \$100 notebook for free distribution to poor schoolchildren in developing countries [1]. Research is required to solve the problem of interoperability and the lack of

economies of scale which other similar systems could not counteract. Long-distance wireless links could help the development of higher-speed access to rural areas not connected to fixed-line networks as well as in providing mobile connectivity over shorter distances. WiMAX could act as an attractor for innovation which impacts fixed and mobile markets, in both their voice and data segments. Furthermore it could be a key component of next-generation coupled or ubiquitous networks. In particular WiMAX research could improve security by wireless surveillance over long distances [105].

The Working Party on Information Security and Privacy (WPISP) of OECD focuses research on authentication [59]. In detail, mechanisms to link different legislative, legal and policy frameworks to provide for cross-jurisdictional authentication shall be developed. The activities promote the use of authentication as an integral element of a safer, more secure Internet especially for transactions. The development of authentication solutions shall also be related to other issues such as online identity theft, management of digital identities, spam, travel security, biometrics etc. Special attention should be given to research in order to overcome drawbacks of new authentication technologies. In order to facilitate interoperability of security, identification and authentication mechanisms, focus needs to be put on the development of tools at technical level and of common standards [59]. Likewise, a cross-boarder common regulatory framework, in particular regarding the recognition of foreign authentication services and the acceptance of certificates of other providers, shall be provided. Furthermore, a framework for assessing the characteristics of authentication methods should be developed to evaluate the degree to which security, identification and authenticity solutions meet the needs of a particular application [59].

The OECD Task Force promotes further development of technical defense measurements against spam [98]. Research shall take place in the field of network management solutions for spam defense and how to reduce mobile spam and instant messaging spam.

4.4.2 UN related research in eGovernment issues

4.4.2.1 Speeding up developments in eProcurement

The United Nations' General Assembly (UNGA) set up the Resolution 59/288 which promotes a procurement reform at governments and public agencies [115]. It increases efforts to undertake in order to improve the efficiency of procurement by reducing redundancy and harmonizing the procurement procedures.

4.4.2.2 ICT and organizational tools for disaster management

UNGA also put in place the Resolution 58/199, which encourages national and international research and development initiatives to create a general ICT security culture and protect critical ICT infrastructures [114]. Thereby, the UN recognized an urgent need to further develop existing ICT to build early warning systems to forecast natural disasters, and to deal with them effectively. Besides, there is a need to promote better understanding and knowledge of the causes of disasters. In addition, capacities to effectively cope with disaster cases must be built and strengthened through transferring and exchanging experiences and technical knowledge, and by providing access to relevant data and information worldwide for the forecasting [116]. A precondition thereby is to set up and strengthen proper institutional arrangements, including community-based organizations. Governments shall establish national platforms or focal points for disaster reduction and management. In particular, such

platforms shall be encouraged and empowered to share relevant information, to develop common standards and practices, and to link up with platforms that already exist.

5. Research programs, activities and strategies at national level

5.1 Austria (AT)

The Austrian eGovernment strategy aims to maintain Austria's advanced position in terms of eGovernment implementation. The following gives a list of relevant eGovernment research priorities of Austria:

- ICT related research programs [118]:
 - i2 (intelligent infrastructures) provides funding for infrastructure projects, among them, also eGovernment related projects may be funded.
 - TAKE ÖV 'Telematics Applications for Public Transportation Passengers' (development and implementation of intelligent telematics applications in public transportation)
- ICT related priorities and national ICT strategies to support government modernization research [4] [118]:
 - eSecurity and trust / privacy
 - interoperability
 - identity management
 - electronic signature
 - broadband.
 - one-stop government portal
 - eProcurement
 - electronic delivery
 - ePayment
 - legislation concerning telecommunication and eCommerce / eSecurity
 - eInclusion (connect all users to and let them act through online portals with the public administration)
 - Health Information Technology Tyrol (eHealth research)
 - increasing quality and efficiency of innovation

5.2 *Bulgaria (BG)*

The Bulgarian eGovernment strategy [13] provides for electronic delivery of high-quality, economically effective and easily accessible services to citizens and businesses. But participation in the governance process presumes the expansion of the technological capabilities of citizens and businesses. The overall objective is to establish an organizational, communication and information environment for effective and transparent performance of the public administration consistent with the principles, rules and best practices of the European Union [110]. There is no explicit eGovernment research program or strategy available apart from a general eGovernment strategy, which focus on the following topics [13]:

- ICT related strategies:
 - eAdministration: the Internet shall be the official communication environment for the Bulgarian Government
 - High level of ICT security
 - Integrated approach for ensuring high level of interoperability
 - Integration of legacy system components
- Strategies to support government modernization:
 - reliable identification and information security system for eGovernment communication
 - decision making support and knowledge management through the establishment of integrated information and management environment
 - Provision of means for modeling, forecasting and utilization of modern decision making methodologies
 - User-centric service delivery by:
 - improving the management and presentation of information
 - providing of secure interactive communication
 - Collaboration at institutional and national levels in order to advance the quality of management of eGovernment business processes
 - Development of an electronic market place for public procurements
- Strategies to investigate society evolution:
 - Training and retraining the personnel of public administration
 - Developing new organizational culture in the public administration
 - Research shall investigate the personal professional, organizational and managerial skills required for working with operation of electronic equipment
 - New personnel management approaches, in particular motivation approaches that public administration employees participate effectively in eGovernment improvement
- Legal framework improvement

5.3 *Czech Republic (CZ)*

The national broadband strategy of the Czech government focuses on [25]:

- improvement of quantitative parameters for broadband access (nominal and actual transfer rates)
- mobile wireless networks and fixed satellite networks to mediate broadband contents

- increasing the capability to use a wide range of voice, data, text and multimedia communications via broadband access
- investigating the access to sources and services which do not limit end-users
- a secure communications infrastructure.

5.4 Denmark (DK)

Denmark's vision of eGovernment in the year 2010 is that the Danish eGovernment is up to best countries in the world in interacting between business and knowledge institutes. Thus, research, education and business shall join to deliver new knowledge. But to exploit the whole human and ICT potential, a widespread use of ICT must be secured. The vision shall be realized through focusing on the following topics [29]:

- Strategies to support government modernization research
 - Reforming the public sector
 - Focusing on user needs
 - Handling full administrative work digitally
- Strategies to investigate society evolution:
 - eInclusion
 - Qualify the Danish population for participating in the future Information Society
 - Educating the Danes to use new ICT in a secure and competent way
 - Set-up eLearning structures and methods for both citizens and business
 - Exploitation of broadband access
- Strategies to spur innovation and change:
 - The telecommunication market shall provide cheap and high quality ICT services, applications and devices regarding multiple user needs
 - Co-operation between public and private sector
 - Business is responsible for ICT development
 - Government remove any barriers and create the best possible digital conditions for citizens, business and public authorities

5.5 Finland (FI)

The Finnish Information Society Council [46] describes that, both, achieving seamless customer service and improving cost-effectiveness presume the implementation of an efficient service system. Besides, the development of better and more cost-efficient public services in regard to gain the citizen acceptance shall be promoted. These objectives shall be transformed by focusing on the following topics [46]:

- ICT related strategies
 - Development of online services base on the development of clear architecture and open interfaces with respect to interoperability
 - Co-operation between public and private institutions
 - Enforcing standardization work and promoting electronic transmission of documents and information
- Strategies to support government modernization research

- user-oriented services
- eAdministration (ability for broad usage of eServices)
- information security
- secure identification
- information management for decision making support
- Strategies to investigate society evolution
 - ambient intelligence
 - eLearning, lifelong learning and the integration of work and learning
 - eInclusion; The capacity to use and exploit ICT shall raise by
 - improving know-how linked to ICT applications
 - taking into account the changing needs and usage situations of individual groups

5.6 France (FR)

During the workshop on eGovernment research held at Telecom Paris in 2005 the proposed areas of eGovernment research are related to Interoperability and Pan-European services, identity management and eDemocracy. Besides, on that workshop the following list of research topics was generated which covers strategic areas France focuses on:

- ICT related strategies
 - organizational modeling and organizational innovation
 - strategy for administrative process re-engineering and integration of inter-organizational IS
 - transformation and calculation of value chain
 - business models and cooperation models for eGovernment
 - interoperability of eGovernment IS
 - numerical identity and management of numerical ID
 - building trust for eGovernment
 - governmental administration process workflow
 - seamless governmental IS
 - electronic voting and eDemocracy

According to several French publications covering eGovernment and eGovernment research, the following research topics that are currently being investigated in French academia could be extracted [117] [24] [2] [93] [74]:

- Inter-governmental IS and interoperability between governmental IS
- Legal issues
- Interoperability of eGovernment applications
- Modeling of governmental processes
- Security and trust
- definition, role and motivation of the use of technology in government and public organizations
- role of local government in local development and eCommerce
- Public Management (Human resources, administrative law , accounting, finance, marketing, information systems)
- Evaluation of eGovernment services, quality management
- citizen and internal oriented Information Services for local government
- citizen, company and internal oriented Information for the central government
- eVoting:
 - Investigation the usage of smart card to help distribute rights in the voting process

- investigate the authentication process for voting security.

