

A Proposed Road Map To Enhance E-Government Services: Kuwait Case Study

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Abstract: Nowadays; key performance indicators (KPI) is considered to be an important factor to evaluate the organizational maturity level. Information and Communication Technology ICT is used as the backbone of the modern countries infrastructure. Kuwait aims to enhance the ICT services for citizens in order to increase citizen satisfaction. This couldn't be reached without evaluating the existing services throughout defining KPIs. The main objective is to provide a solution to the e-government in Kuwait especially in the educational sector in order to facilitate and enhance the decision making process. This paper proposes a road map introduce KPIs measurements for the services in e-government. The proposed road map uses mission, vision, and objectives to define and measure KPIs. We used five key indicators which are loyalty, participation, productivity, communication, and satisfaction. A case study is implemented for the Ministry of Education (MOE) throughout using questionnaire with population with 291 participants. Data mining (DM), Sentiment Analysis (SA), and statistical methods used to analyze the results of the questionnaire which is near similar. The results show that; the clustering process indicates the degree of agreement regarding the predefined Key Result Indicators (KRIs) and based on three clusters reach 63.7% in participation, 64.2% for satisfaction, 65.2% for loyalty, 66.3% communication, and 63.7% for productivity. The sentiment analysis model shows the ability to predict correctly 86 positive reviews with 67.7% and 41 and 32.3% negative reviews. Regarding the statistical methods; after identifying mean, standard deviation and percent shows near values compared to the data mining (clustering) results 64% in participation, 64.8% for satisfaction, 66% for loyalty, 64.4% communication, and 65% for productivity. The results indicate that the output of the three methods of evaluation is near equivalent. This leads to an important implication which is although the excellent infrastructure of Information and Communication Technology (ICT), the proposed road map highlighted that the e-government services need to be enhanced. Enhancements may go through increasing training for teachers and students, developing modern schools, and developing long run educational policies and plans to the Kuwaiti citizens to cope with the tremendous advancements in the ICT sector.

Keywords: KPI, Road map, e-government, Kuwait, data mining, sentiment analysis, statistical methods.

1. Introduction

The process of determining the strategic goals of the organizations that specify values to measure the achievement of these goals is one of the problems that face these organizations. Also, how to define the performance measurement equivalents and linked to the objectives defined by the organizations. Based on the last UN e-government report [1] and The UN e-government knowledge database [2]; Kuwait e-government is ranked from 50th place in 2010 to 40th place in 2016 which means that there a potential to move up. A Key Performance Indicator (KPI) is a measurement which evaluates how a company executes its strategic vision [3]. When identifies organizations objectives they need a way to measure progress towards the organizational goals. KPIs assist organizations in identifying and measuring the progress and achievement of objectives. The core of developing e-government is providing ICT infrastructure. Governments worldwide have recognized the importance of ICT in improving the lives of citizens/residents, and are taking measures to ensure increased ICT adoption and usage. In Kuwait; the government supports citizens and organizations by providing all facilities, equipment, and tools for being ready to apply the e-government concepts. Developing and evaluating Kuwait e-government is the main objective of this research. This paper organized as follows; section 2 discusses the current situation of the ICT in Kuwait. Section 3 describes the proposed KPI measurement road map and its phases. Section 4 shows the establishment of the case study achieved during this

research. Section 5 shows the results analysis of the implemented case regarding the ministry of Education in Kuwait. Section 6 shows the research findings and implications. Finally, section 7 provides conclusion and future work.

2. KUWAIT ICT INFRASTRUCTURE

During 2016; the e-government in Kuwait provided a consolidated national ICT indicators report [4] stated a set of facts that can lead to a huge amount of success in developing any e-government initiative. The report of ICT indicators provides in details many ICT areas such as; Business, healthcare, education, and manpower. This section discusses the facts extracted from the national ICT indicators report. The ICT Infrastructure and Access section provides the details of the telecom infrastructure in Kuwait. As summarized in table 1; the key findings in this section include: 1) the fixed network cover 100% of the country and all of the fixed lines are connected to digital exchanges. 2) Fixed voice utilization rate is low, 56% as of October 2015, due to the preference for mobile voice. 3) Kuwait is estimated to have about 130,000 fiber connections, which is expected to grow to more than 200,000 by 2019. 4) The total mobile cellular telephone subscriptions account to 8,719,000 - a 240% penetration among the population. 5) 100% of land area and population is covered by mobile network, while 4G LTE network has 97% coverage. 6) Kuwait has around 840,000 dedicated mobile data subscribers, two times the number of fixed subscriptions.

Table 1: Summary of ICT Infrastructure in Kuwait

Category Description	Amount
Fixed network cover	100%
Fixed voice utilization	56%
Fiber connections	130000
Cellular telephone subscriptions	8719000
Covered land area and population	100%
Mobile data subscribers	840000

As figure 1 summarizes the governmental sectors in Kuwait uses ICT in business, Education, manpower, and Healthcare. The report [4] is divided into sections and each section contains a set of elements as summarized below.

