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# Assessing the success of e-government systems: An employee perspective

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ABSTRACT

By using information system (IS) success-based approaches from the perspective of government employees, this paper investigates the success of e-government systems. Structural equation modeling (SEM) techniques were applied to data collected by a questionnaire from 154 employees of e-government systems in Serbia. In this study, we empirically evaluated the model for measuring the success of e-government systems consisting of constructs from the updated DeLone and McLean IS success model coupled with the demographic conditions. Seven out of ten hypothesized relationships between the seven success variables are significantly supported. The findings of this study can be used to assess the success of e-government systems from the standpoint of the government employees.



## 1. Introduction

Electronic government (e-government) is defined as the use of computers and the Internet by government of information and communication technologies to deliver information and services to citizens, businesses, and other stakeholders [1]. In the past few decades, it received increased attention because many governments realized the importance of using information and communication technologies to provide efficient and transparent government [2]. In addition, technology helps governments to improve services and assists in building trust between governments and businesses, and between government employees and the general public [3]. An essential part of research concerning e-government deals with ways to evaluate and measure the success of e-government systems [2,4]. A number of empirical studies have tested the updated information system (IS) success model to assess different ISs [2,5–21]. Although IS success models have been receiving much attention among researchers, little is known about the success of the public website systems [22]. Recent studies in e-government have examined the role of demographic characteristics and their importance in the prediction of the use of technologies [1,23,24]. Hence, we still do not have a clear understanding of how demographic conditions (DCs) drive the e-government system success model [1].

Studies that deal with the assessment of e-government systems' success, using IS-success-based approaches, are scarce [2,25,26]; to the best of our knowledge, no research has been conducted to assess e-government systems from the perspective of government employees as primary users. The empirical results of previous studies need to be verified in different user populations and more empirical tests should be conducted to generalize the model validation in the context of e-government [2], especially considering DCs of the population [1].

This study presents an empirically validated model for measuring the success of e-government systems from the employees' perspective. We used the updated DeLone and McLean (D&M, 2003) IS success model in our research. The data were collected from 154 municipal government employees of e-government systems in Serbia using a questionnaire and then were analyzed. The employees were end users of central government applications. Seven out of ten hypothesized relationships between the seven success variables are significantly supported. The findings of this study can be used to assess the success of e-government systems from the standpoint of the government employees who use e-government applications as a tool for everyday operations.

The remainder of the paper is organized into five sections. Section 2 presents a literature review about e-government systems and IS success modeling. The section also proposes a conceptual model and hypothesis. Section 3 describes the materials and methods. Section 4 presents the result of measurement and structural modeling. Section 5 includes a discussion of theoretical and managerial implications of e-government systems. Finally,

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Section 6 provides some concluding comments and limitations along with directions for future research.

## 2. Background and related work

### 2.1. E-government systems

E-government has emerged as a popular catchphrase in public administration to cover functional areas such as service delivery, interactivity, decentralization, transparency, and accountability [27] and also to offer a one-stop shop for all stakeholders. Technology plays a central part in the development of the public sector; it can act both as an enabler and as an obstacle to sustainability [28]. There are three broad classifications of e-government systems: government to government (G2G), government to citizen (G2C), and government to business (G2B; [2]). Snead and Wright [29] found that most of the studies that investigated e-government systems are focused on interaction with citizens, or G2C systems. In addition, citizens receive the widest array of services from the e-government applications [30]. Implementation of e-government systems and appropriate applications require acquisition of new skills from the government employees [31]. Thus, it is important to further investigate G2C e-government systems, not only from the user perspective but also from the perspective of public employees.

The introduction of e-government systems has brought operational benefits for local municipalities and their employees, including the reduction in paperwork, the provision of continuous service availability to customers, a reduction in response time, and a reduction in error rate [32]. Each stakeholder has different interests and objectives that may have an impact on the success and take-up of the e-government system [33]. As e-government is a type of IS [25] and its success is a complex concept, it needs to be assessed with multidimensional factors [2]. Although research on e-government systems' success is in its infancy, general research on IS success has been conducted for almost three decades. Previous studies that investigated e-government systems' success focused on different models. Previous studies investigated factors focusing on experience of the users and meeting user needs in combination with system factors, as well as DCs and their influence on the use of the IS.

The technology acceptance model (TAM) by Davis [34] explained why some ISs are accepted by users better than others. One of the first successful attempts to apply TAM on e-government was made by Carter and Bélanger [35]. They presented a parsimonious model of e-government adoption, which converged on three frameworks (i.e., TAM, diffusion of innovation, and trustworthiness). Shareef et al. [36] applied TAM on e-government focusing on experience of the users and meeting user needs and proposed the e-government adoption model (GAM). However, the COBRA (Costs, Opportunities, Benefits, Risks Analysis) framework [33] focused only on user satisfaction (US). Similarly, another group of authors investigated e-satisfaction from the point of behavioral (i.e., trust and awareness), technical (i.e., security and privacy), and economical (i.e., quality of public services) aspects that affect the success of e-government systems [37].