Strategies in the field of government modernization aim at identifying conditions for local Government to manage their policies in a transparent and trustable way. Two directions are explored [8]: a technical one around a methodology for management of software development and a socio-economic one focused on a methodology to involve all actors in the policy orientation debate.

Research focuses on the use of workflow and expert systems to guide a citizen in the use of eGovernment services for performing governmental formalities for example in the case of passport renewal [60].

5.7 Germany (DE)

Currently in Germany most eGovernment projects funded by the German government [49] are implementation projects. Although the German government has set up several eGovernment implementation strategies and projects, which require eGovernment research as well, research measures are not indicated. Topics of focus in German strategic implementation projects are amongst others [49]:

- ICT related strategies stated by the German government
 - comprehensive integration of administrative processes
 - processes are free of media discontinuity regarding cooperation at the federal level
 - providing all public services of the federal state online
 - connection of all Internet portals from public agencies
 - develop common infrastructures and standards
 - improve the transfer of know-how within the public sector / knowledge management
 - developing a service portfolio
 - combine eGovernment portals seamless
 - common infrastructure
 - identifying user needs both individual and business
 - standards, data and process models

The German Society for Informatics (GI) recently developed a research roadmap for eGovernment. It defined strategic measures to spur eGovernment research in Germany and formulated the following three scenarios of the future which shall be investigated next in eGovernment research [50]:

- New Access Forms: Ubiquitary and Proactive
 - Result-Oriented (Intelligent) Agents and Avatars
 - Proactive Services
- New Production Forms: Service Networks
- New Forms of Democracy: Transparency and Participation

With the research roadmap, the GI initiated an awareness building initiative towards a closer dialogue between academia and practical implementation and towards common efforts in eGovernment initiatives. The authors also stressed that among the measures to bring

forward eGovernment research, investments into university infrastructures and education infrastructures for skills development of students and public sector employees have to be made. Also, more chairs in eGovernment research are needed (currently, only one “real” chair in ICT related eGovernment research exists all over Germany).

The action plan named the following overall eGovernment research areas as to be investigated in the near future [50]:

- Monitoring – Adaptation – Transfer
- Inter-Government Integration
- Information and Knowledge
- Digital Identity
- Human Resource and Change Management

Detailing these themes, the following topics have been named explicitly as being important [50] in the near future:

- One-stop shops, single access point
- avatars and intelligent agents
- information retrieval methods and semantic web
- Proactive services
- Automation, workflow management
- information performance networks
- digital integration of administration systems and interoperability at all levels
- Technical defects like simplicity, modularization or scalability leads to technical oriented research to meet the specific requirements particularly with respect to identification, interoperability, security and trust, simplicity, scalability and usability
- eGovernment should be accepted as a research discipline of its own and basic research shall be set up in that area
- concepts from Information Systems (IS) research can only be taken over to eGovernment, if these are coherent
- Developing methods of working in close connection with institutions in relation to the technical background is necessary.
- Set up a holistic approach through a combination of technical innovation in connection with administration organization and modernization
- Psychological approach to overcome mental and cultural barriers in policy and administration
- more user centric focus in developing eGovernment services.

5.8 Greece (GR)

Greek Government focuses on the following topics of eGovernment implementation [22], [40], [55]:

- ICT related strategies:
 - provide secure privacy, authorization and ePayment

- change the legally framework
- multiple channels access
- Strategies to support government modernization:
 - Redesigning and automating processes
 - user-centric design approach
- Strategies in legal economic issues:
 - increasing broadband availability
 - business best practice
 - online transactions
 - one-stop-shops
 - eCertificates and eProcurement
- Strategies to investigate society evolution
 - New methods of work
 - new skills and the need for continuous learning
 - improve the quality of life by providing better services in health, transport and protection of the environment
 - improve citizen welfare by:
 - enhanced broadband adoption
 - providing services related to citizens needs
 - integrating ICT into education
 - provide most important transactions in a fully electronic way

Apart from the usual ICT implementation strategies listed above, Greece provides several programs for funding eGovernment related research. Among these programs are:

- the 3rd Community Support Framework to promote the Information Society in Greece. This program furthers different government services and consists of fully integrated and additional operations in various sectors of economic and social life. It has been set up to act as a catalyst [22].
- Operation Program “Competitiveness”, which focus on optimizing the co-ordination of activities by linking research to production and strengthening co-operation among the organizations involved [21].
- the Operational Program Information Society (OPIS) sets up eBusiness and eLearning programs [20] that shall lead to
 - long-term research
 - technological development projects
 - demonstration projects intending at producing innovative products attached to the quality of life, meeting EU strategies and coping with social and cultural needs which affect the competitiveness in economy.

5.9 Hungary (HU)

The Hungarian Government focuses on the following topics [64], [34]:

- ICT related strategies:
 - preparing and formulating new eGovernment products, procedures and services
 - devices with user-friendly, flexible interfaces with a high degree of interoperability
 - multiple channel communication

- interconnectability shall enable users shared access to different resources (e.g. grid computing)
- increase of performance and bandwidth of telecommunication networks and wireless network technologies
- open source and its influence to software development and distribution
- development of personal identification techniques (e.g. RFID, privacy enhancing technologies and methods)
- storage
- strategies to support government modernization:
 - swift from products to services
 - swift impact to the labor market
- Strategies in legal economic issues:
 - examine the legal consequences of virtual worlds on working and living
- Strategies to investigate society evolution:
 - the extent to the learning process will cover every section and age group of society
 - comprehensive public eLearning networks
 - development of accredited higher education and further training courses
 - develop the curriculum and set up an information system which monitor the knowledge, abilities and skills acquired, and the progress made
 - development of ambient intelligence methods and applications to relief older citizens.

Apart from the eGovernment implementation strategies, Hungary provides some initiatives to support the Hungarian research community in linking up with EU research initiatives, in cooperating with the development sector and the economy, and in developing a more effective science organization, including tracking, measuring and monitoring of projects in progress develop addressing several dimensions [64]. Furthermore, strategies and programs to spur innovation and change are provided to support Hungarian academia in preparing and formulating new products, procedures or services in which the tools of information technology and telecommunication are used innovatively in different fields [64]. Both initiatives allow for eGovernment research proposals to receive funding.

5.10 Ireland (IR)

The ageing society is a big problem many European countries have to face. Although Ireland has the highest value regarding the participation rate of young workers aged less than 30 years [83], it centers its efforts to support older people.

Therefore, Irish government focuses on the following topics [23], [48]:

- Strategies to support government modernization
 - User centric approach for developing everyday products, services and applications
 - understand user needs across all aging levels
 - developing public services for restricted people
- Strategies to investigate society evolution
 - a high quality of ambient intelligence for a smart home environment
 - develop improved workplace technologies and tools
 - develop healthcare technologies to prevent, in time detection and treat, as well as aid management of chronic conditions

- eInclusion policies focus on:
 - supporting older people by exhaustively utilization of present and future technological developments
 - avoiding negative consequences for older citizens arising from technological developments
- overcome significant skill shortages at key domains by tailoring the educational programs to meet these new demands to produce the right number of graduates with the right knowledge and skills at all educational levels.

