# QUALITY AND IMPACT IN E-GOVERNMENT

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## ABSTRACT

After three decades of research on e-government, it is now timely to reflect how we can measure and benchmark the efficiency and effectiveness of information systems in public administration. Based on related literature it is evident that the theoretical background is extremely diverse and the application of theories by e-government researchers appears to be very different.

Assessing the quality of information systems generally remains a challenging task for IS researchers. Professionals have different perspectives and use a variety of methods to evaluate the success of information systems. In academic circles the most widespread method is the DeLone and McLean (D&M) Information Systems Success Model. Scientists have demonstrated how the six dimensions of this updated model can be used as a framework in e-commerce. Unfortunately, only a few studies have tested the adaptability of the D&M IS success model in the area of public administration.

This study will identify and analyse the success factors of e-government. To examine the validity of the D&M IS success model, a sample of 400 users were asked to assess the e-enrolment system based on their personal experience in Hungary.

The study is composed of three main parts. The first part is an introduction to theoretical foundations. The second one describes research methods with the model's variables in the E-government Success Metrics table, which focuses on the objectives of e-government (e.g. efficient and effective services, improved democracy, user-friendly approaches).

The third part is a quantitative analysis of data collected with the help of questionnaires. The questionnaire was designed based on the IS success metrics. This empirical study focuses on a single e-government service, namely the online enrolment system designed for higher education. In the process of analysis, the following methods were used: descriptive data analysis, correlation, factor analysis and Structural Equation Modeling (SEM) based on Partial Least Square (PLS) which tests how strongly variables are related.

The success of an information system depends on its quality and other factors (for example user attitude). The overall results show that the proposed model can be beneficial in public administration in evaluating the implementation of information systems. Measuring the success of such systems is useful for developing user-centred information systems in public administration.

The theoretical conclusion of this study is that the model can help researchers understand the most important characteristics of a successful information system in public administration from the citizens' point of view. To motivate citizens to use e-government solutions, practitioners must improve the quality of the key factors identified.

Keywords: IS success model, e-enrolment system, performance

## 1. INTRODUCTION

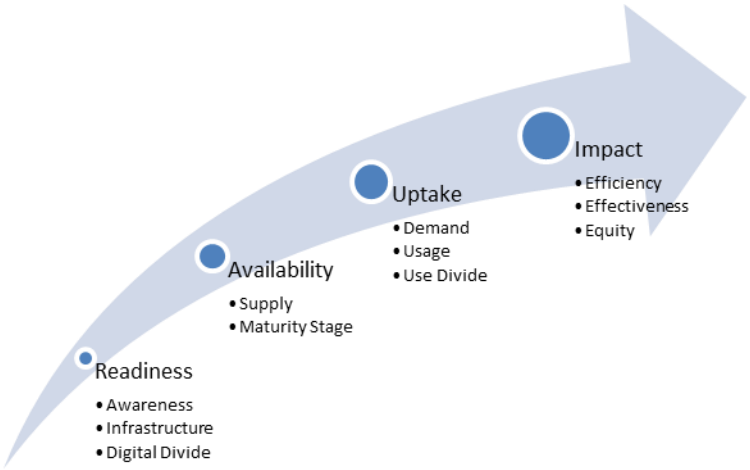
E-government was defined in 2003 as 'the use of information and communication technologies (ICT) in public administrations combined with organisational change and new skills in order to improve public services and democratic processes and strengthen support to public policies.'. (Commission of the European Communities, 2003)

Over the past decade the role of e-government was increased by enabling improved access to public services. ICTs are already widely used in public administration, similarly to private sector, but e-government involves much more than just the digital tools. 'It also involves rethinking organisations and processes, and changing behaviour so that public services are delivered more efficiently to people. Implemented well, e-government

enables citizens, enterprises and organisations to carry out their business with government more easily, more quickly and at lower cost.' (European Commission, 2016)

E-government research must adapt to the development. Ten years ago Heeks already concluded that the key topics of e-government research had changed over time. As e-government activity is growing over time, the key issues are changing as well. So the key topics of e-government research could be grouped into four main thematic periods. (Figure 1.)

*Figure 1: Changing e-government Issues Over Time (Heeks, 2006, p. 3)*




In the first period, the main focus was on measuring and evaluating the maturity of the environment. Then these studies focused primarily on the evaluation of the availability of e-government services. In the subsequent period, the research focus was on the adoption of the options of e-government. In the last thematic period, the prevailing focus is on the evaluation of the impacts of e-government. (Jukic, Todorovski, & Nemeslaki, 2015)

E-government benchmarks have assessed the performance of e-government in European countries since 2001. The key challenges and the aims of e-government are constantly developing. Now the measurements focus on both the qualitative and the quantitative indicators. Assessing the performance of e-government (including quality and impact) is of growing importance. In the 2011-2015 benchmarking framework e-government was described as a supply, use and impact framework. The supply side of e-government is measured through Life Events. Data about use (for example connectivity, ICT usage, e-public services) are collected by National Statistical Institutes. To measure the impact, we need data from different surveys.