Previous empirical studies have confirmed the determining effects of DCs in e-government system use [1,23,24,38]. Nam [1] grouped demographic characteristics (i.e., age, sex, job position, residential, and partisanship) and found determining effects on the use of e-government portal in the case of sex, income or job position, residential categories, and partisanship. Drawing on empirical results, Venkatesh et al. [24] found that gender, education, and income significantly influence e-government portal use. Another study conducted in Malaysia found a positive relationship between demographic characteristics (i.e., age, gender, income, education, and ethnicity) and intention to use e-government applications [23].

Acceptance and US alone, however, are not the same as success, although acceptance and US of an e-government system are necessary elements for measuring success [39]. Thus, this research focuses only on the D&M IS success model as a measurement for e-government assessment in combination with demographic characteristics as predictors of e-government system use.

### 2.2. D&M IS success model

The D&M IS success model was first introduced in 1992 [40]. The taxonomy consisted of six interdependent constructs (Fig. 1): information quality (IQ), system quality (SQ), system use, US, individual impact, and organizational impact [40]. During the first 10 years, many IS researchers critiqued the original D&M model and proposed suggestions for modification or extension of the original model [41–43].

Ten years later, DeLone and McLean [44] published an updated model of IS success, which offered an additional quality component called "service quality," (SV) as suggested by Pitt et al. [41], and merged the individual and organizational impact into one construct called "net benefit," (NB) as proposed by Seddon [43]. System usage continued to be a dependent variable. The authors explained this as follows: "Use must precede 'user satisfaction' in a process sense, but positive experience with 'use' will lead to greater 'user satisfaction' in a causal sense" [44]. Thus, the categories of the updated D&M (2003) IS success model are as follows: system, information, SV, system use, US, and NBs (Fig. 2). The updated model consists of six interrelated and

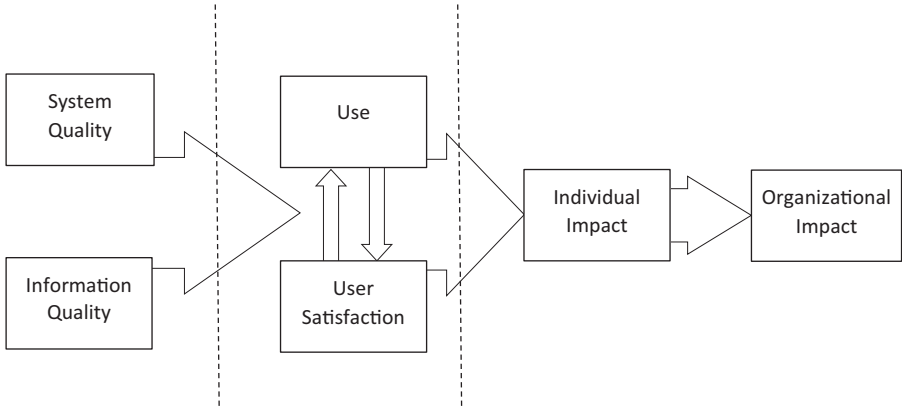


**Fig. 1.** The DeLone and McLean IS success model [40].

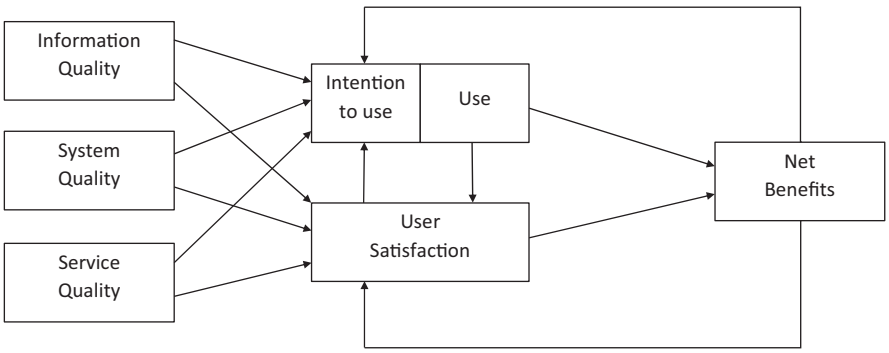


**Fig. 2.** The updated DeLone and McLean IS success model [44].

interdependent dimensions of IS success. The revised D&M model is one of the most widely used models of IS success and has been used for various ISs [12]. The model is applicable to the assessment of the effectiveness of ISs in the World Wide Web environment. Within the e-government context, employees use Internet-based applications to receive orders from citizens for various services (e.g., tax certificate and renewal of license plate sticker) and to improve the services by reducing the time and the costs of administration. Such IS applications can be studied using the updated D&M IS success model [2]. The original authors also suggested that further field studies of their model are needed [44]. As a result, we assume that the updated IS success model can be adapted to system success measurement in the e-government context from the employees' perspective. As the focus of this study is on the measurement of the success of e-government from the employees' perspective, the NB in this study refers to the employee-perceived NB evaluation of a specific e-government system.

