CPB Netherlands Bureau for Economic Policy Analysis

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Study of cost-benefit analysis for e-government

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Summary and conclusions

The Ministry of the Interior and Kingdom Relations (BZK) has asked the Netherlands Bureau for Economic Policy Analysis (CPB) to determine the extent to which the methodology of cost-benefit analysis (CBA), or valuable elements thereof, can be applied in a useful and practical way within the e-government domain. This exploratory memorandum provides for that.

CBAs provide an overview of the welfare effects of a project or measure for society as a whole and can therefore help to substantiate policy choices. The CBA provides not only a go/no go decision, but is also useful as a reference framework or as a tool for project optimisation.

It is important to use a CBA early in the decision-making process and to make a proper problem analysis. A problem analysis ensures that the CBA looks at a solution that actually addresses the problem, it ensures that all possible solutions are identified, it clarifies the legitimacy of government intervention and indicates the government level that best corresponds to the scope of the problem.

A CBA must preferably monetise, or otherwise quantify or at least qualitatively describe the costs and benefits.

The CBA methodology can also be applied to projects surrounding e-government. CBAs are particularly applicable to projects that have broad economic effects. These may include improving services to citizens and businesses, improving the accessibility of public sector information or projects in which coordination problems are involved. For these types of projects, a CBA could be helpful in analysing the problem or opportunity in a structured manner and to map out the broader welfare effects for society as a whole.

Specific areas of attention regarding applicability of the CBA framework for e-government include (uncertain) technological development, effects on privacy, security and fraud, continued development of ICT services (management costs) and path dependency.

CBA handbook

A handbook is a useful tool for outlining a framework for the application of CBAs in the field of e-government. The handbook is the basis on which further experiences can be gained in carrying out CBAs in the field of e-government. The handbook must:

- emphasise the importance and timeliness of the problem analysis;
- pay attention to ways in which technological development can be taken into account as much as possible;
- indicate how the effects of a measure can be determined, used and interpreted as best as possible;
- develop impact assessment techniques (and valuation) for important issues for which little is known as of yet, such as security, fraud and privacy; and
- examine possible reasons for derogations from the real standard discount rate.

In addition, this memorandum includes the following guidelines. The first section deals with general guidelines. The second section deals specifically with e-government.

- A problem analysis must take place in the process as early as possible. A CBA without a problem analysis will not provide relevant answers. ICT is not an end in itself, but a means of solving or tackling a problem.
- The CBA takes into account the costs of path dependency and examines any variations that are less prone to path dependency. When drawing up a CBA, the ideas of adaptive management and real option analysis can be used.
- Significant benefits may go hand-in-hand with a high degree of uncertainty. The CBA must take this into account by specifying ranges.

- Scenarios would need to correspond as much as possible with the study on Welfare, Prosperity and Quality of the Living Environment [*Toekomstverkenning Welvaart en Leefomgeving (WLO)* (2015)]. To do this, additional assumptions need to be made regarding relevant ICT-related variables, in line with the WLO scenarios.
- One of the ways of doing this is to ensure there are CBA experts and independent ICT experts in an advisory group or monitoring committee or to organise expert meetings.
- Distributional aspects must take the digital divide into account: the difference between those who benefit from digital technology and those who cannot or will not.

1 Introduction

Digital communication has penetrated into the fabric of society. This also applies to government and government contacts with and government services to citizens and businesses. The government wants to be able to communicate with all citizens and entrepreneurs electronically (2012 Governmental Agreement). In the run-up to the next government term, the Study Group for Information Society and Government [*Studiegroep Informatiesamenleving en Overheid 2017*] published an advisory report which advises on the functioning of e-government[1] in relation to the rapid digitisation of society.[2]

In addition, the Dutch temporary committee on government ICT projects, also known as the Elias Committee, criticised the decision-making structure of government ICT projects (Tweede Kamer[3], 2014). One of the conclusions drawn by this committee is that government has insufficient insight into the costs and benefits of its ICT. Both the Study Group and the Elias Committee recommend that substantiation in the form of a business case or cost-benefit analysis (CBA)[4] be applied in order to get an indication of the expected results of an ICT project.

In the area of transport infrastructure, the OEI guideline (Eijgenraam et al., 2000) standardised the application of CBAs for that policy area. In 2013, the general guidance for cost-benefit analysis was published, which included an update of the OEI guideline and a broadening of the applicability of the CBA to all policy areas (Romijn and Renes, 2013). The general principles of the CBA guideline are further defined in handbooks [*werkwijzers*] in which the CBA methodology is focussed on a specific policy area. These include, for example, the areas of environment, security and social affairs. There is no handbook for e-government projects yet (see the Ecorys guideline, 2007[5]).

[1] E-government encompasses all digital provision, services and data provided by the government to citizens, businesses and civil society organisations.

[2] This report also refers to this memorandum: ''The area of e-government is currently lacking a focused methodology. The Ministry of the Interior and Kingdom Relations (BZK) has therefore recently given the Netherlands Bureau for Economic Policy Analysis (CPB) the task of exploring which elements a possible handbook could consist of, with an important focus on the specification of values such as information security, reliability, user-friendliness and privacy.''

[3] Dutch Lower House.

[4] A business case is a *business economic performance analysis*. A business case relates to the project owner/operator. In many cases, this is a useful starting point for a CBA. The CBA is a *social welfare analysis*. It will look at the advantages and disadvantages resulting from a project for society as a whole. The balance of the benefits minus costs, expressed in euros, also includes the effects on social welfare components without a market price.

