Prioritize E-Government Strategies Using SWOT-Ranked Voting Analysis Technique: The Case of Jordan

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Summary
Studies performed on the factors and strategies that affect the success of e-government programs around the world are many and varied. But many of those studies ignored the implementation mechanism of the factors and strategies explored in different contexts, including Jordan, to ensure the success of these programs there. Jordan is currently working hard to capture this opportunity through action plans to overcome the economic, social and managerial problems, which may affect the effectiveness of the implementation. Despite these efforts, there is still a lag in performance for lack of identification and also give importance to the strengths, weaknesses, opportunities and threats (SWOT) in the implementation of the program at the national level on the one hand, and on the other hand, the evaluation and ranking of the strategies developed for e-government program depending on the SWOT analysis at the same level. In this paper, SWOT-Ranked voting (Borda count method) was used to achieve this task. Ranked voting theory (also called preferential voting approach) is a measure of individual interests and preferences as an aggregate towards a collective decision. Voters can rank potential candidates in order of their preferences and some aggregating rules are then used to find the winner or group of winners among the various candidates. E-government strategies have been evaluated and prioritized with the participation of 20 experts in the experiment who have experience in such large scale programs to ensure its success in the context under investigation. Kendall tau rank correlation coefficient was also used to measure the ordinal association (similarity) between the rankings that have been obtained as a result of the experiment, and those that have been observed by the experts.

Keywords:
E-government; SWOT; Ranked-voting; Borda count, Strategic planning; Correlation analysis; Jordan

1. Introduction

In recent years the world has witnessed a significant shift because of digital technologies in various aspects of life, including the way in which government departments interact with their citizens [1]. In the late '90s, this technological shift was the main reason for the era of the provision of services over the Internet, causing large and rapid shift in the work of governments on the one hand, and on the other hand, higher expectations from citizens about the level of e-services provided to them [2]. A comprehensive definition of e-government is to implement cost-effective models for citizens, businesses, government employees, and other stakeholders to provide government information and services electronically by taking advantage of Internet technology and the World Wide Web [3]. The Jordanian government has invested heavily in e-government initiatives during the past five years [4]. This is in order to provide incentives to the concerned authorities to make further efforts towards e-transformation to better serve stakeholders, including improving the overall advancement of Jordan's achievements in comparison with regional and global countries [5]. Among these e-transformation initiatives (2014-2016) highlight the “Award”, “Mada” and “Daleel” [4][6]. Award transformation initiative is essentially a competition that awards excellence in transformation achievements in the field of ICT and e-government in order to encourage entities, individuals and organizations to succeed and develop their creativity. Mada is a tool to measure the extent of e-transformation and assesses the progress made. Finally, Daleel is a tool to promote consultancy services for e-government toward business development. This and other e-transformation initiatives made no progress to the Jordanian government on the regional and global levels in the implementation of e-government program as planned [4][7]. The problem is not a lack of theoretical studies on the e-government program in the context of Jordan, but the problem is in the results of these theoretical studies, which were not based on Jordan’s internal and external environment analysis [5][8]. Plans and policies resulting in this case cannot be properly identified, as well as prioritized to ensure the conversion into reality and the success of e-government program on a large scale. This paper fills this gap by proposing a new analytical tool for those who involved in the Jordanian government and their partners to identify the mechanism that will be used to implement strategies for e-government program to ensure its success. In other words, how those will take a decision on giving priority to e-government strategies in the context of the internal and external environmental factors analysis where e-government strategies are affected by. The tool includes a combination of two well-known analytical techniques, SWOT and Ranked-voting (Borda count method). Borda count method [9] was exclusively used for the following reasons: (1) all voters’ preferences are taken into account, (2) supports the

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compromise candidate, (3) good for decision-making with multiple candidates and (4) violations of the fairness criterion is mostly not exist. However, this combination has never been used to help in any context regarding the formulation of strategies and the process of its evaluation. With the SWOT analysis, e-government strategies can be prioritized through Ranked-voting (Borda count method). Moreover, Kendall tau rank correlation coefficient was also used to measure the degree of similarity between the two rankings [10]; those obtained from the experiment and those observed by the experts, and thus can assess the importance of the relationship between them. The data used in the analysis were obtained through questionnaires filled by a number of experts (n=20) who are working in the e-government program through the National E-Government Steering Committee (eGSC).

