FULL-LENGTH ARTICLE

Grounded theory and action research as pillars for interpretive information systems research: A comparative study

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Abstract   In the literature survey, there is evidence "why an interpretive paradigm is more suitable for evaluating e-government systems". However, more than one method can be used when applying interpretive paradigm for evaluating information systems (as we do not consider e-government systems as exception) such as Action Research (AR) and Grounded Theory (GT). In this regard, two problems will arise: First, there is no explicit method that clarifies how AR and GT methods can be used for evaluating information systems. The second problem is to determine which method of them will be more appropriate for evaluating information systems.

Accordingly, two frameworks for evaluating e-government systems have been proposed, namely 'Grounded Evaluation Framework' (GEF) and 'Action Research Evaluation Framework' (AREF), which are based on Grounded Theory (GT) and Action Research (AR) methods respectively, to give an example how GT and AR methods can be used in evaluating information systems. The suggested GEF and AREF have been applied to the "University Enrolment Service" in Egyptian e-government, and the findings have been analyzed to conclude that GEF is more appropriate for evaluating e-government systems.

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1. Introduction

There has been growing criticism on the quality of most of the researches published regarding evaluating information systems in the last ten years, such as the lack of using theory to build frameworks, as the existing evaluation frameworks neither explicitly state the methodologies nor sufficiently justify the paradigms selected as a base [1–3]. Hence, the choice of research methodology and paradigm should be justified by the choice of philosophical assumptions (ontological, epistemological, and methodological) underlying a particular

research [4–6]. Four basic research paradigms have been served as a framework for thinking about assessment and evaluation, which are positivist, post-positivist, critical, and interpretive paradigms. A comparison between these paradigms is shown in Appendix B, Table B1.

It has been stated by Wiredu [7] that the nature of problems in e-government systems and subjective understanding of their reality require qualitative methods. Based on Walsham [8,9] and [10], the qualitative direction is fully compatible with the interpretive information systems (IS) research. Therefore, what is needed is an accent on evaluation that is concerned with the process of devising questions, and interpreting the answers that give results in a systematic way. In addition, it has been discussed by Abdel-Fattah and Galal-Edeen [11] "why an interpretive paradigm is more suitable for evaluating e-government systems?", and the research clarified that the interpretive paradigm will not be suitable for all e-government environments, which means that the interpretive paradigm is likely to be more suitable when the objectives of e-governments are providing intangible benefits and achieving improvement in social and public service.

The paper is organized as follows: Section 2 reviews the existing literature on the recent studies that have been centered on the context of interpretive research. The two proposed frameworks (i.e., Grounded Evaluation framework and Action Research Evaluation framework) will be presented in Section 3. The following section presents applying the proposed frameworks to the "University Enrolment Service". Analysis of the research results and discussion will be offered in Section 5. The conclusion will be outlined in the final section.

2. Interpretive research background

Interpretive IS research has been increasingly used since 1993–2000, accounting to 12–17%. Mingers (2003) cited in [9], as interpretivism encourages researchers to be more interpretive and inductive, rather than seeking to test and validate hypotheses, also, taking into account different perspectives of participants.

The interpretive research can be applied by more than one method, such as Case Study (CS), Research Development

(RD), Ethnographic Research (ER), Action Research (AR), and Grounded Theory (GT) [12,13]. Each of them has its key features and processes when applied. There is a similarity between Action Research and Grounded Theory, as each of them main thrust is to develop a theory regarding social phenomena, and they have the process of devising questions, and interpreting the answers in an iterative way [14–17]. Also, merging GT and AR has been suggested by [18–20] due to the similarity of the cyclic nature of both of GT and AR. Therefore, it seems that AR and GT fulfill the features required for applying interpretive research in evaluating e-government systems. However, the question is which of them is more suitable for evaluating e-government systems? The research endeavors to answer this question.

2.1. Grounded theory

It has been mentioned by [21] that the prime emphasis of a researcher, who attempts to build a Grounded Theory, is the systematic collection, coding and validation (in an iterative fashion) of data that may help to describe a phenomenon of interest, and the most important recommendation of Grounded Theory is to "let the data talk", but at the same time to formalize such "talk", and to use such formalization to guide further data collection and analysis. Also, the importance of the GT method is that it provides a sense of vision, and the techniques and procedures used provide the means for bringing that vision into reality [14]. According to [12], Fig. 1 graphically illustrates the processes and concepts of Grounded Theory. Grounded Theory method was applied for the interviews and analysis in the e-government field by [22,23].