[5] This guideline is not a formal handbook. Its application is not required, as is the case with the CBA handbook for CBAs commissioned by government. Furthermore, the recommendations have not been tested by CPB as is usual (Koopmans and Van Benthem, 2017).

A comparison by SEO shows that existing CBAs in the area of digital provisions and government services are highly diverse and are not comparable. This study concluded that the quality and contribution of CBAs can be improved by drawing up a handbook for ICT policy (Koopmans and Van Benthem, 2017).

Research question

The Ministry of the Interior and Kingdom Relations (BZK) asked the Netherlands Bureau for Economic Policy Analysis (CPB) to what extent the CBA methodology could be applied within the domain of e-government and to provide some suggestions for the development of a handbook. This exploratory memorandum provides for that.[6]

The purpose of this memorandum is not to develop parts of the handbook, but to indicate the issues a CBA author will encounter in the area of e-government and which topics should be addressed in a handbook.

Structure of the memorandum

The next chapter focusses on the question of whether a CBA would be applicable and explains the steps of a CBA (Chapter 2). After that, the structure of the memorandum follows the steps that are taken when setting up a CBA. The work done in preparation for a CBA consists of setting up a problem analysis (Chapter 3) and determining the baseline alternative and policy alternatives (Chapter 4). This requires insight into the relevant exogenous development (Chapter 5). Then, the costs (Chapter 6) and benefits are determined and valued (Chapter 7). Additional attention is then paid to how security and privacy are determined and valued (Chapter 8). Finally, sensitivity analyses and presentation of the result are discussed (Chapter 9).

2 Applicability of a CBA

The cost-benefit analysis (CBA) is a tool for the ex-ante substantiation for policy choices. A CBA can also be used as an ex-post evaluation tool. A CBA provides an overview of the welfare effects of a measure for society as a whole. This relates to welfare in the broad sense of the term, which includes, in principle, all matters that people consider important, including things for which there are no markets or market prices, such as nature, landscape, environment and security. Because the costs and benefits are monetised as much as possible (expressed in euros), an integral assessment of the various effects can be made. The CBA then answers the question of whether the social benefits of a measure outweigh its social costs (Romijn and Renes, 2013).

[6] We would like to thank the following experts for their valuable background information: Chris Peeters (Policy Research Corporation), Herman Ipenburg and Femke Jansma (Dutch Data Protection Authority). In addition, we would like to thank the departmental and academic feedback group for their feedback on this memorandum (the composition of the feedback group can be found in Annex 1).

CBA is suitable for more than go/no go, but not for all types of measures

A CBA can be used to make a go/no go decision, but is certainly not limited to just that. The methodology can also be used to structure the work that is preparatory to drawing up a policy. This can be done by asking such questions as: ‘‘What is the problem or opportunity that occurs?" and "How will this problem develop without government intervention? ’’

It is therefore important to use the CBA early on in the decision-making process. It is possible that a project proposal will be adjusted on the basis of the results of the CBA, prior to implementation. The CBA then becomes an instrument to optimise the design of the project alternative.

The CBA methodology is suitable only for the analysis of concrete policies that relate to well-defined problems or opportunities. It must be a project with a clear problem analysis and for which a baseline alternative can be established. The CBA is less suitable for comprehensive structural changes or demonstrating the usefulness/necessity of an existing instrument or institute. In other words, a CBA can be used to show the welfare effects of a change, not to assess a situation (Romijn and Renes, 2013).

The usefulness of a CBA depends on the extent to which costs and benefits can be measured and monetised. If sufficient information is available about the main effects and these effects can be monetised, then CBA is a suitable tool. The extent to which impact assessment is possible differs per policy area and per measure. The CBA is not a useful assessment method for issues such as justice or morality.

If the size and/or valuation of one or more significant effects of a measure are not known, a CBA will be able to provide only basic information. In that case, one could consider using a different assessment method, for example, a CBA based on index numbers, cost-effectiveness analysis or impact analysis. Consideration could also be given to carrying out further investigation into the missing effects or valuations. Such an investigation will also involve costs that need to be weighed against the benefits. When the main effects cannot be measured or monetised, the CBA will not provide a numerical substantiation and the outcome cannot be called a CBA in practice (Romijn and Renes, 2013).

If the quantification and valuation of effects is possible only to a limited extent, the CBA is still useful as a reference framework/thinking process for structuring decision-making, generating decision-making information and for optimising the project. However, it is possible that the CBA does not deliver a balance upon which basis a go/no go decision can be made.

In practice, some effects are often difficult to determine. For physical infrastructure projects, these could include the impact on the environment or biodiversity. These items are then transferred to PM, but this does not mean that they are necessarily less important. Just because there are PM items is not a reason to refrain from carrying out a CBA at all. The author of the CBA should, if possible, provide quantitative or otherwise qualitative information about the PM items and indicate whether or not they have a significant impact on the balance.

Knowledge development regarding e-government is required

The CBA methodology is suitable for projects concerning e-government. Creating a handbook is possible and useful. The application of CBAs in the field of e-government is currently in its infancy. This means having to work on the development of systems, methods, models, index numbers and scenarios to facilitate the application of CBA in e-government projects. The application may seem complicated at the moment, but that can be overcome with research. Specific areas of attention for the applicability of the CBA framework for e-government include (uncertain) technological development, continued development of ICT services, path dependency and personal data protection. These issues are discussed at a later stage in this memorandum.

