



A proposed model for evaluating Jordanian ministries websites using DEA

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Abstract

The development of E-government improves social sustainability by enhancing the provision of public services to the citizens [41]. This refers to the importance of e-government portals in strengthening public administration reputation, and hence the efficiency of the role of governments. Commonly, many kinds of local government affairs need to manage their efficiency and advances of e-government. Thus, the evaluation of e-government services leads to reduce the expected management cost and reflect the current progress of government administration (performance) of e-government portals depending on some scientific and e-government evaluation methods. Accordingly, the effectiveness and efficiency of Jordanian e-government ministries portals at local level are focused in this research to study the organizational success dimensions using data envelopment analysis. Data Envelopment Analysis (DEA) is a non-parametric method that can be converted into a linear programming problem [45]. Though, a maximum amount of outputs that can be generated from a specific level of input can be measured through efficiency.

Keywords — *data mining, classification, DEA, BCC, CCR*

I. INTRODUCTION

Electronic government is a new form of effective government innovation that has many promising applications as a natural reaction to the rapid development of information science and technology [41]. The development of E-government associated with information systems and technologies improve social



sustainability by enhancing the provision of public services to the citizens [42]. Conversely, Information systems, e.g. e-government websites, are very complex and contain a huge amount of data. Therefore, the main question triggered here is how to turn these large data into manageable units that can be easily controlled and evaluated with respect to the efficiency of e-government portals.

Data Envelopment Analysis (DEA), a non-parametric method that works as a linear programming problem (Farrell, 1957), is one of the latest approaches used to measure efficiency. DEA is a popular quantitative approach, frequently used to evaluate the efficiency of comparable Decision Making Units (DMUs) based on some inputs and outputs [47]. A maximum amount of outputs that can be generated from a specific level of input can be measured through efficiency [43]. DEA is carried out by an identification of the key factors and dimensions [45]. For this study, public services provided on e-government portals have several management dimensions that can be converted into DMUs and hence analyzed to conclude the efficiency. The key management's dimensions of the public service portals are:

- Information management: includes publicly shared information such as announcements, instructions, and contact information.
- System management: includes the activeness and interactivity of the portal such as number of visitors, up to date information, and downloadable forms.
- Service management: includes publicly spread governmental services on the portal such as the number of online services, type of service (partial or totally completed online), and online payment.
- Privacy management: includes the capacity of reserving private information of citizens hidden from the public access such as requiring credentials.
- Security management: includes the capacity of securing online transactions such as secure connection and secure payment.

Many kinds of local government affairs need to manage especially the efficiency and the advance of e-government [42]. The evaluation of e-government services leads to reduce the expected management cost and reflect the current progress of government administration (performance) of e-government portals depending on some scientific and e-government evaluation methods [46]. E-government can produce poor performance and low efficiency if the online services are not in the correct progress and development,

which require evaluation methods to reveal their efficiency. Furthermore, the problematic aspect and performance of e-government portals cannot be easily measured through users' surveys manually.

The efficiency measure is one of the technical measures of public organizations by maximizing outputs and minimizing inputs [44]. In addition, the efficiency is one of the present methods and approaches to evaluate public services. Particularly, the accuracy of efficiency measure increases as the number of measured inputs and outputs increases. In other words, if the number of outputs increases in DEA, then the value of efficiency close to 100%. Technical efficiency of public organizations can be measured by co-exist measure taken impact on the efficiency outcome relying on different assumptions. Moreover, the increased efficiency accuracy as well as the measurements of the efficiency effects lead to expressively higher estimated efficiency.

The contribution of this research concentrates on the performance of e-government ministries portals given their significance in integrating public service provisioning into user access interfaces. The effectiveness and efficiency of Jordanian e-government ministries portals at local level are focused in this research to study the organizational success dimensions. This study devotes an assessment tool for the public local government administration and decision makers of the Jordanian government ministries to allow them to comply with accountability requirements and to determine the impact of the progress of e-services (online services and access to content and resources provided via website) on the user satisfaction and needs.

