

# OECD e-Government Studies Indicators Project



**OECD E-GOVERNMENT STUDIES**

**INDICATORS PROJECT**



## PART I

### BACKGROUND THEORETICAL INTRODUCTION

#### Public sector reforms and e-government

Governments around the world invest large amounts of money in deep public sector reforms. These reforms have been on the agendas of most OECD governments well before the advent of “e-government”. E-Government is conceived as a powerful tool to enhance efficiency and effectiveness in policy making and policy implementation; and it is generally intrinsically embedded in political reforms and organisational changes designed to drive, support and implement transformation in the organisation of the public sector.

E-Government is seen as an important component of today’s reform agendas because it: 1) serves as a tool to reform; 2) renews interest in public management reform; 3) highlights internal inconsistencies; 4) underscores commitment to good governance objectives. E-Government can therefore help administrations do their job better by supporting the administrative reforms that are necessary if e-government is to be successful. E-Government and public sector reforms are therefore mutually reinforcing. (OECD, 2003).

Research in the field has so far prioritised studying the effects of the use of information and communication technology (ICT) as a shortcut to increase public sector efficiency and improve internal administration and management capabilities. The analysis therefore focused less on the broader impacts e-government policies can have on public sector organisation and the services it delivers (Cordella, 2007; Dawes, 2009; J.E. Fountain, 2001), and on the wider societal benefits it can help to achieve (OECD, Denmark 2010).

In line with this tendency, e-government policies have largely envisaged the use of ICT to further develop the re-organisation of the public sector along with the basic principles of efficiency gains and cost savings that have driven ICT adoptions in the private sector.

Although valuable, the focus on efficiency and effectiveness conceived in pure economic terms is limited. For instance, it downplays the role of context-dependent factors in shaping successful e-government initiatives and their implementation. Developments in measuring the impact of the “use of information and communication technologies, and particularly the Internet, as a tool to achieve better government<sup>1</sup>” should therefore better acknowledge the complexity that is associated with their implementation and look at the social and political outcomes of their adoptions (Aberbach & Christensen, 2005; Bozeman & Bretschneider, 1986; Cordella, 2007; Frederickson, 2000; Moore, 1995). In fact, there are a number of areas in which e-government policies can produce impacts that need to be measured.

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<sup>1</sup> The e-Government Imperative

## **From New Public Management to new ways to measure performance**

The relation between ICT policies and public sector reform drivers is an important area of study to better understand the factors that steer and shape e-government initiatives. ICT in the public sector has mainly been discussed as a tool to help create new and better service delivery by increasing efficiency and effectiveness, and by improving accountability in public administration procedures and management. ICT has become a powerful tool to standardise work procedures and smoothen information flows, so that organisational processes become more efficient and transparent through the process of information rationalisation.

The use of ICT appears as a transversal and crucial element in many of the key components of public administration reforms based on the New Public Management (NPM) paradigm. The interconnection between NPM core ideas and e-government is thus explained by the potential benefits that ICT can bring to the re-organisation of internal strategies and working procedures within the public sector. Indeed, e-government initiatives became part of NPM political and managerial reforms in many countries around the world (Cordella, 2007).

The rationales behind the application of NPM and the development of e-government are based upon ideas that are in fact quite similar: perceived unresponsiveness and rigidity of the traditional bureaucratic structures and the resulting public dissatisfaction with the government. As a consequence, the goal of making governments more responsive has become in many instances one of the most important reasons for the initiation of e-government projects.

Positions from scholars differ when identifying NPM as a paradigm in public administration (see for instance M Barzelay, 2001; Gruening, 2001; Lynn Jr, 1997), or as a specific governance strategy (Lane, 2000; Sørensen & Löfgren, 2007). Yet, despite the open debate regarding NPM main attributes, the advent of the NPM as the main driver of the public sector reforms resulted in several ambitious targets: the need for governments to be more responsive, accountable, transparent and result-driven, as well as decentralised, efficient and user oriented. In addition, governments had to achieve these goals with a much slimmer structure, as the pressures for downsizing the State were another indisputable characteristic of the NPM-based reforms.

This approach provided a radical change in the logic underpinning the organisation and governance of the public sector since it is associated with a fundamental shift in the factors used to assess the action of the public administration, *e.g.* from effectiveness to efficiency. Probably, the most evident transformation proposed by NPM has been to promote a management culture for the public sector that, as in the case of the private sector, becomes result-driven where the managerial efficiency risks superseding other needs in the delivery of public services.

Under the flag of creating “a government that works better and costs less”, broader and more intense use of ICT gained a core place in reinventing government’s agenda and public innovation efforts. Yet, even if it can be claimed that NPM has come to an end as main public sector reform driver (P. Dunleavy, H. Margetts, S. Bastow, & J. Tinkler, 2006b), it still has important implications for the use of ICT and the definition of e-government policies. The recent worldwide economic downturn has put even more pressure on governments to innovate and use public resources more efficiently, as well as to foster policies designed to rationalise public sector organisations. As result, a reinvigorated interest in e-government as a short-cut to public sector rationalisation and cost savings, along the lines of NPM prescriptions, has reinforced in some countries, the logic which has informed e-government policies for quite some time.

## **E-Government policy outcomes: A public value perspective**

In line with the fairly extended use of the NPM principles to inspire e-government initiatives, so far the dominant approaches to estimate the impact of e-government policies have largely been based on evaluation frameworks developed to assess ICT impacts in the private sector. These approaches mainly look at efficiency driven performance measures (*e.g.* costs reduction and return on investment) and managerial goal achievements (*e.g.* transparency and accountability) associated to the reorganisation of the government's machinery enabled by ICT, which are closely related to private sector economic standards. As a result, efficiency gains achieved through cost savings in the public sector and services delivery's streamlining are common goals of many e-government programmes carried out around the world.

These approaches, however, neglect the fact that public sector strategies differ from private sector strategies because the former, are driven by the overriding goal of creating public value while the latter should aim at creating private value (Moore, 1995). Therefore, although valuable to assess some of the aspects associated with the deployment of e-government policies, the focus on efficiency, effectiveness and economy is limited because it often neglects the broader impacts of these policies.

Private value can be estimated through financial measurements of profits, while public value is much more difficult to define, despite the important efforts of the Value For Money studies. Public value is related to the achievements of objectives set by government programmes and the delivery of public services to the citizenry. Public value is thus not only related to the efficiency of the public administration action, as it can in fact consist of multiple objectives, such as narrow economic objectives, broader outcomes, and the creation and maintenance of socially shared expectations of fairness, trust and legitimacy whose definition cannot be detached from the socially shaped context within which they are defined. Also, making key, relevant and reliable information available to citizens has been recognized as one of the core elements in many e-government strategies. Indirectly, this has also been part of the "better performance" goals. Also, ICT has been implemented to enhance participatory and democratic governance by opening new and innovative channels of participation (*e.g.* public on line deliberations, e-voting systems). Hence, addressing the question whether, and to what extent, e-government programmes achieve policy goals entails to consider a broader set of public values.

Accordingly, the analysis of ICT developments within the public sector should take into account the complexity of their implementation with regard to how they transform the relationship between citizens and governments, and how this changes citizens' expectation on governments' actions. In fact, outcomes of public sector reforms produce impacts on the social and political dimensions that are not accounted for in private sector frameworks (Aberbach & Christensen, 2005; Bozeman & Bretschneider, 1986; Cordella, 2007; Frederickson, 2000; Moore, 1995).

These considerations provide the background to discuss<sup>2</sup> whether and how an alternative approach to the evaluation of the impact of e-government policies, which discusses the effects of governments' action in terms of public value creation rather than on economic growth, could provide new means to look at government activities, policy making and service delivery, which directly challenge measuring approaches based on the NPM paradigm or similar principles. This alternative approach could contextualise the study, analysis and evaluation of e-government policies as it poses the public nature of government programmes at the centre of the problem. Efficiency plays a key role as enabler of 'good and better government' via front and back-office reorganisation within the wave of public sector reforms (*e.g.* e-government initiatives

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<sup>2</sup> The study of public values is by all means complex and it has a well established debate in the public administration literature (see for instance Alford & Hughes, 2008; Beck Jorgensen & Bozeman, 2007). Although highly important, there is no space here to deal the issue in more details.

with a focus on efficiency may lead to an effective programme and thus, to an increase in public trust), but it is not the only driver to look at.

