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# Measuring and benchmarking the back-end of e-government. A participative self-assessment approach

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**Abstract.** Measuring e-government has traditionally been focused on measuring and benchmarking websites and their use. This provides useful information from a user-perspective, but does not provide any information how well the back-end of e-government is organized and what can be learnt from others. In this paper a self-assessment instrument for organizational and technology infrastructure aspects is developed and tested. This model has been used to benchmark 15 initiatives in the Netherlands in a group session. This helped them to identify opportunities for improvement and to share their experiences and practices. The benchmark results shows that only a disappointingly few investigated back-ends (20%) fall in the highest quadrant. Measuring the back-end should capture both organizational and technical elements. A crucial element for gaining in-depth insight with limited resources is the utilizing of a participative, self-assessment approach. Such an approach ensures an emphasis on learning, avoids the adverse aspects of benchmarking and dispute over the outcomes.

**Keywords:** e-government, measurement, benchmarking, back-end, self-assessment, group session

## 1 Introduction

Electronic Government measurement and benchmarking have gained considerable attention over the recent years. Especially the UN Index, Brown University, Accenture and Cap Gemini surveys have been widely discussed and have stimulated governments to develop their online efforts [1-5]. The basic idea of benchmarking is often to be able to distinct good from bad practices, and provide incentives for improvements. The efforts of these instruments concentrate on measuring the level of e-government in countries or at regional levels to enable comparison. Often, a combination of measurement instruments is employed to accomplish this. These types of instruments access the level of e-government often from the outside, i.e. what is directly observable at the front-end, and often consider the back-end as a black-box. Measurement focuses predominantly on the front (primarily counting the number of services offered) and not on the back-office processes [6]. This is a logical focus when taking the citizens' point of view or from the view of other stakeholders who

are not directly interested or involved in improving the back-end. In contrast, public managers and decisions-makers who are interested in improving the back-end have the concern to understand and measure the performance of the back-end. They have a need to have an understanding of the insides of the black-box, not to a level of detail to understand all processes and system components, but at a level of measuring to enable the benchmarking with others and learning from each other's practices. These insights can then be used to improve their own functioning.

The organization of the back-end of government involves many, often heterogeneous types of business processes, software applications and organizational arrangements. A major bottleneck is the lack of a shared infrastructure [7]. This is further complicated due to the many unrelated changes that happened over time. Each government and each department have developed their own systems and processes, which need to be integrated to enable integrated service delivery. Generally it is assumed that transformation of e-government requires new structures based on citizen/business focus and not in a division in functions. The variety in back-ends is even increased due to the stream of new or altered legislations requiring adaptations in the back-end. The diverse landscape and the need for constantly changing this landscape often block the progress towards more innovative solutions. Despite the significance, the measurement of the back-end of e-government has gained limited attention [6].

One reason for the limited attention is the difficulty of measuring and benchmarking in general and the back-end in particular. Measurements and benchmarks have been criticized from various views [8, 9]. The bottom line is that benchmarks are not a reliable way of measuring. Often the focus of measurement is on a generic level at the expense of detailed insights. This might especially hold for the back-end, as the measurement of this is less straightforward than the front-end. The outcomes of the benchmarks might be discussable and the position might be dependent on normative criteria that might not hold in all situations. There exists little agreement on a uniform set of measures [6]. This difficulty might result in the adverse affects that benchmarks might have limited practical meaning, but might have a huge impact on political decision-making [9]. Benchmarking of websites have resulted in a normative view on citizens as customers and have resulted in uncritically copying each other elements [10]. Instead the focus should be on understanding what is needed and the resulting business models capturing the organizing logic that can fulfill this need [11].

In this paper the focus is on the measurement and benchmarking of the back-end of government organizations. The instrument developed and used in this paper is aimed at enabling the self-assessment of the back-end by providing attention to a variety of elements instead of trying to develop a generic, uni-interpretable instrument providing a single outcome. The aim of the instrument is to measure and benchmark the back-end in comparison with others who are involved in the same situation. In this way it should facilitate learning and help to transfer best practices.