This research aims to evaluate e-government performance of a set of provincial government portals in Jordan using the method of DEA. The current study devotes an evaluation of the government performance of a set of official provincial websites in Jordan to explore their efficiency improvement and development using DEA. Further, it examines the effectiveness of e-government portals in the local administration under qualitative and quantitative approaches. Mainly, the key objectives of this study are:

- To explore the improvement of the development and progress of e-government in Jordan especially the ministries portals.
- To convert several dimensions of management for public services into inputs and output to be fit into DMUs that formulates ministries' websites in Jordan.
- To evaluate e-government ministries performance of a set of provincial government portals in Jordan using the method of DEA with the aid of association rules mining.

II. LITRETURE REVIEW

The evaluation of e-government portals performance has attracted the attention of searches in many disciplines such as banking and economy sector [1], [2], [3], [4], [5], [6], and [7]; healthcare sector [8], [9], [10], [11], [12], and [13]; sustainability affairs [14], [15], and [16]; transport sector [17], [18], [19], and [20]; higher education institutions [21], [22], [23], [24], [25], and [26]; and other domains [27], [28], [29], [30], [31], [32], [33], [34], [35], and [36]. The most related works to this study are those researches conducted for e-government portals such as [37], [38], [39], and [40]. A brief review of a number of related research with respect to the employment of DEA in evaluating e-government portals is shown below. We divide this section into two subsections: studies that have used only DEA without any contribution of data mining, and studies that have used DEA combined with one of the techniques of data mining like out study.

A. *DEA-based studies*

In the paper of [37], DEA method was used to evaluate the performance of 31 e-governmental websites. The results revealed that the investigated websites were inefficient. The efficiency of e-government websites relies on the different districts such as individual provinces. The paper focused on the issues of the evaluation of government performance to improve the efficiency of their websites based on DEA efficiency measurement.

The author [38] has presented a comprehensive approach using DEA to build a better understanding of the role of governments in using inputs for improved quality of e-government portals in Mexico. In the empirical analysis, these portals were evaluated based on an examination of certain inputs and outputs according to output oriented variable return of scale (VRS). The inputs of DEA were translated into organizational and contextual factors such as operation costs, capacity, and demand, while the outputs of DEA were translated into information, interaction, transaction, integration, and participating. The results indicated that the investigated e-government portals have few resources and capabilities that enable them to be in the first places in terms of quality and efficiency. Moreover, the performance of the e-government portals in Mexico needs to adjust their resources and capabilities.

An examination of the efficiency of 41 local city administration of e-government was provided in [39] to make an evaluation method based on DEA. There were 8 inputs and 5 outputs for each city considered. These include information and communication technologies, information security, availability of e-services,

human potential, and information documentation base. Both CCR and BCC models were used to analyse the dataset. However, the author recommended using BCC model since it takes into account the changes in inputs to cause a linear increase of output. The results concluded that there was a much neediness to enhance the city administration units that have resulted in inefficiency.

In the work of [40], a dataset collected about the local government in Flanders was considered to evaluate the efficiency of local governments using three methods (mainly DEA method). The results have endorsed the importance of methodological instruments in analysing the performance of local governments through employing a set of parametric and non-parametric approaches to estimate the level of efficiency. In conclusion, there is an open issue to improve the efficiency of Flemish municipalities.

Using DEA, the study of [50] included an evaluation of management paradigm of a set of BRICS countries including Brazil, Russia, India, China, and South Africa. The authors used MaxDea Basic version 6.4 software to find the relative efficiency scores for BRICS countries. The use of DEA can fill gap in researches that investigated the public services for socio economic development. Negative values were transformed to positive ones by adding the smallest positive number. Therefore, they used CCR model output oriented approach.