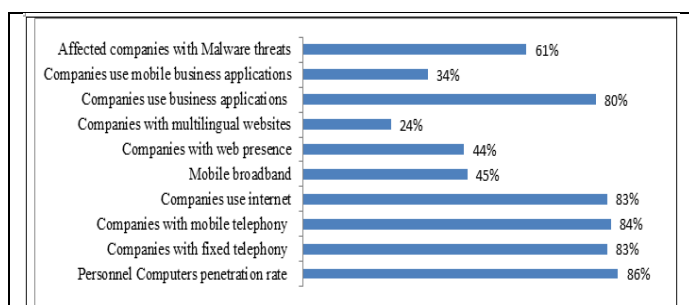


Figure 1a: Kuwait ICT in businesses

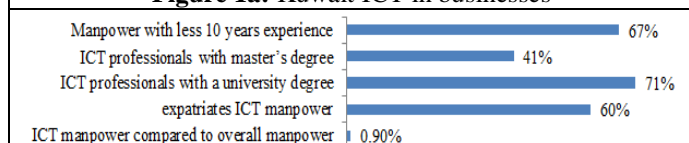


Figure 1b: Kuwait ICT manpower

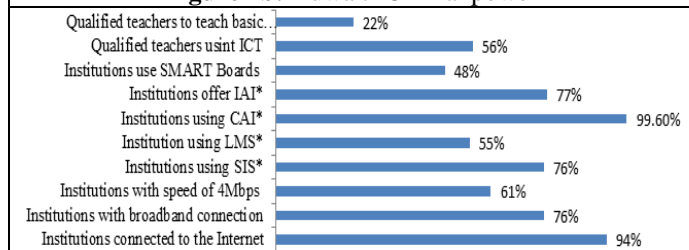


Figure 1c: Kuwait using ICT in Education

- * IAI: Internet Assisted Instruction
- *CAI: Computer Assisted Instruction
- * LMS: Learning Management System
- *SIS: Student Information System

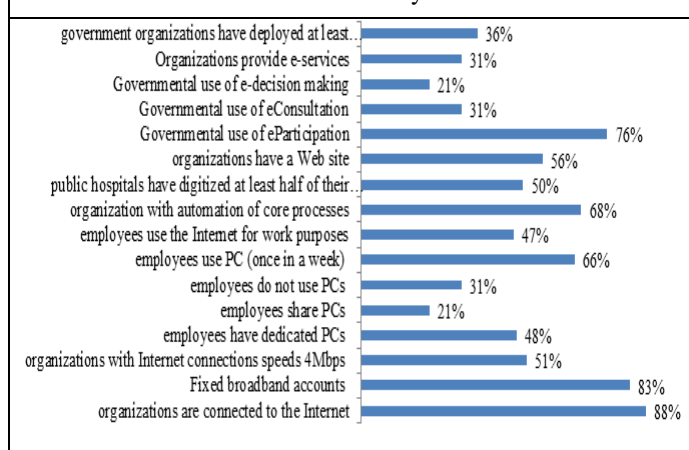


Figure 1d: Kuwait ICT in Government and Healthcare

Figure 1: Kuwait using ICT [4]

The ICT manpower section provides the details of prevalent ICT professions and skills as well as the forecasted manpower requirements for Kuwait with respect to ICT. The ICT market section provides opinions of professionals in Kuwait on various topics related to the political and regulatory aspects. The ICT in education section provides the details of ICT adoption and usage among educational institutions. Moreover; the ICT in government and healthcare section provides the details of ICT adoption and usage among government entities as well as public healthcare organizations. this indicates that Kuwait has a leading ICT infrastructure to enhance the e-services for citizens. using data mining (DM) in this research refers to the overall process of data gathering and analysis, development of inductive learning models and adoption of practical decisions and consequent actions based on the knowledge acquired. DM is a process that uses a variety of data analysis tools to discover patterns and relationships in data that may be used to make valid predictions.

3. KEY PERFORMANCE INDICATOR ROAD MAP FOR MEASURING E-GOVERNMENT (KPI-RM)

The KPIs represent a set of measures corresponding to the organizational goals and serve to evaluate critical performance aspects of the current and the future success of the organization [5]. The proposed KPI Road map Measuring (KPI-RM) e-government in Kuwait is presented during this section. Figure 2 shows the steps and components of the KPI-RM which consists mainly of eight steps. These steps are; 1) identify vision and mission, 2) define objectives, 3) determine KRIs, 4) extract KPIs, 5) implementation of KPIs, 6) measuring KPIs, 7) result analysis, and finally 8) decision making.