This paper is structured as follows. In the next section e-government benchmarking and measurement literature is reviewed. This literature is used as a starting point to develop the back-end measurement and benchmarking model. The research methodology is presented in section three, followed by the measurement model and

the findings of the use of the model in a participative session. The findings are discussed and finally conclusions are drawn.

## 2 Related Literature

There are many stages and growth models in e-governments [12-15]. Although stages and growth models are popular in e-government, these models have not been translated in operational measures for the back-end. There are many other benchmarks available [1-3]. Ojo et al. [16] compare three different surveys, those by the United Nations (UN), Accenture and Brown University to distil out a 'core' set of indicators. Janssen et al. [17] identify 18 benchmarks in four areas e.g. supply studies, demand studies, information society studies and e-Government indicator studies. Kunstelj and Vintar [8] found 41 reports grouped as e-readiness, back office, front office supply, front office demand and effects and impacts. The metrics used concentrate on measuring the level of sophistication, but do not measure the back-end and say little about the effectiveness and level of customer orientation [6]. The European Foundation for Quality Management (EFQM) model has been used for accessing services [18]. EFQM Excellence Model enables managers to effectively self-assess critical performance issues to identify a range of service interrelationships affecting customers [19].

User-centric measuring approaches include functionality, usability and accessibility testing [20]. Functionality is about measuring if the system actually works in the intended behavior, usability is about the way users interact, and accessibility refers to the use by disabled people. The measurement of user satisfaction and perceptions of citizens or businesses is more and more conducted by governments. Although very important, as these approaches take the citizens' perspective into account, the disadvantage of such these approaches for our purposes is that the actual situation is not measured. Instead the experiences as perceived by the citizens/businesses at a certain moment in time are measured. These perceptions might be arbitrarily and can be influenced by other factors, including temporary factors such as mood and attitude, and provide limited insight into how to improve the back-end. A recent example shows that the user satisfaction in a survey increased due to marketing and communication efforts, whereas the actual systems did not change at all (<http://www.uwv.nl/overuwv/pers/nieuwsberichten/overzicht2009/>). In conclusion, these are not appropriate approaches with which to gauge success of the back-end of e-government.

Bannister [9] provides an overview of the major problems with benchmarking in his paper 'the curse of the benchmark'. He criticizes a number of elements. One of them is the scoring method, as often benchmarks are reduced to a score on a single item. There are usually no fixed or agreed rules for this with result in arbitrary scores. Often proxies are measured, interpretation is ambiguous and there is no framework guiding the interpretation by decision-makers [6, 9]. Also the change of metrics over time and the comparisons of services that might actually not be the same due to difference in legislations and other factors are criticized. Comparison over time requires that metrics are time invariant, which is often not the case. The interpretation

of measurements and benchmarks is difficult due to the abstraction and the actual position might tell little about the real performance. Finally, the scope and complexity is criticized by Bannister [9] as many important elements might not become visible. The complexity of the measurement models and the accompanying problems of operationalizing the measures require abstraction that might not prove to be correct.

Much of the critics can be reduced to the measurement methodologies taken in the measurement and benchmarking approaches. Measurement methodologies are guided by cost constraints [9]. As there is no data available that can be directly used, the data should often be collected using limited funds. The limited resources might result in stopping the investigation too early and might result in outcomes that might not be true or only cover the situation partly. There are numerous examples demonstrating this problem. The bottom line is that the available resources constrain the possibilities of benchmarking and influence the validity of the results.

Mosse and Whitley [10] and Janssen [17] suggest that the benchmarking of websites have cultivated a view of citizens as customers and warns against uncritically copying benchmark criteria. This is the criticism implied in the title of Janssen et al.'s [17] article: 'If you measure it they will score'. Rightly or wrongly, the benchmarking has distracted the focus of governmental agencies away from a closer examination of the underlying business logics, which is often used interchangeably with the term, business model [11].