2. Related Work

In a review of studies conducted on the e-government program around the world, it was observed that most of them were not based on an analytical approach [11]. Statistical approach is prevailing for most of these studies, particularly parametric tests [11]. This requires further analytical studies on the e-government programs in order to be evaluated numerically [11][12]. SWOT is one of the analytical tools that support the systematic thinking on the one hand, and on the other hand help in the diagnosis of the factors related to a new product, technology, management or planning [13]. SWOT is an abbreviation for the analysis of the strengths, weaknesses, opportunities and threats. This analytical tool is seeking to achieve a systematic approach and to provide support for a decision by analyzing the internal and external environment. However, it is noteworthy that the internal and external factors of importance to any organization as strategic factors [13][14] and summarized in the SWOT analysis. So, the goal of the strategic planning process, where the SWOT is an early stage, is to develop and adopt a strategy leading to an acceptable fit between the internal and external factors [11]. Moreover, SWOT can be used when an alternative strategy appears in a particular context and appropriate decision about them must be analyzed. Nevertheless, SWOT analysis has several limitations [14][15], most notably the inability to quantitatively measure the importance of each factor in the internal or external environment to support the decision-making process. This means that the evaluation of the factors that could affect the strategic decisions has become very difficult. But with the use of Ranked-voting (Borda count method), provide a quantitative measure of the importance of each factor in supporting strategic decision-making has become easy to achieve. [16] discussed the environmental issues related to SMEs not only by drawing insights from research conducted in different countries, but also by looking at the use of environmental factors of SWOT through the development, context and the ability to adapt to improve the performance of those SMEs environment. Vote-Ranking was used to rank the different competitive strategies and priorities. This analytical technique has helped make the SWOT as a quantitative tool, and thus become more effective in the decision-making issues. [17] addressed to improve awareness of the forestry profession of the potential role that the multiple criteria decision making (MCDM) and group decision making (GDM) approaches and techniques can play, in fact have played, in solving the problems of forests on a global scale. [18] provided simulation to illustrate how to take advantage of the application of Voting-SWOT approach in building a coherent and acceptable strategy on a large scale for Bio-Economy research in favor of the University OF Eastern Finland (UEF). SWOT-Ranked voting (Borda count method) identifies and prioritizes the criteria and sub-criteria listed in the SWOT analysis and thus make those criteria and its sub-criteria are measurable. This combination of analytical tools leads mostly to improve the quantitative basis for information related to strategic planning processes. SWOT analysis is a tool that is typically used at the organizational level [19]. But it can be used on a broader level, such as the national level where the strengths, weaknesses, opportunities and threats can be identified.

3. Proposed Method

The problem of selecting strategies based on SWOT analysis is essentially a ranking problem [11][20]. In this context, there are several strategies that require analysis of multiple criteria support the decision-makers to choose the best of those strategies and thus ensure the success of e-government program. But most of these governments, including the Jordanian government still lack methodologies to ensure the selection of appropriate strategies for the success of its e-initiatives. Therefore, this paper proposes an analysis on the basis of multi-criteria decision-making-based on the SWOT to evaluate alternative e-government strategies to Jordan, as follows: (1) An analysis of the criteria related to the internal and external environment was carried out through the SWOT in the form of a hierarchical model, as shown in Figure 1 below.

At the first level, the selection of e-government strategies appears as a major goal. At the second level, the four SWOT criteria stand out and contribute to achieving the main goal. At the third level, sub-criteria on the strengths (S1, S2, S3, S4, S5, S6 and S7), weaknesses (W1, W2, W3, W4 and W5), opportunities (O1, O2, O3, O4 and O5) and threats (T1, T2, T3, T4, T5 and T6) were listed. At the

fourth level, four alternative strategies for e-government were list, evaluated and then given priority in terms of SWOT sub-criteria listed in the third level, namely ST1, ST2, ST3, and ST4.

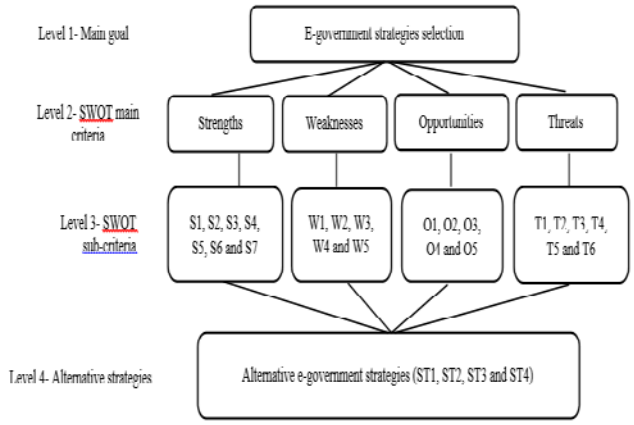

Fig1. SWOT hierarchy of the alternative e-government Strategies

This analysis has been using the report published by the Jordanian government in its strategic plan for the period between 2014 and 2016, as shown in Table 1 below.

