A Decision Support System Procurement Solution for the University of Babylon

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Abstract The procurement activities in organizations typically involve critical decisions made by managers. In order to make a good decision, they need to assess certain relevant criteria. Procurement decision-making faces several challenges such as selecting the best vendor with the right mix of product, price and method to procure it. After studying three multi-criteria decision techniques that have been widely used in procurement decisions, namely, the multi-attribute utility theory, Linear Goal Programming and analytic hierarchy process techniques AHP which is the technique that identified as the foundation on which to build a decision support system for procurement decisions in the University of Babylon, Iraq as a case study. A framework is developed to simplify the design and work of this DSS prototype solution at the university. The research attempts to address the issues regarding information fusion by automatically integrating multiple information sources to enhance the procurement decision-making process through empirical and theoretical findings on the interdependencies that characterize the relationships between information fusion and management decision-making. A pre-implementation study is carried out in order to ascertain the usefulness of this prototype solution in promoting user-centered decisions by explaining the various influences of different decision-making on the information systems and procurement processes at the University of Babylon, Iraq. The major contribution of this study is to develop tools that aid practitioners in decision-making processes regarding procurement decisions such as DSS planning, DSS technique identification and implementation. The proposed DSS procurement solution is consistent, not complex, not difficult to use and that the properties of the DSS solution is sufficient and not excessive, as well as highlighting the benefits and limitations of the proposed solution.

Keywords: decision support system, prototype, procurement, analytical hierarchy process.

1. INTRODUCTION

At the beginning of the era of distributed computing, Decision Support Systems (DSS) was concerned with analyzing ideas, people, technologies and systems produced at the time of applied information technology (power et al., 2011). Those systems were created to support decision-makers in various positions in any organization such as; financial management, operations, and strategic decision making (power,2007). Public procurement, as one of the government functions, involves decisions about the services, materials that will be delivered to local institutions and the people they serve. In this context, procurement processes in educational institutions has been one of the most challenging aspects of university management (Krisanthi et al.,2014). Educational institutions and universities have wide external and internal financial relationships with all levels of their environment including suppliers, contractors, manufacturers, governments, etc. (Csáki & Gelléri, 2009)

Procurement procedures, starting from the procurement order to the final decision phases, passes through many stages of analysis; the need for the order, defining the specifications requirement, cross-checking of current market prices, and selecting the best choice of vendor (Vaidya et al., 2009). This procedure takes a long time partly due to manual processes employed and tasks required to be made. Most often than not, some of these considered variables may change during this stage of analysis such as change in prices, thereby requiring a repeat of the process or re-make of
decisions and causes delay to the work department that needs the procurement or cause the procurement unit to lose its credibility, amongst many other associated problems. Thus, there is need to identify the requirements of decision making process in university procurement and analyze these requirements in the context of available procurement information using the most appropriate method and in the best available time. This paper proposes a DSS procurement prototype solution that makes use of AHP technique in its selection and evaluation process that will not only aid decision makers in the procurement process, but will also help get rid of financial and administrative mismanagement, reduce time, improve work efficiency and transparency, and help in drawing up a strategic plan for all future procurements in universities and institutions of learning.

The rest of the paper is presented as follows: Section two discusses the motivation for this study, Section three discusses the methodology used for the study, Section four presents and elaborates on the prototype solution including the initial model, framework and interface designs of the proposed DSS procurement prototype solution. Section five concludes the paper and lists out the benefits and limitation of the proposed system as well as areas of future works.

2. MOTIVATION OF STUDY

The University of Babylon (UOB) prides as one of the biggest universities in Iraq. Founded in 1991, in Hilla (city center of Babel province and in the very middle of Iraq), it is composed of twenty faculties in various disciplines of science, technology and humanity. The Electronic Computer Centre (ECC) under the University Presidency is responsible for technical and programming design role at the university, training the staff of the university and community in various fields of computers. Furthermore, it is responsibilities extend to the design, deployment and implementation of both software systems and networks in the university. ECC provides good network (LAN and WAN) to the university and has built several web based systems with a central database. All these systems can be accessed via UOB’s internet and intranet (Babylon Electronic University Network, 2012).