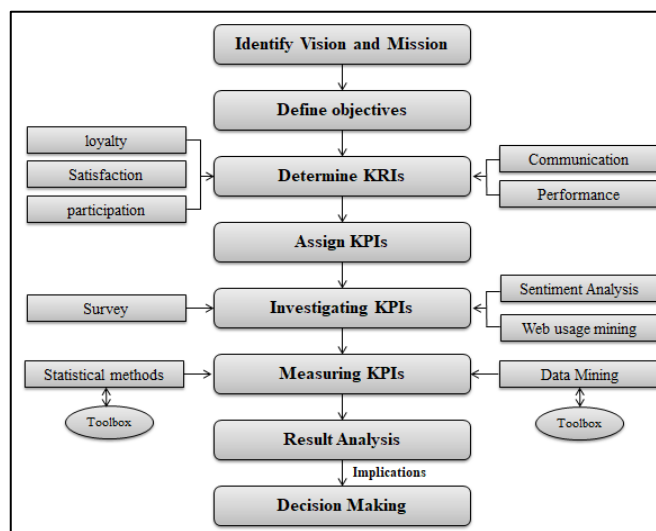


Figure 2: The proposed KPI-RM

Step 1: Identify vision and mission

During this step the strategic management defines mission and vision. Mission and vision are important parts not only for strategic management but also they are part of communication with the citizens [6]. A mission is a statement of the reason or reasons for the existence of the organization, the ultimate purpose the organization serves in society, and the boundaries within which it operates. Vision describes what you want to become or how you want to be. It is the “dream” toward which you are moving [7]. The statements of mission and vision, values and objectives,

become the working platform for identifying the KPI of any corporate, Institution or even a government [8]. A report prepared by Hanover Research [9]; stated that development of KPIs begins from the mission and vision statement so this step aims to highlight what is stated regarding mission and vision of the Kuwait e-government. In Kuwait, the e-government vision is slowly and till the moment it is not clearly identified. The mission of the Kuwait e-government Initiative is to ease the lives of its citizens through offering services using the latest IT technology and using this technology to have better intra-government communication [10].

Step 2: Define objectives

During this step, the strategic planner formulates the objectives from the vision and mission. Based on the ministry of education and the strategic plan of Kuwait that includes the following:

- Practical transformation of the aspirations to build Kuwaiti and doctrinal property in vocational education and training.
- Opening the international culture for the Kuwaiti student.
- Support and develop modern schools and religious institutes in the teaching of high performance and technology.
- Equitable distribution of the educational climate between different regions of the country and the constant pursuit of the delivery of knowledge to the Kuwaiti citizen
- More guidance in this area: definition of human and national mechanisms in the field of education and sports on the long run to achieve these goals
- Developing educational legal plans, policies and basic programs in the field of strategy.
- Reporting the curriculum, techniques and methods that contribute to the refinement of students' personality and development of their abilities.
- Providing material and human resources and develop policies to attract qualified members and technical and attention to the methods of training and evaluation of their performance in order to ensure the good investment and guidance of these elements to serve the education system and mission high.
- Coordination between educational policies and development policies of the State within the framework of a comprehensive planning perspective
- Activating the educational movement and encouraging scientific research in it and working to strengthen the relationship between the various ministry bodies and scientific and educational institutions, local and foreign, and benefit from their experiences in the development of educational work.

Integrating the vision, mission, and objectives will lead to the identification of our KRIs in the e-government of Kuwait. The identified KRIs in this paper are; performance, loyalty, participation, communication, and satisfaction which will be discussed in the following part.

Step 3: Determine Key Result Indicators

During this step the KRIs are defined. KRIs as Parmenter defined, tell you how you have done in a perspective [11]. In this paper KRIs are identified as follows:

Performance; is a fact of life. In work or in play, indeed in any activity where we input even momentary attention, performance can be felt or, at least, deduced if necessary. Yet of all the concepts that reside in the business research at the moment, the idea of performance itself is probably one of the least understood, or certainly the one where the greatest leap of intuition is used, as the initial starting-point for the researcher [12]. Researchers have found that the link between Corporate Social Responsibility (CSR) and company performance is a fully mediated relationship, as CSR helps to improve the level of customer satisfaction, reputation and competitive advantage, which then leads to positive company performance [13]. Performance here is related to the increasing of the stockholders regarding the Kuwait e-government especially the ministry of Education.