The last report presented the policy priorities (user-centricity, transparency, cross-border mobility, key enablers), the customer priorities[1] (tested by life events) and the maturity model of countries[2]. It can be seen that the focus is shifting from the national level to the European Single Market. (Capgemini et al., 2015) The future e-government plans[3] are shown in the Digital Single Market (DSM) Strategy for Europe. (European Commission, 2015)

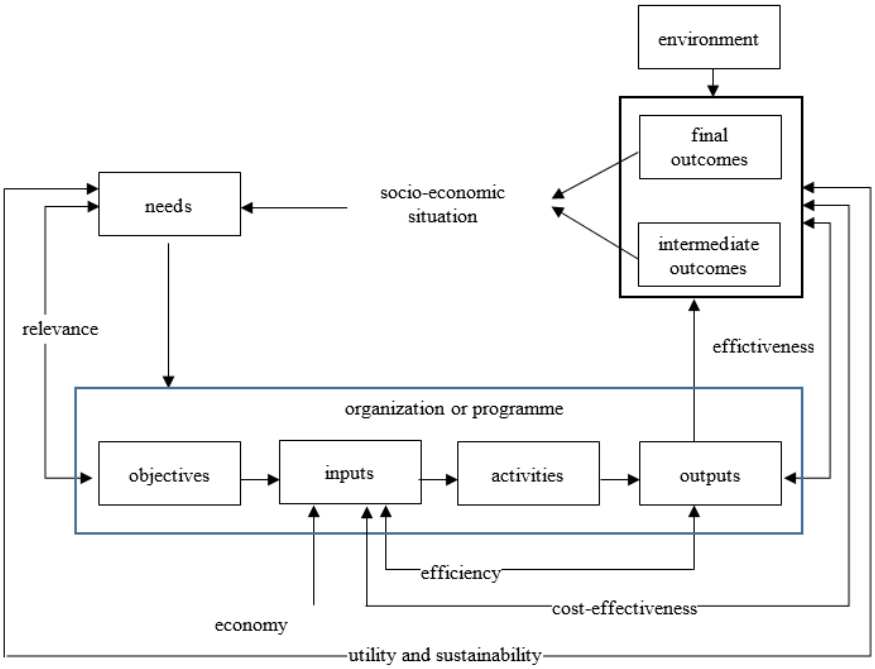
'Being aware of the assessed results makes us capable of making a decision to change something; however, in order to decide whether we achieved our aims or failed, assessments are required again (impact assessment).' (Pintér, 2014) In the absence of a widely accepted theoretical framework for impact measurement, measuring the impacts is still challenging for the nation state and the EU. In particular, the evaluation of social impacts tends to be multi-faced and contain subjective elements.

[1] For example: mobile-friendly websites, transparency, participation, personalisation, simplification.
[2] Countries are grouped into five clusters (neophytes cluster, high potential cluster, progressive cluster, builder cluster, mature cluster).
[3] 'The Commission will present a new e-Government Action Plan 2016-2020 which will include (i) making the interconnection of business registers a reality by 2017, (ii) launching in 2016 an initiative with the Member States to pilot the 'Once-Only' principle; (iii) extending and integrating European and national portals to work towards a 'Single Digital Gateway' to create a user friendly information system for citizens and business and (iv) accelerating Member States' transition towards full e-procurement and interoperable e-signatures.' (European Commission, 2015)

## 2. THEORETICAL BACKGROUND

The quality has been defined as being fit for use. Quality means those features of products or services which meet customer needs and thereby provide customer satisfaction. (Juran, 1999) So the 'goodness' (quality) of e-government can be evaluated by measuring how it meets the expectations (objectives) of clients. E-government can be considered good (effective, efficient, economical) if the outputs, outcomes and impacts meet the objectives (expectations) and administrations deliver more and better services with equal amount of or fewer resources. Performance management analyses the efficiency, effectiveness and economy. Literature contains various definitions of impacts, on various levels. However, it is often not obvious what researchers refer to as outcomes and impacts. The model of performance makes a difference between outcomes and impacts in the results of the process. The components of performance and their relationships are shown in *Figure 1*.

