

Automation of e-Gov Service Quality Measurement Process

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Abstract — In this paper we present development and usage of new instrument to assess quality of e-service provided by regional government's web site. We demonstrate the process of defining precise criteria for all measurements, as well as for all quality categories. Due to complexity of final scoring procedure proposed with new assessment instrument, an automate scoring tool that can be used is introduced.

I. INTRODUCTION

Service quality is not a new research question. There were many scholars and practitioners who were dealing with issues like customer satisfaction with the service provided in traditional face-to-face interaction or perception of quality based on delivered products, delivery terms or kindness of a salesperson. On the other hand, many have argued that the quality of e-service (service provided via web site) offers companies to a gain in some competitive ability ([1], [2]). In order to provide excellent service (better service quality) a company should investigate how e-service users perceive and assess service quality. The new possibilities of communication through web site motivate public authorities to seek for new ways of citizens' involvement. In this context, many European countries have organized public service delivery through one (or few) web portals or government web sites. In addition, there are new trends that introduce the need to develop public service at the regional, and local (city) levels [3].

In European countries, e-government development has been continuously monitored (annually). Indicators of e-government development and usage are being continuously reviewed in order to encompass all newly developed technologies. Although the number of e-government services increases, problems related to quality of public e-services still persist.

In this paper we present the study that we performed in order to measure e-government service quality. In our study we are focused on current state of public service provision in Croatia at NUTS III level (21 counties). Available instruments applied to assess e-service quality usually measure e-service users subjective perception of stated quality measurements. These instruments encompass specific number of items, where users (evaluators) mark their agreement or disagreement on n-point scale. In this manner, overall e-service quality ranking (score) depends on user's subjective evaluation.

Therefore, in this paper we demonstrate process of development of more objective measurement instrument

where we define precise criteria for quality ranking. Consequently, scoring procedure is quite complex due to different criteria for different measurement. Therefore, in addition we propose automation of scoring procedure. We organize our work in the following phases: (1) development of questionnaire (quality measurements), (2) criteria and scale definition, (3) data collection, and (4) automate calculation of e-service quality score.

II. E-GOVERNMENT SERVICE QUALITY

E-service quality usually refers to user's perception of the service provided through particular web site. Consequently, the term of e-service quality can be defined as overall users' judgment regarding excellence and quality of service offered via particular web site [4].

Further on, e-government service quality can be defined as „the extent to which services delivered via an e-government website assist citizens in completing their governmental transactions“ [5]. According to Ref [6] studies, that focus on e-service quality, can be categorized in the following three groups: (1) studies that investigate technical quality of web sites, (2) studies that investigate the dimensions that affect customer satisfaction, and (3) studies that investigate web site service quality.

Most often, this kind of studies are dealing with e-services like online shopping including financial transaction. On other hand, studies that are engaged in public service provided by government web sites are rare.

III. DEVELOPMENT OF QUALITY MEASUREMENTS

In order to measure e-service quality delivered by Croatian regional governments' web sites we defined a questionnaire. Our questionnaire was based on Web Assessment Index (WAI) originally proposed by Ref [7]. In our research WAI was modified to encompass all characteristics of e-government web sites as well as to improve the setup used in category weights.

A. Questionnaire Development

In order to compare the current usage of Internet by different organizations and evaluate the quality of web sites Web Assessment Index (WAI) was developed [7]. WAI covers four categories: (1) *accessibility*, (2) *speed*, (3) *navigability* and (4) *content*. Content category includes three factors: informational content, transactional content and communicational content. Information content refers to the types of information that were provided on web sites. Transaction content

refers to the possibility of placing orders or conducting online financial transaction. Communicational content includes assessment of how the company that owns web site can be contacted (by e-mail, telephone or address) and if there are possibilities to receive news by e-mail, free e-mail service, personalization capacity and entertainment elements.

Every category was weighted with specific number. In later study WAI was (see [8]) modified and used to assess the quality of municipality web sites (in Europe). WAI for municipality web sites was modified in content category. In this version of WAI content category included: (1) informational content, (2) e-government content and (3) communicational content. E-government content covers provision of e-government service online. Service provision was viewed through four levels of provision: forms downloading, performance of e-administration service and current state of administration process, online tax paying and citizen participation.