The justification for using Grounded Theory in evaluating e-government systems is based on the principle that GT provides a set of procedures for coding and analyzing data which suits the interpretive approach since it would keep the analysis close to the data and provide inductive discoveries about the phenomena under study [14]. In brief, the methodology of Grounded Theory is iterative, requiring a steady movement between concept and data, as well as comparative, requiring a constant comparison across different types of evidence to
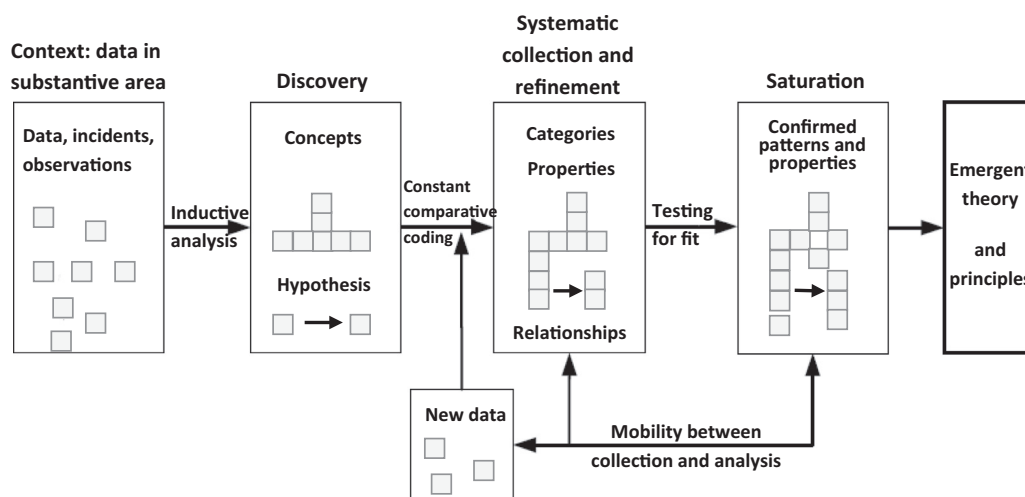

Figure 1   Model of grounded theory 'Adopted from Villiers [12]'.

control the conceptual level and the scope of the emerging theory.

2.2. Action research

A simple definition for Action Research (AR) is provided by [24] that Action Research has two constructs, which are 'action' and 'research' and the links between them. It is quite possible to take action without research or to do research without taking action. It should be borne in mind that the unique combination of the two constructs is what distinguishes action research from other forms of enquiry. AR was born to solve practical problems, and worked to bridge the gap between theory and practice [15]. Also, another factor that differentiates it from common problem- solving research is that AR engages the participants in the research's activities.

There are four types of Action Research, namely, Traditional Action Research, Contextual Action Research (Action Learning), Radical Action Research, and Educational Action Research [25]. This research focuses on ''Traditional Action Research'', as it is applied to the area of Socio-technical systems (e.g., Information systems, e-government systems) [9,26]. Based on our literature survey, Action Research could be described as follows:

a. *Subjective*: It is based on a subjective epistemology, which regards reality as a subjective or a social construction, as there are no real structures in social world, and reality is a product of the mind or a product of individual consciousnesses.
b. *Formative*: It aims to improve an ongoing system; therefore, problems can be identified as they emerge and the next cycle can be improved as the system is being developed.
c. *Qualitative*: It operates more via verbal aspects rather than by numbers [12].
d. *Interpretive*: It investigates issues not easily measured in an empirical manner [27].
e. *Collaborative*: It empowers all individuals concerned with the intention of improving the practices carried out, where stakeholders are full participants in the research process [12,28].
f. *Responsive*: It reacts and adapts flexibly to the findings from each previous cycle [12].
g. *Reflective*: It advances through cycles, 'starting' with reflection on action, and proceeding to a new action which is then further researched. In addition, outcomes from each cycle are used in designing subsequent steps and events.
h. *Experiential model of inquiry*: All individuals involved in the study are known and contributing participants [15].
i. *Cyclic in nature*: It cannot be conducted on a once-off basis, but rather is a continuous process. In other words, action research is an emergent process with a dual cycle, an action cycle integrated with a research cycle [15]. Each cycle has four steps (plan, act, observe, and reflect) as depicted in Fig. 2, which is adopted from [29].
j. *Theory developer*: It generates ideas and perceptions to be tested and validated for more than one cycle, and then it ends by developing a theory.