5.11 Italy (IT)

At the Palermo International Conference on eGovernment for Development the Italian government set up the 'eGovernment for Development Initiative', which shall guarantee the transformation of the following eGovernment research related objectives:

- Creation of conditions for sustain efficiency and transparency in government administration
- Bridge the digital divide

Furthermore the Italian government focuses on the following topics [72]:

- ICT related strategies
 - Higher value-added eGovernment services (e.g. the Electronic ID Card, the National Services Card) require trust and security
 - Secure environments for transactions, trust and security
 - Identification and authentication, identity management
 - Multiple channel access to services
 - Multiple payment instruments, ePayment
 - Open source software
- Strategies to support government modernization
 - digitalization of documents
 - document workflow management with seamless exchange of documents
 - single access point to government services
 - service creation shall organize around the main "life events" of citizens to permit simple and intuitive access and use of government information and services
- Strategies in legal economic issues
 - improve the interaction between public agencies and business through functional integration of existing databases maintained by a variety of operators
 - to provide integrated value-added public services to businesses, Italy funds two projects:
 - the Business Register
 - the Computerized Register of Protests
 - development of eProcurement
 - A pilot project is started to introduce eProcurement solutions to three different types of public agencies which are universities, municipal governments and health authorities
- Strategies to investigate society evolution
 - Training the government employees
 - broader and more comprehensive computer literacy
 - eLearning methods for distance learning

- Furthermore, a standardized certification of PC and Internet skills which is EU-wide valid must develop.

5.12 Latvia (LV)

Latvia aligns its ICT policy to EU guidelines pertaining to the Information Society in an integrated framework with the Lisbon strategy, including the EU initiative i2010. Therefore, Latvia focuses on the following topics [100]:

- The Lisbon National Reform Program focus on:
 - Safety of networks and information
 - Compatibility and interoperability of information systems
 - Extension of broadband networks
 - electronic signature
 - improving the structure of public administration and eliminating redundant elements
 - Transparency and improve efficiency of public administration
 - increase public participation in the decision-making processes
- eGovernment Development Program (2005 – 2009) focus on:
 - Increasing the efficiency of investments in ICT infrastructure of public administration,
 - Integrating the main national registers,
 - Creating the base infrastructure of eGovernment,
 - Improving the existing and create new information systems of public administration, including digitalization of archives, databases and registers, improving security
 - Demand research to evaluate accessibility and efficiency of eServices
 - Supply research to investigate public eServices and their level of automation in governmental and municipal institutions
 - process re-engineering
 - research on governmental and municipal institution homepages
 - research to determine necessity and possibility to develop unite state geographic information system
 - Developing and improving automation of state and municipal services
 - Integrating and improving state information systems
 - Automation of education system, improve skills of staff to work with modern ICT
 - Accessibility to broadband networks and development of Internet public access points, thus facilitating balanced development of state regions
- The draft National Strategic Reference Framework of Latvia focus:
 - the creation, development and improvement of electronic communications networks of national importance
 - ensuring the security of data transmission
 - provide training of the public administration staff
 - counteract the digital divide by adapting the education system electronically
 - access to broadband data transmission networks
- EU Action Plan on eGovernment (2006-2010):
 - improvement of quality of services
 - eProcurement
 - cooperation of all stakeholders, including the public and private sectors

5.13 Lithuania (LT)

The Lithuanian government funded several research programs to investigate certain eGovernment topics. The following list sums some of them:

- Information Technologies for Science and Higher Education (ITMiS)
 - accumulation of data on science and education; employment of this data in the activity of different institutions in decision making and representing the Lithuanian science and studies in the global computer networks;
 - assistance to scientists, teachers and students in gaining necessary information;
 - use of information technologies in education and training of the population.

The program is made up of three basic parts:

- Lithuanian Higher Education and Research Information System (LieMSIS)
 - standardization and integration of the information systems
 - control and assessment institution for science and studies, as well as other organizations
- Development of Distance Education in Lithuania (LieDM);
 - develop and co-ordinate Lithuanian higher and further education system supported by ICT
- Lithuanian Academic Libraries Network (LABT).
 - form up Lithuanian virtual library, by automation of libraries, unification of search and access to information sources and virtual services.

Considering the present readiness and the results of applied science activities already achieved, there are several trends set to develop:

- Production and designing of distributed and mobile information systems, engineering of federal data bases;
- Production and designing of integrated internet, multimedia and mobile systems;
- Designing and production of real time systems;
- Development of eCommerce technologies;
- Engineering of program systems;
- Designing of micro-systems;
- Development of modeling, high efficiency computations and of information technologies of computations engineering;
- Methods of decision – making in the information technologies;
- Development of eLearning;
- Knowledge society technologies;
- Lithuanian language and culture in the information technologies.
- Long-term strategy for research and development covers the period till the year 2015:
 - Lithuania must become a knowledge society till the year 2015
 - during the next seven years, the Lithuanian interaction system between science and industry must comply with European innovation deployment practice
 - Lithuanian research and development must be integrated to the EU scientific technological environment
- National Lisbon Strategy Implementation Program [80]:
 - Creation of conditions for increasing residents' competencies and social cohesion in the area of ICT use:
 - draft a distant learning program for Internet basics
 - eServices for Lithuanian residents;
 - eInclusion: adapting information environment to the needs of the disabled;

- develop and expand an integrated network of public Internet access centers (PIAC) ensure its functioning (quality management)
 - implement the general computer literacy program approved by the Resolution of the Government of the Republic of Lithuania
- Modernization of public administration by means of IT:
 - develop and maintain one eGovernment portal for the provision of public administration services
 - develop a secure network of state and local authorities and establishments
 - eAdministration: 85 per cent of main public services should be transferred to electronic environment
 - create the technique of surveillance of public services provision by the use of ICT;
 - draft a legal act on the functioning of an eGovernment gate for the provision of public services;
 - draft a law regulating the management of public information systems.
- Promotion of economy based on knowledge, innovation, scientific achievements and IT:
 - prepare a program for Innovations Promoting Development of Information Society in accordance with the objectives and tasks of the EU IST program
 - promote research and practical work aimed at adaptation of open source software
 - it is scheduled to provide an opportunity of connecting 80 per cent of the country's territory to the existing broadband networks
- Conceptual Framework of the National Information Society Development of Lithuania.
 - establish conditions for the development of the information society
 - creation of an adequate legal environment
 - development of eGovernment and eDemocracy
 - development of business based on competencies (knowledge), information, ICT
 - eInclusion: minimizing urban and rural information infrastructure differences and to offer all the population equal opportunities to use IT for social and public needs;
- Conceptual Framework of e-Government
 - development of public services
- IT and Telecommunications Development Strategy.
 - development of information technologies and telecommunications
 - modernization of the works
- Public Administration Development Strategy 2010.
 - Better regulation and governance
 - Human resource management
 - Innovative public services
 - eGovernment
- The e-Health Strategy 2005-2010.
 - The Strategy aims at the implementation of information and communication technologies into the national health care sector of Lithuania.

5.14 Malta (MT)

The government of Malta focuses its eGovernment efforts on the following topics [53] [54]:

- electronically security
- identification and authentication, identity management
- fraud prevention, prevention of unauthorized access
- privacy enhancing technology and methods
- appropriate legislative framework for regulating and facilitating public services
- cooperation between public and private sector to develop a registration and authentication mechanism for eGovernment services
- seamless provision of public services across all borders of the public sector
- eGovernment services must be common across multiple delivery channels
- avoid a change in back-office processes currently in existence as far as possible which requires a high degree of interoperability at the interfaces
- middleware applications provide high level of interoperability
- Quality management.