B. Items Modification

For purpose of our study we applied WAI that was used to assess quality of municipality web sites in Europe. Fig 1. presents our modification of original WAI instrument and precise criteria according to every measurement.

Applied original WAI [8] suggests two factors to measure *accessibility* group: (1) search engine presence and (2) link popularity. In Europe the most used search engines in the last two years [9] have been Google (with 94,58% of users), BING (2,03% of users) and Yahoo (1,19% of users). Using inspection method we have checked if the regional government web sites are indexed in those search engines. For link popularity testing we used Link Popularity Check Tool [10] that reports of a webpage's link popularity ratings and the present number of references.

Next category, *speed*, was originally measured by determining the size of the home page. Instead of the originally-proposed size measuring, we measured the loading time of the entire web site. To measure loading time for each county web site we used Free web site speed checker [11].

The third category, *navigability*, was originally measured by establishing the existence of (1) site map and (2) search function. Navigability on web site refers to how easy it is for an individual to get anywhere on the web site and at the same time to not get lost [12]. According to Ref [13] we defined seven new factors to assess this category: (1) every page has organization's name or logo, (2) every page contains hierarchical structure of a web site, (3) every page contains a link to home page, (4) there is a global/local navigation system on all pages, (5) there is a search function, (6) there is a usage guide for the web site, (7) the existence of a web site index.

The fourth category, *content quality*, was originally measured with a set of three factors: (1) informational factors, (2) e-government factors and (3) communicational factors.

From the *information* set of factors the following factors have been excluded: buses, museum and libraries information, city history, travel information, weather

forecast, statistical information, hospital, fire and emergency information, tourist information. The main reason for excluding some factors is that our research is relevant for regions and information for factors stated above is provided by local administrative units in Croatia.

We also made some modifications of WAI instrument regarding to *e-government factors*. A conceptual framework for benchmarking Digital Europe for the period 2011-15 (see [3]) sets out measurement indicators for developments in the information society. For the e-public service, the framework proposes following indicators: (1) online availability and interactivity of the 20 basic public services for citizens and enterprises; (2) % of individuals using the internet for interacting with public authorities by level of sophistication; and (3) % of enterprises using the internet for interacting with public authorities broken down by level of sophistication. Eurostat questionnaire [14] used for survey on ICT usage in households and by individuals 2011 includes two questions for *Use of e-Government*. The first question is "Did you interact with public authorities over the internet for private purposes in the last 12 months for the following activities?" Proposed answers to this question are: (a) Obtaining information from public authorities' web sites; (b) Downloading official forms; and (c) Sending filled in forms. Second question is referring to reasons of no interaction with public authorities over the internet. In our modified WAI we included investigation whether any of these three activities is provided on county web sites.

According to the proposition of Framework for benchmarking Digital Europe 2011-2015 [3] we included one more test connected to e-government factors. Namely, the Framework for benchmarking Digital Europe 2011-2015 proposes some new issues to monitor. Some of propositions are to measure the 20 basic public services at a (City-) Regional level. Twenty basic public services are defined, twelve for citizens and eight for businesses [15]. Basic public services for individuals are: (1) Income taxes: declaration, notification of assessment, (2) Job search services by labour offices, (3) Social security contributions (unemployment benefits, child allowances, medical costs or student grants), (4) Personal documents (passport and driver's license), (5) Car registration (new, used and imported cars), (6) Application for building permission, (7) Declaration to the police (e.g. in case of theft), (8) Public libraries (availability of catalogues, search tools), (9) Certificates (birth and marriage): request and delivery, (10) Enrolment in higher education/university, (11) Announcement of moving (change of address), (12) Health related services (interactive advice on the availability of services in different hospitals; appointments for hospitals). On the other hand, public services for businesses are: (1) Social contribution for employees, (2) Corporation tax: declaration, notification, (3) VAT: declaration, notification, (4) Registration of a new company, (5) Submission of data to statistical offices, (6) Customs declarations, (7) Environment-

related permits (incl. reporting), and (8) Public procurement.