The argument against the sole use of traditional indicators, based on economic drivers, has been discussed by scholars who analysed the effects of ICT on economic growth. An excessive focus on customer service techniques and private sector tools applied to governments may lead to increased political inequality, even when some aspects of service delivery are improved. Scholars have expressed their concerns (Cordella 2007) with regard to the fact that when governments implement reforms driven by a market logic - and considering citizens as customers - they risk to discriminate between groups of citizens and to fail to enforce the democratic values of impartiality and equality. This argument against the use of traditional indicators is strongly reinforced when public value creation is considered. Propper and Wilson (2003) conducted an overview of performance measures and studied them in the fields of health and education in the USA and the UK. The authors found that despite the wide use of performance measures, “there is almost no evidence on whether these schemes improve the efficiency of the public service being delivered”.

Given the multiplicity of the goals and stakeholders, public organisations confront it remains highly challenging to use performance schemes to design and evaluate public services. As no single performance indicator can adequately address all public actors’ objectives (Propper & Wilson, 2003), focusing solely on the managerial values of government may challenge the pursue of other competing values such as equity and fairness. All in all, understanding why measuring performance is important and in which ways it should be done within the public sector remains crucial.

### **A new set of OECD e-government indicators**

OECD countries are increasingly demanding a renewed basic set of e-government indicators supported by international consensus. What is needed is a comprehensive and useful set of indicators to support better policy making in this area, by enabling governments to make use of national and international benchmarking to compare performances across time and among countries.

As the area of e-government is young (*i.e.* it dates back to the second-half of the 1990s) there is no scientific tradition of measuring the performance of e-government that over a number of years has established internationally recognised statistics and indicators. A number of international organisations – including the UN, The World Bank, and the European Union – have in the last eight to ten years worked on providing statistical information and internationally recognised indicators to governments. They have been successful in guiding policy-makers for a number of years, but today there is a need to reassess this set of measures in order to produce others which are capable to guide national decision making processes and to secure an even more effective and efficient e-government.

There is a general agreement that the current e-government indicators alone, while useful, do not fully address the countries’ interests in understanding e-government performance over time and have a limited value in many cases as tools to inform policy makers who increasingly see technology as a critical resource to improve the performance of the public sector, particularly in difficult economic and financial times. Moreover, there is a need in terms of possibility to compare across countries the governments’ ability to reap the benefits of e-government in a generally agreed upon, appropriate and useful way.

The previous work of the OECD on the available e-government indicators has strengthened the assumption that, in order to address the countries’ concerns, it is necessary to rethink the basic concepts and approaches. This will require adding to the areas already measured (*e.g.* online presence of public information and services) new ones with the aim to measure e-government performance and capture its

impacts on the public sector transformation, as well as on the broader societal development. These areas are not fully covered by the analysis and methodology supporting the existing e-government indicators.

In view of the above, the OECD work shall contribute to better policy making by providing governments with a basic set of indicators that, together with other policy tools, should assist them in better understanding how to improve the performance of the public sector through the use of e-government (e.g. by increasing back-office coherency and integration achieved through the reorganisation of operations, processes, systems, information management and sharing, by enabling the delivery of user-friendly and user centred services to citizens and businesses through improved front-office integration).

The need to focus on measuring performance has merged from recent discussions in which OECD member countries indicated that particularly in a time of financial restraints and fiscal consolidation, governments are pressed by the challenge to show they are performing while doing more with less. They are expected to be agile and ubiquitous, and to provide high-quality services more efficiently, effectively and responsively in a context where resources are shrinking and businesses and citizens' needs and preferences are changing and becoming more pressing and complex. Costs and benefits of investments in e-government and IT projects need to be measured, but the key question remains on how outputs and outcomes of e-government can be measured to ensure that data and evidences support policy decisions that lead to the achievement of overarching and specific policy outcomes.

Providing relevant measures of e-government performance requires taking into account a number of different variables. In the next few years, the OECD will look into developing a basic set of e-government indicators that will encompass the following area:

- E-Government impact: indicators on outputs, processes and outcomes would focus on measuring the extent to which e-government programmes are supporting the achievement of policy goals (e.g. efficiency and effectiveness and user-centricity of service delivery). Such indicators could help governments implement a more sustainable, effective and meaningful e-government.
- Economics of e-government: indicators looking at this dimension would allow the definition of an economic “profile” of e-government development and implementation (e.g. transaction costs for e-government services, ratio between e-government investments compared to the size of the public sector in terms of employees or per capita).
- Back-office: whether countries are moving towards making information and data fully accessible to the public, or towards embracing new service delivery concepts using cloud computing or Web 2.0, a coherent back-office is needed to support a more efficient, effective, responsive, open and transparent government. Indicators in this dimension should see how efforts in this area can support governments' need to be more open, responsive, efficient and agile.

The following sections include a very general analysis of some of the main issues that will have to guide the selection of dimensions and variables for the development of the new indicators.

### ***The organisational impacts of e-government***

E-Government has at least two main organisational impacts. First, it deals with the re-engineering of the public sector internal activities and with a redefinition of the relationship (interactions and transactions) between the public administration and the citizens. Secondly, e-government impacts the way in which the boundaries between the State and the market are redrawn by creating the demand to outsource to the private sector a number of operations or services. This is seen as functional to create a more digital and slimmer public sector, and to support more transparent, agile and accountable governments. Outsourcing



can be in fact a valuable solution to reducing the costs and complexity associated with the management and design of the ICT architectures which are part of any e-government policy. Outsourcing within the public sector may be conceived as part of a larger and longer term change in how organisations are structured and managed, part of what is called a move towards a slimmer public sector.

These initiatives are driven, among others, by the concern to lower costs in the public sector (or at least to reduce the public sector borrowing requirement), and by the political belief that private sector companies tend to be more efficient, and that the competition will increase efficiency and effectiveness of management and operations in public services.

With the aim to improve the performance of the public sector, governments have made several efforts, and invested considerable amounts of resources, to reorganise internal activities (*i.e.* work operations, processes, and functions), in order to enhance the ability to serve citizens with the appropriate services and to reduce the costs for these services. Governments have envisaged e-government either as a tool to rationalise existing processes or as an instrument to foster a more profound reengineering of public sector organisations.

The re-engineering of the public sector internal activities deals with the re-organisation of front and back-offices and with the ultimate goal to provide single points of access – either on or off line – to public services and information. The reconsideration of the boundaries between the state and the market, impacts outsourcing practices in public sector management, including the boundaries between what is done by front and back-offices, and what is externalised to third parties organisations.

#### *Back-office and front-office*

There are no widely adopted definitions of back-office and front-office and there is no agreement on the demarcation line between the two. The term back-office (BO) is widely used to refer to all the functions and operations which are needed to provide the public service, while front-office (FO) normally stands for those organisational interfaces which mediate the interaction between those who request a service and the public agency that provides it. The back-office is therefore normally regarded as what produces the services which are distributed by the front-office. The back-office can produce the services manually, using ICT or any combination of both. Moreover, services can be produced by one back-office unit; by different branches of the same department involved in the service production; or by different departments in the most complex cases. Similarly, one or multiple government levels can be involved in the production and provision of the service. In order to improve the efficiency of public sector activities as a whole, both back-office operations as well as front-office delivery have to make a better score.

It has been widely argued that the best outcome of back-office reorganisation does not come from the automation and digitalisation of paper-based processes (OECD, 2003), but rather from using the potential of the technology to re-think, and therefore re-engineer, the processes of the organisation. This implies reconsidering if each organisational step is still necessary, or whether steps might be suppressed or merged, *i.e.* re-engineering the overall processes underpinning the execution of back-office activities.

Following a similar rationale, ICT has been conceived as a powerful tool to redesign the front-offices of public sector organisations. In fact, ICT provides a better and more powerful instrument to facilitate and improve the interaction between governments and citizens by reducing the transaction costs and time needed for the interactions, and by making the services more easily accessible and responsive to users' needs. The goal is to make it easier, faster, and cheaper for citizens to interact with government agencies, and for governments "to build services around citizens' choices".

The linkage between front and back-office reforms is therefore close. In fact, to offer services around the clock and via digital platforms requires that these services are always available and provided whenever the virtual front-office requires them. It goes without saying that the wide reorganisation which is implicit on the digital government models and which proposes a virtual front-office available 24 hours a day 7 days a week to citizens also requires a considerable reorganisation of the back-office to accommodate the request coming from the front-office. ICT led reforms of the front-office are therefore closely intertwined with back-office functions redesign.

The integration of back-offices is complex by nature as it requires cooperation among different organisation structures, which do not necessarily share the same goals and interests. The integrated approach therefore asks for an extended change not only in the structures, but also in the logic underpinning the action of each office involved. Open Government Initiatives and Gov 2.0 policies which aim to “break down barriers to transparency, participation, and collaboration between the federal government and the people it is to serve”<sup>3</sup> and create new collaborative ways of work for civil servants, call for a stronger redefinition of front and back-office boundaries and interdependences, which will ultimately require an even deeper integration and reorganisation of public offices.