5.15 Norway (NO)

In the period between 2005 and 2015 eGovernment in Norway focuses on availability and inclusion like the following list of topics shows [97]:

- Strategies to investigate society evolution
 - Everyone shall have the opportunity to participate in the Information Society
 - digital services shall adapt to the needs of the individual
 - citizens shall own basic digital skills to use all digital available services
 - all transactions which are possible to provide digitally shall available digitally
- Strategies and programs to spur innovation and change
 - Digital services shall meet the needs of business
 - eProcurement

5.16 Poland (PO)

Skulimowski [108] identified several eGovernment research needs for Poland. His recommendations are named in the following:

- eHealth methods and technologies supporting intensive therapies, bioinformatics and biomedical engineering, new bio- and nanotechnologies
- ICT
- sustainable development
- accessible, cheaper, faster, and more secure Internet
- Security and trust
- user friendly and fairly distributed commercial software
- eBusiness research
- eBanking research
- eServices research
- Polish Information Society
- development of the IT education including distance education at all levels

- higher learning ratio and high-quality IT education at all levels, as well as strong IST-related research and development
- the development of open source applications

5.17 Portugal (PT)

Portugal's eGovernment and eGovernment research policy is closely related to the European guidelines like the Lisbon agenda, the i2010 initiative and the eEurope plans for example in the adaptation of the goals like broadband, mobilization of the demand for new services, explicitly in the public administration, health, learning and eBusiness, expansion of the telecommunication infrastructures and access equipment, including mobile phones, televisions and personal computers, and the importance of multimedia contents [104]. The following list of eGovernment topics provides in overview Portugal focuses on:

- The National eProcurement Program [104] provides a set of very clear guidelines for the modernization of the Public Administration which supports:
 - the general use of voice services on the Internet, and the acquisition of the full range of telecommunication services by all public institutions
 - the training of all civil servants in ICT and promoting the use of open source operating systems in all public services
 - Interactive access to public services through multiple channels
 - the general electronic invoicing in commercial transactions and public agencies
 - the development of telework and telemedicine
 - the integration of citizens with special needs
 - eProcurement
- The program "ConnectingPortugal" from the Portuguese Ministry of Science, Technology and Higher education supports [104]
 - development of an inclusive Information Society
 - the e-U initiative (electronic university and virtual campus)
 - the b-on project (online knowledge library)
 - increasing general access to ICT
 - education and training of all Portuguese citizens
 - transform the school environment, creation of virtual work environments for students, supervision of students progresses

5.18 Romania (RO)

Zamfirescu et. al. [123] identified several eGovernment research needs for Romania. Their recommendations are summarized in the following list of topics the government of Romania should focus on:

- collaborate in EU projects
- increase the collaboration between industry and research
- trans-disciplinary approaches aiming at reducing the gap between humanist and technologist perspective in:
 - intelligent agents, semantic web
 - broadband communication
 - ubiquitous computing
 - user friendly and ergonomic interfaces

- improving the security issues for Information Society Technology
- multi-channel access to contact and interact with public agencies
- eProcurement applications and services
- Development of an inclusive Information Society
- eLearning applications
- shifting from a teacher-centered to a learner-centered paradigm
- develop measurements to prevent and counteract slow down course of wide usage of electronic public services
- eHealth:
 - standardization issues in order to assure a coherent integration of eServices

5.19 The Netherlands (NL)

According to the eEurope Action Plan, The Netherlands will develop modern forms of public service provisioning and eBusiness via large-scale broadband distribution with low prices and the finding of a safe and reliable information-infrastructure. Secondary objective is monitoring of the realization of the Lisbon-agenda.

Therefore, The Netherlands focus on the following topics [96]:

- ICT related strategies
 - ICT services must be established in seven domains, which put together form the model of public electronic information infrastructure:
 - Electronic accessibility to the government
 - Electronic authenticity
 - Unambiguous numbers for persons and companies
 - Basic registers
 - Electronic identification means (chip cards)
 - Electronic information exchange
 - Fast connections between governmental organizations
- Strategies to support government modernization
 - simplify and non-bureaucratic procedures supported by ICT research
 - provide as much as possible public services electronically in the shortest possible time duration
 - Semi-governments must handle 65 percent of their public services electronically by the end of 2006. For 2005, aspiration lies at 55 percent, for 2004 45 percent.
 - The program 'Andere Overheid' sets out four actions that the government is to undertake:
 - The government must improve the service provisioning to the citizens
 - The government must govern less and different
 - The government must organize more efficiently
 - The government must improve its relations with other provinces and municipalities
 - Government must limit itself to its core business and carry this out more simply, efficiently and effectively
 - The acknowledgement of the communicative power of municipality websites is lacking
 - developing a shared system for all payroll and employee administration of all departments
 - Centralization of similar information is becoming more important

- Several different developments regarding the connection of various communication systems must be shared among the different governments to improve vital communication for example in disaster situations in their own countries.
- The need for a transparent enterprise network is becoming more apparent.
- Strategies in legal economic issues
 - Public Private Partnerships (PPP) which are using ICT to resolve several governmental and societal problems such as traffic problems, broadband rollout and public safety.
- Research programs and strategies to investigate society evolution
 - Accessibility Monitor (Ministry VWS) shall
 - increase the accessibility of Internet for people with a functioning limitation and seniors
 - Broadband is being employed to enhance information and educational usage, bundling of demand plays a great role in its feasibility
 - The municipality of Amsterdam is working together with private parties to enrol a glass fibre broadband infrastructure within the city.
 - developing an electronic 'child file', which lists all relevant information about the specific child such as the family situation, the environment of the child etc., monitoring of the children's health, education etc
 - The developments of eHealth focusing on
 - the objective that personal (medical) information must at all times be secured regarding privacy and health issues
 - deploying several important measures, such as specific legal regulations, to ensure the security of this type of information
 - a national electronic medical file

The Netherlands are using their expertise and collaboration with various knowledge centers to carry out innovative projects regarding eGovernment. Examples of a few projects are:

- the CLIENT project
 - Control of agricultural products and the import and export involved
- IB Group
 - successful application 'Mine IB Group' which enables customers to review and change their own information
- Rijnland RIES
 - Internet election system for water authority
- Web guidelines
 - guidelines to enable a optimal accessibility and sustainability of websites

They also intend to develop a system of vital records registries, which will provide:

- the government with tools for policy development, fraud-fighting and aid facilitation in disaster situations
- the Dutch citizens with better services

Finally, privacy enhancing technology and methods are topics that will be addressed in future.

5.20 United Kingdom (UK)

The UK digital strategy [14] bases on the desire to overcome the digital divide and make the UK a world leader in digital excellence, concentrating mainly on eInclusion and eLearning, eSafety and eCrime, and eHealth. The following list explicates the topics the United Kingdom focuses in its efforts [14]:

- ICT related strategies
 - Development of innovative broadband content
 - Interoperability
 - Digital rights management to protect intellectual property
- Strategies to support government modernization
 - service delivery bridging the digital divide
 - innovation test beds for best practice in eGovernment
 - improve universal access to advanced public service delivery through multi-channel
 - Reducing delivery risks and costs
- Strategies to investigate society evolution
 - tackle the social exclusion and ease the use for disabled
 - finding innovative solutions for using ICT to provide benefits instead of building barriers
 - Develop a strategy for ICT use in pedagogy
 - Create a personal online learning space
 - Intelligent eLearning systems shall meet the needs of the students for instance identify their weaknesses and provide accordingly lectures
 - Parents shall be able to interact online with schools and to supervise their children's progresses
 - effective and joined-up ICT in the National Health System
- Further strategies are:
 - new measures to improve Internet security
 - developing proactive operations to protect children during the time they are using Internet services, chat rooms and other applications, as well as providing parents special information through the themes
 - Identity management, in particular to identify criminals online
 - develop the absolutely best online-authentication existing on the market
 - new ways of better dealing with unwanted digital content
 - Improving spam filters, firewalls and web blocking technologies to avoid virus infections etc.
 - The criminal justice system shall improve through a modern ICT infrastructure with access to standard office applications
 - A national case management system including all layers of the juridical sector.

6. Synthesis of current eGovernment research programs, activities and national strategies

The most EU member states do not have any real research programs or policy because they are mainly trying to adapt existing ICT to existing administrative structures. Mainly implementation projects instead of eGovernment core research projects are funded by the European Member State governments. At the moment, governments still focus their own implementations, although research is absolutely necessary at fields, which are directly related to the general objectives of the implementation of ICT strategies in eGovernment matters.

Table 2 summarizes the results from the national strategies covering certain eGovernment topics identified per country.