*Figure 2: The Production Model of Performance (Van Dooren, Bouckaert, & Halligan, 2010, p. 18)*




where:

- *Inputs*: resources used for a given objective (financial, human, material, organisational, regulation tools)
- *Outputs*: the directly evaluable and quantifiable results of the activities (products or services)
- *Outcomes*: the changes resulting from the activity, which can be further divided into intermediate outcomes and final outcomes.

In order to evaluate the success of e-government, the whole hierarchy of objectives needs to be studied. Therefore, the levels of the results of activities can be connected to the hierarchy of objectives:

- Outputs – implementation objectives (e.g. e-enrolment service)
- Outcomes – direct objectives (e.g. faster service)
- Impacts – specifics, intermediate and global objectives (e.g. increased trust in government).

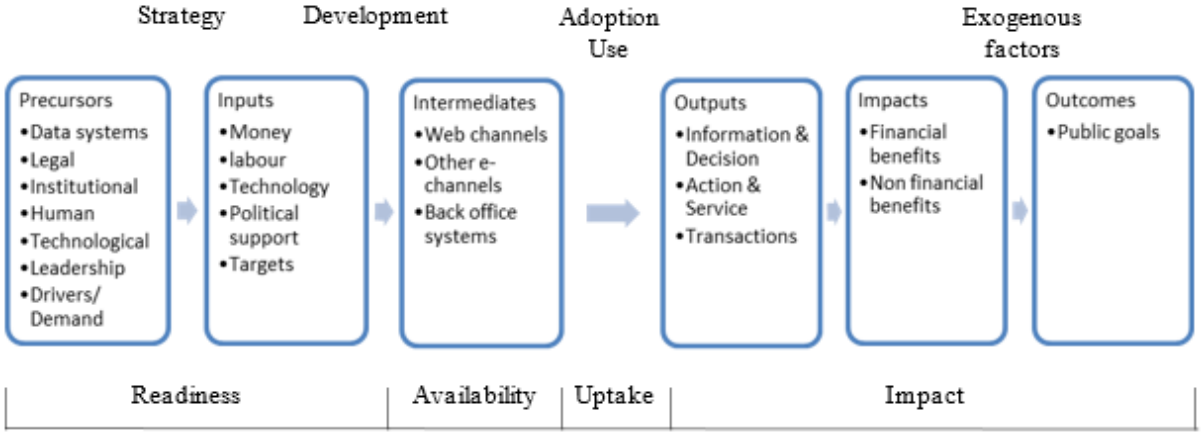
Inputs, activities and outputs are components of planned work. Outputs, outcomes and impacts are intended results. Outcomes can be influenced directly and impacts indirectly.

*Impacts* are the indirect, long-term effects of an activity (on the individual, the economy, the society, the environment).

The relationships between performance components can appear as an interconnected system. The public sector creates value such as services so the summary of the way in which e-government turns inputs into outputs, outcomes and impacts may be represented as a value chain. The value chain model can be used for projects to

trace their history, to analyse their content, and assess and evaluate their results. The Heeks model is composed of four historical domains: readiness, availability, uptake (actual usage) and impact. (Figure 3.)

*Figure 3: The e-government Value Chain (Heeks, 2006, p. 14)*




In his model Heeks defines impact as an umbrella concept that includes all results of the activities:

- Outputs (information & decisions, actions & service transactions)
- Outcomes (public goals)
- Impacts (financial and non-financial benefits).

The eGovMon project (2008-2012) defined impact as 'The measurable effect of service Initiatives that makes a difference to its users, providers, or society'. (Verleye, Karamagioli, Verdegem, Jenner, & Lorenzo, 2010, p. 8)

The authors divided the process into four stages from the beginning to the end:

- Input: policy, money, people
- Outputs: internal, external
- Outcomes: benefits, barriers, uptake, satisfaction
- Impacts: on users, on suppliers, on the economy, on society.

The contextual variables of the process are sector, infrastructure, attitudes, skills, costs, access, use and legislation.

This paper is going to use the wider concept of impact, which can be positive or negative depending on what kind of difference it makes to stakeholders (citizens, businesses, employees, other organisations). People with different user roles (e.g. client, administrator, provider, government) experience different impacts according to their different aims. Therefore, the target groups of research need to be defined in advance. The following part is going to test the impacts of e-government from the client's perspective.