### **3 Research approach**

The goal of this research is to develop an instrument that helps government to assess their back-end and benchmark their situation with other organizations. Bannister [9] argued that a benchmark is a trade-off between cost, scale and quality of information. Due to the limited resources, the need to gain in-depth insight and the aim of helping governments directly, we focus on the use of participative self-assessment approach. The time needed is limited to the session time during which a survey is used to assess the status and the results are discussed to create a benchmark. This instrument was developed in close cooperation with stakeholders and the design was largely determined by their aims and requirements. The aims were to develop a measuring instrument facilitating the insight in the own back-end and provide understanding and improvement directions by benchmarking with others. The requirements on the instrument included simplicity, easy communication and give attention to a broad range of aspects.

The measurement and benchmarking instrument consists of a survey used for self-assessment *and* a group session in which the participants conduct the self-assessment and discuss the results. This instrument was used and tested in a session in which the participants assessed their own situations, discussed their self-assessment with their colleagues in other organizations and identified improvement directions for their own organizations. The session was facilitated by the author and organized by a government representative. The session was held in November 2009 and the participants came from various governmental organizations. Participants included process managers, decision-makers, public managers and administrative staff

involved in back-end processes. Other stakeholder groups like citizens, politicians, associations and action groups were not included. In total 25 participants representing 15 back-ends were involved in the group session. During the session the main steps followed were:

1. *Introduction and background*
2. *Measuring the back-end.* All participants were asked to score the back-ends based on the questionnaire representing the constructs of the measurement models. If more than one person represented a back-end, they were asked to fill in the questionnaire independently, then to compare the results, discuss the deviations and then create consensus about the position.
3. *Benchmarking.* Each back-end was positioned on a projection of the matrix as shown in Figure 1. This matrix provides the relative position of the back-end in comparison to the others.
4. *Motivating the position.* Each participant was asked to explain the positioning. This step is aimed at creating a mutual understanding of the reasons for low and high scores. Furthermore, this step can be viewed as a way to validate the scores.
5. *Discussion the results.* All scores were discussed and all participants were requested to explain the scoring on the matrix. Participants having high scores were challenged to briefly share their experiences with others.
6. *Identifying improvements.* Participants were asked to identify improvement directions for their back-end based on the self-assessment. The other participants were asked to provide contact persons of persons from their organizations who would be able to show how this was tackled in their organizations. In this way 'best practices' could be shared.
7. *Closing*

The measurement and benchmarking model and the session findings are discussed.

#### **4 Measurement model**

Our instrument is aimed at measuring the back-end and enabling communication among stakeholders facing the challenge of improving the back-end. These stakeholders are likely to have different competences and knowledge bases, therefore our aim was to visualize the outcomes of the benchmark. We opted for the use of two main criteria consisting of multiple dimensions, as the use of multiple criteria are favored over the use of a single criterion [e.g. 9] and at the same time the results should be easy to visualize and communicate. Instead of trying to compute a final score on a single scale we opted for visualizing based on two variables.

The back-end is in essence a socio-technical system in which administrative processes are supported by information and in which data is stored in software applications. Socio-technical systems are "systems that involve both complex physical-technical systems and networks of interdependent actors" [21 p. 981]. The

back-end is an organization consisting of human activities, interactions and communications supported by a digital government infrastructure. The latter provide generic functionalities that are used by large numbers of users [22]. Whereas the organization element refers to the responsibilities, governance mechanisms and administrative processes, the infrastructure elements refers to the business processes supported by applications and a communication network. We follow a socio-technical view on the back-end and use as the two main variables 1) organization and 2) infrastructure.

In general, the front-end includes humans, business processes and facilities that are used to interact directly with citizens and/or businesses, whilst the back-end comprises all that do not directly involve customer interactions. To measure the back-end we investigate the relationships between the back-end departments as well as the relationships between the front-end and back-end.