A similar study to the above on is [51] that have used DEA and cluster analysis for 53 African countries. Using DEA, the study was accomplished to compare 53 African countries based on clustering analysis to partition these countries into two or three scoring average efficiency based on multivariate attributes. Further, MaxDea Basic version 6.4 software was used to find the relative efficiency. CCR model with input oriented approach was applied in the study. The results have confirmed a positive transformation of the investigated countries efficiently.

B. DEA and data mining-based studies

The paper of [48] presented a DEA model combined with Bootstrapping to evaluate the efficiency of a data mining algorithm called classification and regression tree. Two-step process of performance productivity analysis was applied; first using DEA model, and second using classification and regression tree. DEA was applied using input oriented technology to reduce inputs based on single and multiple objective linear programming. A set of useful rules were generated to help policy makers in exploring the

main reasons behind the productivity and progress of DMUs and thus to improve the decision-making process.

The study of [49] has discussed the use of DEA to classify multidimensional data associated with environmental assessment. The proposed method was perceived as a data mining methodology to classify groups based on the information of environmental assessment. DEA separates outputs into desirable and undesirable outputs according to the production activities. Thus, the combination between operational performance and environmental performance was considered as a unified treatment. Return to scale RTS and damages to scale DTS were measured to provide a new type of classification. The results showed that the proposed model can only work on dataset that contains only positive observation which might results in unreliable outcomes of RTS and DTS.

III. DATA ENVELOPMENT ANALYSIS (DEA)

The initial stage in the development of DEA model is to select the main crucial inputs and outputs. The selection of inputs and outputs should be subjectively determined as a basic constraint on the selection of relevant variables for decision making analysis [45]. A set of inputs and outputs should be chosen for analysis purpose regarding the measurements units and characteristics such as information security, availability of e-services, privacy management, etc. [47].

DEA is used to determine the efficiency of a set of units called DMUs per some characteristics (inputs) and outcomes (outputs). Each DMU is belonged to the most beneficial weights (maximizing the result of the output and input for each DMU) [43]. The DMUs in this study are belonged to the ministries' websites, precisely 25 ministries portals are on the web in Jordan. The limited amount of data that can be collected from e-government portals is taken into consideration in the evaluation analysis carried out by efficiency measure [43]. If we have n DMUs (25 ministries websites in our case), each DMU has m inputs and s outputs that will be defined in the next section.

A. *Input and outputs*

The main aim of e-services provided by government websites is to provide a start to finish transaction to people such as providing necessary information, adapting payment method, and delivering government service to people[40]. Input measures are the resources and efforts of e-government such as time, costs, and staff [45]. The inputs of efficiency measure regarding e-government portals can be *the number of links per*

page, the number of publication downloads, the number of agencies participating, broken links, and server downtime[42]. Some beneficial inputs of government websites e.g. forms, faces specified issues such as prefilled content, validation of fields, tracking customers' questions and requests, help information, meaningful error messages, multi-page forms, provision of feedback, and no timeout [41, 43, 47]. Thus, standard template, regular content management, usability testing result, accessibility of services, accuracy of information provided, ease of use, usefulness, and adoption rates within specified user groups can be also converted into measurable values [50].

Output measures are the instant actions subsequent from e-government efforts such as money amounts processed through each site, number of transactions completed, level of citizen satisfaction, cost savings from e-government, trust in government by citizens, and staff time savings [44]. The outputs of efficiency can be *the percentage of site visitors over a time (including Visits, unique visitors, and new visits), the number of users return to the site (reputation), the number of visits for every page on a site, page view trends, website rank on search results, path analysis, and number of hits* [51]. The relevant output metrics can be also the number of times people click on the link on an e-government website pages, the amount of time users spend on a site, as well as the number of screens downloaded or printed from a website [43] [49] [53].

B. Efficiency measure

Efficiency is the unit cost ratio that measures the relation between the amount of output and the amount of input of services [54]. Thus, efficiency measure also considers a cost per transaction and data errors tracked from electronic services delivery compared to the traditional ones [43]. Efficiency measure in this type of research finds the capacity of a ministry to utilize its real estate on the website by measuring how much people are engaged in the ministry's website [46]. The aim of using DEA method powered by efficiency measure is to support decision systems to manage the relative performance of e-government ministries portals in Jordan.