Loyalty; Majumdar (2005) stated that "Customer loyalty is a complex, multidimensional concept" [14]. Le Roux (2011) concluded that loyalty can be defined as a demonstrable and positive state of unselfish commitment and trust towards a specific service provider as a result of the evident and consistent satisfactory service levels it has provided to its customers, and can lead to repeat purchases or a lasting relationship. It also includes actions like positive word-of-mouth references and influencing their friends to support the same service provider [15]. Loyalty development is classified into four phases which are; Cognitive loyalty, Affective loyalty, Conative loyalty, and Action loyalty [16]. The aim here is to highlight and reach conative loyalty, and action loyalty in Kuwait e-government. Conative loyalty means, high involvement and motives fueled by strong buying intentions give way to the development of an intense form of loyalty. Besides; action loyalty means the strong motivations that ultimately lead to actions directed by the 'need to remove' every possible problem that might hinder the loyalty driven decision of purchasing a specific brand. Stakeholder loyalty became weak and turnover grew with employees stating they didn't feel valued or appreciated [17]. Reaching loyalty of stockholders in Kuwait especially the ministry of Education needs to be estimated throughout the use of KPIs measurements which will be highlighted later in the questionnaire design.

Participation: Nowadays e-Government has become an important function of any regime, assisting their citizens by offering faster, easier access of information, all types of utility of government services in very efficient and benefiting manner of servicing concepts to their citizens [18]. In spite of these few advantages of e-government, it has expanded the government responsibility for safer public access, further capabilities with success and approval of e-government scheme or plans for the future action such as an online voting scheme, tax paying, online training and license renewal system, are very dependent upon citizen readiness to study on this modernization [19]. The expansion of e-government services at one time depends on the ICT's access, citizens participating by using its applications, tools with moving positive citizens' attitude, trust and successful implementation that sets the authorization, impact on the modern social order. Because of systematic progress of electronic information, communication is performing a dynamic function in digital transformation in developing governments [20]. The e-government participation is referred to as e-participation. In Kuwait eParticipation reached 76%

of the central government entities indicated that their organization's Website is at the first stage compliant with e-information criteria, and 31% compliant with e-consultation and 21% with e-decision making. Regarding the educational sector, the stakeholders cannot obtain fully e-learning services which indicates that the Ministry of Education MOE resides in position 14 among other ministries which indicates that Education and training is the lowest ranked category in Kuwait [4].

Communication: e-democracy refers to the processes and structures that encompass all forms of electronic communication between government and the citizen, such as information, voting, polling, or discussion, thereby enabling citizens to participate in the governments' policy making [21]. The two-way communication between government and citizens facilitates greater efficiency [22]. It was beyond imagination to get any kind of service sitting in your house. All immersive governments are now providing any services through mobile, internet by sending short message or email or putting the responses and inquiries results which could take much time to get the required outputs. In Kuwait we still in need to provide such communication services for citizens to get the government trusted and provide the most effective KPIs measurements.

Satisfaction: In general, satisfaction is a person's feeling of pleasure or disappointment resulting from the performance of a service in relation to expectations. In order to discover the performance of e-government, its level of service to citizens must be assessed. Citizens are increasingly interacting with government services online resulting in a growing expectation of effective service delivery [23]. Citizen satisfaction is a critical and decisive factor for persistent use of e-Government services as it can substantially impact on failure or success of e-Government projects [24]. With the growing recognition of the citizen's role in service demand and self-service delivery, there is an increased impetus on building citizen satisfaction and loyalty with government's e-services. With the global trend in transforming government services through e-government, research on citizen interactions with web based self-service delivery options has been recently emerging in information systems and e-government literatures [25]. Although the internet users in Kuwait are more than 3000000, the percent of citizen satisfaction with the e-service doesn't reach an accepted value. So the need here is to estimate the user satisfaction of the e-services especially in the MOE as our case study.

Step 4: Assign Key Performance Indicators

This step can be achieved through many methods. The Delphi method is used by interviewing field experts through their rich experiences and ideas [26]. Another method is based on the daily operations of an organization via Executing Logs Using Process Models [27]. DEMATEL method was originally developed between 1972 to 1979 by the Science and Human Affairs Program of the Battelle Memorial Institute of Geneva, with the purpose of studying the complex and intertwined problematic group. It has been widely accepted as one of the best tools to solve the cause and effect relationship among the evaluation criteria [28]. This method is applied to analyze and form the relationship of cause and effect among evaluation criteria. The KPI

Karta offers a methodology to identify persons, departments and information sources for creating and supporting KPIs [29]. Here in this paper we depend on identifying the vision, mission and objectives in order to extract the most relevant KPIs.

Step 5: Investigating Key Performance Indicators

KPIs should be agreed upon by an organization's management to select and draw a plan prior to implementation. Managers usually select these KPIs based on their business objectives. So, selected KPIs must reflect the organizational goals [30]. Parmenter (2010) reported in his book 12 steps to implement successful KPIs. Kaplan and Norton (1996), in their groundbreaking book *The Balanced Scorecard: Translating Strategy into action* indicated that 16 weeks is sufficient time to establish a working balanced scorecard with KPIs [31]. Moreover, *intrafocus* [32] provides a guide through the process of developing clear objectives and KPIs to support a strategy. It describes the processes to ensure that KPIs have targets and owners. It shows how to build KPIs that provide evidence that objectives are being met, (or not!). In our road map we rely upon questionnaires, surveys, web usage mining, and sentiment analysis so we are bundling the expected successful KPIs throughout investigating the results of the questionnaire.