### ***Economic impacts of e-government: Growth, productivity and competitiveness***

Despite the accumulated literature on the effects of the use of ICT on economic performances, there is still limited empirical evidence on the relation between e-government and public sector productivity and competitiveness growth. To date, regardless of some negative voices on the subject, several studies have demonstrated that the apparent contradiction between the widespread use of technology and the relatively slow increase in productivity was due to deficiencies in measurements and in the methodological tools used (Brynjolfsson, 1993; Kohli & Grover, 2008).

The accumulated research in the domain suggests that ICT adoption and productivity are associated with at least some aspects of firm value, such as financial, operational or perceived value (Kohli & Grover, 2008). Moreover, research suggests that ICT does create value, not in isolation, but rather under certain conditions and with complementary resources (Brynjolfsson & Hitt, 2000; Kohli & Devaraj, 2003; Kohli & Grover, 2008). These complementary factors include organisational change, IT people management, changes in business processes, process performance, and information sharing, among others. Different dimensions and complementary resources need to be discussed when looking at the public sector, given the political and social nature of government interventions.

Research in the effects of ICT adoptions on economic growth have largely focused on different combinations in the relation of ICT investments and value creation. This research addresses the interaction of ICT with its mediating factors (*e.g.* organisational changes, strategic alignment, capabilities), the analysis of different types of ICT value creation (*e.g.* productivity, profit, processes), and the different levels of impact (individual, firm, industry)<sup>4</sup> making it difficult to univocally define what is the outcome and how it is generated.

However, as in the private sector, the relation of ICT investments and public sector productivity is in itself key to economic growth. The importance of this relation relies on the fact that labour productivity in the public sector is in itself a determinant of average labour productivity at national level. Then, efficiency gains and better internal performance in public services have multiplier effects across the economy as they enable private sector companies to become more efficient and competitive. On the channels through which e-government can enhance economic growth, various authors (Srivastava and Teo, 2008; OECD 2005)

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<sup>3</sup> <http://www.whitehouse.gov/open>, accessed 6 October 2010.

<sup>4</sup> For a review of the most relevant literature on these variables see Kohli and Grover (2008)

underline that e-government may serve to increase the business usage of ICT in a given nation in the form of increased e-business activity, thereby facilitating an increase in its national economic performance.

Thus, e-government can be seen as enabler of economic growth in two senses:

- As an *actor*, increasing government own efficiency, effectiveness and productivity;
- As a *factor*, increasing service delivery and operational efficiency which reduces the cost of regulatory compliance for citizens and businesses as users of governments' services and makes the economic environment conducive for business activity.

Using secondary data from 113 countries, in a Study released in 2008, the authors Srivasa and Teo (Srivastava & Teo, 2008) examine the relationships of e-government development and e-participation with national business competitiveness. Findings seem to suggest there is a strong association of e-government development with business competitiveness, although the relation is also mediated by two environmental factors: human capital and quality of public institutions. A sound national human capital base (approximated by educated and ICT-literate citizens) has been identified as a major enabler for realizing the benefits of e-government on competitiveness. In addition, the better the quality of public institutions, the stronger the relationship between e-government development and business competitiveness.

In a more recent study, Srivastava and Teo (2010) examine the relation between both e-government and e-business and national economic performance. The results show that designing effective ICT policies (*i.e.* national ICT infrastructure policies) is important for both e-government and e-business. In sum, it seems clear that e-government investments alone are not associated with economic performance which is instead the outcome of the combined effects of technologies and social processes.

### ***Methodological limitations of measuring outcomes and impacts***

Measuring e-government's economic impacts poses many challenges that magnify some of the already complex calculations of ICT value creation research. The most salient among these is the need to define public sector reforms general outputs, as well as specific outputs of e-government policies, at a country level. As many services and "goods" produced and delivered by governments do not have a market value, it is very difficult to develop proper economic indicators and measurement frameworks. Moreover, aggregating the many different services that are delivered across agencies as a result of investments in e-government programmes remains a very challenging task which complicates even more the development of aggregate indicators and measurement frameworks, which are able to encompass all the services provided through e-government.

To date, the question of precise measurements on whether the adoption of e-government increases economic growth remains unresolved, even if there are growing efforts towards providing further empirical data on the subject. The fact that there are no concrete measurements does not mean there is no real economic impact coming from investments in e-government policies. Evidence suggests that methodological problems are the major cause for this "missing empirical link".

## PART II

### PROGRAMMATIC SECTION

#### Background

In March 2010, the OECD organised a Workshop on E-Government Indicators<sup>5</sup> to discuss with various stakeholders<sup>6</sup> the main trends and needs in terms of e-government indicators. As governments are increasingly faced with the challenge to do more and to maximise efficiency in a context of budget constraints and economic austerity, the need to measure the performance of various policy areas including e-government to support evidence-based policy making has become crucial as it represents an issue that needs to be addressed quickly. Measuring the outputs and outcomes of e-government, in addition to evaluating costs and investments in this area, becomes essential as it allows governments to measure e-government policy impact.

Interestingly, up to now the development of e-government indicators has not focused on characteristics internal to the public sector as they employ variables that do not necessarily measure the performance of a government in developing the e-government enabling environment within the public sector (*e.g.* the UN e-readiness indicator). This observation fits into a more general discussion concerning the currently recognised and used e-government indicators which have been developed by different institutions over the past two decades.

In line with previously expressed concerns, participants to the OECD Workshop confirmed that as the overall understanding of the value of performance data increases both for policy-makers and practitioners, there is a stronger need to create an international consensus on a comprehensive and useful set of basic e-government indicators that could enable governments to make use of national and international benchmarking to compare performances across time and among countries. The Workshop discussions have strengthened the assumption already mentioned in Part I of this document that assessing e-government performance requires a revision – or broadening – of the basic concepts and approaches on measuring

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<sup>5</sup> Paris, 29-30 March 2010

<sup>6</sup> For the OECD it is very important to work together with other international organisations to ensure a co-ordinated international process to identify a set of core indicators on e-government. Since 2004, the OECD has been an active member of the “The Partnership on Measuring ICT for Development” – an international, multi-stakeholder initiative to improve the availability and quality of ICT data and indicators. Members of the Partnership are: OECD, ITU, UNCTAD, UNESCO, UNDESA, WB, UN-ECA, UN-ECLAC, UN-ESCWA, UN-ESCAP, EUROSTAT. In particular, the OECD, through the E-Government Unit, is an active member of the Partnership’s Task Group on E-Government and sees the participation in the work of the Task Group as essential.

e-government. This definitely implies shifting the attention from the areas normally measured (*e.g.* online presence of public information and services) to others with the aim to appraise e-government performance and capture its impact on public sector outcomes and outputs. For instance, there is increasing interest in measuring the efficiency of the government machinery (*i.e.* back-office) in providing services to citizens and businesses rather than focusing mainly on the front-office supply of e-government services, as many of the currently used indicators do.

The improvement of e-government services has been associated with the increase in the efficiency relative to the front-office area. As indicated previously in this document, in the last years several indicators have been considered for measuring and comparing front-office performances. Measuring the front-office is clearly relevant, but it allows only a partial appraisal of a country's performance in delivering e-government. To this end, the development of the e-government enabling environment within the public sector has been recognised as an important step towards the increase of efficiency and effectiveness in providing services to citizens and in delivering policy outcomes (*e.g.* understanding the outcomes of e-government investments).

In light of the above, and with reference made to the Concept Note<sup>7</sup>, presented at the Workshop introducing the dimensions that the OECD would like the next generation of e-government indicators to cover as well as a new framework and methodology to be adopted, the OECD decided to focus its attention in the upcoming months on measuring e-government performance, *i.e.* outputs, processes, and outcomes of e-government.

The framework presented in the Concept Note suggested building indicators that take into account variables that reflect the level of development of the enabling environment within public sector offices. The framework focuses on measuring the enabling environment within the public sector identifying two important factors: physical and human capital.

The framework was split in two components, both necessary to the functioning of the e-government enabling environment within the public sector. The first part consists of the electronic infrastructure or physical capital in ICT, while the second part consists of the human capital in ICT that is needed to make the infrastructure work. The concept note suggested focusing the attention on the investments in these two components, which represent the costs the public sector bears to develop the enabling environment necessary to foster the national e-government development and the delivery of e-government services.

The need to monitor the amount of resources devoted on a yearly basis to the improvement of the enabling environment within the public sector is a necessary point of departure for governments. These data represent a crucial variable to evaluate the e-government performance of a country as the development of the enabling environment within the public sector supports the overall performance in delivering e-government.