The assessment of the efficiency of e-government portals enables us to apply restrictions on certain inputs or outputs weights to determine the more and less important input and outputs to the efficiency[46]. This approach is possible by placing the constraints on the weights of the input and outputs that are less important in DEA for more realistic results. DEA can be combined with analytical hierarchy process to

decide different weights on input and output that could result in a new dimension of analysis[47]. The relative efficiency is between 0 and 1 [43].

$$Efficiency = \frac{\sum \text{weighted outputs}}{\sum \text{weighted inputs}} \quad (1)$$

$$\max \frac{\sum_{k=1}^s V_k Y_{kp}}{\sum_{j=1}^m u_j x_{jp}} \quad (2)$$

$$\text{stated that } \frac{\sum_{k=1}^s V_k Y_{kp}}{\sum_{j=1}^m u_j x_{jp}} \leq 1 \quad \forall i \quad v_k, u_j \geq 0 \quad \forall k, j,$$

where :

k= 1 to s outputs,

j= 1 to m inputs,

i= 1 to n,

y_{ki}= amount of output k produced by DMU I,

x_{ij}=amount of input j utilized by DMU I,

v_k= weight given to output k,

u_j= weight given to input j.

The main factors that affect e-government efficiency measurements are governance structure, privacy issues, content management, authentication policies, payment policies, information architecture, website accessibility, and maintenance [42]. Other factors are reduced process time, improved service, reduced administrative weight, reduced costs, increased revenues, increased process efficiency, and improved organizational image [41].

C. DEA models (BCC and CCR)

DEA models can be input oriented or output oriented. If we consider input oriented, we would be concerned in reducing inputs and minimizing inputs costs but keeping output at present level (or maximized) at the same time. Conversely, output oriented model is concerned with increasing outputs but to

keep input at the present level and amount. The main similarity between input oriented and output oriented is the identification of the same efficient frontier [45].

Two basic models of DEA are BCC and CCR, where (Banker–Charnes–Cooper) BCC (also called variable returns to scale VRS) considers that the efficiency of production is not dependent to the proportionality relationship between inputs and outputs. Thus, BCC model assumes that the efficiency of DMU depends on the good use of inputs regardless higher scales that can operate. On the other hand, (Charnes–Cooper–Rhodes) CCR (also called constant returns to scale CRS) assumes the use of constant returns to scale by maximizing the ration between the outputs and inputs but not exceeding 1. When the DMU presents the best ratio of outputs in relation to inputs, the efficiency will be guaranteed in CCR model. Both BCC and CCR can be input oriented or output oriented. The choice of orientation should be taken considering the conditions and the goals of the system [53] [55].

D. DEA computational tools

There are few DEA software packages that are designed for free and open source use. For example, DEA solver, MaxDEA, DEAP, and Fronier analyst totally were developed by commercial companies [54]. MaxDEA Basic version 6.13 [52] which was developed by Beijing Real World Research and Consultation Company Limited. It is an easy to use software since it does not need any installation and comes in a folder with a familiar friendly interface. Using this software, we can apply multiple DEA models to be run at the same time, while the results shown as a spreadsheet like Excel can be export to any file such as Microsoft Excel. Two types of this software are available: basic (limited number of DEA models, free download) and professional (premium) [54].

IV. METHOLODGY

The evaluation of e-government portals performance has attracted the attention of searches in many disciplines. Subsequently, both qualitative and quantitative methods were used by many past e-government researchers to make a theoretical and practical assessment [42]. Currently, two levels of analysis can be performed to analyze web usage: statistical measures and data mining techniques (web usage mining). Web usage mining can be used to discover patterns such as frequent items, sequential patterns, cluster of related pages, association rules from large datasets over history of web access logs and transaction logs.