The University of Babylon, as an educational institution spends a large budget to support its procurement needs. The Procurement Unit of the Department of Finance is the body responsible for its procurement processes and decisions. UOB follows the general procurement process laid down by the Iraqi government, which is also used by all Iraqi universities (Babylon Electronic University Network, 2012). However, this process has a lot of setbacks including long-time cycle to analyze purchasing order; incapable of reaching a balanced and optimal supplier selection decisions due to the manual process employed and because the procurement decision making process is not based on a scientific technique.

Decision support system (DSS) was applied to help managers to improve their analysis of semi-structured problems using data and models (power et al., 2011). The essential purpose of designing those systems is to support decision-makers, at any position in an organization (power, 2007). In the context of DSS in procurement management, there are many sub-processes such as: defining and analyzing the specifications of required goods, as well as and analyzing the vendor bids (Pinker & Tilson, 2013). The need for the use of new mechanisms and approach to tackle procurement problems with respect to these sub-processes was earlier proposed by (power et al., 2011). Iraq still lacks behind in terms of using new technologies due to the environments of wars, economic blockade, and military occupation. The deployment of DSS systems in the financial departments have significant proportions of getting rid of financial and administrative mismanagement, reduction in time, improve work efficiency, transparency in dealing, the possibility of making the right decisions in the government procurements, and helping in drawing up strategic plans for the future in all government institutions. This proposed prototype solution therefore, is not only important for the University of Babylon but can also be used as a benchmark for all other government institutions, especially since they all share a general and similar procurement process.

3. METHODOLOGY

The phases of the methodology with respect to objectives are summarized in flowchart as presented in Figure 1, the first phase has conducted by the interview to understand the current procurement system in UOB. A total of eight participants consisting of one procurement manager, one financial manager, three procurement employees and three ECC employees were interviewed through face-to-face meeting and online media. An open-ended question type was used for the study because of the need to understand everything related to UOB procurement decisions. The second phase was to review other alternative approaches used by past studies for the development of DSS procurement systems in educational institutions, This enabled the researcher to identify and improve the weaknesses of previous studies as well as to justify the basis for choosing the AHP technique in the development of the proposed prototype DSS procurement system. Based on the findings of the review, AHP multi criteria decision-making technique was chosen due to its applicability to the decision making process given the context of study, and was mapped with the procurement system requirements of UOB as presented in next section which showed the matching, ability to deal with multi alternatives and
criteria, flexibility, and quick evaluation. In third phase, a review to some studies with the interview as a method of data collection also was used to design the framework. Phase four has done by using C# programming language to design the prototype, this choice of C# language was mainly because of its processing speed and its relatively small language set that gives it an edge over other higher level languages as it can be highly optimized. The prototype has simplifying the procurement decision in choosing best vendor and best quality, this successes has proved in last phase via questionnaire from our case study (UOB) were used to evaluate the pre-implementation phase of the prototype system design so as to validate the proposed prototype system.

![Methodology Flowchart](image)

**Figure 1: Methodology Flowchart**

### 3.1 Identifying DSS Technique

When identifying a DSS technique to model a certain complex decision the principles of the technique selected should be understood, and they should be comply for the characteristics of the decision itself (Lewis, 2004). Chai (2006) identify the most procurement characteristics (as in listed in Table 1) that should be available in DSS technique. AHP, Multi utility Attribute theory and linear goal programming LGP as the most multi-criteria decision-making techniques that are related with the UOB system procurement characteristics. A comparison study of the major procurement features for these three techniques with capabilities and strengths is presented in Table 1.

| Table 1: A Comparison between DSS Techniques with respect to UOB |
|------------------|-----------------|-----------------|
| procurement      | AHP             | MAUT            | LGP             |
| characteristic   |                 |                 |                 |
| Large number of criteria & alternatives. | suitable | suitable | suitable |
| Multi criteria decision making environment | suitable | suitable | suitable |
| Quantitative and qualitative criteria | suitable | suitable | suitable |
| Re-buy and one-time buy | suitable | suitable | suitable |
| High accountability to stakeholders | Yes | Yes | Yes |
| Quick and simple evaluation process | Relatively | complex | Mathematical |
| Cheap evaluation process | Fast | cheap | cost/time consuming |
| Widely used in selecting supplier | Very popular | Relatively popular | Rare |