As stated, the usefulness of a CBA differs for each measure. The project must first of all consist of the smallest possible units of measure that can be evaluated meaningfully (Romijn and Renes, 2013). For large projects, it is therefore useful to divide them into sub-projects.

The CBA is not suitable for evaluating the generic digital infrastructure (GDI), as the GDI as a whole is not a concrete policy proposal. Furthermore, it is unclear what the baseline alternative would be in that case, thus rendering a CBA meaningless. It may be possible to create a CBA for specific policy interventions, such as launching or discontinuing services within the GDI or the further development of parts of the GDI. Even the abolition of the GDI is a concrete measure, although consideration must be given to what would replace the GDI.

The question also remains of whether CBAs can be applied to large-scale ICT projects that improve government's own business operations. These are often projects that run into many billions of euros and which take many years to complete. In its report, the Elias Committee identified major flaws in these projects (Tweede Kamer, 2014). Solutions, according to the Committee, are rather to be found in improving project management. It is not immediately clear what the role of a CBA could be in this regard.

A business case with an estimate of financial effects is certainly useful for these projects, but a CBA would probably not add much. It is often the case in these projects that an ICT investment has been made that ultimately must lead to cost savings.

However, the organisational costs cannot be immediately linked to social benefits outside the government itself.

Finally, many projects in the area of digital services and public sector information most likely have some aspects that do have broader economic effects. These may include improving services to citizens and businesses, improving the accessibility of public sector information or projects in which coordination problems are involved. For this type of project, a CBA could be helpful in analysing the problem in a structured manner and mapping out the broader welfare effects for society as a whole.

Step-by-step plan

Creating a CBA consists of eight steps (Romijn and Renes, 2013):

1. Problem analysis: This analysis investigates what problem or opportunity presents itself, how it develops and whether government intervention is legitimate.
2. Determining the baseline alternative. This describes the most likely development without a new policy. The situation in which a measure or project is executed (project or policy alternative) is compared with the situation in which the project would not be executed (baseline alternative).
3. Definition of policy alternatives: This is a description of the relevant projects or measures that are considered likely to solve the problem. Please note that there may be several potential measures or projects. Furthermore, several alternatives or variations are often formulated for each measure or project.
4. Determining effects and benefits: The effects are identified, quantified and preferably monetised.
5. Determining costs: The means needed to effect and maintain a measure relative to the baseline alternative.
6. Analyse variants and risks: Identifying uncertainty and risk and analysing the consequences for the outcomes.
7. Drawing up an overview of costs and benefits: In this step, all costs and benefits are calculated according to the same base year and the balance is determined.
8. Presenting the results: The author of the CBA interprets the results, so that it becomes clear what the decision-maker can or cannot learn from it.

3 Problem analysis

The problem analysis ensures that the policy alternatives examined in a CBA are in line with the current policy issue. In the absence of a thorough problem analysis, a solution may be considered without it being clear which problem it would solve; or

relevant solutions may be excluded. Without proper performance of a problem analysis, a CBA might not provide any relevant answers (Romijn and Renes, 2013).

The handbook must emphasise the importance of the problem analysis. This step must take place as early as possible in the decision-making process.

The problem analysis must demonstrate what opportunities the ICT application will seize or which problems it will solve. In 2005, it was concluded that the introduction of ICT solutions for government is generally seen more as an end than as a means (Verrips, 2005). Digitisation is not an end in itself, but a means of achieving cost-savings or providing a better service, with the greatest possible user-friendliness, and without the constraints of physical locations and opening hours.

With CBAs carried out for digital provisions of the government and e-government services, it usually does become clear which problem or opportunities present themselves. For example, the eID authentication system should lead to the increased security and efficiency of online transactions (Deloitte en TNO, 2013). For 'e-Herkenning', the government must act as a 'launching customer'[7] and prevent companies from getting a "set of digital keys" from multiple authentication systems (Ecorys, 2011). The OV [public transport] chip card should lead to increased convenience for passengers and a safer travel environment due to the gates on stations; moreover, more detailed information on transport production should offer more opportunities for tariff differentiation and reduce the number of fare dodgers (Hypercube and SEO, 2003).

However, SEO concludes that the problem analysis in the CBAs investigated by them is usually quite brief and does not highlight any other solutions than the current policy measure (Koopmans and Van Benthem, 2017). The unanswered questions are: How big is the problem or opportunity? How does this opportunity or problem develop? What is the resulting policy objective? What is the role of the market and the government? What solutions have potential? Are all relevant solutions in the picture? Have all non-relevant solutions been eliminated? (Romijn and Renes, 2013).

Legitimacy

When assessing a measure or project, it is important to show that government intervention is legitimate. This is the case, for example, when the government improves its own services, for matters that are regarded as primary public tasks (common-pool resources, services of general interest) or in case of market failures. The question must then be asked: to what extent the government should be given a role in this in relation to competition with the private sector?[8] The fact that the desirability of a policy is expressed in policy papers is in itself an insufficient

[7] The 'launching customer' is the first customer of a start-up or new product.
[8] The Public Sector Market Operations Act [*Wet Markt en Overheid*] imposes rules of conduct on the government regarding the provision of resources or services to the market.

argument for legitimacy in an economic sense. Without sufficient legitimacy, a CBA will lead to an unfavourable outcome in relation to the baseline alternative.