Performance of websites may drop with the service delay such as missed notification, connectivity problems, slow page load, and content errors.

Evaluating websites requires the use of systematic approaches to evaluate the effectiveness of web based information systems such as e-government portals on an ongoing basis. This process helps to facilitate organizational planning, tracking websites, and altering information and services provided on portals based on the objectives and policies on an ongoing basis [41]. Many prior works have involved many criteria in evaluating e-government portals such as web metrics, interface design, usability, comparison with benchmarks, fit with theoretical models, website strategy, hypertext structure, information and service quality.

Two categories of data mining methods are existed; supervised and unsupervised learning [49]. In this research, we are focused on supervised learning to compute the class value which is the efficiency of each ministry's website. After that, the main role of data mining will be the generation of association rules based on training dataset. As shown in Figure 2 shows our proposed model that will be followed to apply DEA in evaluating the performance and efficiency of e-government ministries portals in Jordan.

Figure 2 shows the flow chart as an approach of this research. First, data collection takes place via a set of tools that collect intended attributes of the stated websites such as similar web, broken link check, and small SEO tools. Second, after getting a training data set, the role of DEA is to divide the attributes into inputs and outputs, and then to compute the efficiency for each DMU. Third, the next step dedicates in applying data mining techniques, more specifically classification techniques. We will use one or more of the following supervised learning algorithms: rule induction, k-nearest neighbor, decision tree, and association rules. After evaluating the results obtaining by classification methods, we can use them to another dataset based on an accepted accuracy and confidence.

In this project, we will first use CCR model and then BCC model, both input oriented. This refers to the ability of reducing resources required to obtain the efficiency. In this research, we will use MaxDEA Basic version 6.13. Some automatic web tools of general websites are provided in this section that can generate some statistics about the services and information on the e-government portals. The tools are: web tool hub, page scoring, pingdom, similar web, web wait, and w3c link checker. These tools and their description are summarized in table 1.

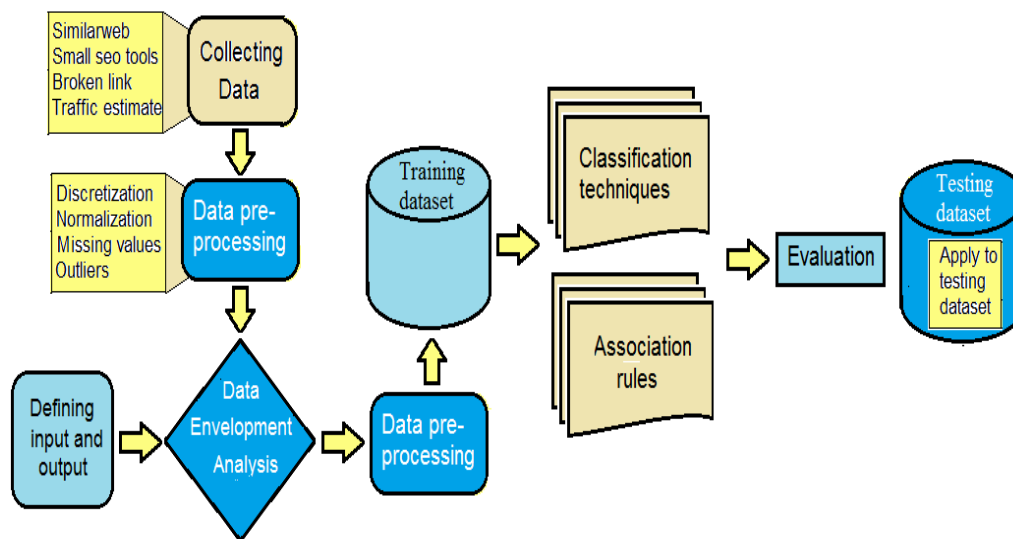


Figure 1: flow chart

Table 1: a set of popular tools used for websites analysis

No.	URL of the tool	Name of the tool	Brief description of the main purpose to use a tool
1.	http://www.webtoolhub.com/t-n561353-website-speedtest.aspx	WebToolHub	WebToolHub checks how fast web pages load [57]. Load time is retrieved using this tool.
2.	http://pagescoring.com/website-speedtest/	PageScoring	Page Scoring is an online tool for checking the website performance [57]. Total pages and Page size are retrieved using this tool.