Nevertheless, measuring impact is not so simple:

- Impact is multi-dimensional and can be extremely complex. The measurement can only be completed with a limited number of indicators which can lead to the loss of some aspects during the tests.
- The impact can be perceived after a longer period of time (long-term) as opposed to the measurement which only reflects a current status. (Berntzen, 2014)

The measurement of outcomes and impacts of e-government is challenging for researchers for the following reasons:

- It is not easy to choose performance indicators and collect data. Data come from daily transactions – from data provided automatically by information systems – from regular or ad hoc statistical data collections. Data availability, accessibility and data structures can be problematic.
- There are only a few useful and reliable analyses for decision makers. Processing a large amount and only partly structured data requires professional competence, time, money, technical and methodological background.

- The performance indicators are related to different areas of public administration (financial, political, professional); therefore the scope of authorities and responsibilities needs to be identified.
- In order to establish measurement systems, the specific policy and program should exactly be known since their establishment usually takes a longer period of time. (based on (Castro, 2011))

# 3. RESEARCH METHODOLOGY AND RESULTS

### 3.1. Selected models: IS Success Model and IS Impact Model

Professionals have different perspectives and use multiple methods to evaluate the impacts of information systems. In the academic literature the most significant theory and model is the DeLone and McLean (D&M) information systems (IS) success model.

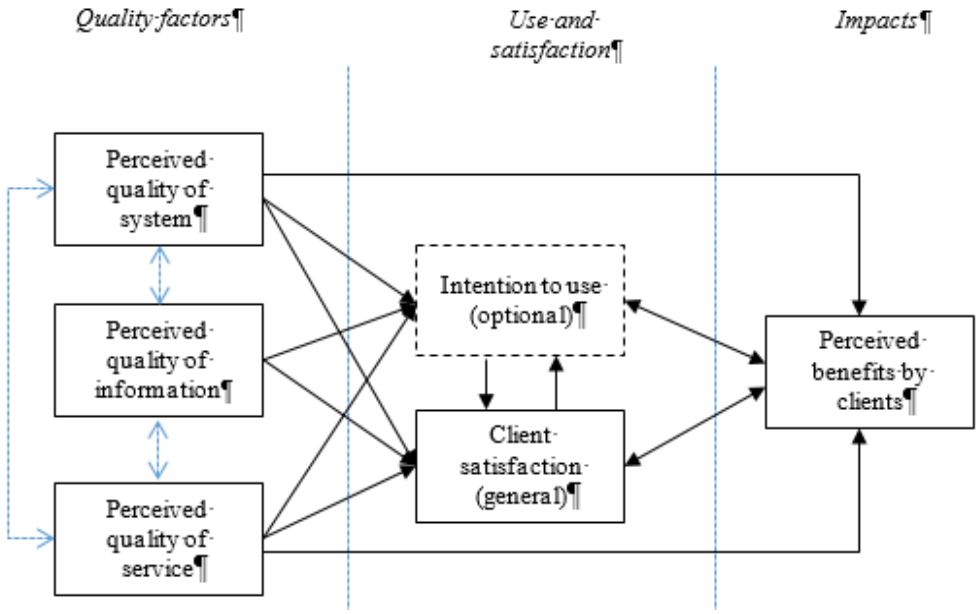
In 1992 DeLone and McLean identified six dimensions of IS success (quality of system, quality of information, use, user satisfaction, individual impact, organisational impact). (DeLone & McLean, 1992)

After ten years they updated the IS Success model. The model was extended with a new dimension (quality of service) and the impacts were integrated into one dimension. *System quality* measures the quality of information processing within the system. *Information quality* focuses on IS output. *Service quality* shows the quality of system support. *Use* (and *intention to use*) measures the user attitude. *User satisfaction* shows the level of users' satisfaction. *Net benefit* summarizes the individual, organizational, social and other impacts. Authors also presented how the IS success updated model and its six dimensions can be applied as a framework for the measurement of the success of e-commerce. (DeLone & McLean, 2003)

The D&M model has also been found to be a useful framework for organizing IS success measurements. The model has been widely used by IS researchers for understanding and measuring the dimensions of IS success in different contexts. However, only a few studies have tested the full model empirically. While IS success models have received much attention among researchers, little research has been conducted to assess the success of e-government systems. (Rana, Williams, Dwivedi, & Williams, 2012) (Sorum, Medaglia, Andersen, Scott, & DeLone, 2012) (Wang & Liao, 2008)

The empirical research is based on the D&M IS success model (2003). The components of the model fall into three categories: quality factors, use and satisfaction, impacts.

*Figure 4: The D&M IS success model from the clients' perspective (own edition based on (DeLone & McLean, 2003, p. 24)*




Another aspect of measuring IS performance is the IS Impact Model. The model contains four dimensions divided into two parts:

- Impacts (impacts to date): individual and organization impact
- Quality (future impact): system quality and information quality. (Gable, Sedera, & Chan, 2008)

The authors emphasize that the 'use' dimension is inadequate for the measurement of IS success; furthermore, 'user satisfaction' is reflected in the other dimensions. They do not assess 'service quality' either, because it is considered to be the provision of the IS function.