Step 6: Measuring Key Performance Indicators

Importance of a measuring is significant. Continual measuring is a base for continual improvements of organization performances that is one of the most important management principles. Measuring performances of the organization means qualitative and quantitative expression of some results by chosen indicators. Performance measurement enable to effective organizations to express their success by numbers. Selection of appropriate indicators that will be used for measurement and appraisal of the performances is a very important activity. Among all information that can be gotten is necessary to choose some critical quantity that on the best way representing the whole business [33]. The main objective of evaluating and measuring the KPIs measurements is to provide continuous improvements in the organization throughout the use of qualitative and quantitative methods. In order to determine the applicable KPIs for measuring achievement of an organization, it is necessary to do an analysis of the vision statement, mission statement and objectives of the organization. Performance measurement also helps organization to be consistent in making decision with the intention to ensure the operational activities are linked with the organization's vision and mission. The measurement of market share, customer demand and customer satisfaction can be essential elements for an organization to understand its current position and make necessary improvements to achieve its target. However, the process of discovering the right measurement is very complex [30]. During this study we follow two types of measurement. These two methods are statistical (correlation analyses, mean, standard deviation), and DM (clustering) throughout using any algorithm or technique from a toolbox.

Step 7: Result Analysis

This steps aims to provide value added to the process of measuring and evaluating the KPIs. The result analysis process can use the extracted results, moreover; the type of

data that the decision making committee aims to obtain (demographic, educational ...). There are various reasons for prioritizing KPIs. For instance, the size and complexity of organizations can affect the type and number of selected KPIs. As the e-government is considered to be a large organization, Shahin et al. (2007) reported that the performance measurement team might have to deal with a large number of KPIs [34]. Results should be represented in a meaningful format in order to facilitate the process of decision making. The results should be presented in dashboards, charts, and summary or detailed reports based on the request of the management level.

Step 8: Decision making

The aim of this step is to provide the top level management with the results of KPIs measurement and highlight the implications for the decision makers in the governmental sector. For KPIs to be valuable they should be actionable metrics that immediately inform how things are progressing and what activities should be taken to improve performance measurement [35]. Defines some objectives derived from decision-making and one associated set of key performance indicators. A project performance management system includes many management processes, such as defining targets, planning, communication, monitoring, reporting and feedback. These processes have been embedded in decision making system solutions. KPI measurement supporting decision making is critical for companies to improve project performance effectiveness and efficiency. In addition, these system solutions measure and KPIs which are crucial for optimizing project performance [36]. Make KPIs measurement more effective by mapping them out. There is, or at least should be, a logical thought process for how those numbers were conceived that creates a hierarchical, decision structure. By showing the logical structure of how KPIs are conceived, team members understand how they are determined, what activities people are working on, and how their work affects business performance measurement and the overall goals for the company [35]. During our case study, the implications and results of the implemented case study will be provided to the Kuwaiti e-government board to take in consideration the resulted output.

4. CASE STUDY IMPLEMENTATION

The implemented questionnaire developed to contain demographic and the other questions used to identify the KPIs measurements throughout five main categories, which are Participation, satisfaction, loyalty, communication, and productivity data. The first section of questionnaire focuses on information such as: sex to recognize percentage of male and female and their satisfaction. Age: of sample and which group of age are most satisfied. Education Level: to find that the Level's Education Occupation: to recognize the sample's Job classification background for evaluating the designs, researcher designed and constructed a questionnaire includes 70 Items, each item was assessed on a 5-degree (1 totally disagree, 2 disagree, 3 neutral, 4 agree, 5 totally agree). The questionnaire measurement variables are shown in table 2.

Table 2: Measurement of variables

Variable	Question number
Part 1 : Demographic data:	
Gender:	1
Age	2
Education Level	3
Occupation	4
Part 2: Key Indicators	
Section One – Participation	1-9
Section Two – Satisfaction	10-24
Section Three Loyalty	25-30
Section Four Communication	31-59
Section five Productivity	60-70

The survey is conducted in two approaches: The 1st one is Google forms and the 2nd is through manual distribution. After distributing questionnaires, the respondents are 291 classified into two groups manual, and Google forms which are represented in figure 3. The participants using manual method are 172 and the participants using the electronic (Google form) are 119. Respondents must use the e-government system to handle some services, and not just to view and browse government websites.