3.	https://www.similarweb.com/	Similar web	Similar web is an integrated web tool that is used to statistically find web pages visitors. Country rank, total visits, visit duration, and pages per visit are retrieved using this tool.
4.	https://www.webwait.com/	WebWait	Webwait tests the speed of website connection. [56]. Up to date and social interest are retrieved using this tool.
5.	http://validator.w3.org/checklink	W3C link checker	To show Broken link using W3C link checker and online broken link checker [57]. Back Links, internal links, and not followed links are retrieved using this tool.

V. ANALYSIS

The data collected from the formal ministries' websites of 25 e-government portals to assess the input and output of each website separately. Table 2 shows the investigated ministries. Websites and their associated URLs.

A. Preprocessing 1

Some values were collected cannot directly fit into DEA; they need transformation to other data types or formats. For example, avg. visit duration could be converted either to time format or to float number. Therefore, this preprocessing step is much needed to obtain more accurate and dominated values. There are only 9 ministries' websites are efficient according to the above table based on efficiency measurement scores.

B. Preprocessing 2

Another pre-processing step is needed to be inserted before introducing final data to one of the classification and association rules techniques. In other words, we need to discretize, categorize, and/or normalize input and output data to be suitable to any classifier and flexible enough for association at the



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same time. First, input attributes including counted data such as Total pages, Back Links, Internal links, Not-follows, broken links, Total visits, and Social interest can be discretized or transformed to categorical attributes. Other attributes such as Page size, Load time, Up to data, and Country rank might be normalized and generalized using different set of values between 0 and 1. Lastly but not least, Avg. visit duration is a time data type and we can round it to approximate number in percentage.

Table 2: the investigated ministries' websites and their associated URLs

Ministry Name in	Code	URL
The Ministry of Public Works and Housing	MPWH	http://www.mpwh.gov.jo/
The Ministry of Education	MOE	http://www.moe.gov.jo/
The Ministry of Higher Education and Scientific Research	MOHE	http://www.mohe.gov.jo/
Ministry of Transportation	MOT	http://www.mot.gov.jo/
Ministry of Justice	MOJ	http://www.moj.gov.jo/
The Ministry of Planning and International Cooperation	MOP	http://www.mop.gov.jo/
The Ministry of Environment	MOENV	http://www.moenv.gov.jo/
The Ministry of Industry and Trade and Supply	MIT	http://www.mit.gov.jo/
The Ministry of Awqaf and Islamic Affairs and Holy Places	AWQAF	http://www.awqaf.gov.jo/
Ministry of Municipal Affairs	MMA	http://www.mma.gov.jo/
Ministry of Interior Affairs	MOI	http://www.moi.gov.jo/
The Ministry of Tourism and Antiquities	MOTA	http://www.mota.gov.jo/
The Ministry of Communications and Information Technology	MOICT	http://www.moict.gov.jo/
Ministry Of Agriculture	MOA	http://www.moa.gov.jo/
The Ministry of Energy and Mineral Resources	MEMR	http://www.memr.gov.jo/
Ministry of Health	MOH	http://www.moh.gov.jo/
Ministry of Social Development	MOSD	http://www.mosd.gov.jo/
Ministry of Culture	MOC	http://culture.gov.jo/

The Ministry of Water and Irrigation	MWI	http://www.mwi.gov.jo/
Ministry of Labor	MOL	http://mol.gov.jo/
Ministry of Foreign Affairs and Expatriates Affairs	MFA	http://www.mfa.gov.jo/
Ministry of Political and Parliamentary Affairs	MOPPA	http://www.moppa.gov.jo/
Ministry of Youth	MOY	http://www.moy.gov.jo/
Ministry of Finance	MOF	http://www.mof.gov.jo/
The Ministry of Public Sector Development	MOPSD	http://www.mopsd.gov.jo/

Table 3 shows input attributes and Table 4 shows the output attributes. Input attributes are Total pages, Back Links, Internal links, Not-follows, broken links, Total visits, and Social interest. Output attributes are Country rank vs. visit duration, Pages per visit, and Social interest.