This study focuses on two categories of e-government systems' success. The **quality** factors (information quality, systems quality, service quality) and the **impacts** (perceived net benefits) are essential success variables in e-government.

The 'use of system' should be an optional (subprime) dimension, because using some e-services is a legal requirement for the clients. It happens quite often that other information systems or other channels of administration cannot be chosen (e.g. students can only apply for higher education electronically).

Customers' rating of the quality of e-government depends on how their personal experience meets their expectations. Therefore, client satisfaction is reflected in the evaluation of quality categories.

This empirical study focuses on a single e-government service, namely the online admission system designed for higher education. The main question is the following 'What makes e-government successful?'. It may be hypothesized that the higher quality e-government has, the better impact it makes.

- H1: Systems quality has a positive effect on the perceived benefits (impacts).
- H2: Information quality has a positive effect on the perceived benefits (impacts).
- H3: Service quality has a positive effect on the perceived benefits (impacts).

### 3.2. Collection of data about IS success – Success Metrics

This paper adopts a quantitative approach and survey as a method for collecting data. The sample is focused on people who have experience in using e-government services, especially e-admission services. The respondents were asked to answer the questions based on their experience of the e-admission system. A total of 370 usable responses were obtained. The respondents preferred electronic channel (35.1%) and multi-channel (46.8%). They use the internet daily and have advanced skills in the digital world. Most of them possess the technical conditions (90.4%) and skills (77.8%) for electronic administration. They use client gateway for authentication (73.5%). (Orbán, 2015)

The questions based on the desired characteristics of an e-government system. The e-Government Action Plan (2011-2015) complementing the Digital Agenda for Europe (DAE) supports the provision of a new generation of e-government services. It focuses on four political priorities:

- User Empowerment
- Internal Market
- Efficiency and Effectiveness of Governments and Administrations
- Pre-conditions for developing e-Government

The new e-Government Action Plan (2016-2020) would contribute to the realisation of the Digital Single Market through efforts to modernise public administration. The key objectives are cross-border interoperability, the interconnection of systems, the 'once-only' principle, the 'Single Digital Gateway', the user friendly information system for citizens and business, accelerating transition towards full e-procurement and interoperable e-signatures. (European Commission, 2015)

Once defined, the goals must be translated into meaningful measures of success. Researchers need to determine the measures (metrics), which involves identified criteria that are important to the success of information systems. DeLone and McLean created the success metrics of e-commerce system in 2003, but it has to be update in the e-government context based on priorities.

*Table 1: E-commerce and E-government Success Metrics*[4]

| Dimensions of IS success model | E-commerce Success Metrics (DeLone & McLean, 2003, p. 26.) | E-government Success Metrics (extended and modified variables) |
|---|---|---|
| Systems quality | Adaptability<br>Availability<br>Reliability<br>Response time<br>Usability | Adaptability<br>Availability<br>Reliability<br>Response time<br>Usability<br>*Interoperability* |
| Information quality | Completeness<br>Ease of understanding<br>Personalization<br>Relevance<br>Security | Completeness<br>Ease of understanding<br>Personalization<br>Relevance<br>Security |
| Service quality | Assurance<br>Empathy<br>Responsiveness | *User-centricity*<br>Assurance<br>Empathy<br>Responsiveness |
| Use | Nature of use<br>Navigation patterns<br>Number of site visits<br>Number of transactions executed | Nature of use<br>Navigation patterns<br>Number of site visits<br>Number of transactions executed |
| User satisfaction | Repeat purchases<br>Repeat visits<br>User surveys | Repeat *use of services*<br>Repeat visits<br>User surveys |
| Net benefits | Cost savings<br>Expanded markets<br>Incremental additional sales<br>Reduced search costs<br>Time savings | Cost savings<br>Time savings<br>*Flexibility*<br>*Transparency*<br>*Increase of trust*<br>*Increase of democracy*<br>*Expansion of services*<br>*Improvement of services' quality* |

This study tested the relationship between the measured characteristics as well. In the process of analysis, the following methods were used: descriptive data analysis, factor analysis, correlation and SEM-PLS to test how strongly variables are related. Some criteria may be useful for other dimension too. Factor analysis can test the factor structure of the variables. Based on the selected theoretical model, there are actually five study components. The results (Table 2.) demonstrate that the clients interpret the groups of characteristics differently from the applied model. It is difficult to differentiate the systems quality from its output (information quality) and from the mode of service (service quality). Clients tend to evaluate the service as a whole (system, web portal, service, output).