Table1: SWOT analysis (criteria and sub-criteria) and alternative e-government strategies for Jordan

Strengths **S1-** Sponsorship and buy-in by the leadership at all levels in government through the activation of the role of National e-government steering committee eGSC. **S2-** The availability of resources, for example budget support, current ICT assets and other intangible assets such as ICT, e-transformation and business skills. **S3-** Availability of laws and regulations that support the implementation of e-transformation. **S4-** The appointment of an influential CIO council In addition to the cooperation between the various government agencies to support the decision-making process with regard to e-transformation initiatives. **S5-** Readiness of government agencies to document and share their business requirements, data, services, processes, and strategies. **S6-** The effective role of the private sector in support of e-transformation. **S7-** Sustainability of the implementation of e-government strategy despite the political changes.
Weaknesses **W1-** Lack of access to the Internet among certain groups of society (digital divide). **W2-** Lack of funding for capital investment in new technologies. **W3-** The low level of R & D, according to the international standards. **W4-** The need to support a common culture on e-transactions at the national level. **W5-** The weakness of the economic power of citizens and businesses.
Opportunities **O1-** Jordanian effort in the various sub-sectors of ICT, including telecoms, e-learning, e-health, the Internet, mobile, and gaming content. **O2-** Jordan has an attractive business environment that combines smart and effective talent in terms of cost, infrastructure and supporting policies. It contains young talent and growing supported by a modern education system that ensures that graduates have the right skills to support the business processes of ICT, which led to new disciplines, specialized in Internet content and mobile phone and outsourcing applications. **O3-** Jordan is a regional gateway to the Arab world with more than two-thirds of exports destined for the Gulf states. It includes the top five export markets for ICT such as KSA, USA, UAE, Iraq and Oman. **O4-** The partnership between the private sector and the public sector to improve large-scale projects such as e-government, e-learning and e-health. **O5-** ICT companies in Jordan serve different economic sectors. This gives them the knowledge and skills required for the export of effective services to find complete ICT solutions to the neighboring markets and beyond. Several companies have built significant intellectual property, especially in the field of software solutions and content creation, making it succeed in penetrating the US, Europe and regional markets.
Threats **T1-** Competitive regional and local clustering. **T2-** Lack of local and regional political stability. **T3-** Disallow to foreign investors from a long-term investment in the country. **T4-** Lack of financial support for investment in ICT sector and improve e-services. **T5-** Tax advantages **T6-** Lack of trust among the citizens, which would affect the performance of e-services.
E-government strategies **(ST1)** G2C & G2B quality service with accessibility. **(ST2)** G2G & G2E information sharing by interoperability. **(ST3)** Infrastructure efficiency by connectivity. **(ST4)** Policy and standard reforming by process reengineering.

(2) 20 experts involved in the Jordanian e-government program through the National E-Government Steering Committee (eGSC) were asked to rank the four alternative e-government strategies (ST1, ST2, ST3 and ST4) according to each individual sub-criterion specified in the third level in Figure 1. (3) For each individual sub-criterion, Ranked-voting (Borda count method) was applied to obtain the order of preference for e-government strategies through the 20 experts involved. (4) For each individual main criterion (e.g. strengths) including its sub-criteria (S1, S2, S3, S4, S5, S6 and S7), Borda count method was also re-applied to get the order of preference for e-government strategies through the multiple sub-criteria for each individual main criterion under investigation. (5) Borda count method was re-applied to get the order of preference for e-government strategies, but

through all the main criteria together. (6) Finally, to measure the similarity between the obtained rankings and the real expert rankings, Kendall tau rank correlation coefficient was applied between the obtained ranking and each expert ranking for each individual sub-criterion. After that, the average correlation values were computed for each individual sub-criterion. Kendall tau correlation measures the correlation between the two rankings. The obtained results are presented in the last row of Table 4 (a), (b), (c) and (d). Briefly, three multi-level experiments were conducted to rank the alternative strategies as follows: First, ranking on the basis of each individual sub-criterion. Second, ranking on the basis of each individual main criterion and finally ranking on the basis of all main criteria together. In this case, the inclusion of an example of how Borda count method works would help in better understanding of the methodology used in this paper. Each alternative strategy can be ranked according to the preference of SWOT criteria and its sub-criteria that were assigned by experts. The challenge is how to find the rank of alternative strategies for each SWOT sub-criterion. To accomplish this, we use Ranked-voting (Borda count method) to calculate the collective decisions. For each SWOT sub-criterion, the preference rank of any expert can be represented by a sequence of strategies in which the first appeared strategy is the top ranked one. For example, in Table 2, consider the following ranking voted by Expert1 for a particular SWOT sub-criterion: (ST2≻ST1≻ST4≻ST3≻ST5). This sequence represents the order of five strategies where ST2 is ranked first then ST1, then ST4 and so forth. When multiple experts vote on the same way, we obtain many similar sequences, but with different orders, of course, as shown in Table 2.