Thereby, we have excluded measurement for the e-government factors that were used in the original WAI. We stated four new measurements: (1) the existence of information about e-services provided on regional governments' web sites; (2) possibility of downloading official forms; and (3) possibility of sending filled in forms and (4) number of public service provided for citizens and businesses. For the first three measurements we used YES/NO answers while for the fourth measurement we marked number and types of services provided online.

Study on User expectations of a life events approach for designing e-Government services (SMART 2009-0075) [16] provides vision of a future e-Government service. One of the observed approaches was the usage of Web 2.0. to provide e-Government service. This study provides some preliminary observations regarding benefits and costs of implementing "Gov 2.0". The final conclusion is that Gov 2.0 can make government services more responsive and effective and also can transform the economy and people's lives. Therefore we included one new measurement for *communicational factors* (instead of the original measurement called discussion forums), which we named Usage of web 2.0 tools. Some Web 2.0 tools that can be used for providing better e-Government

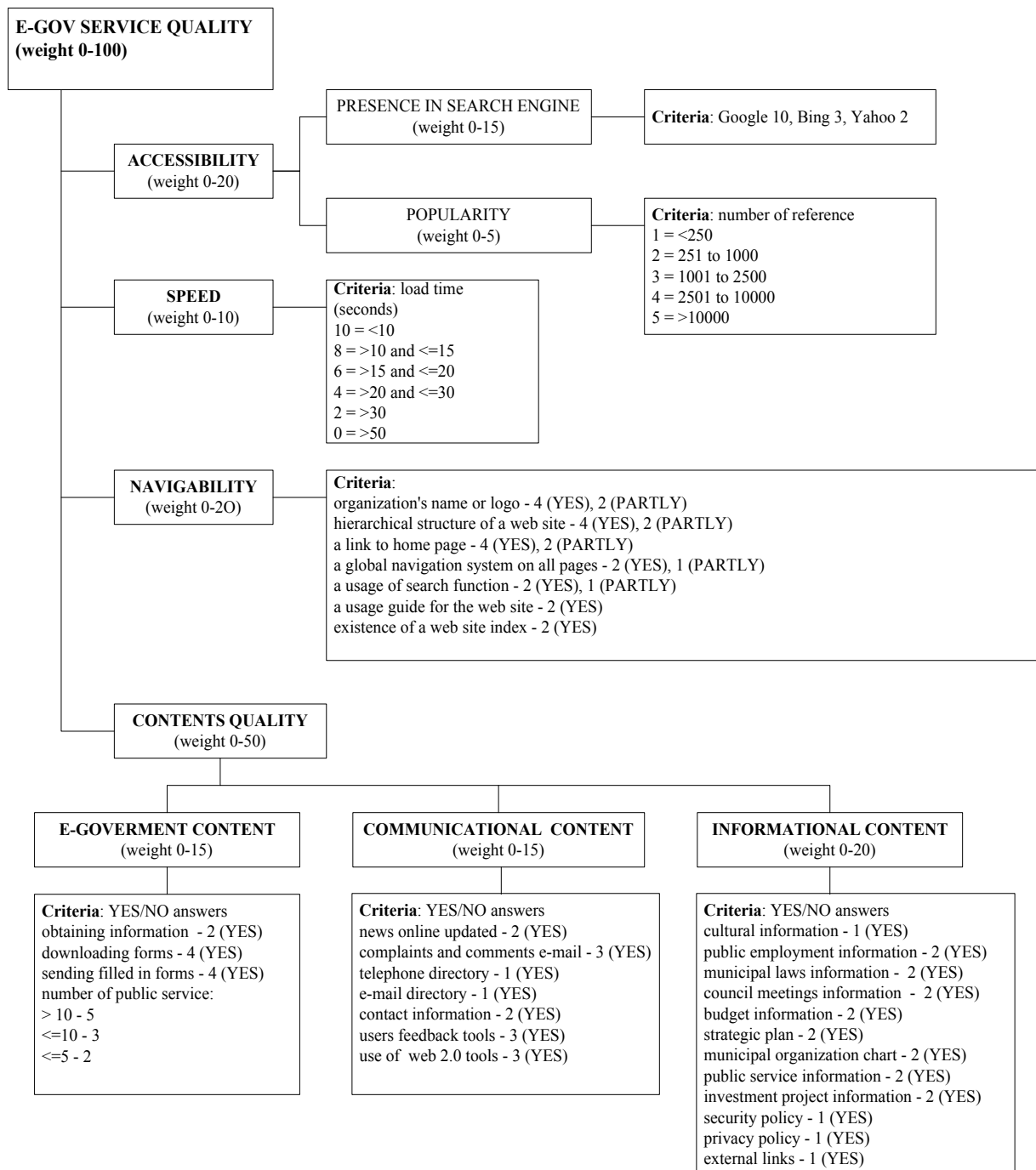


Figure 1. Modified WAI, categories and defined criteria

service are: (1) tools for information sharing: blogs, forums or YouTube, (2) tools for content co-creation and collaboration: e.g. wikis, (3) online social networking: e.g. Facebook, LinkedIn, MySpace, Twitter and (4) re-use of information across media.

IV. CRITERIA AND SCALE DEFINITION

Reference [17] introduced scale to assess the content and service quality of local government web site. Author used scale consisting of nine questions. Each question was evaluated using a 5-point Likert-type scale. Scale was defined with precise criteria. Similarly, we defined criteria for each e-government service quality category. Reference [7] originally proposed weights for every original WAI category. *Accessibility* has a weight 20, *Speed* has a weight 10, *Navigability* has a weight 20 and *Contents Quality* has a weight 50. We have included these weights and defined precise criteria for every measure in our modified WAI. Our criteria for every category and measurement indicator are presented in Fig. 1.