When the government improves its own services, private parties may be pushed out of the market. However, this – in and of itself – is not a reason not to improve its own services. For example, consider the Wolters Kluwer tax disk, which is no longer required due to the digital (pre-filled) tax return program. The government has improved its own services by reducing the information problem for the citizen.

Another reason for government intervention is in providing common-pool resources such as national security and counter-terrorism, or safeguarding matters of public interest such as the accessibility of public sector information and services for all citizens, without losing sight of personal data protection.

'Make or buy' (buying a ready-made solution or developing it yourself) can also play a role, whereby the government develops products itself that cannot be traded in the marketplace. This may the case, for example, for military equipment, which is preferably developed at the national level. See, for example, the FES[9]-claims 'SENSATION' (Verrips, 2006), 'PASSIE', 'NEC' and 'Information Awareness' (CPB, 2006).

Government intervention is justified from an economic welfare point of view if there is a case of market failure. Market failure means that the market is unable to produce the optimal outcome itself. This is often the result of external effects, whereby private parties invest too little (or too much), than is desirable from a social perspective. Examples of other forms of market failures are coordination problems, market power, entry barriers, network externalities and information problems.
The government must then be able to solve or reduce this market failure, without replacing it with government failure that is as large or even larger. If there is no market failure, government intervention does not have any public interest benefits. The market would have solved the problem or the social costs would be higher than the benefits. But even if there is a market failure, government intervention is rarely without its drawbacks. Those drawbacks are government failures; intervention is only legitimate if those drawbacks are not excessively large. Incidentally, reducing government failures can also be a reason for a new policy.

Assessing FES projects has provided much experience in assessing the legitimacy of government interventions (see Ossokina and Verrips, 2009). The following are some examples of legitimacy in government interventions on the basis of FES claims.

[9] The Economic Structure Enhancing Fund [*Fonds Economische Structuurversterking (FES)*] was a Dutch budgetary fund that was funded from some of the profits coming from natural gas. The purpose of the fund was to strengthen the Dutch economic structure.

An external effect occurred in the ICT & Sector action program (Verrips, 2005) in the form of knowledge spill overs and innovation. The government was able to help by supporting applications that, because of fragmentation, lack of scale and coordination problems, were not being created or scaled-up. In the FES claims 'SURFnet7' (Huizinga and Verrips, 2008) and 'Innovatie Informatiebeveiliging' (CPB, 2006), it was not profitable for commercial providers to design highly advanced networks or products. The first project also generated benefits in the form of knowledge spill overs. With the second project, the security product requested by the government was not going to be developed because providers would not be able to recoup the necessary investments in research and development because of the limited sales market.

The government's role as 'launching customer' needs two side notes. First, it can be difficult to introduce innovative ICT solutions to the government, when using preferably (if not exclusively) proven technologies that do not pose a threat to the business process and security. Second, there is the question whether the government as a consumer knows how to support the right technology.[10]

A government role can be legitimate in the construction and maintenance of (network) infrastructure. The construction of this type of infrastructure is often associated with high fixed costs while, after construction, it is often difficult to monetise the use of the facility. This applies in particular to infrastructures of which the government itself is the largest user.

In the case of 'non-excludable goods', the market parties will be less interested. However, the questions remain as to whether this relates to external effects and/or whether private parties need government interference. For example, the broadband market shows that market players, driven by commercial interest, are also able to develop and build new communication infrastructures (Verrips, 2006).

The FES claim "Software as a Service" did not clarify why government intervention was legitimate. The petitioners mentioned a number of arguments, such as the loss of sectors and the loss of employment opportunities. However, it was judged that the market would be more than able to take the opportunities on board itself and to internalise the effects by marketing the products or via patents and licences. For a limited part of the project, government intervention was legitimate because of knowledge spill overs (Verrips, 2006).

Subsidiarity

If the government has a role to play, the next question is: which level of scale is most appropriate – national, decentralised or international? In principle, a project must be

[10] An alternative is using small-scale innovative procurement, for example via the sbir instrument (see Straathof et al., 2017).

carried out at whichever government level best fits the scope of the problem to be resolved or the opportunity to be taken. This underlines once again the importance of the problem analysis. Therefore, a local problem can be resolved best by decentralised authorities and an international problem via international cooperation.

In the case of a coordinating role or protecting confidentiality, national government intervention is most likely. Improving own services can take place at both a decentralised and a national level. With respect to standards, measures in the international context are probably most appropriate . See, for example, the measures to prevent lock-in effects (European Commission, 2013).

4 Baseline and project alternatives

The situation in which a measure or project is executed (project or policy alternative) is compared with the situation in which the project would not be executed (baseline alternative). The baseline alternative describes the most likely development without new policy.

The policy alternative or project alternative is a description of the relevant projects or measures that are considered likely to solve the problem. Please note that there may be several potential measures or projects. Furthermore, several alternatives or variations are often formulated for each measure or project.

It is often desirable to look at several policy alternatives and/or variations in order to find the best solution. It is standard to include at least those project alternatives that involve a phased introduction or a postponement of implementation. Certain ICT projects often lend themselves to phased implementation by means of a pilot project (see also Chapter 7).