Table 2: Overview of strategic eGovernment topic named by country

Strategic eGovernment topic	Named by national strategy	Number of occurrences
Security and trust	AT, BG, CZ, FI, FR, DE, GR, IT, LV, MT, PL, RO, UK	13
eLearning	AT, DK, FI, GR, HU, IT, LV, LT, PT, UK, RO, PL	12
Co-operation between public and private sector	AT, BG, DK, DE, FI, GR, HU, LV, LT, MT, RO	11
Added value service generating and delivery	AT, DK, FI, HU, IR, IT, LV, LT, NO, UK, RO	11
Understanding user needs, user-centric service delivery	BG, DK, FI, DE, GR, IR, IT, NO, PT, RO	10
Identity management and authentication	AT, BG, FI, FR, DE, HU, IT, MT, NL, UK	10
eInclusion	AT, DK, FI, IR, IT, LV, NO, PT, RO, UK	10
Interoperability	AT, BG, FI, FR, DE, IT, LV, MT, UK	9
Broadband technology and access	AT, DK, GR, LV, LT, NL, CZ, UK, RO	9
eProcurement (eCommerce, eBusiness)	AT, BG, GR, IT, LV, NO, PT, RO	8
eHealth	AT, GR, IR, LT, NL, PT, RO, PL	8
Multiple channel access	GR, HU, IT, PT, UK, RO	6
Regulatory framework	AT, BG, FR, HU, LT, MT	6
Government modernization / organizational modeling	BG, DK, FR, GR, LV, LT	6
Standardization	FI, DE, IT, LT, RO	5
Open source software	HU, IT, LT, PT, PL	5
Single access point / one-stop shop	AT, DE, GR, IT, LT	5
eAdministration	BG, DK, FI, FR, LT	5
Workflow management	FR, DE, GR, IT	4

Privacy enhancing technology	GR, HU, MT, NL	4
Intelligent Telecommunication Infrastructure	DK, HU, LT, PT	4
Decision making support system	BG, FI, LV, LT	4
Search (semantic web) and guiding (intelligent agents) methods	AT, DE, HU, RO	4
Knowledge management	AT, BG, DE, LT	4
Quality management	AT, LV, LT, MT	4
Ambient intelligence	FI, HU, IR	3
New working methods	GR, LT, PT	3
Innovation	AT, DK, LT	3
Integration of legacy systems	BG, MT	2
Usability	DE, HU	2
eDemocracy / eVoting	FR, LT	2
ePayment	AT, IT	2
Value chain	FR	1
Storage	HU	1
Digital Rights Management	UK	1
Citizen ICT empowerment	DK	1
Electronic signature	AT	1

Looking up the named strategic priorities resulting from the national eGovernment policies, a clear similarity to the results of the Danish Technology Institute presenting the research challenges until 2010 [88] can be recognized. The national strategies of the EU member states are more detailed descriptions of both the results of the Danish Technology Institute and the Lisbon agenda, which promotes IT innovation and investment as well as society evolution and government modernization. From this it follows that the EU member states direct their eGovernment priorities in a straight line to guidelines set up at the European level. It can also be recognized from the above introduction of national strategies and programs in European eGovernment research and implementation that only a few countries have research programs for eGovernment. In most cases, research is supported only via EC programs and international programs.

The table above shows that governments in their ICT strategies strongly focus on ‘trust and security’ issues. Since customers expect eGovernment services to be secure and trustworthy, this is a natural observation. Because a lot of personal data interchange and critical data which must not be changed or misused through electronic transmission is dealt with in public service provision, also ‘identity management and authentication’ have a high importance in various countries.

In comparison to the EC related topics, some countries have a clear focus on digital divide related topics such as ‘eLearning’, ‘eInclusion’, ‘user-centric service delivery’. These topics cover the need to empower citizens to take part in the Information Society. Particular attention is given to value added service generation for both the general public and handicapped citizens like elderly, disabled and socially unprivileged.

We recognized that strategic topics of high priority are related to socio-economic issues instead of clear ICT issues.

To sum up, current clusters of strategic topics of national implementation in eGovernment settings are ranked as follows:

- Research to investigate society evolution
- Research to support government modernization
- ICT related research
- Research in legal economic issues.

What is depressing, but not surprising, is the fact that research programs for innovation in eGovernment are barely provided at national level and in national innovation programs. Currently, most research funding in Europe is provided by the EC. Even national support for take-up and exploitation of international research results is only claimed to be provided in the near future, but barely provided yet.

Let us now leave the current research focus apart and turn to the challenges of identifying future images of governments in 2020. In the following chapter, first indications of the scenario building methodology to be applied in workpackage 2 are provided.

7. First indication of needs for a more detailed and focused scenario building and roadmapping exercise

In order to build future scenarios and a well founded roadmapping, a review of the existing studies on foresight methodologies has been carried out. The most relevant studies and institutions are briefly named here.

The European Commission maintains a thematic network on Foresight on Information Society Technologies in the European Research Area (FISTERA) to exercise future predictions for IST. FISTERA studies expected IST research trends for the timeframe of several years – depending on the methodology used. For example for the development of Information Society, Compano and Pascu [17] and Skulimowski [107] identified three main socio-economic indicators, which will impact the success of the transformation process. First aspect is related to the ageing society and the pressure on providing basic social security. Governments must prepare the future in regards to that problem accordingly. In this respect, eHealth will become more and more important. Second point is related to the lifelong learning in order to handle ICT in all situations. Promotion and support of eLearning with

adequate infrastructures, and developing new methods of online learning will require proper research as well. In addition, the positive attitude towards postsecondary learning with tertiary scholar indicators will continue. Third development is the growing mobility of workforce, which will lead to new working structures and methods.

For the years up to 2020, Peterson has identified the following general trends and research needs [103]:

- Research efforts on everything, which is related to and can adapt through tele-mediation including tele-presence, tele-medicine, tele-education
- constant and sustainable monitoring and surveillance because of coherent change detection
- Information fusion will require autonomous data organization, analysis, filtering, and prioritization of 'findings'
- Information accessibility for all who need massive amounts of archival and near real time information
- Information modeling including large complex systems modeling and simulations like geo-forewarning information systems
- Information security and encryption
- Cooperation, integration, interoperability, knowledge management

Lloyd also forecasts a complete integration of TV and computer communication technologies [81].

The threat of so called brain-drain can be recognized everywhere in the world. In particular within the European Union, Buhigas-Schubert and Marten [12] identified a critical aspect of well educated researchers leaving their countries due to reasons such as higher salary elsewhere or an unattractive research environment at home University. The European research landscape is coined through those developments, where some regions, which offer a higher degree on life quality than others, get more intakes of researchers. If this trend continues, massive problems will invade countries trying to build up an Information Society but not providing proper, prosperous environments for research.

Considering the eGovRTD2020 scenario building and roadmapping development of society until 2020, assumptions about how societies may look like in fifteen years and beyond will be made. Thereby, many changes will have to be monitored. For instance, one may expect that the nature of work and business will change over the next 15 years. Likewise, organizations will change. But what will be the shape of work and organizations in about 15 years?

Surely, the trend of the increasing infiltration of ICT in all areas of life will continue. But it will also lead to social exclusion of those who are not able to take part in the Information Society for whatever reason.

We expect that societies will change in the way that at a global scale regions' importance will grow, and they will work more closely together. This implies new governmental structures and cooperation across borders. Thereby a trend to reconstruct government at all levels will come up. The European Union itself is the best example of such a development.

As already pointed out, healthcare will gain further importance and especially eHealth and eMedicare as well as selling of drugs and distant therapies will become issues of everyday life.

In regard to globalization, a need and likely a successful development of automatic translation machines will progress, which will help to bridge the distance between people speaking different languages. Mettler forecasts that these machines and many more

developments in relation to the use of ICT will facilitate to grasp, memorize and intelligently infer knowledge from anywhere, which will probably lead to collective intelligence [87].

Other assumptions claim that the market is saturated and accordingly the Internet rush is over [91]. Therefore, no higher degree of Internet penetration is expected. Especially the Nordic European Member States have a very high Internet penetration rate per household of up to 75 percent in Denmark and 84 percent in Island [45]. In countries with such a high degree of Internet access at home, it is likely that there is no more need and, consequently, no more potential for Internet access growth.

Recalling the European objective to become the world leading Information Society, this still requires a lot of ICT deployment and use. It is assumed that the new member states will implement the necessary ICT infrastructure until 2020 [107]. Besides that, the new European Member States as well as the candidate countries will implement more eGovernment services for business than for individuals. This implies that trust and security in particular to allow secure trade in the new economy for eBusiness and eCommerce will still be in the centre of research [17].

At the moment, research already focuses on nanotechnology, information technology and cognitive science and it is assumed that these sciences are possible future mega-trends in technology developments. According to [17], in particular the convergence of nanotechnology, biotechnologies, information and communication technologies and cognitive sciences will impact the future research landscape.