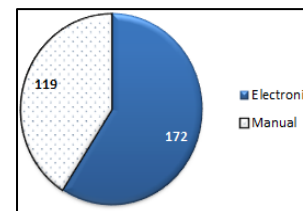


Figure 3: Questionnaire participants

Both approaches have advantages and disadvantages. Hence, using two approaches will compensate for the disadvantages of each other. On one hand, face-to-face interview have an advantage which gives more accurate and immediate responses from the interviewees. On the other hand, it may consume a substantial amount of time from the interviewers moreover; the participants' responses are possibly biased by the interviewers' personality and influence [37] Meanwhile, Google form survey was regarded as having the problem of low response rates; the most advantage of this approach is the capacity of involving a large sample of respondents. It is also very helpful for the participants to be given the opportunity to "have their say" in anonymous way [38]. The characteristics of the participants appear in figure 4.

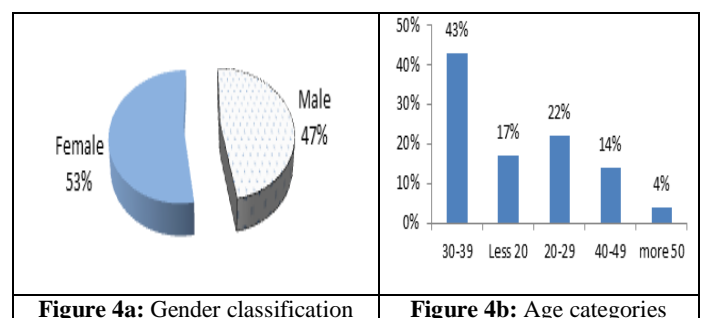


Figure 4a: Gender classification

Figure 4b: Age categories

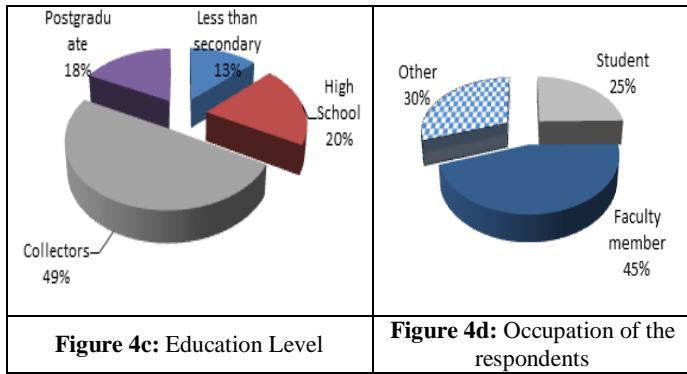


Figure 4: Participants characteristics

The survey distributed during the period December 2017 – February 2018

5. RESULTS ANALYSIS

The Data Preparation is conducted regarding our proposed road map KPI-RM, the used methods for measurements are DM and statistical methods. In this research the used tool for DM is WEKA. WEKA is developed at the University of Waikato in New Zealand. It is open-source DM software written in Java and has an object-oriented structure that easily allows the algorithms and functions to be extended, thus creating new objects in the hierarchy [39]. The data file normally used by WEKA is in ARFF file format, which consists of special tags to indicate different things in the data file (foremost: attribute names, attribute types, attribute values and the data). The main interface in WEKA is the Explorer. It has a set of panels, each of which can be used to perform a certain task. Once a dataset has been loaded, one of the other panels in the Explorer can be used to perform further analysis [40]. During this study WEKA is used in classification and clustering sub-phases. The data was analyzed using the Statistical Package for the Social Sciences (SPSS), Version 25.0. To ensure validity and consistency of the results, the data was screened and leaned at a holistic level incorporating the entire data set.

5.1 DATA MINING ANALYSIS (CLUSTERING)

Clustering used to identify the number of clusters, the number of respondents in each cluster, and the distribution of the instances in the problem space. Clustering is a division of data into groups of similar objects. Each group, called cluster, consists of objects that are similar between themselves and dissimilar to objects of other groups [41]. In order to cluster the population we use K-means algorithm that is considered to give the most accurate results. Based on the obtained clusters from the Weka open source tool; participation indicator which is used in this paper as a sample and looking to the three clusters. Figure 5 show that the maximum indicators about the participation appears in cluster 1 which reflects that 75 participants see the level of participation reaches 76%. One can consider this ratio is moderate and in order to increase participation needs other methodologies and strategies to increase this value for citizens and stakeholders. Figure 6 represents the instances in each cluster based on participation.

Attribute	Full Data (291.0)	Cluster#		
		0 (92.0)	1 (75.0)	2 (124.0)
Sex	1.5258	1.3152	1	2
Age	2.6564	3.0217	2.4533	2.5081
Education Level	2.7148	2.587	2.7333	2.7984
Occupation	2.055	2.5978	1.6267	1.9113
Q1	3.4364	2.8152	3.8	3.6774
Q2	3.1031	2.6848	3.44	3.2097
Q3	3.055	3.0217	3.44	2.8468
Q4	3.2715	2.8478	3.2	3.629
Q5	3.2474	3.163	3.28	3.2903
Q6	3.4261	2.913	3.6667	3.6613
Q7	2.9897	2.3804	3.0933	3.379
Q8	3.189	2.3804	3.84	3.3952
Q9	3.0825	2.5435	3.4267	3.2742