The supporting technical *infrastructure* needs to be changed to realize and support the e-government ambitions. Infrastructures are often developed over time and consist of applications for processing information, databases for storing information, connections among these components and the network transporting information. This incremental and gradual development underlines the path-dependent nature of infrastructure developments. Decisions in the past influence the current infrastructure. These decisions are not necessarily taken by having e-government purposes into account. In consultation with the participants, the level of infrastructure is measured using the following factors.

- Availability of shared infrastructure
- Openness and interoperability of applications
- Level of systems integration
- Standardization of data and messages
- Generic integration architecture
- Automatic routing of data
- Tracking and tracing and monitoring systems
- Citizens relationship management (CRM) system
- Integral management information

The *organization* part refers to the whole organization of the back-end. This concerns the humans working in the administrative processes, the organization of these processes in service centers, the division of responsibilities, the control of the workload and lead time and governance mechanisms to discuss the status of requests, problems in processing and joint decision-making. Governance mechanisms determine how communication, responsibilities and decision-making structures are formalized [23]. The main variables used are related to the following elements.

- Organizational structure
- Departments are aware of each other processes
- Cross-departmental workflow management
- Governance mechanisms (decision-making structures, responsibilities and communication)
- Readiness
- Knowledge, education and training

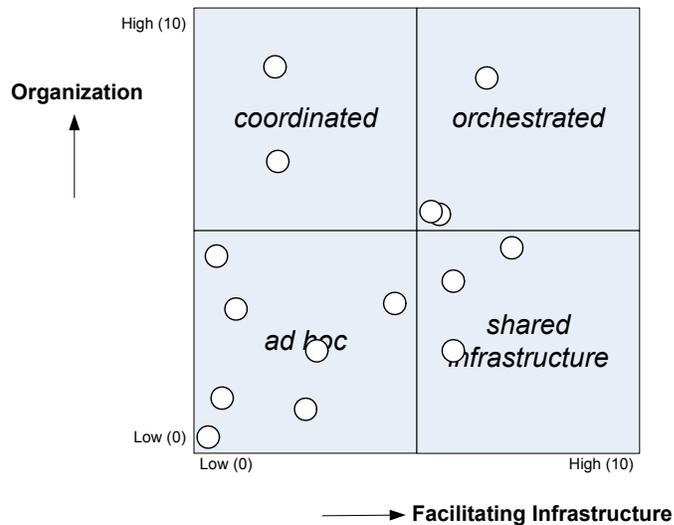
The use of the two main dimensions resulted in the creation of four quadrants and each quadrant was given a name. The naming and explanation of the quadrants should help the session participants to give meaning to the position which should improve the interpretation of the right positioning. The following four quadrants were used.

1. *ad hoc*: there is hardly any facilitating infrastructure or coordination of processes.
2. *coordinated*: there is hardly any facilitating infrastructure, but the processes and activities in the front-end and back-end are coordinated. The employees know each other and how to contact each other, but exchange is primarily paper or telephone-based
3. *shared infrastructure*: an infrastructure enabling the integration between the back-end and front-end is available. Information can be exchanged. Nevertheless the processes in the front-end and back-end are not aligned and there is hardly any insight in the status of processes and dependencies.
4. *Orchestrated*: There is both a facilitating infrastructure as well as processes in the front and back-end are aligned. Like in an orchestra both elements function in concert and are harmonious.

The variables of the two dimensions were translated into a self-assessment instrument. The self-assessment instrument was used as part of a group session. The measurement and benchmarking methodology is made up by combining the two instruments.