Measuring performance is relevant for several reasons and knowing the costs is crucial since measuring performance requires comparing costs and benefits in relation to the outputs produced. As governments are concerned about the proper functioning of their public systems, they are interested in assessing how “productive” their public administrations across levels of government are and in comparing that “productivity” to other countries. In fact, the concept of performance is somehow related to the one of productivity in economics. The productivity of a firm can be measured by considering the output of a production process per unit of input. Similarly, measuring e-government performance requires evaluating the increase of the “e-government output” given a certain amount of costs (input).

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<sup>7</sup> OECD (2010), “E-Government Indicators: Proposal for a New Framework and Methodology”, conference paper, Workshop on OECD E-Government Indicators, Paris, 29-30 March 2010.

Therefore, the joint analysis of costs and benefits would allow an evaluation of the development and improvement of e-government services provided to citizens and business, given the public administrations' yearly investments. This is relevant not only at country level but also for a cross-country analysis. For example, a government might achieve good results in providing e-government services to citizens by investing a huge amount of resources whereas, another government might achieve the same results without employing the same amount of resources. In this situation, it can be claimed that the two governments have a similar e-government development, yet it would not be fair to assert that the two governments perform similarly. Moreover, assuming that country X provides less online services compared to country Y, but that country X performs better than Y in providing online services (comparing costs and outputs), the higher efficiency of country X is relevant since it shows that X manages its resources more efficiently. In fact, its relevance might even overcome the issue of X providing less online services than Y. Performance indicators could in this sense help to evaluate how efficient a government is in providing online services given the amount of expenses sustained during a specific year.

### **Measuring performance in delivering e-government**

In light of the above, it would be particularly useful to measure the amount of governments' expenses devoted to the development of the enabling environment within the public sector. It should be noted that measuring costs is only instrumental to a performance analysis and does not represent the final target. The idea is in fact not to develop expenditure-based indicators, but to collect data on expenditures which are necessary for the final aim to measure performance. This will be a challenging exercise given that countries have different ways to define and calculate public expenditures in the ICT domain. The main challenges will thus be to identify how to measure expenditures, collect such data, and ensure the quality of such data. The OECD focus will be on collecting data that is appropriate given the measuring needs of the member countries, rather than the data that is easy to collect.

The Concept Note suggests measuring the annual investments in ICT physical capital and those in human capital within the public sector out of the total public spending. Any possible spending variable should carefully take into account these aspects as they represent how governments' focus and approach the development of e-government enabling environment in the public sector, which enables an effective e-government development and the maximisation of e-government benefits.

It should be noted that the concept of investing in ICT human capital might be associated with the amount of salaries and expenses to hire staff with ICT competencies. This is however a vague and debatable concept as the costs of hiring staff might vary across countries and hence it might not be a good proxy. On the other hand, a better indicator of human capital is the number of ICT staff employed out of the total staff members.

Spending in ICT physical and human capital represents a good proxy of the financial efforts devoted to supporting the development of the e-government enabling environment. This allows associating the amount of expenses (*i.e. i.e.* the costs) borne by a public administration to produce a certain output in providing e-government services to business and citizens.

### **Data collection and methodology**

In the third quarter of 2010, the OECD will focus on collecting country data to measure spending in ICT infrastructure and staff. To this aim, countries will be asked to provide data on spending in physical and human capital by single public sector organisation (*e.g.* ministry, agency, arms-length institutions). The breakdown by specific public administration organisation is particularly useful in order to assess the sectors performing better compared to those where the performance is poor. The recent OECD questionnaire submitted to member countries in the first semester of 2010 represents a good starting point.

Yet, it is relevant to be very specific and to reduce the amount of data required in order to facilitate the data collection and to accelerate the process.

Once a clear picture on the annual spending of each country is established, the focus should move to the variables that need to be considered to assess the performance of the countries. These variables might be based on measuring the proportion of services provided on line out of the total amount of services provided to citizens. Alternatively it could be interesting to evaluate the year-to-year increase of online services. Moreover, in accordance with indicators considered by other organisations, it might also be possible to employ other front-office indicators measuring the level of satisfaction of citizens in approaching public offices. Anyhow, the variables will be selected together with the member countries in order to ensure that the indicator responds to their needs in terms of measuring e-government's performance. In fact, to be successful in providing value to policy makers and practitioners through e-government indicators, it is necessary to understand and incorporate their needs into the design and implementation of the indicators.

The idea is to address the request which also emerged from the Workshop to develop meaningful performance indicators related to specific outcomes in consideration of the fact that developing an overall performance indicator might be difficult, and might not be the appropriate approach. This effort implies the need to conceptualise clear, and widely agreed-upon definitions, which shall take into consideration the national perspective and needs with regard to the definition of e-government performance, outcome and outputs.

Finally, the methodological proposal put forward in the OECD Concept Note should be considered in building indicators. The methodological section discusses the advantages of using the geometric mean, rather than the arithmetic one, when summarizing (*i.e.* aggregating) different indicators. The suggested use of geometric mean represents an improvement in assessing and comparing country performance. This methodology can be employed once the detailed data are available for building indicators (see Annex 1 of this booklet).

## PART III

### DATA FROM THE OECD BASIC STRUCTURAL AND ECONOMIC E-GOVERNMENT DATA

In the first half of 2010 the OECD conducted a survey on basic structural and economic e-government data aimed to collect basic structural e-government data in five areas: legal and regulatory framework, institutional settings, public expenditures on e-government, indicators used to measure e-government impact and performance, e-governments' results governments expect to achieve. The survey was sent to 42 countries (*i.e.* OECD members, official observers, accession countries, enhanced engagement countries) of which 23 responded. The following sections provide graphs with the collected data.

#### Legal and regulatory framework

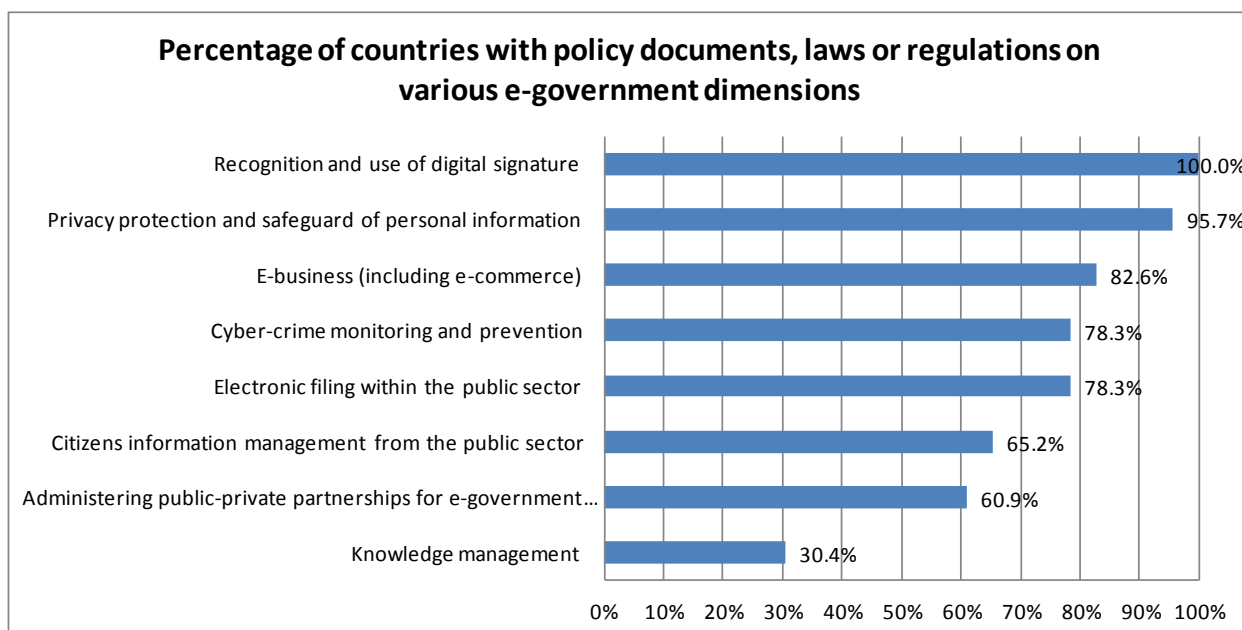
The success of e-government initiatives and processes is highly dependent on the governments' role in ensuring a proper legal framework (OECD, 2003). Legislative and legal barriers can indeed impede the further development, or up-take, of e-government. Obstacles to the further implementation of e-government may come from the lack of measures addressing basic issues (*e.g.* ensuring the formal legal equivalence between paper-based and digital documents, establishing digital signature) as well as of others tackling problems associated with more sophisticated levels of e-government (*e.g.* absence of measures that support the integration of processes, the sharing of resources including data). In sum, a complex, incomplete or obsolete legal and regulatory enabling environment may hinder the provision of integrated and responsive e-government services. Given the relevance of the topic, the OECD survey asked questions aimed at collecting information also on this area. The aim of the questions was to acquire an overview of the current legal and regulatory framework supporting e-government implementation within OECD member countries.