V. DATA COLLECTION

The process of data collection was performed using an online form where an evaluator checks the presence/non presence of defined measurement indicator. The evaluator used inspection method to mark answers for particular indicator. Possible answers in most of indicators were YES, NO and PARTLY. For some indicators results of performed tests needed to be entered (like link popularity testing, presence in search engine and loading time measurement). Based on the performed investigation of county web sites a data set was defined. This data set included the results obtained in 21 counties in Croatia.

VI. AUTOMATE CALCULATION OF E-GOVERNMENT SERVICE QUALITY

Data set that was the result of data collection was used to calculate e-government service quality score for every of 21 counties in Croatia. The process of calculation was automated using application programmed in C++ programming language. The application has read data set and based on defined criteria, returned results of scoring. For every county the application presents scoring on four categories (Accessibility, Speed, Navigability and Contents quality) as well as the total e-government service quality score.

A. Results of e-government service quality evaluation

Fig. 2. presents the results of e-service quality evaluation. Using instrument that we proposed (modified WAI) service quality provided by Croatian counties web sites are ranked according overall e-service quality. All web sites provide service that is ranked over 50. Minimum weight (that web site was ranked) is 54, and maximum is 84. Four web sites have a total score between 50 and 60, and seven web sites have total score between 61 and 70, and eight web sites scored between 71 and 80. Only two web sites have total score over 80 (weight 82 and 84). In addition, Fig 2. presents the results according particular service quality category. Web sites provided service scored the best in speed category (all web sites scored with maximum 10 weights). Further on, in category Accessibility web sites scored relative high

(minimum weight was 18 of maximum 20). In category Navigability web sites varied the most. Minimum weight is 6, and maximum is 16 (this category weight is 20). Category Content quality could score with maximum 50 weights. However, according to the study results maximum score in this category is 39.