Figure 5: Result of clustering based on participation

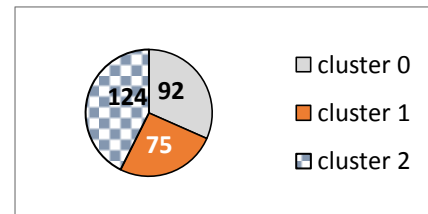


Figure 6: Instances in each cluster based on participation

Table 3: positive impact related to each cluster

		Cluster 0	Cluster 1	Cluster 2
Participation	Instances	92	75	124
	Positive impact 63.7%	54.8%	69%	67.4%
Satisfaction	Instances	138	48	105
	Positive impact 64.2%	65.2%	65.4%	62%
Loyalty	Instances	107	92	92
	Positive impact 65.2%	75.7%	42%	78%
communication	Instances	155	62	76
	Positive impact 66.3%	57.7%	67.2%	74%
Productivity	Instances	57	95	139
	Positive impact 63.7%	58%	69%	64%

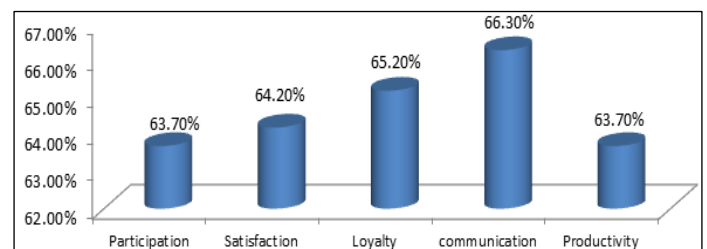


Figure 7: The positive impact related to each key indicator

The participants' agreement with positive impact on the five key result indicators doesn't exceed 70% at all. Also the participants with young age who doesn't satisfied to a great extent with the offered services. Moreover; the high percentage who rely on the available services are females.

5.2 SENTIMENT ANALYSIS

The proposed sentiment model was built based on reviews dataset that collected from the questionnaire. Then Graphlap is used to build sentiment model by using Logistic regression classifier with bi-gram feature selection. During the implementation phase; Ipython notebook and Graphlab are

used to enable scaling much larger data than other available resources like Pandas. Classification algorithms used to take an existing dataset with predefined categories to build a predictive model for future classification. Logistic regression is workhorse of statistic and it can be used for binary classification or for predicting the certainty of binary outcome [42]. Logistic regression is a probabilistic statistical classification method, which has been widely applied to two class classification tasks [43]. The logistic regression model has been used for many years to explain a binary response variable Y through a vector of explanatory variables (X_1, X_2, \dots, X_p) . This could be quantitative, qualitative or both. This model is more flexible than the linear regression model since it does not have the requirements of the independent variables to be normally distributed, linearly related, nor equal variance within each group [43]. Feature Selection is implemented using N-Grams technique. N-gram based techniques are predominant in modern natural language processing (NLP) and its applications. Usually, they are used as features in representing vector space model and then the standard classification algorithms are applied for this model. N-grams are sequences of elements as they appear in texts. These elements can be words, characters, POS tags or any other elements as they appear one after another in texts. Common convention is that ‘‘n’’ in n-grams corresponds to the number of elements in a sequence [43]. The Sentiment Analysis implementation methodology is applied through workflow appears in figure 8.

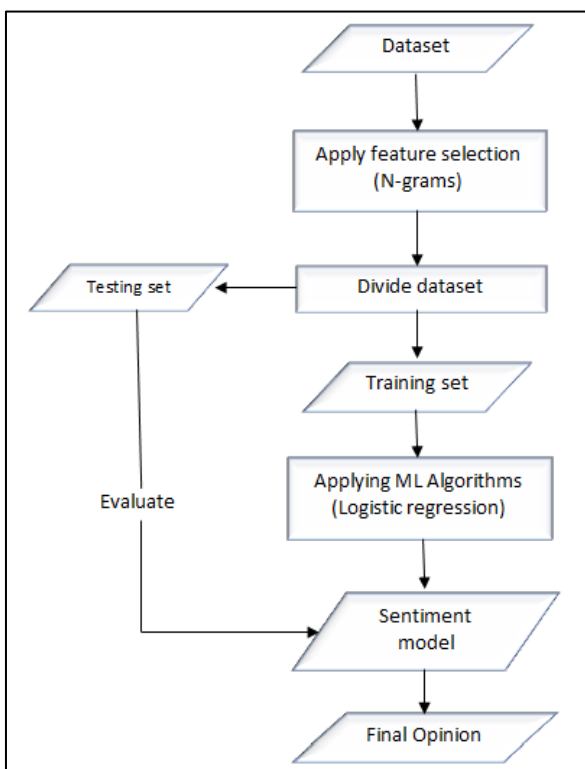


Figure 8: The Proposed Sentiment Model

The proposed Sentiment Analysis model stages appear as follows:

Dataset: comments part from the questionnaire is used as a dataset. Dataset description appears in table 4

Table 4: Dataset (reviews) description

Attribute	Type	Description
Comment	String	Review
Sentiment	Binary	Negative sentiment equal 0 and positive sentiment equal 1

Applying feature selection: Bi-gram feature selection was applied on a dataset. Divide dataset: Randomly dataset was divided into training set and test set. The percentage of training set and test set is shown in figure 9.