The baseline alternative is not the same as doing nothing. This can be seen, for example, in the CBA 'eHerkenning' (Ecorys, 2011). The project alternative is the introduction of eHerkenning as an authentication method for government organisations. The logical baseline alternative is: no eHerkenning. But without eHerkenning, government organisations will still need a digital business service desk. With the baseline alternative, companies will therefore release their own digital authentication keys.

An important question is how the baseline alternative should consider continued ICT development. Technological developments are quick and unpredictable. The e-government CBA handbook must carefully elaborate on this further. Scenarios (see Chapter 5) can help. In addition, it may be useful to organise expert meetings with ICT experts.

Path dependency

Creating digital services is not a one-off event. Because of technological developments and changing security risks, these services will probably require constant updates. Choosing a particular ICT application often also determines the course of any future projects. Software is often designed in such a way that, after a period of time, it will be necessary to incur significant switching costs – because of file formats that are incompatible with other software, for example. A "lock-in effect" occurs when the costs of switching to another product or supplier are very high. The government may therefore become dependent on a particular product or supplier. For the purchase of new components or updates, the government is then, in fact, locked in with its ICT system and the same provider. In order to prevent such effects, it is possible to increase the use of open source software and open standards.

It is important that a CBA takes the path-dependency costs of ICT applications into account. This means that such a CBA can be used not only to assess a specific proposal for a new ICT application, but also to look for variations and alternatives that are less prone to path dependency. For example, the European Commission (2013) advises using ICT systems based on standards instead of manufacturer-based technology. According to the Commission, standards ensure that basic knowledge about a system is generally available so that other potential suppliers can maintain or further develop the system under competitive conditions. This will prevent a lock-in situation.

When drawing up a CBA, the ideas of adaptive management and real option analysis can be used. It is important that multiple decision-making moments are distinguished in the analysis. Real option analysis can be used if the policy alternative has at least three decision-making moments: a first decision on the purchase of an ICT application, a second decision on whether or not to extend this ICT application and a third decision on whether or not to switch to another ICT application or supplier. The timing of this third decision must be strongly linked to changes in additional costs for switching: these are often limited at the start, but often increase in time and are not always linear. At each of these decision-making moments, the costs and benefits and the associated uncertainties must be clarified as much as possible. Making a decision tree is usually very useful in such an analysis. Break-even analysis and sensitivity analysis with different assumptions about the opportunities can give a rough indication of the value of a new ICT application or supplier and variations with less path dependency.

5 Scenarios

The description of the baseline alternative and the project alternatives requires an overview of exogenous development. Scenarios are helpful in analysing the results for

the different future developments. A scenario describes the possible future development of factors that are not affected by decisions within the project. The development of the different variables logically fits into the scenario: a scenario tells a story (Romijn and Renes, 2013).

For instance, in the area of the physical environment (including transport, energy and water projects), the Welfare, Prosperity and Quality of the Living Environment scenarios (WLO scenarios) are used. The WLO identifies demographic and economic trends and analyses developments in the environment. In this context, High and Low scenarios have been developed. In the High scenario, the Dutch economy will grow by two percent per year, combined with a relatively strong population growth. The Low scenario assumes moderate economic growth of one percent per year and limited demographic development (CPB and PBL, 2015).

The WLO scenarios give a broad outline of ICT development. In the High scenario, there is relatively rapid technological development. In the service sector, new ICT applications are being developed and ICT strongly contributes to automation and robotization.

E-government projects are likely to require additional scenarios within the WLO. The scenarios must contain the exogenous developments that are relevant to the project. This means, for example, that specific assumptions need to be made about how cybercrime will develop, how fast the home-shopping market will grow or how the demand for certain government services will develop. Such influential factors will then get a place in the scenarios, bearing in mind that scenarios are cohesive future possibilities, and any additional assumptions should be consistent with the baseline scenarios.

A second reason for supplementing WLO scenarios for ICT projects is due to the relatively short term. The WLO focuses on 2030 and 2050. In contrast to CBAs for infrastructure projects, for example, which often assume a 100-year or indefinite horizon, the lifespan of ICT systems is on the order of 10 to 15 years. If the horizon of the present ICT CBA is closer than 2030, it may be necessary to translate the WLO scenarios to the short or medium term. This means that current developments and trends that have less influence on longer-term scenarios can be taken into account.

A third reason for supplementing the WLO scenarios is that e-government services in relation to matters such as safeguarding privacy and fraud prevention are influenced by the extent to which people and businesses value government interference or not, and the extent to which they trust the government or not. The previous WLO (Huizinga and Smid, 2004, Janssen et al., 2006) distinguishes the level of public services as a key variable: is society looking for public or private solutions? This distinction between a greater or smaller role for the government could be used to tailor the current WLO scenarios a little more towards being used for e-government

projects, for example, to show how a future society will deal with privacy or the extent to which new technologies will be accepted.

6 Cost estimation

The main cost items differ for each policy measure. Frequently occurring costs for ICT projects are investment costs (acquisition, development and implementation), management and operating costs (system maintenance, supervision) and costs for the users of the new ICT provision (time spent, staff costs). See Ecorys (2007) for a checklist for identifying cost items.

Also the ratios between investment costs and management and maintenance costs differ per project. For example, consider the OV chip card with its high investment costs versus P-direkt (central personnel administration for ministries) with high personnel costs (Koopmans and Van Benthem, 2017). The price policy for road traffic is also a government project with an important ICT component, whereby a significant part of the costs is included in management and maintenance costs (Verrips et al., 2015). Unlike physical infrastructure, ICT projects usually have a higher proportion of management costs compared to investment costs.