Although Linear Goal Programming LGP and MAUT have their strengths and a broad application in many other areas, particularly in scientific research, however, with consideration to experts’ requirement definition of the problem, the AHP is regarded as the most suitable decision technique for the supplier’s selection in complex systems. The strengths of AHP over the other decision making techniques lie within its core characteristics; that are its flexibility, simplicity, its balance, and its comprehensiveness. Flexibility is very important because purchasing occurs in a dynamic, economic, political, technological and social environments and all these make the purchasing into a complex process (Fung, 1999). AHP appears as the best tool when compared with MAUT and linear goal programming in the following aspects for evaluating complex system:

1. Its ability in handling qualitative criteria by effectively specifying the qualitative criteria.
2. Its ability to operate under different criteria environment effectively,
3. Use simple theory with easy mathematics calculation,
4. Relatively easy to apply and very interactive to ordinary procurement bids,
5. Has proven records in government, academic, and industrial applications.
6. Can organise wide number of criteria, subcriteria and alternatives.
7. It has built-in consistency checking mechanism.

Table 2 shows some capabilities of the Analytic Hierarchy process and its capability to match the
procurement characteristics, the selection of AHP technique is largely due to its capability to match and handle the characteristics of procurement complex systems environment more effectively as large numbers of quantitative and qualitative criteria and alternatives. In addition to its capability, simplicity, and flexibility in adapting both financial and technical, whether separately or collectively, by a single or different evaluation teams and in a single or multiple sites to provide the high degree of transparency.

<table>
<thead>
<tr>
<th>Procurement Characteristics</th>
<th>AHP Matching Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large number of criteria and alternatives</td>
<td>Able to handle with large numbers.</td>
</tr>
<tr>
<td>Multi criteria decision making environment</td>
<td>Able to handle multi criteria</td>
</tr>
<tr>
<td>Quantitative and qualitative criteria</td>
<td>Able to handle quantitative and qualitative criteria</td>
</tr>
<tr>
<td>Re-buy and one time buy</td>
<td>Flexible</td>
</tr>
<tr>
<td>High accountability to stakeholders</td>
<td>Able to provide audit trails clearly</td>
</tr>
<tr>
<td>Quick and simple evaluation process</td>
<td>Quick and simple</td>
</tr>
<tr>
<td>High degree of transparency</td>
<td>Process centric and group consensus on all decisions</td>
</tr>
</tbody>
</table>

3.2 Conceptual Model

The conceptual design shown in Figure 2 illustrates the principles of the Model, showing the basic constructs behind the procurement selection based on the findings of our literature review. The model is based on Usability Technology Acceptance Model (TAM3) which stressed that the “perceived usefulness” is the most indicator of “behavioral intent”, and that the “perceived ease of use” also has significant effect on the “behavioral intent” which is influenced “experience” (Venkatesh & Bala, 2008). This also helped us in constructing the research questions used for data collection through interview method. The identified factors are experience, perceived usefulness and perceived ease of use.

- Experience degree that required to use this DSS framework has the effect on the “easy to use” preserved, so as the framework need simple experience to use as the “easy to use” perspective become high (Venkatesh & Bala, 2008).
- “Perceived ease of use” is affected by technology self-efficacy and the DSS anxiety (and some other factors which are outside the scope of this study (Venkatesh & Bala, 2008). Technology self-efficacy can be defined as the degree of belief that an individual can perform a specific task using this technology, while technology anxiety explains the degree of belief that an individual is apprehensive when using the technology (Webster & Martocchio, 1992).
- “Perceived usefulness” is affected by the output quality and job relevance (and some other factors which are outside the scope of our study) (Hughes & Laryea, 2013). Job relevance is defined as the degree of belief which the individual has that the technology can be or not be applicable to the job. Output quality is defined as the degree of belief of the individual that the technology can perform the job tasks in good manner (Moore & Benbasat, 1991).

4. THE PROPOSED DSS FRAMEWORK

Designing UOB DSS framework is based on the data collected from the interview and its analysis, which is constructed based on the conceptual model and the findings of the literature review. The proposed design, as shown in Figure 3, can be used to process simple and complex decision probabilities and provide accurate results for each of the criterion and sub criteria. The framework consists of five distinct stages in simulating the UOB procurement requirements using AHP technique:

- Stage One: Initial Goods Evaluation This stage of framework will be active with all decisions types (simple and complex decisions) there is one of three ways that procurement process will be carried on:
  i. If the expected price is between 1000,000 ID and 10,000,000 ID, the decision will be simple and will directly go to the private sector’s vendor.
  ii. Continue in the procurement process way if the expected price is more than 10,000,000 ID.
  iii. Government supplementing way if the goods are in order of government manufacturers.
Finally all the information will be stored in the database.