*Table 2: Results of factor analysis*

| Dimension | Characteristics (variables) | Evaluation by clients | Components | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| Systems quality | Availability | 75.9% | 0.222 | 0.316 | 0.138 | 0.839 | 0.076 |
| | Reliability | 77.3% | 0.282 | 0.346 | 0.222 | 0.809 | 0.027 |
| | Adaptability | 73.3% | 0.341 | 0.362 | 0.434 | 0.608 | 0.153 |
| | Response time | 74.6% | 0.250 | 0.554 | 0.322 | 0.514 | 0.178 |
| | Usability | 79.5% | 0.320 | 0.649 | 0.172 | 0.461 | 0.062 |
| | *Interoperability* | 75.8% | 0.301 | 0.706 | 0.173 | 0.410 | -0.036 |

[4] Italics indicate the differences

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Information quality | Completeness | 74.9% | 0.222 | 0.734 | 0.333 | 0.305 | 0.162 |
| | Relevance | 74.6% | 0.289 | 0.753 | 0.354 | 0.188 | 0.092 |
| | Ease of understanding | 75.3% | 0.316 | 0.715 | 0.225 | 0.284 | 0.085 |
| | Personalization | 74.7% | 0.370 | 0.674 | 0.347 | 0.134 | 0.167 |
| | Security | 78.5% | 0.311 | 0.649 | 0.344 | 0.259 | 0.116 |
| Service quality | *Client-centricity* | 75.4% | 0.296 | 0.568 | 0.547 | 0.200 | 0.212 |
| | Assurance | 75.0% | 0.293 | 0.370 | 0.743 | 0.245 | 0.048 |
| | Empathy | 71.6% | 0.336 | 0.330 | 0.772 | 0.196 | -0.019 |
| | Responsiveness | 69.9% | 0.322 | 0.401 | 0.742 | 0.197 | 0.109 |
| User satisfaction | *Overall satisfaction* | 62.0% | 0.308 | 0.165 | 0.069 | 0.090 | 0.877 |
| Net benefits | *Flexibility* | 77.1% | 0.740 | 0.340 | 0.147 | 0.280 | -0.066 |
| | Time saving | 80.6% | 0.836 | 0.333 | 0.131 | 0.179 | -0.054 |
| | Cost saving | 75.5% | 0.731 | 0.245 | 0.234 | 0.071 | 0.205 |
| | *Transparency* | 74.8% | 0.758 | 0.247 | 0.263 | 0.237 | 0.260 |
| | *Increase of trust* | 73.0% | 0.716 | 0.158 | 0.362 | 0.278 | 0.253 |
| | *Improvement of services' quality* | 75.0% | 0.776 | 0.256 | 0.314 | 0.215 | 0.213 |
| | *Expansion of services* | 78.0% | 0.760 | 0.304 | 0.239 | 0.232 | 0.233 |

The results illustrate that clients are generally satisfied with e-services and their components. Surprisingly, however, the level of overall satisfaction is lower than others. The factor analysis has been confirmed by the isolation of dimensions. The five main components include all the attributes.

### 3.3. Analyses of data - Results

The model used in this study applied structural equations modelling (SEM) based on partial least square (PLS). The PLS-SEM helps researchers understand relations among the sets of observed variables.

The first stage with SEM is the evaluation of the measurement model regarding validity and reliability. Assessment included individual indicator reliability (Table 3), construct reliability and validity (Table 4) and discriminant validity (Table 5). (Hair, Hult, Ringle, & Sarstedt, 2013)

*Table 3: Individual indicator reliability (cross loading of indicators)*

| Item | System Quality | Information Quality | Service Quality | Satisfaction | Impact |
|---|---|---|---|---|---|
| @SysQ_1 | 0.854 | 0.637 | 0.612 | 0.188 | 0.473 |
| @SysQ_2 | 0.887 | 0.702 | 0.679 | 0.254 | 0.547 |
| @SysQ_3 | 0.786 | 0.612 | 0.646 | 0.255 | 0.448 |
| @SysQ_4 | 0.887 | 0.750 | 0.714 | 0.217 | 0.506 |
| @SysQ_5 | 0.844 | 0.699 | 0.638 | 0.261 | 0.510 |
| @SysQ_6 | **0.656** | 0.521 | 0.485 | 0.308 | 0.325 |
| @InfQ_1 | 0.725 | 0.905 | 0.704 | 0.256 | 0.524 |
| @InfQ_2 | 0.681 | 0.887 | 0.650 | 0.241 | 0.463 |
| @InfQ_3 | 0.723 | 0.898 | 0.709 | 0.243 | 0.530 |
| @InfQ_4 | 0.618 | 0.783 | 0.605 | 0.298 | 0.426 |
| @InfQ_5 | 0.663 | 0.795 | 0.623 | 0.318 | 0.488 |
| @ServQ_1 | 0.731 | 0.775 | 0.868 | 0.276 | 0.539 |
| @ServQ_2 | 0.702 | 0.681 | 0.896 | 0.218 | 0.524 |
| @ServQ_3 | 0.640 | 0.627 | 0.888 | 0.206 | 0.486 |
| @ServQ_4 | 0.626 | 0.618 | 0.872 | 0.264 | 0.465 |
| @UserSat | 0.197 | 0.200 | 0.188 | 0.797 | 0.332 |