#### Survey question: Which of the following exist in your country?

- Policy document and/or Law and/or regulation on e-business (including e-commerce).
- Policy document and/or Law and or/regulation administering public-private partnerships for e-government projects
- Policy document and/or Law and/or regulation on electronic filing within the public sector
- Policy document and/or Law and regulation for the recognition and use of digital signature
- Policy document and/or Law and regulation on citizens' information management from the public sector



- Policy document and/or Law and/or regulation on cyber-crime monitoring and prevention
- Policy document and/or Law and/or regulation on privacy protection and for the safeguard of personal information
- Policy document and/or Law and/or regulation on knowledge management.



Source: OECD survey on Basic E-Government Structural and Economic Data, 2010

The survey's results seem to show that while OECD countries are fairly advanced in tackling issues such as privacy, digital signature, and e-commerce the same level of sophistication has not been reached when dealing with issues that characterise more sophisticated levels of e-government, such as electronic filing, knowledge management and information management. As countries are putting considerable efforts to increase integration of processes and sharing of resources – e.g. including information – ensuring the right level of regulatory clarity within the area of information management is needed to maximise the benefits of their efforts.

Furthermore, countries are increasingly exploring the possibility to exploit new technologies (e.g. Web 2.0, cloud computing, mobile technology) to change the way the public sector works and engages with citizens and businesses to achieve higher efficiencies, to be more ubiquitous and more agile (OECD, 2010). In this context, learning from, and partnering with the private sector, which is more experienced in using certain technologies, becomes crucial for the governments. The development of an adequate legal and regulatory framework for administering the relationship between the public and private sectors is, therefore, crucial. The survey's results seem to show that more efforts are needed to this regard.

### **Institutional settings**

Effective and efficient e-government implementation requires institutional settings that enable integration of processes and operations, co-ordination and co-operation across levels of government, and achievement of synergies and economies of scale in the use of all kinds of resources. Also, ensuring that efforts are aligned with common goals, and that scarce resources are used coherently to achieve common

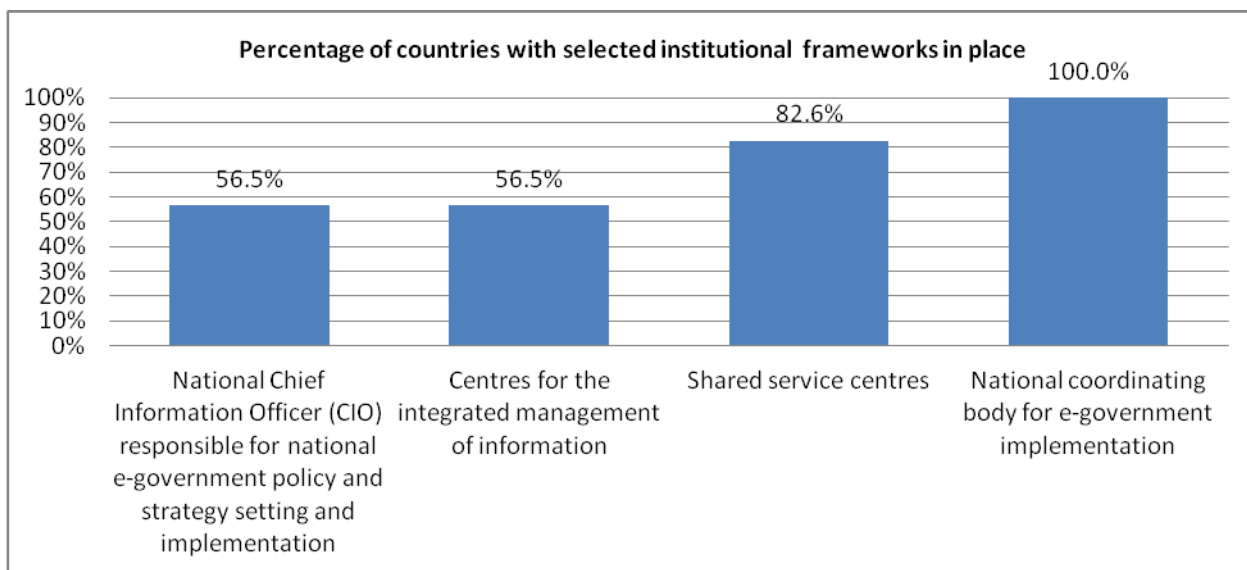
targets, is particularly important in a context of economic austerity. Having adequate institutional settings is crucial to reach this objective.

National contexts influence the type of institutional settings in place, so that homogeneity among countries' choices in this regard is not what matters. Instead, asking questions concerning the institutional and organisational frameworks in place is relevant to understand the trends in the national efforts aimed to establish a framework that supports further e-government development.

A second set of questions aimed at acquiring information on the institutional settings.

**Survey questions:**

- Do you have a national Chief Information Officer (CIO) responsible for national e-government policy and strategy setting and implementation?
- Do you have a national coordinating body for e-government implementation?
- Do you have shared service centres<sup>8</sup>?
- Do you have centres for the integrated management of information<sup>9</sup>?



Source: OECD survey on Basic E-Government Structural and Economic Data, 2010

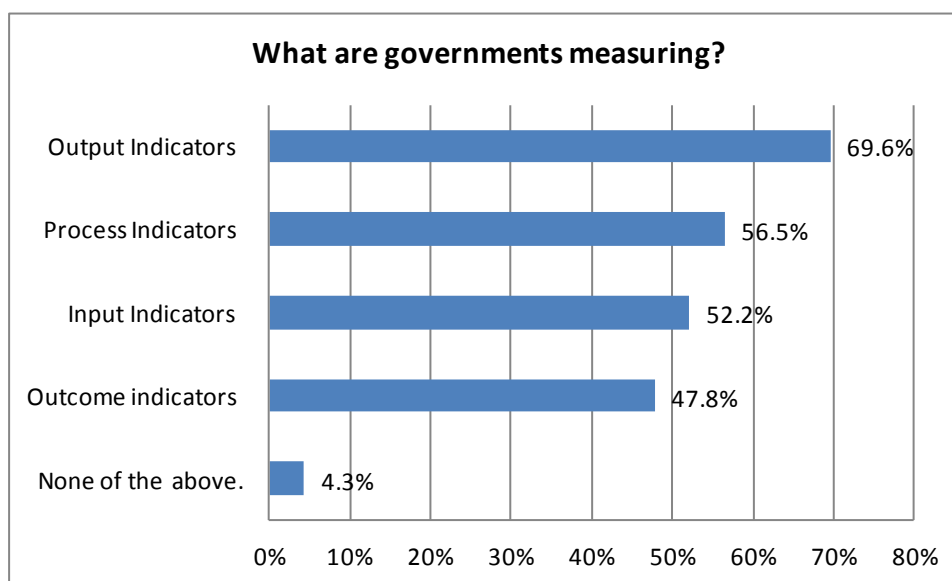
<sup>8</sup> A Shared service centre is a common entity responsible for providing support services to more than a single public sector organisation. Examples of services provided are: accounting, HR, ICT related support, etc.

<sup>9</sup> Information management is the collection, organisation and control of information from one or more sources and how it is distributed to one or more users entitled to access the information. Information management is often a part of planning and decision processes.

## Measuring e-government impact and performance

Performing, producing results and proving achievements is a priority for governments. The international community is increasingly being asked to work closely with governments around the world to provide indicators which shall, together with other policy tools, support better policy making. In regard to this, it is interesting to see what type of indicators countries are already using at the national level.