Table 2: An example of ranking preference made by four experts for five strategies, each cell represents rank made by an expert for a strategy

	ST1	***ST2***	***ST3***	***ST4***	***ST5***
Expert1	2	1	4	3	5
Expert2	1	3	4	2	5
Expert3	3	1	5	2	4
Expert4	1	4	5	2	3

To compute the collective decisions (i.e. final order preference) using *Borda count method*, we should first construct a majority margins matrix as shown in Table 3, where each entry in the majority margins matrix represents how many times a strategy ST_x proceeds strategy ST_y across all voters (i.e. subtracting the times that ST_x beats ST_y from the times that ST_y beats ST_x. After that, the summation of scores is calculated for each strategy. The alternative strategies are then ranked in a descending order based on the final summation where the strategy with the largest score is the top winner. From the example we can observe that the strategy *ST1* is the top winner. The order of final preference is: ($ST_1 \succ ST_2$, $ST_4 \succ ST_5 \succ ST_3$).

Table 3: Majority margin matrix where the rows and columns headers represent potential candidates

	ST1	***ST2***	***ST3***	***ST4***	***ST5***	***Scores***
ST1		0	4	2	4	10
ST2	0		4	0	2	6
ST3	-4	-4		-4	0	-12
ST4	-2	0	4		4	6
ST5	-4	-2	0	-4		-10

4. Experiment Result

Based on the SWOT hierarchy in Figure 1, the evaluation of e-government strategies and then get on the order of preference for those strategies has become more measurable than ever, due to the use of a combination of two analytical techniques, SWOT and Ranked-voting (Borda count method). For each sub-criterion in the hierarchy, the order of preference for alternative e-government strategies was obtained. This means that the strategy, which has the highest score, should be implemented first, and so forth. In Table 4 (a) (b) (c) and (d), the results of ranking e-government strategies with respect to each SWOT sub-criterion were addressed respectively.

Table 4 (a): Ranking with respect to strengths sub-criteria only

	S1	***S2***	***S3***	***S4***	***S5***	***S6***	***S7***
Rank 1	ST4	ST3	ST1	ST2	ST4	ST3	ST4
Rank 2	ST3	ST2	ST2	ST1	ST2	ST1	ST2
Rank 3	ST2	ST1	ST3	ST4	ST3	ST2	ST3
Rank 4	ST1	ST4	ST4	ST3	ST1	ST4	ST1
Average Correlation	0.58	0.52	0.51	0.65	0.58	0.61	0.58

Table 4 (b): Ranking with respect to weaknesses sub-criteria only

	W1	***W2***	***W3***	***W4***	***W5***
Rank 1	ST3	ST3	ST4	ST1	ST3
Rank 2	ST1	ST2	ST2	ST3	ST1
Rank 3	ST2	ST1	ST3	ST2	ST2
Rank 4	ST4	ST4	ST1	ST4	ST4
Average Correlation	0.55	0.62	0.55	0.56	0.53

Table 4 (c): Ranking with respect to opportunities sub-criteria only

	O1	***O2***	***O3***	***O4***	***O5***
Rank 1	ST2	ST2	ST4	ST3	ST2
Rank 2	ST3	ST4	ST2	ST1	ST1
Rank 3	ST1	ST3	ST3	ST4	ST4
Rank 4	ST4	ST1	ST1	ST2	ST3
Average Correlation	0.4	0.62	0.53	0.53	0.33

Table 4 (d): Ranking with respect to threats sub-criteria only

	T1	***T2***	***T3***	***T4***	***T5***	***T6***
Rank 1	ST4	ST4	ST3	ST3	ST1	ST4
Rank 2	ST3	ST2	ST1	ST1	ST3	ST3
Rank 3	ST2	ST3	ST4	ST2	ST4	ST1
Rank 4	ST1	ST1	ST2	ST4	ST2	ST2
Average Correlation	0.53	0.63	0.43	0.43	0.6	0.53