Figure 2   Action research cycle.

k. *Open-ended research*: It starts with a concept, perception, or idea that has been developed, rather than starting with a fixed hypothesis [15].
l. *Informal*: There is no one correct way; the researcher must decide what is right for his/her, and develop his/her own views.
m. *Form of self-evaluation*: It is the developmental process of following the perception or idea, seeing how it is progressing, and constantly checking its development [15].

To sum up, AR seeks to produce practical solutions to real problems, and expand scientific knowledge, especially when the situations are too ambiguous to conduct a precise research question [12,25]. Since AR is a participative research, its focus is on turning the people involved, into researchers who are more willing to apply what they have learned when they try it themselves [25], which enhances the competencies of all participants, unlike other research methods which keep the observer and the participants isolated [12,16]. It offers a guide model to monitor and improve the progress of a research project, through iterative stages. Finally, there are opportunities for a theory to emerge rather than always following a previously formulated theory [16], given that most approaches have a lack of testing and developing a theory. All these factors have given a justification why AR is chosen for evaluating e-government systems.

3. Proposed grounded evaluation & action research evaluation frameworks

In this section, we endeavor to postulate two frameworks for evaluating e-government systems, namely,

Grounded Evaluation Framework (GEF) and Action Research Evaluation Framework (AREF).

3.1. Grounded evaluation framework

Our proposed Grounded Evaluation Framework (GEF) for evaluating e-government systems is divided into three phases as outlined in Fig. 3.

3.1.1. Phase I (planning)

This phase focuses on two steps:

1. *Service surveying step*, a quick overview for the service (which will be evaluated) should be made through the e-government portal, to determine the characteristics of this service, and whether it is mandatory service or not, etc. Hence, we can initially postulate some questions that should be investigated during data collection phase.
2. *Stakeholder identification step*, this step, identifies stakeholders; their perspectives or points of view, their positions, i.e. the participants for evaluating the service should be determined during this step.

3.1.2. Phase II (data collection)

This phase focuses on two methods of data collection, which are documentation and interviews. The purpose of using a combination of data collection methods is to minimize weaknesses inherent in a single method [30] and increase the robustness of results [31]. Data collection phase will be divided into three steps:

1. *Provider interview (background) step*, this step aims to determine the providers adopted view of evaluation, the relative position of the provider to the organization. This interview focuses on background or history about the service that will be evaluated without getting into further details.
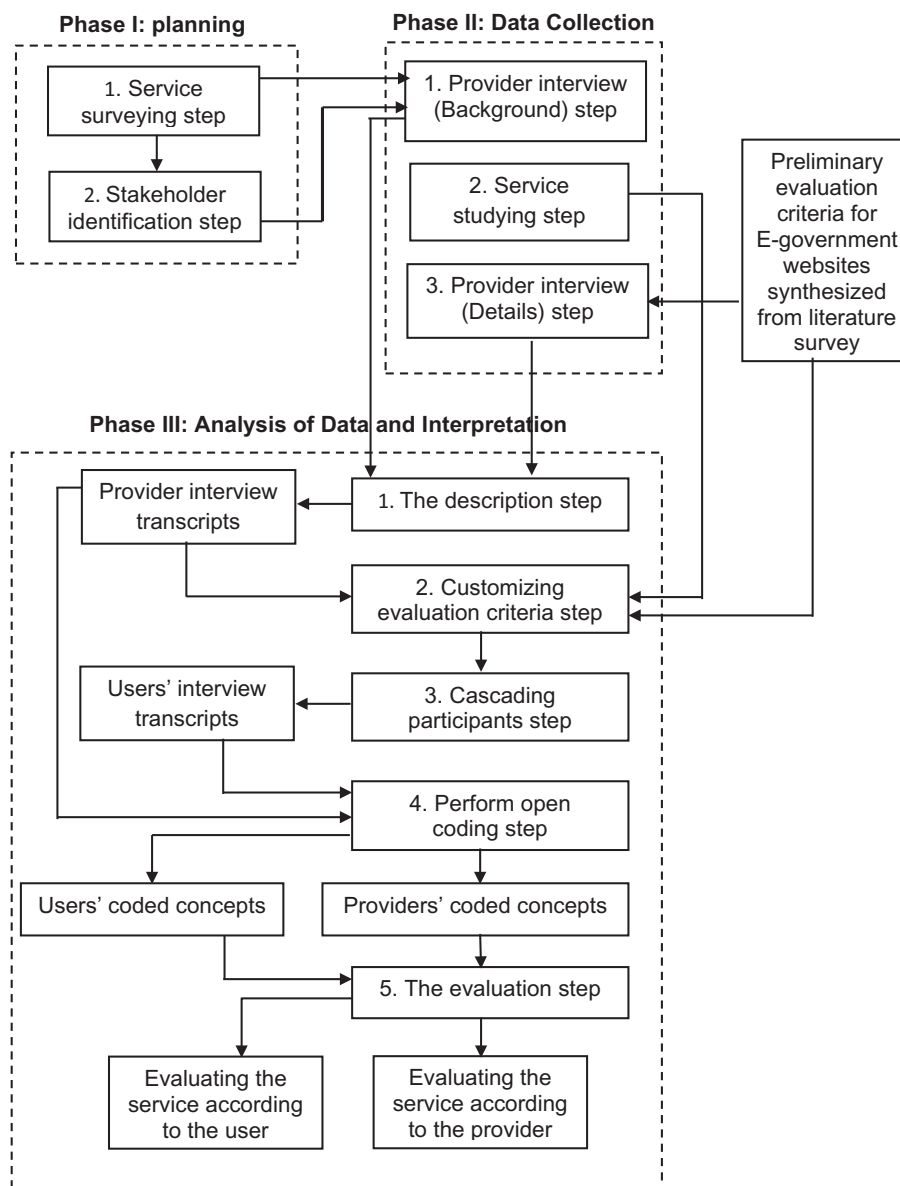

Figure 3 The proposed grounded evaluation framework (adopted from [47]).

2. *Service studying step*, this step examines the documents for the selected service, which are provided from the service provider. These documents should define the strategic objectives, vision, mission, and the benefits of a service/system, and any other available documents.

3. *Provider interview (details) step*, this step focuses on the details of the participants' present experience in the topic area of study, problems such as incomplete, missing, unusable data should be identified and resolved during this phase, rather than after its completion [32]. Through this step we will use the evaluation criteria according to the provider's perspective, which are presented in [33], as a guide to make this interview. For each case (e-government service) these criteria will be customized according to the nature of this case.

3.1.3. Phase III (analysis of data and interpretation)

This phase encompasses a set of steps:

1. *The description step*, the researcher describes the facts which are socially shared realities agreed upon by all participants [34]. The background and the details interviews of the provider should be read several times, then divided into paragraphs, and then each paragraph is given a code. This step will end by writing up the provider interview transcripts.

2. *Customizing evaluation criteria step*, depending on the interview transcripts given by the provider in the previous step, and the study of the service which is provided in the second step of the data collection phase, we can customize the evaluation criteria for e-government website according to the user's perspective, which are presented in [33]. The customized evaluation criteria will be used for interviewing the user.

3. *Cascading participants step*, the researcher determines the way participants ascribe meaning to their separate realities by how they perceive cause and effect [34]. After applying this step on the users, we will repeat the same step done with the provider, to reach the user transcript interview.

4. *Perform open coding step*, this step applies Grounded Theory (mainly open coding and axial coding). The researcher identifies categories (also referred to as concepts) [14] based upon patterns and ideas that have been obtained from the interviewees' transcripts (service provider and users). As s/he reads looking for primary concepts that are repeated and stand out, some of these concepts are simply words or phrases used by the interviewees. As more data are collected the open coding is continued and categories begin to emerge. Categories are then compared and integrated and more abstract categories are formed leading to a hierarchy of categories [35]. Open coding serves two main functions, which are, to reduce large amounts of data, and to help the researcher to build cognitive map to understand what is happening in each case.
While [20] divided preliminary descriptive coding into five categories, which are environmental, organizational, individual, object and supplier, the perform open coding step is applied twice to obtain the coded concepts for the user and the coded concepts for the provider.