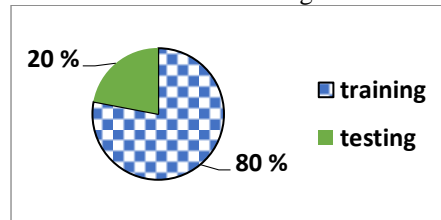


Figure 9: Training and Testing dataset.

Training data contains 120 comments and the testing set contains 30 comments Applying MultiLayer (ML) Algorithm: in order to build a sentiment analysis model the logistic regression algorithm is applied through dataset. Sentiment Model: sentiment analysis model is built by using logistic regression classifier along with bi-gram feature selection then it is used to get the final sentiment.

5.2.1 Sentiment Analysis Experimental Results

Applying Logistic regression with bigrams feature gives accuracy about 99 %. That model is able to correctly predict 86 positive reviews and 41 negative ones. Table 5 shows that Sentiment Analysis model gave high accuracy 99% and the error rate was only 1 % this because of the small number of instances.

Table 5: Details of experimental results according to accuracy

Classifier	Feature selection	Accuracy Rate	Error Rate
Logistic regres	Bi-grams	99 %	1 %

5.3 STATISTICAL ANALYSIS

Based on the obtained results; Correlation analyses between variables were conducted using Pearson correlations. A simple correlation was computed within each question with sum of all questions, the significance level for the correlation statistics in this study was set at $p < 0.01$. The correlation analysis gives the results about the variables and consider if they tend to indicate variety or not. Table 6 shows the ranking of indicators according to their importance. The most important indicators to measure performance of the whole system and user perception to a large extent, system quality determines citizens' trust in educational-governmental services.

Table 6: Ranking of Indicators according to their importance

KRI	Mean	Std. Deviation	Percent %
Participation	3.20	1.07	64%
Satisfaction	3.24	1.06	64.8%
Loyalty	3.30	1.03	66%
Communication	3.21	1.08	64.2%
Productivity	3.25	1.07	65%

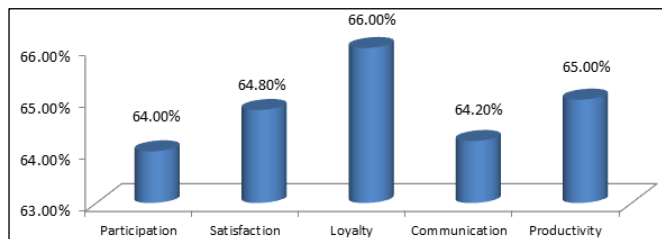


Figure 10: The statistical impact related to each key indicator

The statistical results appears in figure 10 and after identifying mean, standard deviation and percent shows near values compared to the DM (clustering) results.

6. FINDINGS AND IMPLICATIONS

Based on the results obtained from clustering, sentiment analysis, and statistical methods in this paper; one can indicate that although the huge amount of ICT infrastructure in Kuwait and the willingness of the governmental sector to increase citizen satisfaction but the impact doesn't exceed 75% of the five indicators used in this research. Moreover; the results indicate that the most users of the electronic services are female which reflects the culture of the Kuwait community. This low impact of the ICT in the e-government leads to keep in considerations the following implications: 1) the government should investigate other aspects such as the approach of management they use. 2) KPIs measurements should be identified based on the upper level of management to define mission, vision and also prioritize the e-government need and objectives. 3) The government also has to publicize the hits, reviews, and comments for the researchers to use in order to enhance the e-government evaluation.

7. CONCLUSION

This research introduced a KPIs measurement road map relaying upon data mining, sentiment analysis, and statistical methods. The proposed road map is dominated to the performance the Kuwait e-government. The KPIs measurements are investigated through applying a questionnaire to collect data and review throughout using Google forms and traditional methods. The participants feedback used via Weka data mining tool to cluster the output from the questionnaire besides; applying sentiment model using logistic regression classifier. This is to apply classification based on the collected reviews. Moreover; statistical methods are used via mean and standard deviation. The results indicate that although the huge amount of investment in ICT sector but the impact is not sufficient enough to feel the citizens and users great satisfaction. The future information science research regarding Kuwait e-government should be based on collected datasets from the dashboard of the government. The scientists can go through fuzzy logic methods besides enhancing the management approach to gain more citizenship satisfaction.

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