#### **4 Measurement and benchmarking results**

The organization and infrastructure dimensions are used to measure and position the case studies. The participants were asked to answer the questions and the positioning consists of the counting of the scores on the constructs mentioned above on the two dimensions. No weighting or other means was used to give more priority to certain factors over other factors. The resulting positions should not be viewed as a hard benchmark, instead it should be viewed as an indication. In total 15 back-ends are positioned as shown in Figure 1. Several back-ends were represented by more than one person. Each of these persons scored their own back-end independently. This sometimes resulted in small deviations in outcomes. These persons were asked to compare their scores and to seek consensus concerning the outcomes. This step was completed within minutes as there were no large deviations. Next the various outcomes were discussed to explain the ranking. This was used as an instrument to validate whether the position was right. There was hardly any surprise concerning the position of their back-end. Most persons were aware of the functioning of their back-end and status in comparison with others. Nevertheless this was viewed as an important step as one person mentioned “*we already knew this, still it is confronting to end-up in the lowest quadrant*”. The hope of many persons representing a relatively bad-performing back-end was to gain understanding about how to move forward and their hope was that the benchmark results will help them to get funding to move up.



**Figure 1. Measurement and benchmarking outcomes**

The results of the benchmark showed that 7 out of 15 (47%) are in the ad hoc quadrant, 3 (20%) are in the orchestrated quadrant, only 2 (13%) are in the coordinated quadrant and 3 (20%) fall in the shared infrastructure quadrant. These outcomes did not really come as a surprise to most participants. One participant indicated ‘*The front-end has gained a lot of attention and has been leading*’. The developments in the back-end are lagging behind and improvements might be more difficult to realize and might take much longer.

### Discussing the session results

The results provide no clear indication for whether the infrastructure or organization should be developed first. The participants agreed on the normative starting point that having both a good organization and a good infrastructure is necessary. The plot in Figure 1 provides some indication that both are correlated. The investigation of which type of change strategy was preferred (organization or infrastructure first) resulted in mixed feelings. Although there was no consensus, most participants agreed that the organization development should go hand in hand with the infrastructure development. Both are necessary to improve the back-end and one cannot do without the other.

The discussion of the results showed that low scores on the *organization* dimension is characterized by many complaints on front-end by back-end. The cause of these complaints is that the back-end was often supplied with low quality of information, and many calls and/or emails from the back-end to the citizen/business are necessary to ensure that the right information is collected. Although we have no direct prove, the impression is that low levels of organization is characterized by duplication of

activities, as the back-end and front-end are not aware of each other activities. The problems result in the introduction of duplicate activities.

Organizations having high scores on the organization dimensions had often accomplished a change in their organization structure. The structure is changed from a functional to a customer-oriented organization structure and often service centers are introduced. Furthermore, high scores on the organization dimension were often created by an understanding of processes crossing the various departments which are supported by regular meetings to discuss work-in-progress and problems.

When looking at the *infrastructure* dimensions almost all organization have a basic infrastructure connecting the systems with each other and only a limited number of organizations have integrated their systems. The organizations having high scores on the infrastructure dimension often utilize some kind of broker structure (mid-office) facilitating the data exchange among systems.

None of the investigated back-ends had a single system providing an overview of interactions and history of the citizens/businesses. The lack of a Citizens Relationship Management (CRM) system was viewed as a major weakness for creating integrated service delivery. The departments are not aware of each other interactions with citizens/businesses.

### **Discussing the measurement and benchmarking approach**

The self-assessment instrument and participative session proved to be a useful instrument for measuring and benchmarking the back-end. Most session participants were positive concerning the session and the session results. As one persons stated “*this provides us insight and now I know who to contact to learn from*”. From the other hand, the filling-in of the self-assessment and positioning in the matrix was viewed as difficult. One of the participants commented that the filling in of the self-assessment instrument to position it on the matrix had little value. He argued that the position could be done without using a self-assessment instrument and the subsequent discussion of the results brings the real added value. He suggested creating an easier measurement instrument and using the variables to score the dimensions only as a checklist to understand the score. On the other hand, several participants indicated that the benchmark created by positioning the cases in the matrix should be based on some measurable variables. One of the main problems with the variables used for the self-assessment is the use of objective criteria. The inclusion of normative elements is an essential part of the benchmark in order to give direction and determine the relative position. Normative elements are probably always subject to discussions as it is not likely that all persons agree on all elements. Furthermore the normative base might change over time due to increased understanding. Finally, a good back-end can be organized and realized in different ways.