| | | | | | |
|---|---|---|---|---|---|
| @Imp_1 | 0.469 | 0.466 | 0.440 | 0.255 | 0.791 |
| @Imp_2 | 0.434 | 0.441 | 0.425 | 0.243 | 0.843 |
| @Imp_3 | 0.414 | 0.417 | 0.410 | 0.337 | 0.762 |
| @Imp_4 | 0.534 | 0.528 | 0.494 | 0.403 | 0.845 |
| @Imp_5 | 0.495 | 0.478 | 0.519 | 0.352 | 0.868 |
| @Imp_6 | 0.520 | 0.496 | 0.526 | 0.318 | 0.898 |
| @Imp_7 | 0.491 | 0.510 | 0.535 | 0.283 | 0.855 |

Table 3 shows the results of individual indicator reliability. In most cases, the value of the indicators is higher than 0.708, as recommended. Only one value of indicator is slightly lower (Interoperability: 0.656).

*Table 4: Construct Reliability and Validity*

| | Cronbach's Alpha (CA) (≥ 0.70) | Reliability Coefficient (rho_A) (≥ 0.70) | Composite Reliability (CR) (≥ 0.70) | Average Variance Extracted (AVE) (≥ 0.50) |
|---|---|---|---|---|
| System Quality | 0.902 | 0.912 | 0.926 | 0.677 |
| Information Quality | 0.907 | 0.910 | 0.931 | 0.731 |
| Service Quality | 0.904 | 0.908 | 0.933 | 0.777 |
| Satisfaction | 0.146 | -0.180 | 0.058 | 0.463 |
| Impact | 0.929 | 0.933 | 0.943 | 0.703 |

Cronbach's Alpha (CA), Reliability Coefficient (Dijkstra-Henseler's rho) and Composite Reliability (CR) are commonly applied criteria for the evaluation of reflective measurement constructs. All values calculated of quality and impact dimensions are above 0.900, which indicated high model reliability. Convergent validity was evaluated by means of the Average Variance Extracted (AVE). The values calculated are acceptable above 0.50. The indicator's loading should be greater on the associated construct than its loadings on other constructs, confirming the discriminant validity. We compared the square root of the AVE with the latent variable correlations (Table 5). Both methods evaluated indicated discriminant validity of the tested model.

*Table 5: Discriminant Validity*

| | Impact | Information Quality | Satisfaction | Service Quality | System Quality |
|---|---|---|---|---|---|
| Impact | 0.839 | | | | |
| Information Quality | 0.571 | 0.855 | | | |
| Satisfaction | 0.376 | 0.316 | **0.680** | | |
| Service Quality | 0.574 | 0.771 | 0.275 | 0.881 | |
| System Quality | 0.575 | 0.799 | 0.296 | 0.769 | 0.823 |

Pearson correlation was used to examine the correlation between the components. The results show that the relationship is significant and positive between the tested components, but the correlation coefficients are different (Table 6).

- Systems quality - Information quality — strong relationship
- Systems quality - Service quality — strong relationship
- Systems quality - Satisfaction — weak relationship
- Systems quality - Net benefits — moderate relationship
- Information quality - Service quality — strong relationship
- Information quality - Satisfaction — weak relationship
- Information quality - Net benefits — moderate relationship

- Service quality - Satisfaction — weak relationship
- Service quality - Net benefits — moderate relationship
- Satisfaction – Net benefits — weak relationship