Figure 3: The Proposed UOB DSS Procurement Framework

- Stage Two: Development of Goods Evaluation: In this stage, the Activities of AHP technique will start to deal with the complex decision by evaluating the inputted goods specification criteria/subcriteria of stage.
- Stage Three: Vendor Bids Evaluation: In this stage, continuing in applying AHP technique, to compare between the vendor’s bids with goods evaluations of stage two by analyzing the inputs of the evaluation of bids of vendors with respect to each goods type of subcriteria with goods evaluations of their specifications.
- Stage Four: Vendor Selection: To select the best vendor’s bid, an AHP calculation will compare the results of goods evaluations in stage two and vendor’s evaluations in stage three with respect to each criterion/subcriterion. The result of this calculation has to give the final decision for best vendor that has get most high evaluations with respect to other vendors.
- Stage Five: Supplements: In this stage the supplement process will be done either with simple or complex decisions to go for government or the private sector’s vendors.

5. Development of the DSS Prototype Solution

The development of the proposed DSS prototype solution was based on the evaluated framework (see Figure 3), which consisted of three major phases: the Database development (back end), System interface design (Front end) and System testing. C# programming language was used for developing this prototype solution. AHP technique was used for selecting and evaluating the criteria and the system was tested using sample cases from the Procurement Unit of the UOB. The C# language was chosen because of its wide popularity all over the world and its ease of use. Other reasons for choosing C# include: a) it is a procedure oriented language which enables the user create and use functions or procedures to execute their task. Besides, it is very easy to learn procedure oriented language because it executes statements based on algorithms. C# language has a lot of libraries, fast compilation speed, highly portable and easy to learn.

This prototype system was developed using AHP technique based on the framework design shown in Figure 3 above. The following subsection explains each of the phases system design interface with screen shot illustrations.

I. System Interfaces

The system interfaces for the prototype system put all these into consideration when developing the system as presented below. The first screen of the DSS procurement prototype system prompts the user to login (Figure 4). This screen leads to the main menu screen page upon successful login. The main menu consists of four major submenus namely: the order information, criteria evaluation, vendor bids evaluation, DSS report (vendor selection). Each of these submenus are elaborated with screen shots in the following subsections.

Figure 4: The Preface Screen

II. Order Information Screen

The order information screen (Figure 5) based on the procurement need, simulates two stages (1&2) illustrated in framework design (initial goods evaluation and goods evaluation, see Figure 3). This screen receives and processes inputs such as the order no., order type, expected price, purchase from, department requesting the order, and a description about the order. The output from the processing should be able to classify the type of decision to be made as simple decision if the expected price is more than 10millionID and also the hardware manufacture is not from government source else it called as complex decision which is the problem that we want to solve.
III. Complex Decision

Based on the input information as illustrated in Figure 5, the type of procurement decision to be made will be a complex one because the expected price is more than 10 million ID and also the hardware manufacture is not from government source. This decision was reached based on certain criteria built into the prototype system as presented below:

- **Technical factors**
  - Technical features TF: characteristics of hardware type.
  - System reliability SR: the probability that the system will yield correct outputs up for a certain period of time.
  - System performance SP: Amount of useful work done that can be done by the hardware system, compared with the time and resources to be used in procuring it.
  - Upgradability UG: ability and availability of upgrade and replacement parts for the system.

- **Cost factor:** - the total cost of hardware.

- **Operational factors:**
  - System security features SSF: security of implementing the technology for the hardware system.
  - Ease to use ETU: effective and efficient interaction of the hardware system.
  - Performance monitoring tools PMT: tools that are designed to simplify monitoring of the hardware system performance.

i. **Criteria Evaluation**

This submenu evaluates the inputs of every single criterion in relation to other major criteria as well as each of their sub-criterion with respect to sub-criteria (under each main criterion). This submenu simulates and evaluates values from the inputs and presents them according to Saaty table. For example, based on the hardware sample study case illustrated in Figure 5 above, the user inputs are simplified by reversing the evaluation criteria automatically such that when the input value is 3 for “technical to cost”, the reverse 1/3 is automatically entered for cost. Figure 6a and 6b shows the classification of criteria and their subcriteria according to inputs and evaluations respectively, while Figure 6c shows the error message that will display if there is any mistake in user input evaluations.