5. *The evaluation step*, the researcher identifies themes (or invariants) that emerge from the research and these are then used to develop common interpretations [34]. The coded concepts (produced from step four) are used at this step for evaluating the services, but it should be emphasized that the coded concepts used in this evaluation will differ from a service to another. Moreover, coded concepts for one service differ from the service provider's perspective to the user's perspective.

3.2. Action research evaluation framework

Our proposed Action Research Evaluation framework (AREF) for evaluating e-government systems is divided into two cycles. Each cycle encompasses five phases as outlined in Fig. 4. These phases are as follows:

3.2.1. Phase I: Identifying initial idea for the situation/case study

This step identifies the needs and requirements of the case study, which in turn triggers the need for a change and series of actions to be designed, implemented and evaluated [36].

3.2.2. Phase II: Planning action/intervention

This step reviews objectives, designs the process to achieve the identified objectives, and participants should be agreed on. Also, tasks/actions, form task groups, and schedule/timeline should be determined. In addition, pilot survey (questionnaire) may be considered [37]. Hence, evaluation items can be listed. Furthermore, it should be taken into account that the plan should be flexible enough to adapt to any unforeseen effects and unrecognized constraints [38].

3.2.3. Phase III: Implementing action/intervention

This step implements the plan. Implementation activities could be a sort of discussion for the material provided in greater depth in small groups [25], participant observations, interviewing, process consultation and task Group reports [15,36].

3.2.4. Phase IV: Analyzing and evaluating on action

This step, initially, analyzes the action taken, and then evaluates the results. Observations, formative and summative evaluations could be used to investigate the effectiveness of the workshops [15].

3.2.5. Phase V: Reflecting on action

This steps provides a feedback on the evaluation phase and outcomes, and makes decisions for the direction of the next cycle of Action Research Evaluation Framework. The results of this reflection phase are then used to plan the action of the next iteration (Baskerville and Wood-Harper, 1996), cited by [36].

4. Applying the proposed frameworks to the case study

4.1. Case study background

The University Enrolment Service (UES) is one of the services that is provided by the Egyptian e-government portal www.Egypt.gov.eg. The UES background could be divided into
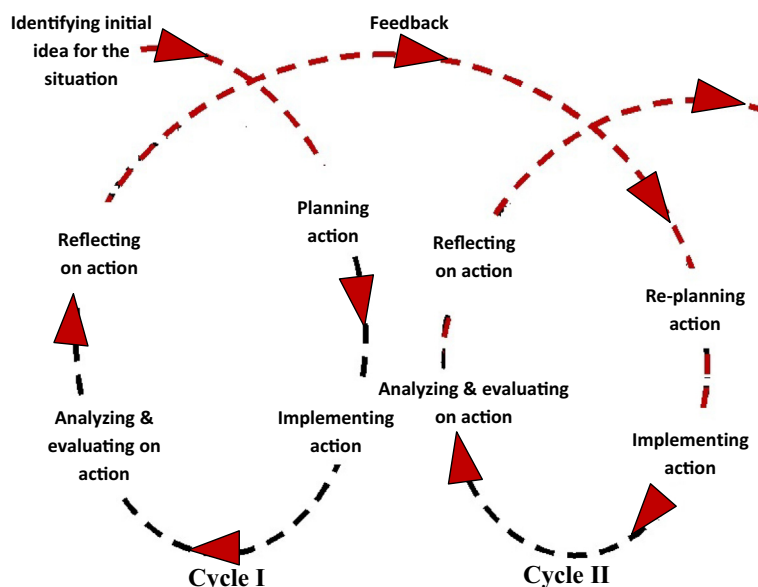
Figure 4 The proposed action research framework (synthesized by the author).

two stages. The first stage is before initiating the service, and the second stage is after initiating it:

First: The situation before initiating the UES service: Usually, each year, following the announcement of the Egyptian General Secondary Certificate results, students flooded the university enrolment offices to buy the paper application forms (costing EGP40.00 for each form). This application process took place in 19 offices distributed all over Egypt in order to try to cover all regions in Egypt. Students are asked to fill the admissions application by listing their choices of their desired discipline and university in a descending order of preference. The forms were filled manually by affixing a stamp for each choice, the total number of choices that each student had to fill being 48. The applications are then submitted back to the university enrolment offices.