### 2.3. E-government in Serbia

The Republic of Serbia is considered a developing country with 59% urban population with 62.8% of households who have Internet access. Gender is equally distributed in Serbia with 51% of females, but the disparity in the use of the Internet between men and women is very high. Approximately, 66.4% of men are Internet users compared with 46.8% of women [63]. The cause of this gender divide is the disparity between men and women in terms of lack of education and social attitudes toward female usage of technologies. The computer literacy rate in urban areas is 59% and is higher compared with the population in rural areas, where only 34% of people out of the whole rural population are able to perform any activity on the computer (i.e., persons who use the computer in everyday life) [63]. Serbia has a comparatively old overall population (among the 10 oldest in the world), with the average age of 42.2 years [63]. According to the World Bank [45] data, Serbia is considered as an upper-middle-income country with an average monthly net income of RSD 45,000 or $415 [46], which is considered one of the lowest in Europe.

In 2010, the Digital Agenda Authority of the Republic of Serbia launched an e-government portal (http://www.euprava.gov.rs/) for citizens, businesses, and local governments to improve economic efficiency and citizens' quality of life. All e-government services were developed by the Digital Agenda Authority, as a central government body, aimed at creating a simpler everyday existence for private individuals and businesses, and more efficient public administration. Based on the latest available statistics [47], 168 local government municipalities are currently providing 162 different pieces of information and services for citizens and businesses. The Digital Agenda Authority is responsible for the training of all current and new municipal government employees who work directly with e-government portals. According to the United Nations E-Government survey report, Serbia rapidly rose to a world ranking of 69 [31]. This study aims to further assess the effectiveness of the Government Information System (GIS) from the perspective of municipal government employees as the primary users.

### 2.4. Conceptual model and hypothesis

In this paper, we use the concepts and models mentioned in similar studies, considering the views of employees, and provide a model for measuring the success of e-government systems, extending previous research. As e-government systems are considered to be an aspect of IS [25], their success can be analyzed with the updated D&M IS success model. Based on a review of previous research results (e.g., [2,44]), we designed the initial conceptual model, presented in Fig. 3. Brief definitions of each measure in the model are as follows:

- SQ – Technical SQ of an e-government system represents the performance of the system in terms of ease of use, user-friendliness, and usability [2,44,48]. This construct measures the technical success of an e-government system [44].
- IQ – This construct is defined as the quality of e-government system output [49] and is measured by different semantic attributes presented in Table 1 [44].
- SV – It is the quality of service that users of an e-government system receive from IS personnel [49]. In addition to SQ and IQ, this construct measures the general quality of an e-government system from the perspective of readiness of personnel to provide proper service, safety of transactions when using the e-government system, availability of the system to users, individual attention of IS personnel, and providing specific needs for users.
- Intention to use/use (U) – It is the degree and manner in which employees utilize the capabilities of an e-government system [49]. This construct measures the behavior and attitude of users in regard to dependency on the e-government system, frequency of system use, as well as tendency and duration of future use.
- US – It is the general idea the users have about the e-government system [50]. This construct is the users' attitude toward the system [40]. It measures the municipal government employees' general satisfaction with the e-government applications, perceived utility, fulfilled expectations, and whether it is worthwhile to use the e-government system as they are the end users of central government applications, and using the system as a tool for everyday operations.

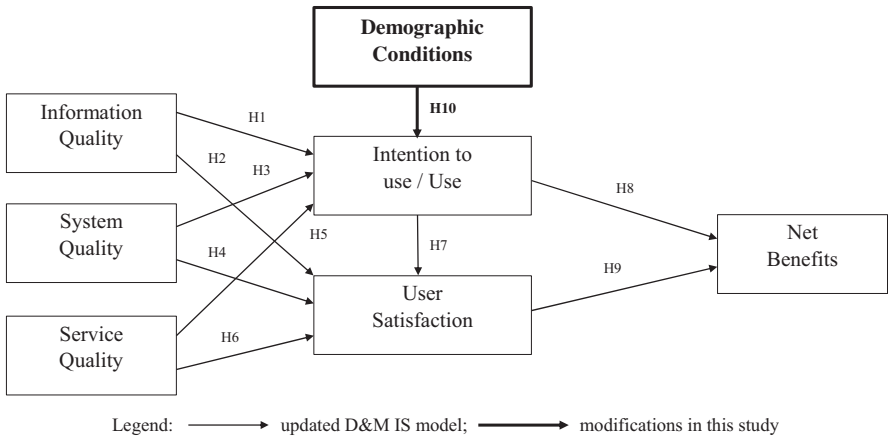


**Fig. 3.** Conceptual model.

- NBs – It is the extent to which the e-government system contributes to the success of individual employees [49]. Over time, NBs ceased to be the monopoly of only one employee but increasingly expanded to organizations [44].
- DCs – The demographic characteristics were derived from Nam [1], which include age in years, gender, job position of the municipal government employee, monthly income of the employee as proxy measures of socioeconomic status, residential categories, and self-identified partisanship.

According to Fig. 3, the updated D&M model is coupled with demographic characteristics to measure the success of e-government systems. DeLone and McLean [44] contend that the use and intention to use are alternatives in their model, and that the intention to use may be a more acceptable variable in the context of mandatory usage. Thus, we chose to consider both the intention to use and other measures of system use as the same construct for this study.