In addition, Gartner [33], a provider of research and analysis about the global information technology industry, developed future scenarios and identified trends, which will likely become true in 2020. The following four future scenarios were developed. They are different through the degree of government intervention in economy and citizens attitude to privacy and surveillance [33]:

1. *Status quo development*
Light degree of government intervention and restrictive use of citizens' personal data.
2. *The good "big brother"*
Heavy degree of government intervention and permissive use of citizens' personal data
3. *Governing phantoms*
Heavy degree of government intervention and restrictive use of citizens' personal data
4. *Free enterprise Government*
Light degree of government intervention and permissive use of citizens' personal data.

On the basis of these four scenarios, the following trends could be identified [33]:

- provision of a single point of contact is not fully realizable, because intermediaries are central for service delivery and will inhibit it
- smaller, more active governments will come up by pooling at the interagency level and reducing local responsibilities and efforts
- responsibilities and resources will significantly shift between different tiers of governments, whereby data analytics and business intelligence play a major role
- greater consolidation and shared services to support integration, to be more efficient or to satisfy an increasing reliance on external service providers

- no single system for government-controlled identity management because of privacy concerns or because of the established role of intermediaries in service delivery.

Turning from results of existing studies of foresight and scenario building to the exercise in eGovRTD2020: in the following chapter, an outlook to the methodology of scenario building in eGovRTD2020 is provided.

8. Outlook to the methodology of scenario building and example

Within eGovRTD2020, regional workshops are foreseen as a part to develop the research roadmap for eGovernment 2020. The scenario building workshops are a cornerstone in order to generate high quality ideas and to elicit feedback from key players in public administrations, government and research, and assemble a constituency for later research. Hence, a thorough workshop methodology for the scenario building is key for successfully generating valuable pictures of the future.

8.1 Basic concept for the scenario building methodology

The future can be predicted to some extent based on extrapolation of the current developments, however, this is a prediction for the next couple of years. The 2020 time-line is too far away for extrapolation. The most central assumption of the (use of the) scenario method is that the future can not be predicted. **Figure 4** shows that certain developments will continue for some time into the future (the grey line). However, after a certain length of time it becomes impossible to extend the line (or development) because there is too much uncertainty.

Also scenario development is being used as a method to imagine future developments. There are many different methods of scenario development (e.g. [51], [85]). In eGovRTD2020, multiple methods are used to derive scenarios and finally to integrate the results into a common recommendation for future research programs and themes at the various levels of strategic decision-makers.

In general, scenario building is a technique to stimulate different perspectives or images on the future of a certain area in order to allow better predictions for evolution. Based on the insights from such visionary views, concerted and focused actions can be derived to positively or negatively impact future developments. Scenario building strongly differs from forecasting (see Figure 1): while forecasting predicts the near future based on the extrapolation of past and current developments, scenario building cuts off the past and requires to look into the future solely. Of course, even these scenarios are biased, since every expert participating in such scenario building exercises reflects on his or her past and current knowledge of actual developments and from there extrapolates his or her view on potential futures.

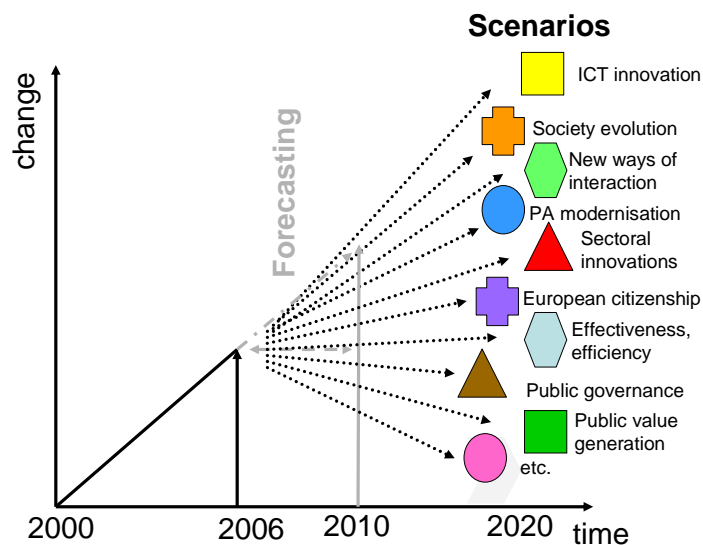


Figure 4: Scenario building in eGovRTD2020: images of diverging form and distinct character of the future taking into consideration the multidisciplinary of eGovernment

When applying the scenario building methodology, one must be aware of the fact that this implicit bias can never be turned off fully. However, it is important that during the workshop exercises the environment is relieved and neutralized from past and current states that could then be just projected to the future as is being done in the forecasting.

Scenario building does not pretend to predict the future. If an adequate environment is being provided, the technique facilitates the development of essentials of an image of the unpredictable future. To develop scenarios in a prosperous environment, the following principles and rules should be followed (adopted from [51], [124]):

- Scenarios describe a coherent set of visions, images and policies on a possible future
- Facilitators should make clear that scenarios are archetypal images or pictures (plausible, mutually different stories) about possible futures
- Facilitators should make clear that scenarios are no predictions, they are not extrapolated from current and past evolutions
- During a scenario session, no consensus is necessary. Scenarios may differ one from the other: even extreme opposite scenarios can – and should – be developed; in case of extremely opposing ideas, scenario axes should be determined to bring the extremes into relation
- Facilitators should make clear that scenarios are neither good nor bad futures
- To stimulate the imagination, moderators or facilitators should introduce the scenario building session with a visionary sketch that may even provoke the participants' views
- The essentials of a scenario description need to be explained, and supportive templates for the scenario description should be provided
- Participants shall be motivated to think the unthinkable (Popper "if you know it now, it is no future")
- Facilitators need to make sure that no criticism is exerted on each other's ideas.

Figure 5 reflects the general context of the set of elements and the structure of scenario questions for eGovRTD2020 in order to investigate future images of governments in 2020.

After the works of the single groups, all participants come together again to present their scenarios and to discuss them with the others. After the scenario discussion in the plenum, a final round of categorizing scenarios according to their impact and likelihood is being carried

out (see *Figure 6*). This is necessary to identify those developments having a high uncertainty and high impact on the future [11]. The rationale is that developments having a high uncertainty and high impact result in alternative futures, e.g. different scenarios. Developments having a high impact and low uncertainty result in one type of future. Developments having a low impact do not influence the future at all.

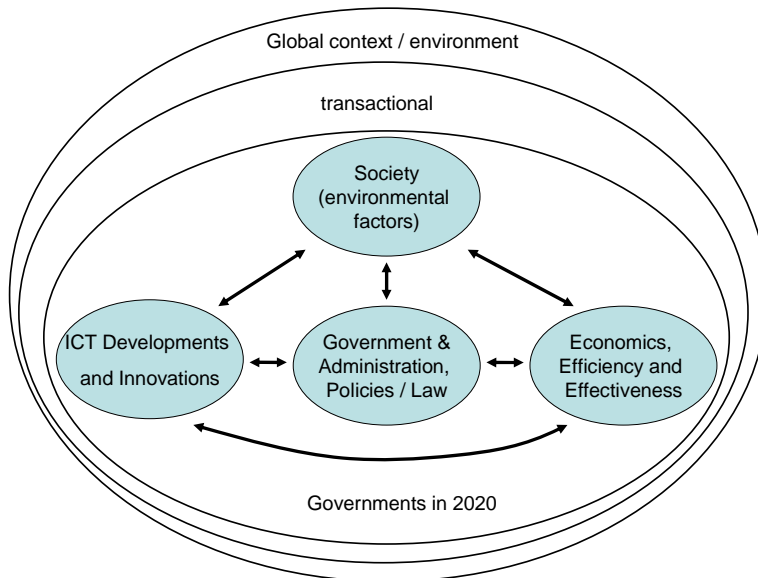


Figure 5: Context of scenario development: comprehensive view on issues impacting eGovernment

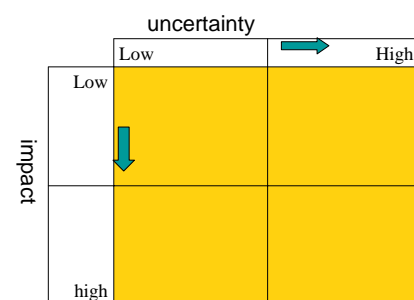


Figure 6: Assessing scenarios according to impact and uncertainty

8.2 Carrying out the scenario building workshops

Within the eGovRTD2020 scenario building workshops, some initial input of future sketches is being provided to the audience. Then, small groups of four to six participants develop scenarios by 2020. These are moderated by facilitators that help in getting started with the visionary discussions and that secure conformity to the rules described above. The scenarios are discussed along a set of elements such as: society characteristics in 2020; government characteristics in 2020; interaction among society and governments in 2020; which catastrophes will have to be faced and resolved till 2020 by interventions and regulations of governments; what form of ICT will be available in 2020; familiarity of society with which kind of ICT; what will be the main business of the public sector in 2020, etc.