Table 3: inputs attributes

Code	Total pages	Page size (KB)	Load time (s)	Back Links	Inter- nal links	Not fo- llows	Bro- ken links	Up-to date
MPW H	166	110.13	9.3	343	49	6	181	2014
MOE	3000	228.69	3.5	8,108	55	260	120	2010
MOHE	109	68.65	4.3	825	84	69	2	2015
MOT	182	95.71	6.2	271	91	24	3	2014
MOJ	221	139.97	11.7	501	85	20	18	2015
MOP	139	57.58	13.2	583	181	27	23	2014
MOE- NV	440	119.93	10	387	63	10	6	2013
MIT	167	111.36	8.2	2,759	366	140	7	2015
AWQ	92	79.73	8.2	501	63	21	11	2015

AF								
MMA	24	33.61	4.9	59	24	12	6	2008
MOI	262	105.91	4.5	951	97	54	1	2015
MOTA	270	46.03	38.13	745	94	60	8	2014
MOIC T	188	48.76	5.9	562	147	17	3	2016
MOA	2017	152.96	5.7	574	207	18	67	2015
MEM R	142	99.81	10	494	128	131	3	2015
MOH	1392	1.29	0.8	587	169	24	857	2013
MOSD	1040	32.37	8	772	100	48	12	2005
MOC	3000	79.13	3.1	1,371	133	43	50	2014
MWI	370	26.43	3.4	625	122	26	34	2015
MOL	108	100.6	5.3	601	118	31	3	2016
MFA	35	97.31	7.6	1,604	258	79	12	2011
MOPP A	130	77.33	5.5	21	6	0	3	2015
MOY	1028	154.38	25.4	479	187	0	7	2016
MOF	124	0.15	0.5	2,077	184	32	0	2011
MOPS D	92	226.24	8.9	106	19	1	3	2014

Table 4: outputs attributes

Code	Country rank	Total visits (k)	Avg. visit duration (m)	Pages per visit	Social interest	BCC score	CCR score	Efficiency
MPWH	10,698	1.0	2:26	4.733	25	0.340143	0.340143	Not efficient
MOE	20	266.5	12:55	18.196	13,690	1	1	Efficient
MOHE	1,201	19.3	02:06	2.205	6,667	0.184875	0.184875	Not efficient
MOT	9,875	5.1	00:25	1.670	731	0.155403	0.155403	Not efficient
MOJ	299	36.7	07:33	6.094	9,250	0.721552	0.721552	Not efficient
MOP	6,920	2.9	04:22	3.726	17,884	0.397468	0.397468	Not efficient
MOENV	129,225	3.4	01:08	2.284	2,276	1	1	Efficient
MIT	848	13.5	03:51	6.634	9,782	0.241779	0.241779	Not efficient
AWQAF	9,558	4.5	00:55	2.121	10,803	0.111184	0.111184	Not efficient
MMA	6,357	2.3	01:12	2.475	75	0.232611	0.232611	Not efficient
MOI	1,494	11.6	15:23	9.8	10	1	1	Efficient
MOTA	6,510	9.8	09:08	2.579	96	1	1	Efficient
MOICT	4,959	4.7	01:05	1.924	9,710	0.165684	0.165684	Not efficient