![Figure 5: The Order Information Screen.](image)

![Figure 6a: Stage 1: Inputs for Criteria and Subcriteria](image)

![Figure 6b: Stage 2: Evaluation of Inputs for Criteria](image)

![Figure 6c: Error Message for Wrong Input Evaluation.](image)

ii. **Vendor Bids Evaluation**

This submenu receives inputs of vendor names and evaluates these inputs for each vendor with respect to
each criteria and sub-criteria previously evaluated in Figure 6. The submenu simulates the evaluation part (stage 3) of the framework design (see Figure 3). The inputs of vendors based on the hardware example used in this study. The system also checks user inputs and displays error message requesting the user to re-input the correct evaluation. Figure 7a shows the inputs of the vendor names (X, Y, and Z) that submitted offers to supply the hardware order used as an example in this study, and Figure 7b shows the input evaluation for vendor bids. The criteria used for this evaluation is also presented below:

- **Vendor specific criteria**
  - Quality of support services QOSS: - warranty, maintenance, and the way to access support may include telephone hot lines and, fax, e-mail, Web sites, and others.
  - Delivery lead time DLT: - the amount of time that a company takes to deliver goods.
  - Vendor’s experience in related products VER: - Vendor’s CV items that related to specialization and skills in related product.

After input evaluation for vendor bids have been carried out, the prototype code calculation will simulate the selection of the best choice of vendor based on the AHP technique employed in its design. In this stage AHP will automatically calculate which vendor’s bid is the best contract order.

### i. Decision Report Screen

This submenu (Figure 8) shows the decision report which includes the order information and the vendor name that wins the supply order, with the "RVV" value for each of the vendor’s specification criteria results.

![Figure 8: DSS Report](image)

From this DSS report page user can review his inputs and the calculation of AHP that led to get final decision presented in Figure 8. This submenu also allows users to save the full details of the order decision report as shown in Figure 9.

### 5.1 SYSTEM TESTING

The testing phase was carried out using sample and actual test data. The sample data was used to determine the accuracy of the prototype system by manually computing the result and comparing it with that
automatically computed by the prototype software. The major reason for the testing phase was to determine the accuracy of the proposed prototype system. Table 5 shows the marginal error percentage of the prototype software automated sample data result compared against the manually computed results of the sample data of hardware order, ordered by the department of computer science and tendered by three non-government listed companies: X, Y, and Z.

i. **Manual Computation of Results**

**Construct Option Performance Matrix (OPM):**
The input values for vendors against operational sub-criteria as presented in Table 2.

Table 2: OPM Values for Vendors with Respect to Each Main Specification.

<table>
<thead>
<tr>
<th>Vendors</th>
<th>Technical</th>
<th>Cost</th>
<th>Operational</th>
<th>Vendors</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>0.085</td>
<td>0.637</td>
<td>0.391</td>
<td>0.193</td>
</tr>
<tr>
<td>Y</td>
<td>0.175</td>
<td>0.258</td>
<td>0.072</td>
<td>0.550</td>
</tr>
<tr>
<td>Z</td>
<td>0.734</td>
<td>0.104</td>
<td>0.530</td>
<td>0.254</td>
</tr>
</tbody>
</table>

- To evaluate the best vendor we apply this relation:
  
  \[ \text{Performance} \times \text{requirement} = \text{value for money}. \]
  
  "FM"
  
  \[ \text{OPM} \times \text{RVV} = \text{VFM} \]
  
  (Table 3)

Table 3: VFM Calculations for Vendors with Respect to Main Specifications

<table>
<thead>
<tr>
<th>Vendors</th>
<th>Technical</th>
<th>Cost</th>
<th>Operational</th>
<th>Vendors</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>0.065</td>
<td>0.657</td>
<td>0.391</td>
<td>0.193</td>
</tr>
<tr>
<td>Y</td>
<td>0.175</td>
<td>0.258</td>
<td>0.072</td>
<td>0.550</td>
</tr>
<tr>
<td>Z</td>
<td>0.734</td>
<td>0.104</td>
<td>0.530</td>
<td>0.254</td>
</tr>
</tbody>
</table>

From these results, we observe that vendor Z’s offer is better than vendor X’s offer, and X’s offer is better than vendor Y’s offer. Therefore, vendor Z makes the best offer with respect to the other vendors’ bids.