**Survey question: What indicators do you use to monitor and evaluate the development, implementation and impact of e-government projects?**



Source: OECD survey on Basic E-Government Structural and Economic Data, 2010

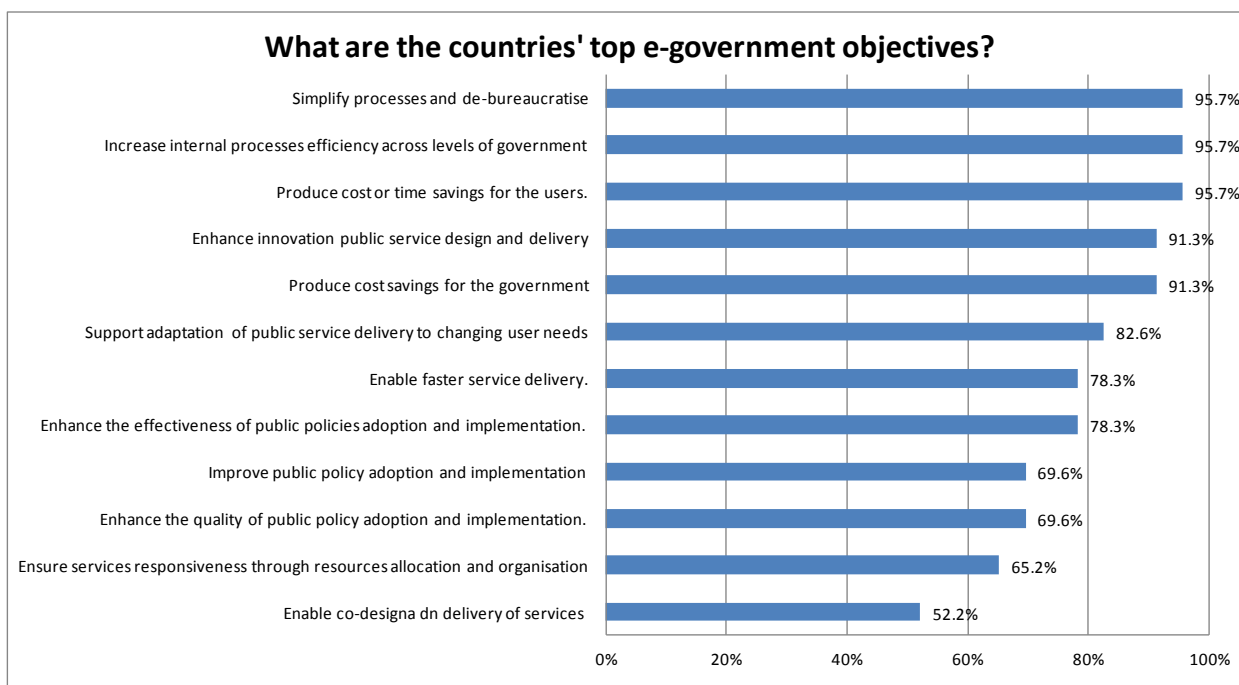
## Expected results of e-government

E-Government can be a powerful enabler of public sector reforms. Within the framework of their national reform programmes, governments conceive and implement e-government initiatives with the purpose to reach specific policy objectives, all contributing to overall goals, e.g. improving service delivery, enhancing the public sector's efficiency and effectiveness, innovate and increase citizens' participation. The aim to ask countries about the results they aim to achieve with their e-government programmes is important in order to understand where the national priorities lay. Results to the survey seem to show that regardless of what appears to be as a context where the governments' challenges are rapidly evolving, governments' main priorities in terms of e-government's objectives seem to have remain unaltered from some years ago, i.e. foster administrative simplification and de-bureaucratisation, improve internal processes efficiency across levels of government, enable cost or time savings for the users, achieve savings for governments, enhance innovation in public service design and delivery).

**Survey question: Which of the following results do you expect to achieve through your e-government programme?**

- Enhancing the quality of public policy adoption and implementation.
- Enhancing the productivity of public policy adoption and implementation.

- Enhancing the effectiveness (*i.e.* degree of targeted goals accomplishment) of public policies adoption and implementation.
- Reprioritising resources allocation and organisation of public services to ensure responsiveness to citizens' needs.
- Producing cost or time savings for the users.
- Producing cost savings for the government.
- Enabling faster service delivery.
- Increasing processes efficiency internally and across levels of government.
- Enhancing innovation in public service design and delivery (*e.g.* value, content, delivery process, delivery channels)?
- Supporting adaptation of public service delivery to changing user needs (*e.g.* moving from off-line to on-line service delivery).
- Enabling users' participation and direct involvement in service design and delivery.
- Simplification of processes and de-bureaucratisation.



Source: OECD survey on Basic E-Government Structural and Economic Data, 2010

## **Public expenditures on e-government**

The aim of the section of the questionnaire on public expenditures on e-government was to collect data on the total expenditures on ICT infrastructure and human capital as percentage of the total public expenditures. Taking into consideration that public accounts and ICT expenditures are organised differently in the various OECD countries (central/federal level vs. regional and local level, by single agency, by single ministry, at the centre of government level, etc.) the questionnaire asked respondents to provide the data in any available format. Out of the 17 countries that provided some information on their public expenditures only 5 provided data which enable comparison.

The complexity of gathering this type of data may be explained, among other reasons, by the fact that these expenses are not accounted for uniformly by the countries. As extensively explained in the methodological section of this document, knowing the cost of developing e-government is essential to be able to appraise governments' performance in using it to achieve different goals. The questionnaire to be used to collect data for the e-government indicator will further refine data collection in this area.

## ANNEX

### FRAMEWORK AND METHODOLOGY

#### Introduction

The challenge to optimise the efficiency and effectiveness of the public sector is linked to the development of a digital environment that is able to reduce not only the costs of production and delivery of services, but also the time between the demand of the citizen and the supply of the service. The increase in the use of ICT in the public sector experienced by OECD countries in the last two decades represented an important driver and tool to reorganise processes and achieve targets. The development of ICT infrastructure within the public sector has been able to reduce the distance between the citizens' needs and the response of the public administration. Creating an e-government enabling environment and supportive system is therefore a cornerstone for improving the performance and the impact of governments on citizens' lives. This is the reason why governments recognise the need to use indicators that enable them to evaluate the development and impact of e-government. In developing these indicators it is crucial to ensure that they are harmonised to enable the comparison of performance between countries and over time.

This annex recognises this need and puts forward a proposal to fill the gap in the e-government indicators currently in use. First, this section presents the general framework to be employed to build e-government indicators. Second, it proposes a simple methodology, the geometric mean, that can be considered as an improvement compared with the standard arithmetic mean used by other indicators. Empirical examples help showing the difference arising when using different methodologies.

The aim of this Annex is to consider the basis for building e-government indicators, in terms of both variables to be included and methodology to be employed.

#### The framework

Measuring the overall enabling environment of e-government and the governments' efforts to establish it, is challenging due to the heterogeneous aspects, specific to the national context, that determine such an environment. For example, the enabling environment comprises elements like the legal and regulatory framework that would be difficult to measure through the use of any statistical tool. The framework developed by the OECD, and presented in this section, does not aim to measure the entire e-government enabling environment, but focuses in particular on the enabling environment within the public sector.

Regardless of the national specificities, there are some fundamental aspects relative to the e-government enabling environment within the public sector that can be measured and which can therefore be considered as a benchmark proxy in measuring the whole e-government structure within the public

sector. Before introducing any possible indicator, it is important to identify the key factors of the e-government enabling environment within the public sector which, if measured, can quantify the degree of sophistication and development of such environment. More specifically, the analysis aims at addressing the question of how to quantify if and how a government is involved in the process of building an e-government enabling environment within its public sector. This question leads to considerations of the variables that enable the measurement of the elements of the environment within the public sector that supports the development of e-government and its effective and efficient implementation.

One of the main tasks of the public sector is to deliver services to citizens and businesses. As in the private sector context, the production of services requires an adequate structure in order to guarantee an efficient and effective production and delivery process. This is why the concept of an e-government enabling environment within the public sector is strongly linked to the economic concept of the capital structure. This structure can be broadly split in two parts that are both necessary for its functioning. The first part consists of the electronic infrastructure, or physical capital in ICT, while the second part consists of the human capital that is needed to make the infrastructure work. The first is represented by all elements that contribute to the functioning of the electronic system, such as computers, printers, machines, hardware, software, networks, Public Key Infrastructure – or *PKI*<sup>10</sup>, standards, Enterprise Architecture and utilities. These two elements represent the heart of the functioning of an e-government enabling environment in the back-office of the public sector. In fact, these key elements can be considered as the main pillars for producing consistent e-government indicators to monitor the capacity of a government to establish the enabling environment within the public sector which is needed to support an efficient and effective implementation of the e-government programme.

In order to be able to assess the level of e-government sophistication within a national context it is essential to build indicators that take into account variables that reflect the efforts of a government to develop the e-government enabling environment within the public sector, as these are the efforts that determine and impact the level of sophistication of e-government services delivery and access. These can be seen, therefore, as a prerequisite for the assessment of other e-government aspects (e.g. the sophistication of the access offered to e-government services, sophistication of websites, national e-readiness).

### ***Building ICT infrastructures***

The level of ICT infrastructure – *i.e.* the whole amount of physical capital available within the public organisation under consideration – developed within the public sector can be considered as the basis for building an e-government system within its back-office. Measuring the stock of ICT capital owned by a public organisation might not be feasible as it is often the result of a process of development that took place over a period of several years. It is definitely more feasible for public organisations to measure the flow of expenditures that is annually devoted to support the further development of the ICT infrastructure.