All student applications ultimately end up at a center in which all data from each and every student application form are entered by seasonal data entry personnel, into the back-end legacy system where the matching process is carried out. Once the enrolment phase results were declared, students are notified of their results by post mail.

Second: The situation and benefits after initiating the UES service: The UES taken was replacing the traditional paper process by a comprehensive web-based application that accepts student university enrolment applications, and is supported by a 24/7 call center hotline. Students were able to access the application with their student IDs and a special PIN code that they received along with their secondary school certificates. The online application was offered entirely free of charge.

The application provides the students with guidelines, rules and interactive online help together with the ability to update personal data. All other incentives are added automatically to the student's grades. Also, students now have the chance to alter their choices after submitting them, as long as it is in the timeframe. In addition, huge savings resulted as well for the operational costs of the government, such as savings in paper forms, and seasonal staffing of university enrolment

offices. Enrolment results are communicated to the students not only through mail but also, through SMS and the web application.

4.2. Applying grounded evaluation framework

4.2.1. Phase I (planning)
4.2.1.1. Phase I: Service surveying step. The UES is a seasonable service. Hence, it is not available in the Egyptian e-government portal all the year. Also, to examine this service student ID and password should be provided to log in.

4.2.1.2. Phase I: Stakeholder identification step. The project manager of the UES project is determined as the service provider. The users for this service could be all Universities' students as it is a mandatory service, however, the students of Faculty of Computers & Information are chosen to be the users of this service.

4.2.2. Phase II (data collection)
4.2.2.1. Phase II: Provider interview (background) step. The project manager of the UES was contacted and interviewed. The interview was open-ended and conducted at his workplace. It took approximately one hour and was recorded manually. It was designed to reveal the project manager's perception of the UES, the following questions were asked: What was the motivation to develop the UES? what were the strategies used to implement the UES? and what were the benefits resulting from the UES?.

4.2.2.2. Phase II: Service studying step. Documentation of the UES has revealed the information that is presented in section (4.1, case study background), which are provided by the Ministry of State for Administrative Development (MSAD).

4.2.2.3. Phase II: Provider interview (details) step. The second interview was conducted; it took approximately one and half an hour and was recorded manually. In order to prevent the

interviewee and the interviewer from digressing into a trivial conversation, a semi-structured interview protocol was used as a reference for the interviewer. However, the actual interview process was managed as an open-ended interview to serve and reveal unintended latent constructs.

The protocol questions were largely grouped into five sets, and the evaluation criteria according to the provider's perspective, provided in [33] were used as a guide for this interview. However, some modifications were made as shown in Appendix A Table A1.

4.2.3. Phase III (analysis of data and interpretation)

4.2.3.1. Phase III: The description step. The background and the detail provider interviews were then read three times. Some information from the documentation in the background interview to get further details through some questions was merged too. The interviews were divided up into paragraphs, and then each paragraph was coded. By applying this step, a transcript consisting of 46 paragraphs in 5 pages was coded.

4.2.3.2. Phase III: Customizing evaluation criteria step. This step started by determining the criteria that should drive the customization, after reading the previous transcript (provided in the description step) and studying the UES and its documentation, it was noticed that some features should be merged, deleted or new ones added in the evaluation criteria, provided in [33]. Some examples can be given as shown below:

> The provider also mentioned that the UES was available earlier than its actual time to offer the students a chance to test the service. Hence, an additional feature was added regarding this test.
> The provider mentioned that the students were offered the technology clubs and faculties laboratories on the UES as multiple-channels for using the service, so we added a new feature asking the students whether the service was really provided through multiple channels or not.
> The service should be available 24 h a day, seven days a week (24/7), and the technical support on using this service was also added.
> It was mentioned that the objectives of this service is to allow the students to alter their choices more than once without any fees. Thus, we added a new feature to evaluate whether this objective was achieved or not.

To sum up, if we need to add a new feature to the evaluation criteria, it should be explicitly mentioned by the provider or in the documentation (not deduced). In case of deleting or merging any features, there should be a reasonable reason. Table A2 in Appendix A describes the evaluation criteria according to the user's perspective after customization.