Table 4: Marginal Error Percentage

<table>
<thead>
<tr>
<th>Vendors</th>
<th>Software</th>
<th>Manual</th>
<th>Marginal Error %</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>0.086</td>
<td>0.104</td>
<td>0.28</td>
</tr>
<tr>
<td>Y</td>
<td>0.354</td>
<td>0.014</td>
<td>0.24</td>
</tr>
<tr>
<td>Z</td>
<td>0.18</td>
<td>0.07</td>
<td>0.17</td>
</tr>
</tbody>
</table>

From Table 4 above, we see that the average marginal percentage error is 0.19% which can be attributed to decimal round offs during the manual computation. We therefore conclude that the proposed DSS procurement prototype system is accurate.

5.2 **SYSTEM EVALUATION**

The perceives of usability technology framework TAM3 has covered in questions that have asked to UOB respondents, the respondent agreements that have got to perceived easy to use factors (Perceived Experience, Perceived DSS Self-Efficacy, Perceived DSS Anxiety) and usefulness factors (Perceived Subjective Norms, Perceived DSS Job Relevance, Perceived DSS Output Quality, Perceived Result demonstrability) have proved the reasons that why this prototype is suitable, useful, easy to use, and lead to behavior intent which also proved by the respondent feedbacks that clarify UOB opinion to use this DSS prototype. Table 5 shows the summery for perceives results and the final result that determined from these perceives. The evaluation results showed that the prototype system is compliant with the UOB procurement regulations and fully covered its procedures. Furthermore, the results indicate that the proposed prototype system is consistent, easy to use and sufficient in addressing the procurement challenges faced by UOB.

Table 5: Final Results for Respondent Feedback

<table>
<thead>
<tr>
<th>Perceive</th>
<th>Sub perceive</th>
<th>Sub perceive Result</th>
<th>Perceive Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to Use</td>
<td>Perceived Experience</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>Perceived DSS Self-Efficacy</td>
<td>Agree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived DSS Anxiety</td>
<td>Agree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usefulness</td>
<td>Perceived Subjective Norms</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Perceived DSS Job Relevance</td>
<td>Agree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived DSS Output Quality</td>
<td>Strongly Agree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Result demonstrability</td>
<td>Strongly Agree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behaviour</td>
<td>Perceived Behaviour intent</td>
<td>Strongly Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Final Result</td>
<td>Strongly Agree</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.3 **Benefits of the Proposed DSS Solution**

The proposed DSS solution has many features that were proved in its validation at UOB that is easy to use and useful for simple and complex decisions that can be identified in the first stage after inputting the procurement order information. Also it is easy to use and useful for inputting the evaluation of the criteria/subcriteria of the procurement order and provides a high quality output and not need for users to have a high level of experience due to its simplicity and the personal self-efficacy is enough to use it since the prototype controls transitions to the subsequent stages by showing an error message for any mistake in an evaluation, and does not go to the next stage before correcting the evaluation, also the prototype shows a graphic plan window for the main and subcriteria inputs in order to give more understanding of the criteria classification according to the AHP technique.
Finally this solution provides high job relevance to UOB procurement as a public procurement type.

5.4 Limitations of the Proposed DSS Prototype and Areas of Future Works

The development of the proposed DSS prototype focused on the decision-making process involved in selecting the best vendor with the best type of goods. The proposed prototype does not cover the management processes related to budget, store and suppliers because of the time limitations in the study. Future works can improve the framework and prototype by covering these related management areas. Another limitation arises from applying the DSS prototype with a high number of criteria and sub-criteria; this may become tedious and arduous to implement, so the prototype can be further developed by adding expert techniques to the current AHP technique to enable the system to predict the relevant criteria/sub-criteria for any order of goods and specify the suitable vendors based on the history of previous orders.

CONCLUSION

This paper presented a detailed study on the processes undertaken in developing a DSS procurement prototype solution for the UOB. AHP technique was used to select the criteria. The study employed the use of a conceptual model based on TAM3, a study framework based on factors identified from the literature review findings and case study method to develop the proposed DSS procurement prototype solution. The evaluation results show that the proposed system is highly applicable, accurate and valid and addressed the procurement challenges faced by UOB. A major limitation of this study is that it is a standalone system and needs to be connected to other databases and possibly the Internet.

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