IS success is a multidimensional and interdependent construct, and it is therefore necessary to study the interrelationships among those dimensions [44]. Our hypotheses about the relationships in the model are presented as follows:

H1: IQ has a positive effect on intention to use/use of an e-government system's employees
H2: IQ has a positive effect on US of an e-government system's employees
H3: SQ has a positive effect on intention to use/use of an e-government system's employees
H4: SQ has a positive effect on US of an e-government system's employees
H5: SV has a positive effect on intention to use/use of an e-government system's employees
H6: SV has a positive effect on US of an e-government system's employees
H7: Intention to use/use has a positive effect on US with an e-government system
H8: Intention to use/use of an e-government system has a positive effect on NBs
H9: E-government system US has a positive effect on NBs
H10: DCs (gender, age, job position, income, residential categories, and partisanship) have a positive effect on intention to use/use of an e-government system's employees.

**Table 1**
Construct measures for e-government system success.

| Construct | Indicator | References |
|---|---|---|
| System quality (SQ) | (1) User-friendly | [2,48] |
| | (2) Easy to use | [44,61] |
| | (3) Usability | [44] |
| Information quality (IQ) | (4) Precise information | [2,44] |
| | (5) Up-to-date information | [2,48] |
| | (6) Sufficient information | [2] |
| | (7) Reliable information | [20] |
| | (8) Useful information | [48] |
| Service quality (SV) | (9) Readiness for service | [2] |
| | (10) Safe transactions | [2] |
| | (11) Availability | [6] |
| | (12) Individual attention | [2] |
| | (13) Specific needs for users | [9] |
| Intention to use/use (U) | (14) Dependency | [2] |
| | (15) Frequency of system use | [2,48] |
| | (16) Tendency to use | [12,17] |
| | (17) Duration of future use | [17] |
| User satisfaction (US) | (18) Satisfaction with system | [2] |
| | (19) Perceived utility | [48] |
| | (20) Expectations | [2] |
| Net benefits (NBs) | (21) Makes job easier | [2] |
| | (22) Time savings | [2,44] |
| | (23) Useful | [20] |

## 3. Materials and methods

### 3.1. Measures

The indicators and constructs of the conceptual model have been determined based on previous research on IS success. The measures that have been used to analyze the success of various types of IS, in previous studies, which have been adopted in this study are listed in Table 1.

### 3.2. Sample and data collection procedure

The data used to test the conceptual model were obtained from a sample of local government municipalities' employees from the Republic of Serbia. The focus was on employees who have a better understanding of the government and IT operations, information creation, storage, and utilization processes as they are the end users of e-government portal applications developed by the central government. The Republic of Serbia is organized into 168[1] municipalities grouped in 25 districts [46]. Thus, to increase the generalizability of the results, respondents were spread across

[1] Excluding Autonomous Province of Kosovo.

25 districts in the Republic of Serbia. In each district, a representative municipality was selected and contacted to take part in the survey. Out of 25 representative municipalities, 20 agreed to participate in the research. Following Dillman's [51] recommendations of applying the total design method of surveys, we e-mailed 558 employees. A total of 159 responses were received over a period of 10 weeks, representing a response rate of 28.5%. After conducting non-engaged bias analysis, five responses were deleted and the remaining 154 useful responses were available for data analysis, yielding a 27.6% usable response rate. Approximately, 57% of the respondents were male. Age distribution was approximately normal: under 20 (0.0%), between 21 and 30 (13.0%), between 31 and 40 (37.0%), between 41 and 50 (29.2%), and over 51 (21.8%). The respondents were identified as assistant mayors (8.4%), information technology (IT) directors (14.3%), assistant IT directors (14.3%), counselors for IT (9.7%), IT administrators (13.6%), and associates (39.6%). Out of 25 representative municipalities, five did not agree to participate in the research. As employees from five districts were not interested in participating in the research, robust statistical analyses were conducted to ensure that there was no bias effect. Analysis of variance (ANOVA) and Pearson's chi-squared tests comparing the employees from districts who took part in the research (respondents) and those who were not interested (non-respondents), across all demographic variables (i.e., gender, age, job position, income, place, and partisanship), did not show statistically significant differences between groups, nor a dependency of the nonrespondent group. In the case of ANOVA tests, at significance level $\alpha = 0.05$, the lowest $p$-value is 0.381 and the highest is 0.883. In the case of chi-squared tests, the lowest value of Pearson's coefficient is 0.517 (df = 2; $p$-value = 0.772), and the highest is 2.574 (df = 5; $p$-value = 0.765). Thus, it could be said that the results from five districts cannot significantly, or negatively, influence the quality and representativeness of a sample. Therefore, it could be presumed that the lack of responses from the five districts has no significant influence on the results of this research and that the results are not biased. Nonresponse bias was examined by comparing the demographics of the respondents with those of the population. $T$-tests comparing the responses received across the demographic variables of age, gender, and job position, within a municipality, did not reveal any significant differences between the groups ($p$-value >0.10). Therefore, it could be stated that the bias effect is not present across control groups (non-bias). Detailed descriptive statistics relating to the demographic characteristics are shown in Table 2. To measure all the constructs, 23 indicators were measured with a seven-point Likert scale [52].

## 4. Results

In general, the structural equation modeling (SEM) technique was conducted in SPSS Amos to examine the model fit for each construct (to assess the measurement model) and to test the relationships among the constructs (to test the hypotheses in the structural model).