All participants agreed that participation is an essential ingredient of the measurement and benchmarking exercise. Without a good understanding the benchmarks can easily be misinterpreted and misused. The self-measurement and self-assessment is much dependent on the input and involvement of stakeholders. Non-involved stakeholders might give different meaning to the scores. As such a

participative session might be viewed as a sense-making process. This part was favored by the participants as they indicated that the goal of the process is not the ending up of a certain position in the ranking. Instead the goal is to support the improvement of the back-end and the mutual learning to understand what needs and can be done to improve it. Especially the exchange of practices and experiences was found to be valuable and the measurement and benchmarking exercise is a useful means to accomplish this.

The stakeholders did like the visualization of the scores in the quadrants as this provides an indication of the position at first glance. As this was a participant session they were less concerned about the exact position, which they are when they were positioned on the public benchmarks. As one participant phrased “*this benchmark makes it transparent for us, and this might not be the case for the outside world... This cultivates learning instead of copying each other features*”. This avoids the adverse affects of benchmarking that all organizations want to end up in the top 10 or top 3 and start copying each other features. On the other hand this might give no direct external incentives to improve and might not result in attention to attract resources for performing better.

## **5 Conclusions and further research directions**

Measuring the back-end of e-government is a difficult endeavor. First, many technical and organizational elements should be taken into account. The more aspects the more resources are needed and the more difficult comparison is. Second, measurement is further complicated by the heterogeneity of possible back-ends’ which are not as homogenous as the front-end. This heterogeneity complicates the calculation of a score to benchmark the relative position. A good back-end can be accomplished in a variety of ways. Third, the performance of back-ends consists of both technology and organizational aspects which need to be both captured. The interplay between these determines the overall performance. These factors complicate the creation of a straightforward benchmark.

The requirements on the benchmarking instrument included simplicity, consume limited resources, measure in-depth, enable easy communication and give attention to a broad range of aspects. Given these requirements a participative self-assessment instrument was developed and employed in a group session. A survey was developed as a self-assessment instrument which was filled in by organizational representatives during the group session. The survey provided the detailed elements and helped to position the own back-end based on two-dimensions. The resulting two-by-two matrix proved to enable easy communication. The stakeholders did like the visualization of the scores in the quadrants as this provides an indication of the position at first glance.

The utilization of the group session proved to be an essential ingredient of the measurement and benchmarking exercise, as this provides the opportunity to gain in-depth insight with limited resources. Furthermore, the group session provided the opportunity to discuss the relative position in detail, explain the position on the benchmark and foster mutual learning and sharing experiences and practices. The use

of a group session ensures an emphasis on learning, avoid adverse aspects of benchmarking and dispute over the outcomes.

The self-assessment was viewed a fruitful instrument to assess the status, to compare the own score with the scores of those of the own organizations, and to compare the own position with that of other organizations. This approach is focused on consensus about the position and making the results discussable. This results in the exchange of practices and experiences which facilitates future development of the back-end. Another advantage of utilizing a participative instrument is that it avoids the focus on a single measure, especially discussions broadens the views. Furthermore, there was less discussion about the actual scores, as the score were based on self-assessment. A shared understanding of the scores was created by discussing the arguments and position.

The results show that measuring the back-end should capture both organizational and technical elements. For gaining in-depth insight in the back-end many research challenges remain open. We opted for a participative session utilizing a self-assessment instrument based on the measurement of limited elements. In further research this instrument can be transformed to an instrument that can measure and benchmark without needing a participative session. The number of elements that were measured in this research can easily be extended. We recommend further research in the use of participative sessions as they are less resource intensive. An option can be to develop an online assessment instrument that can be filled in by organizational members and used as an input for discussing the back-end performance and possible improvements. A drawback might be the possible bias and interpretations.

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