As a supportive instrument to guide the scenario description of the future, a template scenario questionnaire has been developed. It guides the scenario building groups to discuss and develop their scenario(s) along the elements eGovRTD2020 wants to investigate by providing the following questions:

- Contextual environment
 - Society - e.g.: How will the society look like? Which role will individuals and communities play? Which attitude will individuals, groups and the society have towards governments?
 - Political system and climate - e.g.: Which societal and democratic values will be important? Which governance value will be important? Which role will transparency,

- privacy, security, enforcement of laws, compliance to laws and constitution, political system, etc play?
- Economical climate - e.g.: What employment will exist? Which types of labor will exist? Which age composition and labor force will exist? Which position / role will the country / the EC have in the world?
 - Governments and their stakeholders
 - Government, administration, polices and law - e.g.: Which roles will governments perform? Which role will European, national and local level of governments play? What relationships will exist with citizens and business?
 - Kinds of services Governments will be providing and customers will be consuming – e.g.: What kind of services will governments provide in 2020?
 - Mode of participation of stakeholders in the democratic processes – e.g.: Which stakeholders will play a role? Who will participate and how? What impact and power of decision-making will certain types of stakeholders have?
 - Government Environment - e.g.: What roles and activities of interest groups will impact government activities? What role will NGOs and private parties play in government service provision and in participation in policy making?
 - Technology developments
 - ICT available – e.g.: Which kind of technology will be used in 2020?
 - Interaction modes via ICT – e.g.: How will stakeholders be interacting with this technology in order to provide/consume public services and to participate in political processes?
 - Purpose of ICT usage in interacting with governments – e.g.: For which services and/or intentions of participation will the stakeholders use these technologies for interaction with governments in 2020?

After the works of the single groups, all participants come together again to present their scenarios and to discuss them with the others. After the scenario discussion in the plenum, a final round of categorizing scenarios according to their impact and likelihood is being carried out. This is necessary to identify those developments having a high uncertainty and high impact on the future [11]. The rationale is that developments having a high uncertainty and high impact result in alternative futures, e.g. different scenarios. Developments having a high impact and low uncertainty result in one type of future. Developments having a low impact do not influence the future at all.

To sum up the scenario building, several workshops are currently being carried out in different regions in Europe and in America.

8.3 Exemplifying the assessment of impact and likelihood of research themes identified in the course of the state of play investigations

As a test exercise to approve the concept of categorizing scenarios in terms of risks and impact, the themes identified in the state of play analysis have been mapped to the two-by-two matrix as depicted in *Figure 6*.

Table 3 demonstrates the results. The developments that will be most influencing the scenario development are shown in the grey cell. Some developments (like ageing of the labor force as indicated in the upper left cell) have a high impact, however, have a low certainty and as a result will not lead to alternative scenario sketches.

Table 3: Overview of main development categories

High	<ul style="list-style-type: none"> • Ageing of workforce and society • Importing skilled people • Centralizing agencies and sharing services • Web 2.0; Weblogs, Wikipedia and so on • Natural language processing and translation • Sensor technology and • Use of only open source software • Use of simulation, animation and gaming in policy making • Integration of ICT-health sector • Distance therapy and medicare and selling of drugs • Use of cameras and so on to ensure security • Constant and sustainable monitoring and surveillance for law enforcement and crime mapping • Communication between relief workers • Use of Geographical information • Information accessibility for those who need massive amounts of archival and real-time information • Development of separate network to deal with low Internet reliability, security and governance problems • Use of legal systems for automatic jurisdiction 	<ul style="list-style-type: none"> • Individualizing of the society • One citizen super-file, privacy and information availability for prevention of crime and terrorism • Convergence of nanotechnology, cognitive science and ICT • Privatization of social systems and health care • Integral approach towards IT governmental projects • Globally regions grow more and more together with will lead to new governmental structures and cooperation across borders and wide landscape • Slow adoption of legislation to facilitate newest e-government opportunities • Software developments coordinated at central level • Government functions and roles performed by private sector (security, health, insurance) • Customization and standardization of service provisioning • Cooperation among member states • Harmonization of policies and rules and standardization of security and tax systems • Industry activity will decrease in certain geographical regions • Use of knowledge and divide in high and low skilled and rich and poor • Social exclusion of skilled, non-skilled; rich and poor; and disabled people
Impact	<ul style="list-style-type: none"> • Understand of user needs and developing a user centric eGovernment approach • Semantic interoperability of systems • One-stop shop • Broadband adoption • Integration data, voice and video • An inclusive information society by e-learning, lifelong learning and integration of work and learning • Ambient intelligence • Infrastructure containing all kinds of services including security, privacy, authorization and payment • Availability of standards, data and process models • Proactive service delivery 	<ul style="list-style-type: none"> • Use of private parties and public-private partnerships for service provisioning • Use of private parties as channel for service provision • Governmental agencies and private companies work together for ICT dissemination • Centralized citizens, health and criminal records • All government communication will be dealt with using the Internet • IT expenditure is increasing • Policy Participation tiredness • Government as director of IT efforts
Low	Low	High
	uncertainty	

From the table it might become clear that many current eGovernment developments are often technology-driven and only deal with implementation of existing technology. Especially the new member states focus their efforts on bridging the gap with the other countries.

The lead-time of the impact of developments on reality is difficult to predict. Developing a new mobile phone takes only two years, a car seven years and a new medicine fifteen years. So how far the developments can predict the future is unsure. Based on the developments having a high uncertainty and high impact scenarios will be derived in the following section.

8.4 Test results: Scenario sketch for eGovernment 2020

Based on the state of play in eGovernment research strategies and policies, a first version of scenarios was derived within the eGovRTD2020 consortium by extrapolating the developments derived in the state of play study. This means that trends describing only the

next couple of years have been considered here for exemplification². This kind of approach is often depicted as *trend analysis*. A trend has already started and can therefore be identified. Scenarios investigate the type(s) of future(s) to which these trends may lead. Trend analysis is conducted by performing the following steps:

1. Identify development (state-of-the-play);
2. Select developments that have a high uncertainty and high impact;
3. Cluster developments with high uncertainty and high impact to derive scenario axis;
4. Derive and sketch scenarios.