### 4.1. Measurement model

For the purpose of validity testing of the measurement model, confirmatory factor analysis (CFA) was conducted by SPSS Amos [53]. We used the following goodness-of-fit indices: the ratio of $\chi^2$ to degrees of freedom (df), adjusted goodness-of-fit index (AGFI), normalized fit index (NFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). As shown in Table 3, all the model fit indices exceeded their respective common acceptance levels suggested by previous research [54–56], thus demonstrating that the measurement model exhibited a fairly good fit with the data collected ($\chi^2 = 315.87$

**Table 2**
The demographic composition.

| Characteristic | Mean | SD | Min | Max | Number | Percentage |
|---|---|---|---|---|---|---|
| Gender | | | | | | |
| Female | | | | | 66 | 42.9 |
| Male | | | | | 88 | 57.1 |
| Age | 41.24 | 10.17 | 24 | 65 | | |
| <20 | | | | | 0 | 0.0 |
| 21–30 | | | | | 20 | 13.0 |
| 31–40 | | | | | 57 | 37.0 |
| 41–50 | | | | | 45 | 29.2 |
| >51 | | | | | 32 | 21.8 |
| Job position | | | | | | |
| Assistant mayor | | | | | 13 | 8.4 |
| IT director | | | | | 22 | 14.3 |
| Assistant IT director | | | | | 22 | 14.3 |
| Counselor for IT | | | | | 15 | 9.7 |
| IT administrator | | | | | 21 | 13.6 |
| Associate | | | | | 61 | 39.6 |
| Monthly income | 53.900 | 21.300 | 21.000 | 130.000 | | |
| RSD 20,000 or less | | | | | 5 | 3.2 |
| RSD 20,001–50,000 | | | | | 76 | 49.4 |
| RSD 50,001–80,000 | | | | | 56 | 36.4 |
| RSD 80,001–110,000 | | | | | 16 | 10.4 |
| RSD 110,001 or more | | | | | 1 | 0.6 |
| Residential place | | | | | | |
| Rural | | | | | 34 | 22.1 |
| Suburban | | | | | 63 | 40.9 |
| Urban | | | | | 57 | 37.0 |
| Partisanship | | | | | | |
| Left-oriented | | | | | 71 | 46.1 |
| Center-oriented | | | | | 69 | 44.8 |
| Right-oriented | | | | | 14 | 9.1 |

**Table 3**
Summary of goodness of fit statistics for CFA and SEM.

| Model | $\chi^2$/df | AGFI | NFI | CFI | RMSEA |
|---|---|---|---|---|---|
| Measurement model | 1.48 | 0.823 | 0.910 | 0.969 | 0.056 |
| Structural model | 1.55 | 0.817 | 0.905 | 0.964 | 0.060 |
| Recommended value | <3.00[a,b] | >0.80[b] | >0.90[b,c] | >0.90[a,c] | <0.08[a,b,c] |

*Note.* AGFI, adjusted goodness of fit index; NFI, normalized fit index; CFI, comparative fit index; RMSEA, root mean square error of approximation.
[a] Kline [62].
[b] Hair et al. [57].
[c] Hu and Bentler [55].

with df = 213, AGFI = 0.823, NFI = 0.91, CFI = 0.969, and RMSEA = 0.056).

Reliability was evaluated by calculating Cronbach's alpha coefficients [52]. The reliability of each factor collected by the survey instrument was as follows: SQ = 0.866; IQ = 0.854; SV = 0.956; intention to use/use = 0.938; US = 0.881; NB = 0.930. The reliability of the whole instrument was 0.941. In addition, the reliability and convergent validity of the factors were estimated by composite reliability (CR) and average variance extracted (AVE). The results are presented in Table 4. All the Cronbach's alpha coefficients and CR values satisfied the minimum criterion value of ≥0.70, as suggested by Hair et al. [57]. The average variances extracted were all above the recommended 0.50 level [57], which meant that more than one-half of the variances observed in the items were accounted for by their hypothesized factors. CR was greater than AVE for each factor. Thus, all the factors in the measurement model had adequate convergent validity.

Discriminant validity can be evaluated by examining the AVE, MSV, and ASV. Following the recommendation by Hair et al. [57], MSV greater than AVE and ASV greater than AVE will lead to discriminant validity. None of the factors had convergent validity concerns (Table 4). In summary, the measurement model had adequate reliability, convergent validity, and discriminant validity.

Next, we conducted the common method bias (CMB) test. CMB refers to the measurement error resulting from variance due to the measurement method utilized [58]. The common latent factor (CLF) test is used to examine CMB. This test is conducted to capture the common variance among all the observed variables in the model [58]. If there are great differences (>0.2) in the standardized regression weights from the model with CLF to the standardized regression weights of a model without the CLF, then there is a CMB issue [58]. By using this approach, the CLF test of the items in our study was conducted. This analysis showed that the differences in the standardized regression weights with and without CLF were <0.2 in all 23 observed variables, which is a strong indication that CMB is not present in our sample.