Public spending on ICT physical capital requires a continuous financial effort to make the entire system work properly. Therefore, a relevant variable to be considered as a starting point for the establishment of an e-government system within a public organisation is represented by the annual investments in ICT infrastructure. Theoretically, this variable can be easily quantified by the public administration as it is part of the annual budget. The use of this flow variable should be considered in

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<sup>10</sup> A method for authenticating a message sender or receiver and/or encrypting a message. PKI enables users of an insecure public electronic network, such as the Internet, to securely and privately exchange data through the use of a cryptographic key pair obtained and shared through a trusted authority. It provides for use of digital certificates that can identify an individual or an organisation, and directory services that can store, verify and, when necessary, revoke the certificates.

conjunction with the total annual expenditure. The proportion of investments in ICT of the total expenditure gives a clearer picture of the annual financial “effort” that the public administration devoted in building its e-infrastructure. Therefore, measuring the level of public investments in ICT physical capital, as part of the total annual investments, should be feasible, as these data are generally available, and it would also show the degree of priority that a public organisation gives to using available resources for the development of the ICT infrastructure.

Moreover, once the entries in the annual budget referring to the ICT infrastructure expenditure have been identified, time series for several years can be used to give an indication of the total stock of ICT infrastructure accumulated over time.

### ***Human capital***

Spending in ICT infrastructure can be considered a necessary, but alone not sufficient, condition for developing an e-government enabling-environment within the public sector. In other words, the availability of physical capital alone, despite being the cornerstone for building an ICT system within public organisations, is not enough to develop a public electronic system. The sufficient condition is represented by the staff hired to run and manage the system. This second concept refers to the amount of human capital that is involved in the proper functioning of the ICT system.

Physical and human capitals are strongly interconnected and must be considered jointly in evaluating the degree of digitisation of a public organisation. In fact, staff members employed in ICT management are fully complementary to ICT infrastructure.

As for the physical capital, investing in ICT experts is an important variable for establishing an e-government enabling environment within the public sector to be measured through e-government indicators. We suggest using the proportion of staff employed on ICT tasks within the public sector out of the total staff employed. That is, regardless of the total number of staff employed, the attention here focuses on the proportion (quota) of public investments used to employ experts to maintain and manage the ICT infrastructure. The procedure suggested in the previous subsection would not fit in here since the amount of investments in ICT staff is determined by the salary conditions of the specific countries. Therefore, it would not be suitable for an international comparison. On the contrary, the number of ICT experts employed is a good proxy of the resources devoted to support the e-government system. The identification of the annual financial “effort” (in terms of number of staff members) allows assessing the commitment of public administration to the development of their ICT system. As in the case of the infrastructure, the object of interest is the identification of a ratio that describes the contribution of human capital to the development of the e-government enabling environment within the public sector.

In brief, the analysis conducted so far focuses on two fundamental aspects related to ICT within the public sector. Spending in human and physical capitals out of the total expenditure could be considered as the starting point of an evaluation process that aims at building a set of e-government indicators.

Note that this Annex restricted its attention to a general analysis of the enabling environment within the public sector. There are obviously other relevant aspects that should be considered for analyzing the overall degree of back-office development.

The proportion of investments on ICT infrastructure and on ICT experts employed represent good proxy of the costs supported by the public administration. Those factors do not represent the complete target of the analysis. They rather represent a starting point for building performance indicators. These indicators will be developed in due course. Yet a clear picture of the costs borne by countries represents relevant information.



### ***Linear versus geometric aggregation: some methodological considerations***

Building indicators that measure the performance of countries on different fields requires an aggregation scheme. As noted above, the main aggregation schemes considered so far are linear. This type of scheme has advantages and disadvantages that should be taken into consideration before deciding to employ this approach. The evaluation of aggregation schemes is fully addressed in the technical document produced by the OECD and JRC European Commission (2009), *Handbook of constructing composite indicators, methodology and user guide*.

One of the important aspects analysed in the handbook is the concept of compensability. This concept is relevant since it discriminates between the linear and geometric aggregation schemes. It can be easily described throughout the use of a simple example. Let's assume that countries are ranked based on three different dimensions (say dimensions *A*, *B* and *C*) and the linear aggregation scheme is employed for building the final indicator. The arithmetic average approach described above is one of the possible linear aggregation schemes. If a country reports a low score in a specific dimension (say *A*), this can be fully compensated by scoring higher in the other dimensions (*i.e.* *B* and *C*). Assume for example that country *X* reports the following scores  $A=1$ ;  $B=9$  and  $C=5$  while country *Y* reports the following scores:  $A=5$ ;  $B=5$  and  $C=5$ . Despite the fact that country *X* reports a low score for *A*, a linear aggregation criterion, such as the arithmetic approach, would not be able to distinguish between country *X* and *Y*. In other words the two countries would be considered as having the same performance since a deficit in one dimension can be offset by a high score in another dimension. Therefore, as noted in the handbook, “...in benchmarking exercises, countries with low scores prefer a linear rather than a geometric aggregation”.

It is then worth discussing the validity of the compensability property in building aggregated indicators. To address this issue, the options and the incentives of countries reporting low scores should be analysed. Under a full compensability regime, a country with a low score is not necessarily motivated to reduce the gap between the underperforming dimension and the other dimensions as long as the other dimensions are good enough. In other words, there is no evident incentive for a country to improve on a specific (and problematic) dimension, especially if the country has problems regarding that dimension and can more easily improve the other dimensions and as a result the final score of the indicator. This might not be a problem if the dimensions are similar. Instead, it is a clear problem when the dimensions are heterogeneous<sup>11</sup>. It is true that the arithmetic mean is thought of as giving the same weight to each dimension and therefore it does not discriminate dimensions in terms of importance. However, as noted by Desai (1991), additivity over different dimensions implies perfect substitution which can hardly be appropriate.

Therefore, compensability is not a good property for an indicator dealing with heterogeneous dimensions. This issue can be overcome through the use of the geometric approach. The geometric aggregation scheme in fact does not allow for full compensability among dimensions<sup>12</sup>. In particular, the geometric approach tends to penalize countries that report low scores in single dimensions. Consider for instance the previous example using countries *X* and *Y*. Using a geometric aggregation procedure country *X* would score  $\sqrt[3]{(1 * 5 * 9)} = 3.56$  against country *Y* that would score  $\sqrt[3]{(5 * 5 * 5)} = 5$ . It is straightforward to observe the penalisation of country *X* by nearly one and half point. Assuming that the previous ranking was

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<sup>11</sup> Consider for example the Human Development index proposed by Amartya Sen and Sudhir Anand during the nineties. This index has been heavily criticized by several authors since it adopts the full compensability approach.

<sup>12</sup> The use of the geometric mean has been suggested by several authors criticizing the Human development Index, (see for example Desai (1991), Sagar and Najam(1998), Herrero, Martinez and Villar(2008)). Despite these critiques the UNDP keeps using the linear aggregation scheme originally proposed by Sen and Anand.

carried out in 2005, in 2006 countries *X* and *Y* report respectively the following scores (2;5;9) and (6;5;5). This implies that both countries improved on the first dimension by a unity. In this situation the linear aggregation would still not be able to discriminate between the two countries. The geometric ranking however, would now yield the following results:  $\sqrt[3]{(3*5*9)}=4.48$  for country *X* and  $\sqrt[3]{(6*5*5)}=5.31$  for *Y*.

The difference between the two approaches is significant. In fact, country *X* improved its ranking by nearly a unit (4.48 in 2006 against 3.56 in 2005), while country *Y* improved only by 0.31. That is, the marginal increase obtained by improving the low score dimension is much stronger than in the linear case (if a linear scheme was in use, both countries would have increase the ranking with the same gain of 0.33). Consequently, a country would have a greater incentive to address those sectors/ dimensions with low scores if the aggregation were geometric rather than linear.

At this stage the reader might argue that, if the geometric aggregation is employed, the indicator would give more weight to the dimension with low score and therefore it would reduce the importance of the other dimensions. This is not true. In fact, as soon as the score relative to the problematic dimension rises, the impact on the indicator gets smaller (an example linked to the proposed e-government indicator is provided in the next section). That is, the more the scoring gets homogeneous among the dimensions the less the geometric scheme penalises. In general, when scores are close enough there would be little difference between the geometric and the linear schemes. Therefore penalising does not mean discriminating in terms of priorities and targets. Yet, penalising has the crucial role of stimulating a country in reducing the gaps among sectors through the reinforcement of dimensions with poor performance.