The costs are calculated by comparing the project alternative with the baseline alternative. A number of things have to be taken into account.

First of all, it is important that the cost (and benefits) be calculated against the total lifespan of the ICT system. This includes the development and operation of the project. The development phase must also be included, especially where costs precede benefits.

Second, it should be noted that the demand for certain services may be affected by the ICT project. For example, a higher level of security may increase the use of certain digital services.

Also, it should be considered that, when services are provided, they are not usually fully digital, and the physical infrastructure therefore continues to play a partial role in the project alternative. An example of this is the online application and payment of a passport or ID card. These still require a visit to the town hall in order to provide a passport photo, a signature and the collection of the identity document. However, the time per appointment is reduced due to the application being partially digital. Likewise, the physical route must remain for those people who cannot or do not want to use digital services.

Furthermore, reliability is important. Can digital services be provided without any malfunctions ('keeping on air')? Any malfunctions may incur costs.[11]

It is customary in cost estimates that the costs include a line item under the heading "unforeseen'. These are estimates of unknown costs, which may come to light during rollout. The "unforeseen" item is not a risk premium or risk reserve (Romijn and Renes, 2013).

Finally, it can be difficult to allocate the costs to the ICT project. This is the case, for example, when making data available (open data). The data provider must probably incur costs to use the data in its own business. The costs of making this data publicly available are likely to be limited compared to the overall cost of developing this data. In order to make data suitable for publication as open data, additional processing needs to take place. For example, personal data must be removed and/or the data must be aggregated, data formats must be modified, and metadata must be completed. Often, the costs of open data cannot be separated from regular business operations (Welle Donker et al., 2017).

7 Determining and valuing effects

Digital applications for the government can increase the quality of the service and/or efficiency. The effects that can be logically expected are a reduction of the administrative burden for citizens and/or businesses (time-saving), a change in satisfaction, security and privacy, a reduction in (personnel) costs or avoided investments in decentralised ICT services.

In the case of avoided investments, as a side note it must be said that in those cases it is also necessary to look at the unrealised gains due to the avoided investments. In the case of a relatively large 'avoided investment' item, it is important to check whether these investments are really necessary in the baseline alternative. If that is not the case, the benefits of the policy alternative will be overestimated.

The way in which the effects of a measure should be determined, used and interpreted, is an ideal subject for the handbook that provide more substance to the different policy areas of the CBA (Romijn and Renes, 2013). For example, in existing CBAs for the ICT area, the estimate of the extent of time-savings is often estimated without visible substantiation (Koopmans and Van Benthem, 2017).

Business cases, (field) experiments and index numbers can be used to determine the effects of ICT projects. For pilots, effectiveness studies can be done before a national

[11] Conversely, a benefit of an ICT project could be that reliability improves, meaning that these costs can be avoided.

roll-out or phased introduction. The advantage of a pilot is that the measure is tested in the 'real world'. However, the question is: to what extent the results of the pilot can be generalised?

It is also important to estimate the future use of the ICT application. The degree of use determines the extent to which effects and benefits can be realised (Ecorys, 2007). What is the current demand? Are there competitive alternatives? What are the results of a user survey? A handbook could also deal with these questions.

In addition, a handbook could look at models that could be used for making the calculations. The question is whether this would be a beneficial route though, as projects are diverse and customisation is often required.

Direct and indirect effects

A CBA shows both direct effects and the most important indirect effects. Direct effects apply to the owner/provider and user/customer in the market where the service is provided. These direct effects are passed on to other markets in the economy. These effects on other markets are called indirect effects. The indirect effects are important if they relate to *additional* welfare changes.[12] This is an important issue. It is often the case that effects are passed on without additional welfare gains. However, double counting must be avoided. This occurs, for example, if passing on the direct effect to another market is merely the passing on of the direct effect (Romijn and Renes, 2013).

One example of this is when an improvement in digital services leads to cost-savings for companies. That cost-saving is a benefit. Companies pass these cost-savings on to their customers in the form of lower prices. This creates a benefit for the customers of the companies. However, it would be a case of double counting if this benefit for the customers is added to the cost savings for the companies. After all, this is the benefit of direct costs savings, whereby this benefit is passed on. The customer's benefit is due to the benefit for the cost-saving companies having disappeared.[13]

Double counting can arise in e-government, for example, when a service improvement results in time saving, higher customer satisfaction, and increased use. Particular attention must be paid to the fact that the various effects are included, but that the total is not unduly inflated.

[12] The fixed surcharge percentage, which was normally used for infrastructure projects, does not apply to e-government. This percentage, 0-30% of the direct benefits, is based on experiences with agglomeration effects.
[13] This is, of course, a stylised example. For example, the lower prices for the customers could trigger additional demand. This would lead to benefits in the form of a change in consumer surplus, which can be calculated using the so-called halving rule. Section 3.2 of the general SCBA practical guide will discuss this further.

Identifying uncertainty

A CBA must take into account uncertainty by indicating ranges. The benefits of ICT projects can be associated with great uncertainty. For example, it is difficult to estimate the future use. The outcomes are also influenced by legislation. An example of this is the change in validity of a passport from five years to ten years. This reduces the time savings associated with the ability to apply for a passport digitally.