### 4.2. Structural model

The same set of fit indices was used to examine the structural model. Table 3 shows that all fit index values are in the acceptable range, indicating a good fit of the model ($\chi^2$ = 334.38 with df = 216, AGFI = 0.817, NFI = 0.905, CFI = 0.964, and RMSEA = 0.06). Path coefficients, *p*-values, *z*-scores, and variance explained are shown in Fig. 4.

The results indicate that seven out of ten hypotheses were supported. IQ had a significant influence on intention to use/use but an insignificant effect on US. Thus, H1 was supported ($\beta$ = 0.249; $t$ = 2.950) and H2 was rejected ($\beta$ = 0.097; $t$ = 1.075). As expected, SQ had a significant influence on both the intention to use/use and US. Hence, H3 and H4 were supported ($\beta$ = 0.325; $t$ = 3.619 and $\beta$ = 0.283; $t$ = 2.467, respectively). SV had a significant impact on intention to use/use, but it had no significant effect on US. H5 was supported ($\beta$ = 0.260; $t$ = 3.521), whereas H6 was rejected ($\beta$ = 0.033; $t$ = 0.407). Out of three exogenous factors, SQ demonstrated a stronger effect than IQ and SV on intention to use/use and US. Intention to use/use had a significant influence on both US and NBs. H7 and H8 were supported ($\beta$ = 0.307; $t$ = 3.135 and $\beta$ = 0.441; $t$ = 5.619, respectively). Finally, US had a positive effect on NBs. Thus, H9 was supported ($\beta$ = 0.333; $t$ = 4.069). H10 was not supported as none of the demographic characteristics have a significant influence on intention to use/use (H10.1: $\beta$ = 0.018, $t$ = 0.288; H10.2: $\beta$ = 0.066, $t$ = 0.946; H10.3: $\beta$ = −0.010, $t$ = −0.106; H10.4: $\beta$ = 0.050, $t$ = 0.413; H10.5: $\beta$ = 0.115, $t$ = 1.183; H10.6: $\beta$ = −0.043, $t$ = −0.650). The findings regarding the 10 hypotheses are summarized in Table 5.

Henseler et al. [59] suggested using the coefficient of determination ($R^2$) of the endogenous latent variables as the essential criterion for structural model assessment. $R^2$ was 45% when the quality triad was used to predict the intention to use/use. Moreover, the coefficient of determination for US was 36%, when predicted by the quality triad and the intention to use/use. The overall model accounted for 46% of the variance in the perceived NB, with the intention to use/use exerting a stronger direct effect than US on the perceived NB. Among the quality triad, SQ has the strongest total effect on NBs. We used bootstrapping with 5000 resamples and 0.90 confidence interval to determine the effects of variables and the significance of the path within the structural model. Table 6 shows all direct, indirect, and total effects (beta values) in the model.

## 5. Discussion

This research has addressed the problem of measuring the success of an e-government system deployment from the perspective of the municipal government employees as primary users of the central government applications. In this study, we have empirically revalidated the model for measuring the success of

**Table 4**
Reliability, convergent validity, and construct correlations.

| Factor | Mean | SD | α | CR | AVE | MSV | ASV | SQ | IQ | SV | U | US | NB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SQ | 5.05 | 0.62 | 0.866 | 0.869 | 0.690 | 0.332 | 0.255 | 0.831[a] | | | | | |
| IQ | 5.00 | 0.53 | 0.854 | 0.861 | 0.567 | 0.283 | 0.232 | 0.532 | 0.753[a] | | | | |
| SV | 4.88 | 0.56 | 0.956 | 0.954 | 0.806 | 0.285 | 0.208 | 0.480 | 0.412 | 0.898[a] | | | |
| U | 4.88 | 0.57 | 0.938 | 0.941 | 0.799 | 0.377 | 0.313 | 0.576 | 0.519 | 0.514 | 0.894[a] | | |
| US | 4.93 | 0.50 | 0.881 | 0.877 | 0.782 | 0.324 | 0.220 | 0.465 | 0.417 | 0.297 | 0.569 | 0.884[a] | |
| NB | 4.98 | 0.54 | 0.930 | 0.935 | 0.830 | 0.377 | 0.287 | 0.460 | 0.512 | 0.534 | 0.614 | 0.545 | 0.911[a] |

*Note.* α, Cronbach's alpha; CR, composite reliability; AVE, average variance extracted; MSV, maximum shared variance; ASV, average shared variance.
[a] It indicates the square root of AVE of the construct.

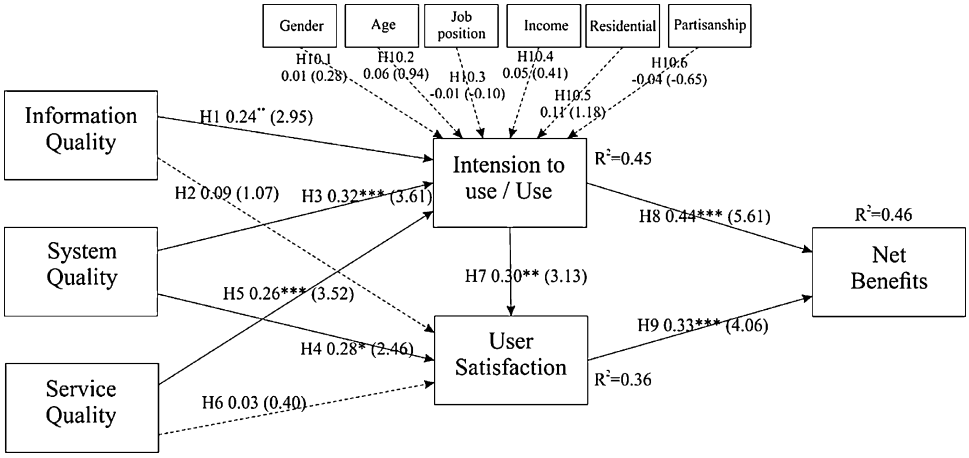


**Fig. 4.** Structural model. *Note.* Statistically significant —; statistically nonsignificant —; $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$, () *z*-score.