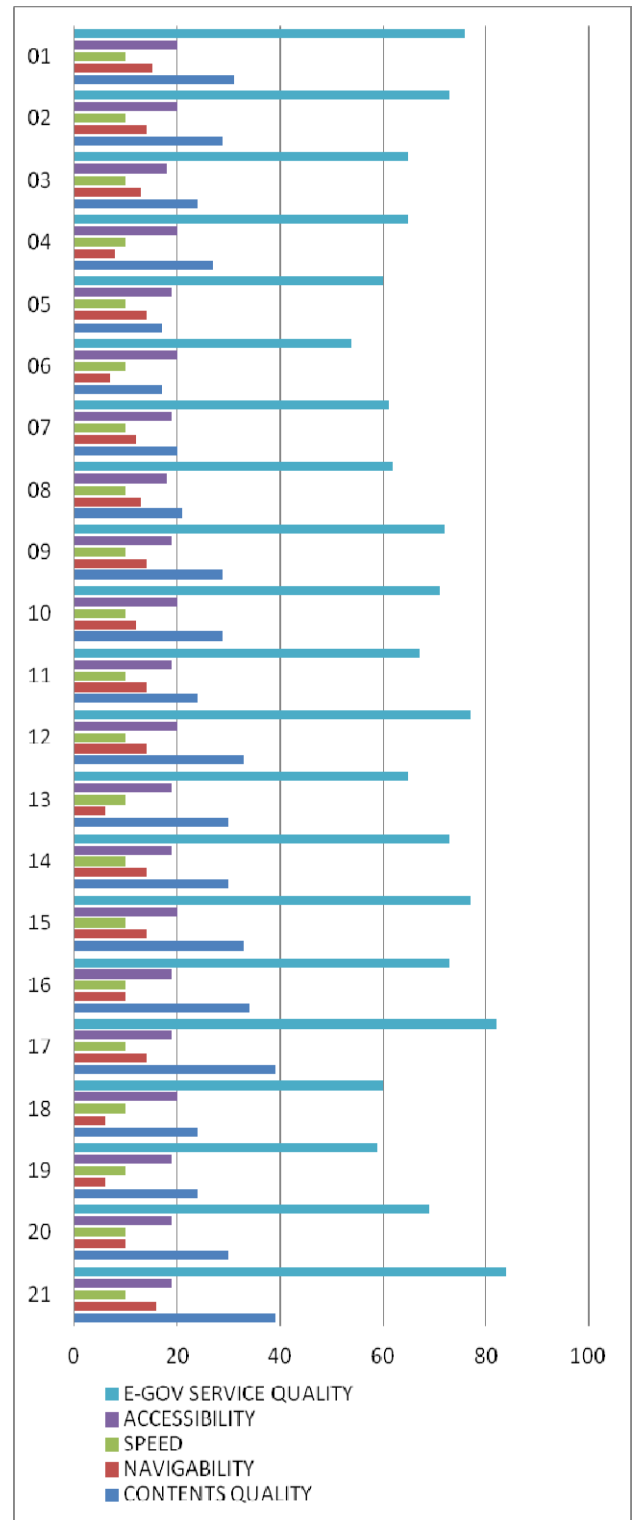


Figure 2. Results of e-government service quality evaluation

VII. CONCLUSION

Our main goal was to evaluate service quality delivered via regional governments' web sites in Croatia. Currently, the provision of public services in Croatia is organized via one central web portal. However, the next step in e-government development in Europe introduces the need for citizens' involvement at local and regional level. Accordingly, we demonstrate the evaluation of service provided on regional government web sites in Croatia. The evaluation instrument introduced in this paper was used to evaluate web service quality provided via Croatian counties web sites, as well as to compare those evaluation results.

Furthermore, we stated one condition that the instrument used in this evaluation process should fulfill. The instrument should be independent of subjectivity of evaluator (regarding his perception of particular quality measurements). Usually, evaluators' answers are influenced by his previous interaction with particular web site, his opinions, current mode and etc. Therefore, in our instrument, indicators that can objectively be measured are used.

The study findings suggest that although the public authorities at the county level in Croatia recognize the importance of web presence, the whole process of providing service online is at the beginning phase. There are only 13 counties that provide information about the public services. The number of counties that enable downloading of official forms is even smaller, only 7. The service of sending filled in forms isn't supported.

There are several important reasons that justify study described in this paper: (1) the e-government service quality evaluation instrument is modified to eliminate the subjectivity of an evaluator; (2) the evaluation instrument is modified to encompass the characteristics of regional governance in Croatia; (3) the evaluation instrument is used to assess public service provision (this kind of survey wasn't performed yet in Croatia), (4) the investigation results enable comparison of provided service quality.