When exploring the benefits of eID, uncertainty was high. Due to the higher level of security of eID, a greater volume of sensitive information will be shared. This is an important benefit item. But new security risks are introduced simultaneously, as a larger number of applications also increase the attractiveness for criminals. On balance, it is unclear whether fraud will decrease (CPB, 2014).

Monetisation is preferred

In a CBA, effects are preferably monetised. Only then do we get a comprehensive and balanced picture of a measure's effect on the broader social welfare. The valuation of effects must be aligned with (observed) market prices as much as possible. After all, in well-functioning markets, they represent the (marginal) willingness to pay. If there are no (suitable) market prices, it is wise to look at alternative methods to get an impression of the willingness to pay.

When government services can be handled digitally instead of on paper or physically, they often result in time-savings and, therefore, in lower transaction costs for both the government and the citizen and/or businesses. The value of the time-saving (per hour) differs significantly between the CBAs (Koopmans and Van Benthem, 2017).

Time-saving is preferably valued at an actual hourly rate. With respect to travel time, different valuations apply for freight, business, commuter or recreational traffic. In addition, a handbook could provide index numbers . Default values for transaction costs such as time-saving or the reduction of administrative burdens can be obtained from Ecorys (2007), for example, and from Regiegroep Regeldruk (2008).

Distributional aspects and the digital divide

Distributional effects occur when the benefits and costs of projects have differing effects on different groups. As CBAs look at social welfare, distributional effects do not affect the balance, unless some of the effect occurs outside the Netherlands.[14] However, distribution effects can be important for political decision-making and a CBA must map this.

The working group entitled Marginal costs of public funds and CBAs [Kosten van belastingheffing en MKBA's] (2016) has concluded that, if a measure is aimed at

[14] In the SCBA balance, costs and benefits are added based on the principle that one euro is one euro, regardless of who benefits from or is disadvantaged by this euro. This is known as the Hicks-Kaldor criterion.

income redistribution or if the effects are distributed across income groups in such a way that decision-making could be influenced, a CBA must pay explicit attention to separately identifying the extent to which different income groups experience positive or negative effects resulting from a measure.

E-government has particular consequences for the digital divide: the difference between those who benefit from digital technology and those who cannot or will not. It is likely that older people find it more difficult to keep up with digital progress. This also applies to some of the low-skilled. The Studiegroep Informatiesamenleving en Overheid 2017 focusses on citizens who are insufficiently self-reliant and who have trouble communicating digitally with the government. The Study Group states that digital communication with the government places high demands on the skills of 2.5 million Dutch people who have difficulty reading and writing (Netherlands Court of Audit 2016, National Ombudsman, 2013). The WRR also confirms the view that modern society places high demands on the self-reliance of citizens and that the government's expectations of its citizens' abilities are sometimes too high (WRR, 2017).

In addition, there may also be regional distributional aspects. People living in the countryside benefit more from savings on travelling time due to digital services than residents who live closer to a town hall or district office. On the other hand, people who live in rural areas with limited mobile accessibility and/or slow internet probably benefit less from digital services.

8 Security and privacy

It is striking that issues surrounding security and privacy are not yet included in many CBAs, although these are important issues in the area of e-government and also important objectives of government policy with regard to ICT. In cases where this is an important objective of the project, these effects are not always quantified (Koopmans and Van Benthem, 2017).

However, security and privacy are an outstanding example of subjects that belong in a CBA. The optimum level of security is first of all a matter of meeting minimum requirements at minimum cost. This is similar to the environmental standards and safety standards that physical infrastructure must meet. For example, e-government must comply at least with the Personal Data Protection Act.[15] This Act sets rules for the protection of privacy.

[15] As of 25 May 2018, this Act will be replaced by the General Data Protection regulation (GDPR), which provides the same privacy legislation throughout the entire European Union.

For the collection of personal data, there must be a public-service remit, a legal basis or permission must have been given. The electronic patient file is an example in which privacy has been insufficiently guaranteed according to the Dutch Data Protection Authority and the Lower House, and therefore requires the patient's permission. The AH supermarket bonus card is an example where there is no public or legal remit and where customers give permission to share their personal information and purchase history with the company in exchange for a discount.

Second, increasing security can be an important benefit. Since full security is usually not feasible because the benefits would not outweigh the costs, a CBA can clarify this consideration. In this way, the costs of protection against hackers and *ransomware* can be offset against the potential damage and the probability that an attack might occur.

A good example is electronic voting. This was abolished because voting anonymity could not be guaranteed. When re-introducing the voting computer, the first priority must be to guarantee voter anonymity. This is a minimal requirement. Furthermore, the question remains of whether the system is adequately protected against attacks by hackers. The latter is a cost-benefit consideration and political desirability needs to be examined.

The appropriate level of security or privacy differs per situation and moment. Storing or sharing medical data requires a higher level of security than storing name and address data. The combination of data is also relevant, as a person's identity can be traced from even a limited amount of data (see Koot, 2012). In any case, open data is often at odds with personal data protection. In the case of personal data, data must be anonymised in such a way that it can no longer be traced back to individual persons (Van Loenen et al., 2016). When linking different data sets, the traceability of non-personal data must also be prevented. Even when data sets are de-identified, the combination of information may still lead to re-identification (Koot, 2012, Van Loenen et al., 2016).

There can sometimes also be a trade-off between privacy and general security. The powers of AIVD [General Intelligence and Security Service], judicial authorities or the police can violate the privacy of suspects. Encryption, on the one hand, leads to greater privacy, but on the other hand it affects the work of the intelligence services to retrieve information from an iPhone or WhatsApp conversation.