e-government systems based on the updated D&M (2003) IS success model and assessed demographic characteristics and their influences on use. The assessment, which focused on multidimensional factors, is consistent with the literature on e-government effectiveness.

This study provides several important theoretical and practical implications for the success of e-government systems. Based on our model and structural equations, it can be said that technical SQ is one component of measuring the success of an e-government system in a municipality. Through a direct effect on intention to use/use and US, and an indirect effect on NBs, it can also affect the success of these systems. Hence, whenever the technical quality of an e-government system is higher, intention to use/use and US are also higher, including NBs. To increase the success of an e-government system, e-government authorities need to develop such systems that have a high level of usability, user-friendliness, and ease of use. Other quality components of IS success, such as IQ and SV, have a direct effect on the intention to use/use, and an indirect effect on NBs. In other words, higher IQ and higher SV lead to an increased success of e-government systems. Because of the indirect impact of information and SV on the NBs of using the system, the benefits (i.e., easier job, time savings, and usefulness) will be higher. Compared with two other quality dimensions, SQ has stronger direct effects on both the intention to use/use and US, as well as indirect effects on benefits. Thus, central government management should pay much more attention in promoting the SQ of e-government systems. When the intention to use/use of an e-government system is higher, US will increase (direct effect). Hence, the use of the system, through a direct effect on user (employee) satisfaction, can also affect the success of these systems. In addition, the use of the system through US will indirectly increase the benefits of the system and make it more effective. In our model, the intention to use/use was found to have the strongest direct and total effect on NBs, indicating the importance of system use in promoting employee-perceived NBs. The more employees in municipalities are satisfied with e-government systems, the more direct will be the impact on their NBs. Finally, according to the proposed model, NBs construct is considered to be a closer measure of e-government systems' success than the other five success measures. NBs should develop if the formation of the quality triad, intention to use/use, and US is properly managed. Central government management needs to pay attention during the development stage to IQ, SQ, and SV in order to influence intention to use/use, US, and NBs of municipal government employees, which will lead to greater success of e-government system. As all the components in the model are interrelated and interdependent [44], establishing strategies to improve only one success variable is therefore an incomplete strategy if the effects of the others are not considered.

The demographic characteristics of the municipal government employees are not a predictor of e-government use in the Republic of Serbia. These results are not unusual as there are other studies that found no statistically significant relationship between demographic characteristics and use of the e-government system. Venkatesh et al. [24] found that the age factor does not have any influence on e-government portal use in India. Another study conducted in the United States found that personal backgrounds (i.e., age) are not a predictor of e-government use [1]. Such results revealed a strong foundation of the updated D&M (2003) IS success model and its generalizability. The lack of a statistically significant relationship can be explained with the mandatory training

**Table 5**
Summary of hypotheses testing.

| Hypothesis | Relationship | *t*-Value | *β*-Value | Result |
|---|---|---|---|---|
| H1 | IQ → U | 2.950** | 0.249 | Supported |
| H2 | IQ → US | 1.075 | 0.097 | Not supported |
| H3 | SQ → U | 3.619*** | 0.325 | Supported |
| H4 | SQ → US | 2.467* | 0.283 | Supported |
| H5 | SV → U | 3.521*** | 0.260 | Supported |
| H6 | SV → US | 0.407 | 0.033 | Not supported |
| H7 | U → US | 3.135** | 0.307 | Supported |
| H8 | U → NB | 5.619*** | 0.441 | Supported |
| H9 | US → NB | 4.069*** | 0.333 | Supported |
| H10.1 | Gender → U | 0.288 | 0.018 | Not supported |
| H10.2 | Age → U | 0.946 | 0.066 | Not supported |
| H10.3 | Job position → U | −0.106 | −0.010 | Not supported |
| H10.4 | Income → U | 0.413 | 0.050 | Not supported |
| H10.5 | Residential → U | 1.183 | 0.115 | Not supported |
| H10.6 | Partisanship → U | −0.650 | −0.043 | Not supported |