*Table 6: Correlations coefficients with origin dimensions*

| Dimensions | | System quality | Information quality | Service quality | Satisfaction | Net benefits |
|---|---|---|---|---|---|---|
| System quality | Pearson Correlation | 1 | 0.789** | 0.749** | 0.268** | 0.654** |
| | Sig. (2-tailed) | | .000 | .000 | .000 | .000 |
| Information quality | Pearson Correlation | 0.789** | 1 | 0.775** | 0.302** | 0.668** |
| | Sig. (2-tailed) | .000 | | .000 | .000 | .000 |
| Service quality | Pearson Correlation | 0.749** | 0.775** | 1 | 0.306** | 0.667** |
| | Sig. (2-tailed) | .000 | .000 | | .000 | .000 |
| Satisfaction | Pearson Correlation | 0.268** | 0.302** | 0.306** | 1 | 0.391** |
| | Sig. (2-tailed) | .000 | .000 | .000 | | .000 |
| Net benefits | Pearson Correlation | 0.654** | 0.668** | 0.667** | 0.391** | 1 |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | |

**. Correlation is significant at the 0.01 level (2-tailed).

It can be concluded that systems quality, information quality and service quality *are not independent* from the citizens' perspective although DeLone and McLean assumed them as independent dimensions.

The hypotheses have been confirmed, but the results of the test indicate only a moderate connection between the tested variables.

- H1: Systems quality has a positive effect on the perceived benefits (impacts) ✓
- H2: Information quality has a positive effect on the perceived benefits (impacts) ✓
- H3: Service quality has a positive effect on the perceived benefits (impacts) ✓

Other factors can influence the opinion of respondents. Those who preferred electronic channel and multi-channel added higher scores generally. The result also showed differences by region and age. Students aged between 30 and 40 have a better assessment of systems quality, information quality and service quality, but in generally they were less satisfied. However, elderly people were more satisfied with the services in general. The age effect was significant on systems quality, information quality, service quality and benefits (Table 7).

*Table 7: The age effect on evaluation of dimensions*

| Age | | System quality | Information quality | Service quality | Overall satisfaction | Impact |
|---|---|---|---|---|---|---|
| -20 | Mean | 4,74 | 5,05 | 4,41 | 4,36 | 5,06 |
| | N | 16 | 15 | 16 | 14 | 17 |
| | Std. Deviation | 1,50 | 0,60 | 1,48 | 1,82 | 1,07 |
| 20 - 30 | Mean | 5,17 | 5,10 | 4,88 | 4,34 | 5,21 |
| | N | 184 | 181 | 181 | 174 | 187 |
| | Std. Deviation | 1,19 | 1,21 | 1,31 | 1,71 | 1,10 |
| 30 - 40 | Mean | 5,80 | 5,78 | 5,57 | 3,92 | 5,68 |
| | N | 47 | 47 | 47 | 37 | 47 |
| | Std. Deviation | 1,20 | 1,27 | 1,32 | 1,69 | 1,21 |
| 40 - 50 | Mean | 5,42 | 5,39 | 5,38 | 4,45 | 5,47 |
| | N | 75 | 74 | 72 | 51 | 75 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Std. Deviation | 1,41 | 1,27 | 1,35 | 1,65 | 1,42 |
| 50 - | Mean | 5,52 | 5,62 | 5,60 | 5,00 | 5,58 |
| | N | 21 | 20 | 21 | 12 | 21 |
| | Std. Deviation | 1,12 | 1,27 | 1,36 | 1,95 | 1,16 |
| Total | Mean | 5,31 | 5,28 | 5,11 | 4,33 | 5,34 |
| | N | 343 | 337 | 337 | 288 | 347 |
| | Std. Deviation | 1,27 | 1,23 | 1,36 | 1,71 | 1,20 |

## 4. CONCLUSION

The aim of this research was to examine the efficiency of e-government from the citizens' perspective. The definitions of efficiency, effectiveness and efficacy are interpreted differently by the various authors and in various contexts. The study based on the definitions of performance management. The result chain (input – output – outcome – impact) as a causal sequence helps to understand the whole process. An immediate and broader understanding of the concept of impact is acceptable, but the most important aspect is measurability. Several models and frameworks exist to measure the effects. The popular D&M IS Success Model and the IS Impact Model can be used partly as a framework to study the impacts of e-government.

This study proposes a modified D&M IS success model for measuring the success of e-government services. The D&M updated IS success model (2003) was modified by cancelling the 'use/intention to use' dimensions. The use of certain services is required in public administration; therefore, the 'use/intention to use' is optional in the model. An information system is considered good from the citizens' if it meets their expectations. From the viewpoint of the citizens, the components of information systems and their relationship can be evaluated. The empirical research tested the success factors of e-admission system. It can be concluded that the quality of an information system, quality of information and quality of service are closely related. Net benefits (impacts) depend on the rest of the dimensions in different rates. Other factors also affect the satisfaction of citizens (such as age, education, place of residence, preferred channel). It requires further research to explore the reason for the moderate level of satisfaction, namely which factors influence overall satisfaction with public administration.

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