Valuation is a challenge

It will be a challenge to monetise the unpriced social impacts in the area of security and privacy. Although these topics are generally excluded from existing CBAs, these might be very important benefits for e-government. For example, in the CBAs for the eID system, the non-quantified benefits are potentially substantial (Deloitte and TNO, 2013, CPB, 2014).

One possible approach is to assess people's willingness to pay for certain effects. The willingness to pay reflects what somebody is willing to pay (maximum) for the services generated by the proposed project or policies. In the event of negative effects, the willingness to pay to avoid these effects is used to estimate the social costs.

A lot of experience has been gained in valuing unpriced effects in other policy areas – in nature and the living environment for example. The methods used to examine the willingness to pay can also be used for the unpriced effects of e-government.

In order to determine willingness to pay, revealed preference or stated preference can be used. If revealed preference is possible, this is preferable. The disadvantage of the first method is that a similar associated market is not always available. The comparability of circumstances is important because the valuation of privacy can vary greatly, depending on the purpose. However, the disadvantage of the second method is greater: what a respondent alleges does not always match what they would do. For example, a respondent may know little about the possible damage caused by fraud or the consequences of giving up personal information. In that case, he or she is insufficiently aware of the risks. As a result, it may be that he/she indicates that privacy is of great importance, but the measured valuation in the market is nevertheless low.

The difference between stated and revealed preferences concerning privacy – the so-called privacy paradox – is revealed by the study of Athey et al. (2017). In this experiment, consumers say they care a lot about their privacy, although they seem quite willing to release their personal information when encouraged to do so. It also appears that the choices made by consumers with respect to their privacy protection are more closely related to the effort required than to their stated preferences. Thirdly, irrelevant yet reassuring information appears to affect consumer behaviour.

With regard to security, one could also look at the reduction of (identity) fraud cases. The reduction of fraud is then a way of approaching the increase in security. It is then necessary to determine by how much the number of fraud cases and/or the average fraud amounts has decreased. It is possible that only the tip of the iceberg is known. Using this approach, Ecorys (2016) sets the damage to society at 40,000 euros per fraud case with a false eID. Deloitte and TNO (2013) and CPB (2014) quantify the benefits for companies due to preventing identity fraud in online credit transactions as a percentage of the turnover of the home shopping market. Such methods could also be useful in other CBAs, whereby the exact valuation depends on the project or the proposed measure.

Government differs from private parties

Security and privacy are probably more important for the government than for private companies. Private organisations can choose the parties to whom they offer

their services and consumers can, to some extent, choose which party they want to use for a service. A company's failure to deal with security and privacy carefully will lead to a damaged reputation and loss of customers. The government, on the other hand, is a monopolist.

In addition, the government stores a lot of personal information. Some examples of information that are kept (digitally) by the government are the Personal Records Database (formerly the municipal personal records database), Income Tax Return, Employee Insurance Agency [UWV] policy administration, Commercial Register, national vehicle licence plate register, WOZ valuation [Real Estate Valuation] or Cadastral information. And let us not forget healthcare, in which medical records are digitally updated and increasing quantities of information are shared digitally between private parties, such as healthcare providers and insurers via the electronic patient file.

9 Sensitivity analyses and overview of costs and benefits

As stated above, uncertainty plays a major role in ICT projects due to rapid and unexpected technological developments (future uncertainty). The outcomes of the CBA can therefore depend heavily on the assumptions that are made. The uncertainty bandwidth should therefore also be presented. This can be done by using different scenarios. In addition, uncertainty can be dealt with by taking into account the benefits of postponement or a phased entry of the measure or by allowing the precise details of the measure to depend on future development (Romijn and Renes, 2013). A sensitivity analysis is able to vary assumptions that are used in the analyses, such as key elasticities or other measure-effect relationships, the discount rate and start time of the project. In addition, project-specific sensitivity analyses can be added in which other relevant assumptions can be given a place.

Discount rate

Discounting makes costs and benefits that occur in different years comparable. The discount rate is affected by time preference and risk aversion. In the case of risk aversion, someone will want to have a higher discount rate in order to compensate for systemic risk. This premium on the discount rate is called the risk premium. The (real) discount rate consists of the (real) risk-free discount rate and the risk premium (Romijn and Renes, 2013).

Use of the discount rate must be in line with the recommendation of the Werkgroep Discontovoet (2015). This working group has issued recommendations on the discount rates that must be used in CBAs. Although ICT or e-government is not one of

the applications addressed in the report, the advice is still applicable. The working group recommends using a uniform discount as much as possible.

The working group advises a real standard discount rate of 3 percent for both the short term and the long term, in combination with constant relative prices. These standard rates can be deviated from only in exceptional cases. If based on convincing scientific research, project-specific values for discount and price development can be used.

A handbook should determine whether a different discount rate is relevant for e-government projects. This may be the case with market-based projects, i.e. projects in which the government makes an assessment between private or public implementation, for projects in which the government cooperates with market parties (PPS) and in the short-term evaluation of risk-free projects. For such projects, the current market interest rate is applicable. A second reason for deviating from the standard discount rate is for investments with relatively high fixed costs, such as infrastructure and networks. If these projects are more risky, a higher discount rate might be used. For example, 4.5 percent is used for the construction of physical infrastructure.

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