REFERENCES

- [1] A. Parasuraman, V. Zeithaml, and A. Malhotra, "E-S-QUAL, A multiple-item scale for assessing electronic service quality", *Journal of Service Research*, Vol. 7, No. 3, February 2005., pp. 213-233.
- [2] J. Santos, "E-service quality: a model of virtual service quality dimensions", *Managing Service Quality*, Vol. 13, No. 3, 2003, pp. 233-246.
- [3] European Commission, Information society and media, "i2010 high level group benchmarking Digital Europe 2011-2015 a conceptual framework", ISSUE NO:27, October, 2009, URL: http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/benchmarking_digital_europe_2011-2015.pdf, accessed 19.11.2011.
- [4] A.C.R. Van Riel, V. Liljander, and P. Jurriens, "Exploring consumer evaluations of e-services: a portal site", *International Journal of Service Industry Management*, Vol. 12, No. 4, 2001, pp. 359-377.
- [5] C-W. Tan, I. Benbasat, and R. Cenfetelli, "Understanding the antecedents and consequences of e-Government service quality: transactional frequency as a moderator of citizens' quality perceptions" in 18th European Conference on Information Systems, T. Alexander, M. Turpin, and JP. van Deventer; Eds, pp. 1558-1570, Department of Informatics, Pretoria, South Africa.
- [6] S. Akinci, E. Atilgan-Inan, and S. Aksoy, "Re-assessment of E-S-Qual and E-RecS-Qual in a pure service setting", *Journal of Business research*, Vol 63, 2010, pp. 232-40
- [7] F.J. Miranda Gonzales and T.M. Banegil Palacios, "Quantitative evaluation of commercial web sites: an empirical study of Spanish firms", *International Journal of Information Management* Vol 24, 2004, pp. 313-328.
- [8] F.J. Miranda, R. Sanguino, and T.M. Banegil, "Quantitative assessment of European municipal web sites – development and use of an evaluation tool", *Internet Research*, Vol. 19, No. 4, 2009. pp 425-441
- [9] StatCounter Global Stats, "Top 5 search engines in Europe form Sept 2009 to Sept 2011", URL: http://gs.statcounter.com/#search_engine-eu-monthly-200909-201109-bar, accessed 19.10.2011.
- [10] ***, "Link popularity check tool", URL: <http://www.seocentro.com/tools/search-engines/link-popularity.html>, accessed 19.10.2011.
- [11] Self SEO, "Free web site speed checker", URL: http://www.selfseo.com/website_speed_test.php, accessed 19.10.2011.
- [12] L. Rosenfeld and P. Morville, *Information Architecture for the World Wide Web*, 3rd Edition, O'Reilly, 2006, pp. 115.
- [13] R. Mekovec, G. Bubaš, and N. Vrček, "A method for improvement of objectivity of e-service quality evaluation", *Journal of information and organizational sciences*, Faculty of Information and Informatics, Varaždin, 2007, pp 19-20.
- [14] ***, "Community survey on ICT usage in households and by individuals 2011, Eurostat Model Questionnaire (version 3.1)", URL: <http://www.dst.dk/extranet/varedekl/202.pdf>, accessed 20.10.2011.
- [15] ***, "eGovernment indicators for benchmarking eEurope", URL: http://ec.europa.eu/information_society/eeurope/2002/action_plan/pdf/egovindicators.pdf, accessed 20.10.2011.
- [16] Deloitte, "User expectations of a life events approach for designing e-Government services Final Report, Prepared for the European Commission", DG Information Society and Media, December 3, 2010, URL: http://ec.europa.eu/information_society/activities/egovernment/docs/studies/smart_2009_0075/life_events-final_reports_final.pdf, accessed 19.10.2011.
- [17] G. Kuk, "The digital divide and the quality of electronic service delivery in local government in the United Kingdom", *Government Information Quarterly*, Vol 20, 2003, pp. 353-363.