MOA	3,392	10.7	10:07	2,114	42	1	1	Efficient
MEMR	5,315	3.2	05:07	3,495	134,231	0.36555	0.36555	Not efficient
MOH	1,111	18.4	03:09	3,430	25	0.973333	0.973333	Not efficient
MOSD	3,328	11.5	01:13	2,604	5,759	0.106177	0.106177	Not efficient
MOC	2,406	14.1	01:44	1,908	4,889	0.198408	0.198408	Not efficient
MWI	5,983	5.1	01:42	2,315	33	0.249295	0.249295	Not efficient
MOL	1,982	18.7	02:05	2,396	36,411	0.204326	0.204326	Not efficient
MFA	5,606	4.0	03:10	3,278	16,040	0.242661	0.242661	Not efficient
MOPPA	24,951	496	00:40	1,886	3,569	1	1	Efficient
MOY	9,730	916	03:05	3,892	57,982	1	1	Efficient
MOF	2,444	7.2	03:24	3,779	116	1	1	Efficient
MOPSD	6,654	3.1	07:31	2,526	318	1	1	Efficient

VI. RESULTS AND DISCUSSION

A. Experiment 1: Association rules

Data mining association rules are useful extracted patterns from huge databases that usually indicate of the presences of a set of item sets in market transactions [58].

According to Apriori algorithm, mminimum support is 0.85 (21 instances);minimum metric (confidence)is 0.9; and number of cycles performed is 3. Consequently, the generated sets of large item sets contain the following:

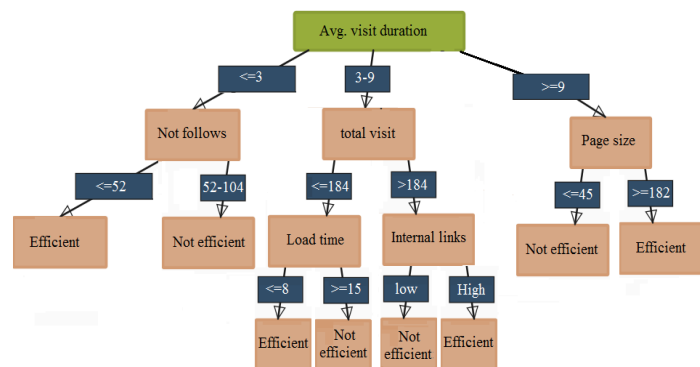
- Size of set of large item sets $L(1) = 5$.
- Size of set of large item sets $L(2) = 7$.

Therefore, best rules found are:

- Avg. visit duration $\leq 3 \rightarrow$ not follows $\leq 52 \rightarrow$ efficient conf:(0.96).
- Avg. visit duration $\leq 3 \rightarrow$ not follows 52-104 \rightarrow not efficient conf:(0.96).
- Avg. visit duration 3-9 \rightarrow total visit $\leq 184 \rightarrow$ load time $\leq 8 \rightarrow$ efficient conf:(0.96).
- Avg. visit duration 3-9 \rightarrow total visit $\leq 184 \rightarrow$ load time $\geq 15 \rightarrow$ not efficient conf:(0.95).
- Avg. visit duration 3-9 \rightarrow total visit $> 184 \rightarrow$ internal links low \rightarrow not efficient conf:(0.95).

- Avg. visit duration 3-9 → total visit >184 → internal links high → efficient conf:(0.95).
- Avg. visit duration >=9 → page size <=45 → not efficient [conf:\(0.92\)](#).
- Avg. visit duration >=9 → page size >=182 → not efficient [conf:\(0.92\)](#).

B. Experiment 2: Classification (Decision tree)



VII. CONCLUSION AND FUTURE WORK

The evaluation of e-government services leads to reduce the expected management cost and reflect the current progress of government administration (performance) of e-government portals depending on some scientific and e-government evaluation methods. Accordingly, the effectiveness and efficiency of Jordanian e-government ministries portals at local level are focused in this research to study the organizational success dimensions using data envelopment analysis. In conclusion, there are only eight efficient websites of the Jordanian ministries.

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