From the results above, we can also observe that all the correlation values are positive, which indicate that the rankings obtained from Borda count method were representative of the rankings obtained from the 20 experts. Apparently, the rankings obtained for strength sub-criteria were the highest compared to the others, and the lowest was for opportunities sub-criteria. For each main criterion in the hierarchy, the order of preference for alternative e-government strategies was also obtained. This means that the strategy, which has the highest score, should be implemented first, and so forth. For strengths sub-criteria, we can observe that the strategy *ST2* is the top winner. The order of final preference is: ($ST_2 \succ ST_3$, $ST_4 \succ ST_1$), while the strategy *ST3* is the top winner of the weaknesses sub-criteria. This is with the order of final preference as follows: ($ST_3 \succ ST_1$, $ST_2 \succ ST_4$). Finally, the order of preference to the opportunities and threats sub-criteria respectively, as follows: ($ST_2 \succ ST_4$, $ST_3 \succ ST_1$) and ($ST_3 \succ ST_4$, $ST_1 \succ ST_2$). Table 5 shows the results of ranking e-government strategies with respect to each SWOT main criterion.

In general, the impact of internal and external environmental criteria on the decision-makers in Jordan to move forward in the implementation of e-government can be summarized in the following order of preference ($ST_3 \succ ST_2$, $ST_4 \succ ST_1$). This means that the strategy *ST3* (improve ICT infrastructure through connectivity at the national level), should be of first priority to the Jordanian government to ensure the successful implementation of e-government, followed by *ST2* (manage information sharing and support interoperability among government departments at the national level), *ST4* (modernize and restructure key business processes in government departments), and finally *ST1* (improve quality of service through accessibility at the national level). This means that the Jordanian government can summarize the priorities regarding the implementation of e-government program as follows: First, the need to focus more on building the ICT infrastructure by improving connectivity at the national level on the one hand, and support higher level of processing data. Second, empowering stakeholders and building trust through information sharing across multiple government departments. Third, the need to reform and restructure key business processes in government departments. This would help make the transition from the old system to the new automated system smoother, finally, the need to improve quality through ease of access to countless information and public services. These priorities represent a direction for decision-makers towards the optimum utilization of various resources (e.g. financial, human and other) to support the implementation and success of e-government program at the national level.

Table 5: Ranking with respect to each SWOT main criterion

	Strengths	***Weaknesses***	***Opportunities***	***Threats***
Rank 1	ST2	ST3	ST2	ST3
Rank 2	ST3	ST1	ST4	ST4
Rank 3	ST4	ST2	ST3	ST1
Rank 4	ST1	ST4	ST1	ST2

The order of preference for e-government strategies was also obtained on the basis of all SWOT main criteria together, as shown in Table 6.

Table 6: Ranking with respect to all SWOT main criteria together

	Strengths, Weaknesses, Opportunities and Threats
Rank1	ST3
Rank2	ST2
Rank3	ST4
Rank4	ST1

5. Conclusion

Analysis based on a combination of two common analytical techniques, SWOT and Ranked-voting (Borda count method), has never been used to evaluate e-government policies worldwide. This combination can efficiently evaluate SWOT sub-criteria and thus give them priority in order to allow decision-makers to determine which of those should be given attention first. E-government is no longer just an option but a necessity for countries, especially developing countries to catch up with the developed countries with regard to globalization. Studies have shown that one of the important success factors for e-government, are the people, as well as policies that are placed in this regard. The methodology used in this paper has paved the way for decision-makers to evaluate e-government strategies to ensure its success. Jordan case study provided an illustrative model for evaluating strategies. This model will be useful to evaluate any other national strategies for e-government, as well as the comparison between its priorities and the priorities of other e-government strategies. SWOT analysis has several limitations, most notably the inability to quantitatively measure the importance of each criterion in the internal or external environment to support the decision-making process. This means that the evaluation of the criteria that could affect the strategic decisions has become very difficult. This since the qualitative analysis of these criteria and strategies is subjective and therefore can vary from one expert to another. But with the use of Ranked-voting (Borda count method), provide a quantitative measure of the importance of each criterion in supporting strategic decision-making has become easy to achieve. This paper concludes that the strategy '*ICT infrastructure efficiency by connectivity*' is the most important among the strategies for e-government in Jordan. The second-order strategy is

'*G2G and G2E information sharing by interoperability*'. The third-order strategy is '*policy and standard reforming by process reengineering*'. The last-order strategy is '*G2C and G2B quality service with accessibility*'. New strategies for e-government can be proposed and added to the SWOT-Ranked voting analysis technique. In literature, there are a lot of common multiple criteria decision-making analysis techniques, such as *WSM/WPM*, *AHP*, *TOPSIS*, *ELECTRE* and *PROMETHEE*, which can be combined in the future with the SWOT, and thus compare the results of these with the results of this paper.

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