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

**Table 6**
Effects of variables in the final structural model.

| | Direct effect | | | Indirect effect | | | Total effect | | |
|---|---|---|---|---|---|---|---|---|---|
| | U | US | NB | U | US | NB | U | US | NB |
| IQ | 0.24 | 0.09 | | | 0.08 | 0.17 | 0.24 | 0.17 | 0.17 |
| SQ | 0.32 | 0.28 | | | 0.10 | 0.26 | 0.32 | 0.38 | 0.26 |
| SV | 0.26 | 0.03 | | | 0.08 | 0.16 | 0.26 | 0.11 | 0.16 |
| U | | 0.30 | 0.44 | | | 0.11 | | 0.30 | 0.55 |
| US | | | 0.33 | | | | | | 0.33 |

program for all current and new employees delivered by the Digital Agenda Authority. All municipal government employees in Serbia are going through a training process regardless of gender, age, job position, income, place, and partisanship. Another possible justification might be due to the mandatory daily routine use of the e-government portal, by municipal government employees, as a business tool for solving everyday operations. It could be concluded that, regardless of demographic characteristics, municipal government employees in Serbia are willing to use technology-enabled initiatives. Thus, the influence of demographic characteristics on intention to use/use is nonsignificant in fostering the success of e-government in Serbia. The lack of statistically significant links between DCs and e-government system intention to use/use is providing additional insights to researchers and practitioners that they cannot be considered as key drivers of e-government system success in developing countries, such as Serbia.

Serbia is still in the early stage of e-government development. Even though digital divides, regarding gender and residential place, do exist in Serbia, it is not statistically significant in the case of municipal government employees and their use of the e-government portal as they are all undergoing training programs (i.e., computer literacy). These findings suggest that in countries with a high degree of disparity in the use of the Internet (i.e., gender and residential place) the disparity is not the key influence on the success of the e-government system, if employee training is promptly implemented in the early stages of e-government development. In this way, the impact of a digital divide can be reduced, if not completely eliminated.

Another interesting finding is that IQ and SV do not directly affect US. One way to explain this is that employees are more experienced with information on e-government system and services provided by IS personnel, and IQ and SV are not critical for employees in determining whether to express satisfaction or not. Thus, respondents showed more concern about the SQ (e.g., user-friendly) than about IQ (e.g., reliable information) and SV (e.g., individual attention). Given that the target user group consists of a large number of municipal government employees from diverse districts throughout the Republic of Serbia who are using e-government portals developed by the central government, the findings of this study suggest that, to increase municipal government employee satisfaction with regard to the e-government system, it is not enough to simplify information and service. It is of vital importance for the central government (the Digital Agenda Authority of the Republic of Serbia) to develop e-government systems that provide high technical quality, and that are usable, user-friendly, and easy to use for municipal government employees, who, in turn, will provide proper services for citizens and businesses.

Our model underscored the importance of information, system and SV, intention to use/use, and US as a driving force in obtaining benefits such as higher performance of municipal government employees. In practice, the central government needs to measure the quality of municipalities' operations to assess their productivity and efficiency. This needs to be performed every 6 months [60]. By using our instrument, central government representatives could assess the overall strength as well as the effectiveness of their e-government portal. Such information allows decision makers of central government to carry out corrective actions in order to increase the effectiveness of GIS, develop strategies to address problems, provide better service for citizens and businesses, and create more efficient public administration. Governments can use this assessment model to be more responsive, citizen-centric, and socially inclusive.

## 6. Conclusion

This research paper examined the IS success of an e-government system on the individual level of analysis from the employees' perspective. A field survey was conducted in the Republic of Serbia to test the model. The empirical results verified the validity of the D&M success model in the context of e-government. Seven out of ten hypotheses were supported. Our analysis showed that all three quality dimensions (i.e., IQ, SQ, and SV) had a positive impact on the intention to use/use, and that only SQ had a significant effect on US. Intention to use/use had a positive and direct effect on US. Both intention to use/use and US are significant in predicting NBs.

The proposed model provided some additional supporting evidence that, compared with the other two quality dimensions, SQ is more vital for the development stage of an e-government system. This success also supported the contention that SQ drives better utilization of IT and can create many benefits for organizations. The additional set of determinants representing demographic characteristics was applied to updated D&M IS success model. They are included in the structural model as control variables. It has been shown that they do not confound the D&M research model.

With respect to the IS success model of DeLone and McLean [44], this research has its limitations as we did not examine the feedback that could relate NBs to intention to use/use and US. Attention to such feedback should be paid in future studies in order to investigate the interrelationships and to understand the IS success model more thoroughly.

## Appendix. Questionnaire items used in this study

System quality
SQ1: The e-government system is user-friendly
SQ2: The e-government system is easy to use
SQ3: Use of e-government system can provide desired service
Information quality
IQ1: The e-government system provides precise information
IQ2: The e-government system provides accurate information
IQ3: The e-government system provides sufficient information
IQ4: The e-government system provides reliable information
IQ5: Information content of the e-government system fits your needs
Service quality
SV1: The e-government system is always ready to help
SV2: Transactions within the e-government system are secure and protect privacy
SV3: The e-government system is available at all times
SV4: The e-government system gives you individual attention
SV5: The e-government system understands your specific needs
Intention to use/use
U1: You are dependent on the e-government system
U2: The frequency of use with the e-government system is high
U3: You are going to use the e-government system in the future
U4: You will often use the e-government system in the future
User satisfaction
US1: You are satisfied with the e-government system
US2: Services of the e-government system are of high quality
US3: The e-government system has met your expectations
Net benefits
US1: The e-government system makes my job easier
US2: The e-government system saves my time
US3: The e-government system is useful for my job.

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