Despite the well known properties, the geometric scheme has not yet been employed in building e-government indicators.

### Comparing methodologies

This section is devoted to further discussion of the difference produced by using different aggregation schemes. In particular, using data published in the UN E-Government Survey 2010, a real example of how different the ranking of countries can be if geometric versus linear approaches are adopted is shown in Table 1.

**Table 1. Example of differences in ranking using different aggregation schemes**

	Web Measure Index	Infrastructure Index	Human Capital Index	E-readiness (Linear) Index	E-readiness (Geometric) Index
Cambodia	0.136	0.030	0.702	0.289	0.142
Mauritania	0.089	0.080	0.543	0.237	0.157
Gambia	0.083	0.095	0.461	0.213	0.154
Bangladesh	0.356	0.033	0.518	0.302	0.183

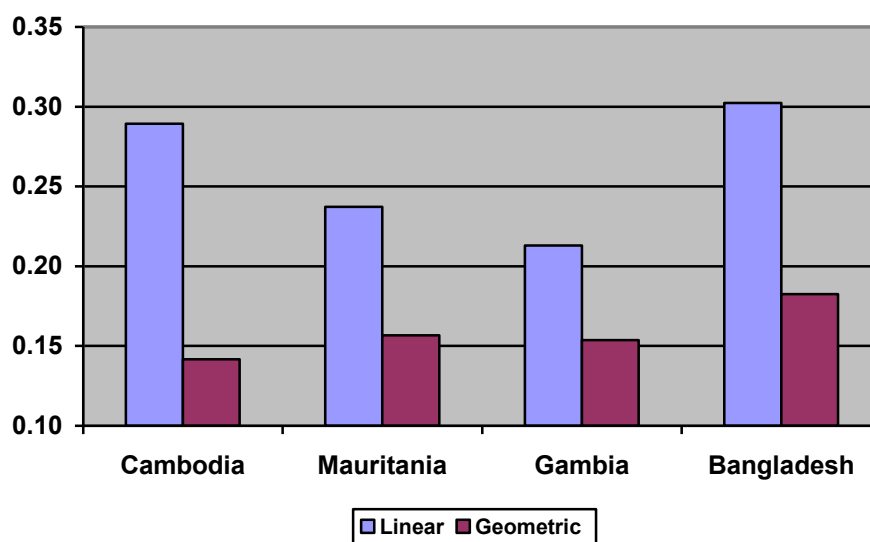
Source: OECD compilation, 2010.

Table 1 reports an extract of the results contained in the appendix of the UNDESA's report with reference to four countries: Cambodia, Mauritania, Gambia and Bangladesh. More specifically, the first three columns refer to the components that are used to build the e-readiness indicator. The latter is contained in the fourth column while the fifth column contains the e-readiness indicator computed according to the geometric aggregation scheme.

The example has been chosen to highlight the evident differences between the linear and geometric approaches in terms of results. According to the linear scheme, the gap in the index between Cambodia and Mauritania is about five points while, according to the geometric approach, the two countries behave to a large extent similarly. This is because the geometric scheme tends to penalise Cambodia due to the low Infrastructure Index. Therefore, despite Cambodia reporting a Human Capital Index of 70% (15 points higher than Mauritania) and a Web Measure Index of about 14% (5 points higher than Mauritania), the Infrastructure index heavily penalizes the country by ranking it below Mauritania. Similar results can be observed in comparing Gambia and Bangladesh. According to the linear aggregation, the two countries have a quite different ranking while the same does not hold for the other aggregation scheme.

As noted, if a geometric aggregation scheme were in use, both Cambodia and Bangladesh would concentrate their efforts in increasing the Infrastructure Index in order to raise their ranking. Under a linear aggregation regime on the other hand, there would be no incentives for Cambodia and Bangladesh to focus on their weakness. Somehow, due to the penalisation property, the geometric approach could be considered “fairer” than the linear approach. This is simply because it forces countries to find a balance among the components rather than disregarding the gaps among the scores.

**Figure 1. Linear vs. geometric e-readiness**



Source: OECD compilation, 2010.

Other interesting cases, although not as extreme as seen so far, are relative to OECD countries. Table 2 reports an example using a sample of four OECD countries extracted from the UNDESA Report 2010.

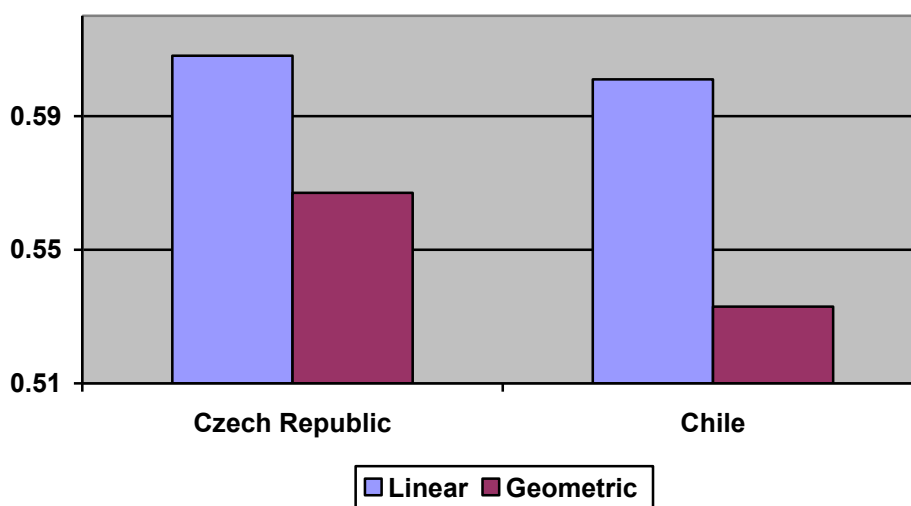
**Table 2. UN indices – OECD country examples**

	Web Measure Index	Infrastructure Index	Human Capital Index	E-Readiness (Linea) Index	E-Readiness (Geometric) Index
Czech Republic	0.1543	0.1405	0.3112	0.608	0.567
Chile	0.2072	0.089	0.3047	0.601	0.533
Italy	0.0982	0.1622	0.3196	0.583	0.516
Portugal	0.1317	0.1382	0.3088	0.581	0.533

Source: OECD compilation, 2010.

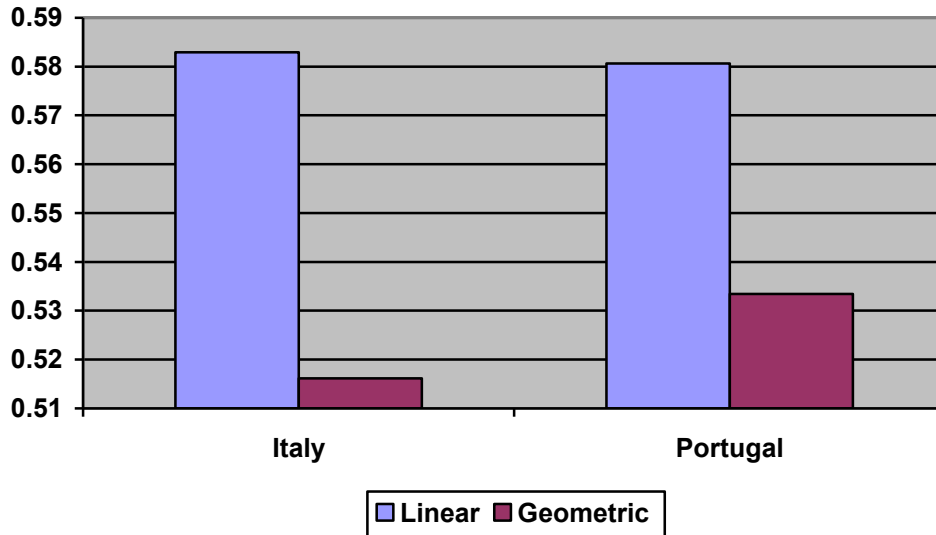
Figure 2 shows clearly that the linear aggregation would be nearly neutral with respect to Czech Republic and Chile, while the geometric aggregation would clearly favour Czech Republic. Therefore, Czech Republic would score higher than Chile using the geometric approach.

**Figure 2. Linear vs. geometric e-readiness**



Source: OECD compilation, 2010.

Figure 3. Linear vs. geometric e-readiness



Source: OECD compilation, 2010.

A more interesting case is shown Figure 3. Note in fact that the linear approach ranks Italy higher than Portugal. On the other hand, the geometric approach would rank Portugal higher than Italy (about two points higher). This is because the geometric approach penalises Italy due to the low web measure index reported in 2010. This example shows clearly the differences between the two competing approaches.

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