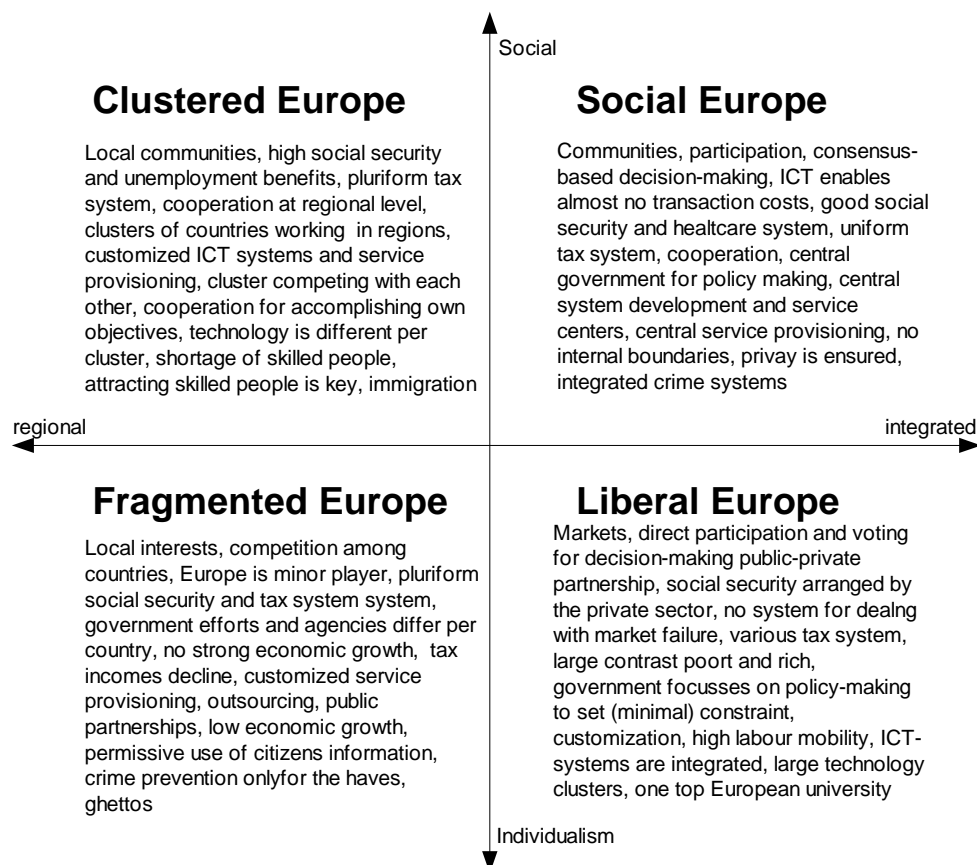


Figure 3: Scenarios derived from the state-of-the-play

The developments depicted in the grey cell of

Table 3 were clustered into categories to identify the main uncertainties. The developments that are correlated were merged into key uncertainties having a high impact. The purpose of this step is to end up with only a limited number of key uncertainties, from which general characterizations of the scenarios could be derived. The first key uncertainty we identified is whether the European countries are able to create a harmonized and unified Europe. In particular this uncertainty comes from the difficulties in reforming public administration, in coordinating ICT efforts and standardization and in harmonizing policies and common laws. The second key uncertainty reflects to the role of humans in the society. This scenario is

² The real scenarios from the workshops will be provided within the deliverable of workpackage 2 after the scenario workshops have been completed in summer 2006.

derived from societal developments such as the divide between low and high skilled, rich and poor, individualization and so on.

The two key uncertainties are combined in order to create the four scenarios as depicted in figure 3. The vertical axis focuses on public responsibility on top and private responsibility on the bottom. The horizontal axis shows the ability to integrate on the left versus a regional focus on the right.

The scenarios are aimed at describing extremes on the key uncertainty axis. Sketches of each scenario were developed to enable easy communication of the scenarios. Note that it is not always possible to unequivocally select developments that are consistent with the characterization in the sketches. The following four sketches were derived.

Social Europe: In a social Europe harmonization has succeeded, national sovereignty is limited and we have one integrated public administration taking responsibility for its citizens. There is a well-developed social welfare, security and healthcare and this is ensured by governments, the good big brother. Transaction costs are close to zero. There is one large super-file for each citizen and used for crime and terrorism prevention. Solidarity with the most vulnerable groups is maintained. System development and public service provisioning is centralized in large data centers and interoperability and standardization has succeeded. Local governments focus primarily on participation and customization to the local situation.

Liberal Europe: The public sector retreats and leaves it up to the market to provide security services, unemployment benefits, healthcare and so on. European governments concentrate on their core tasks, provide only pure public services and setting policies for privacy, insurance and so on. There are large technology clusters and European top universities are created researching particular topics such as nanotechnology. Citizens are not inclined to participate in policy-making and take care of their own welfare. Democracy is synonymous with voting. The negative side is that governments fail to adequately deal with market failures, especially disabled can hardly participate in society.

Clustered Europe: This scenario combines public responsibility with little cooperation among regions. Autonomous countries cooperate in clusters having similar objectives. The main objective of cooperation is to gain efficiency benefits and cooperation is primarily for accomplishing their own selfish objectives, innovation is fragmented and investments in ICT have a local nature. The labyrinth of policies, organizations and information systems are able to communicate with each other to ensure public safety. There is a shortage of skilled people and a large divide between the skilled and non-skilled and rich and poor. Each cluster focused on different technology development.

Fragmented Europe: Local interests dominate, there is hardly harmonization and integration and there is a pluriformity of social, security and health systems. Most of the functions and roles are performed by private parties and public-private partnerships. Countries compete with each other, and have a limited degree of cooperation. Tax incomes decline under the competition among countries. Most countries are unsuccessful in modernizing their public administration. There is only a light degree of governmental intervention and there is permissive use of citizens' personal data. Crime prevention is only accessible for the rich and there are ghettos separating the haves and have not. Europe is a minor player in the world and economic growth is limited.

The scenarios building will be further completed by conducting regional workshops and a validation workshop and after a gap analysis used for road mapping the research agenda.

Attention is given to new emerging information and communication technology (ICT) but also recognition and identification of trends arising from government, society and business sectors influencing eGovernment research topics and set up priorities in funding. To identify the research needs and rank these fields in order to urgency and the benefit they offer are the main goals. Besides, most road mapping reports in relation to future foresight are very vague, fuzzy and abstract which means they do not go in depth in their explanations of what measurements shall be undertaken to support the realization of the target future. The intention of eGovRTD2020 is to develop a more detailed road map on which ICT research topics must be focused in future to realize the vision for eGovernment in 2020. Naturally, there are a lot of influences in the environment on which the realization of the vision depends but the roadmap shall identify the most likely influences and provide a profound research guideline which leads to the best possible way in counteract these influences.

9. Conclusions

The state of play analysis in eGovRTD2020 started with a review of the current status of eGovernment research themes, programs and strategic policies of Europe and the single member states thereby focusing on technical, political, administrative, organizational and social research in eGovernment.

Resuming from the results, the European Community's strategies are primarily oriented towards the Lisbon strategy and the new i2010 initiative. In these strategic documents, focus lays on more investment and innovation, particular in increasing the speed of innovation development and productivity. Further catchwords from the i2010 document are to set up a single European information space and to promote an inclusive European information society. These strategies are reflected in many European member state strategies to modernize Governments by implementing eGovernment. The single member states have broken down these high level strategic objectives to key topics of implementation priorities. Yet, most EU member states are focusing on their implementation of existing ICT without research aspects involved or without linking up with research questions. Most countries in Europe do not have own research programs for eGovernment related research. Instead, most research funding in Europe is provided by the European Commission.

Having a closer look at the new member states, their efforts concentrate on bridging the gap between them and the remaining countries. Also in this case, research is rather neglected.

Countries that invest a lot of money in eGovernment research are the USA and Australia. One reason for the big investments in the United States may be grounded in the changes in the past. For example USA research emphasizes security and trust issues for several domains to realize some kind of transactions at first.

In several foresight studies carried out by FISTERA, within a project of DTI and EIPA for the EC, and Gartner, a series of themes of eGovernment research and investigations have been identified. In most cases, eServices provision in general and with specific focus of pan-European services (in the case of EC-related programs), eInclusion, accessibility, interoperability and standards, trust and security, knowledge management and semantic web technologies, understanding user needs, eParticipation and eVoting (yet still on an early stage) are among these topics.

In one of the workshops carried out along the study of DTI and EIPA, one of the authors claimed that eGovernment needs also a harmonized common understanding of the

eGovernment research and application (maturity of eGovernment). This includes a commonly established European eGovernment ontology and a commonly agreed European eGovernment glossary. To reach this, a common effort is required by the main actors of Governments and eGovernment research. If this objective will not be reached, the vision of eGovernment will not become true, people and systems of eGovernment won't speak the "same language" and huge investigations already done or still to be done will not pay back at the end.

As already pointed out, international research programs for eGovernment do exist. However, at the national scale, e.g. European Member States' national research programs lack concrete research tracks to nurture eGovernment research. A further insight gained so far is that currently, governments in the EC member states barely work in cooperation with academia in order to advance integration of innovative research developments into practical applications. So, we are coming back to the initial claim that research and government practitioner need to foster a stronger dialogue among themselves in order to bring research results faster to application and to identify needs for research investigations from practice.

Within eGovRTD2020, a dialogue is being initiated in the way that regional workshops are being carried out with stakeholders from distinct areas of expertise in order to develop

- a) future scenarios of Governments in 2020 and
- b) a research roadmap to prepare the findings and solutions for the future visions.

Next step is the scenario building workshops. Details for the methodology and the results will be available in Deliverable D 2.1. A first approach for the methodology and a test scenario have been described here.

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