4.2.3.3. Phase III: Cascading participants step. In this step, Table A2 was used to interview the users (students). Initially, twenty students from the first grade of Faculty of Computers and Information (Cairo University) were interviewed. On interviewing those students, it was found that most of their opinions were similar in most of the evaluation criteria. Consequently, we did not need to add more users. As we did in the provider interview, the user interviews were divided up into paragraphs, and then each paragraph was coded. By applying this step, we continued from the paragraph 46 to reach the paragraph 466 and from page 5 to reach page 45 (these paragraphs/pages will not be presented in this research), only an example for these paragraphs will be presented, as shown in Fig. 5.

4.2.3.4. Phase III: Perform open coding step. This step was applied twice. The first time was performed for the provider interview transcript and the second time was for the users' interviews transcript. These transcribed interviews were manually analyzed to identify the underlying concepts.

First for the provider interview transcript:

1. By reading the provider interview transcript, initially, the concept, its property and the value of each coded paragraph were conducted. Each of the concept, property and value were highlighted by using yellow, blue and green respectively as shown in Fig. 5.
2. A table was created for each concept, which encompasses three columns. The first column is for the property. The second is for the dimensional range or scale for the values, and if it is "nominal" which means that the value is not determined or "ordinal" which means the range of the value could be determined. The third column is for the value. "≪CRM≫" denotes the concept name of the table. Table 1 provides a "concept" example, which is one of the "concepts" of Fig. 5.
3. We can notice that Fig. 5 has more than one concept, which is useful to find the relationship between these concepts. The same steps were applied for the entire provider interview transcript coded paragraphs; at the end we obtained the 17 "concept" tables. After reading these tables carefully, we found that three concepts (problems, students, service) were redundant, so they were merged in the same table. Policy and performance concepts contained one property for each; hence we merged them in the service concept table. Again, after determining all concepts, we read the provider interview transcript carefully, and then we compared it with the determined concepts to ensure making all the appropriate modifications to reach the final 12 "concepts" tables, and then the provider's "concepts" were counted to determine the frequency of each concept. For example, the frequency of "application concept" provided in Fig. 6 is 15.

There is full data about the students' behavior on using the service, and if the student contacted the CRM center either by phone or by email, timing of the call/email is recorded, and what is his/her problem/enquiry, and when did s/he receive the response. So that the problems that face the student could be determined and fixed in the future.

Figure 5   Paragraph example from the provider interview transcript.

Table 1 The concept table example.

≪CRM≫		
Property	Dimensional range	Value
Communication method	Ordinal	Phone, email
Time of communication	Ordinal	Morning & night & work hours & day off
Problem	Nominal	Network problem & technical problem
Time for response	Ordinal	Immediately, later
Response method	Ordinal	Phone, email and SMS

4. The research assumes that the number of codes for each concept determines the weight of this concept in the evaluation (assumption). Thus, the concept which has a low frequency of occurrence e.g. 1 or 2 should not be considered as a main concept. Perform open coding step ends by finding the relationships between these concepts, as shown in Fig. 6 (details of Fig. 6 are offered in Table 3). As the main objective for this step was to devise the providers' coded concepts, before obtaining them, so all the concepts with similar meaning were merged in one concept and the concepts that don't relate to the UES were deleted.

Second for the users' interviews transcript:

The same steps which were followed in the provider interview transcript were applied to the users' interviews transcript. The proposed coded concepts according to the user's perspective, are outlined in Fig. 7.

4.2.3.5. Phase III: The evaluation step. This step was applied twice, once for evaluating according to the provider's perspective and the other for evaluating according to the user's perspective.

First for the provider's perspective:

On examining the provider's coded concepts, provided in Fig. 6, it was found that the student concept is not appropriate for evaluating the provider. Hence, it was deleted and examined in the evaluation of the service according to the user's perspective. Table 2 depicts the weight (expressed as a percentage) for each concept according to the provider's perspective.

The steps followed to calculate the total evaluation percentage for UES can be summarized as follows:

1. Concept weight = (concept) frequency × 100)/Σ category frequency.

For example, "service" (Table 2) = (18 × 100)/68 = 26.47%.

2. Each item was evaluated according to range scale. This scale encompasses three values: (1) less than 50% poor; (2) 50% – less than 80% good; and (3) more than 80% very good as shown in Table 3. For items which contain sub items, we calculate the percentage of the available sub items to score the item.

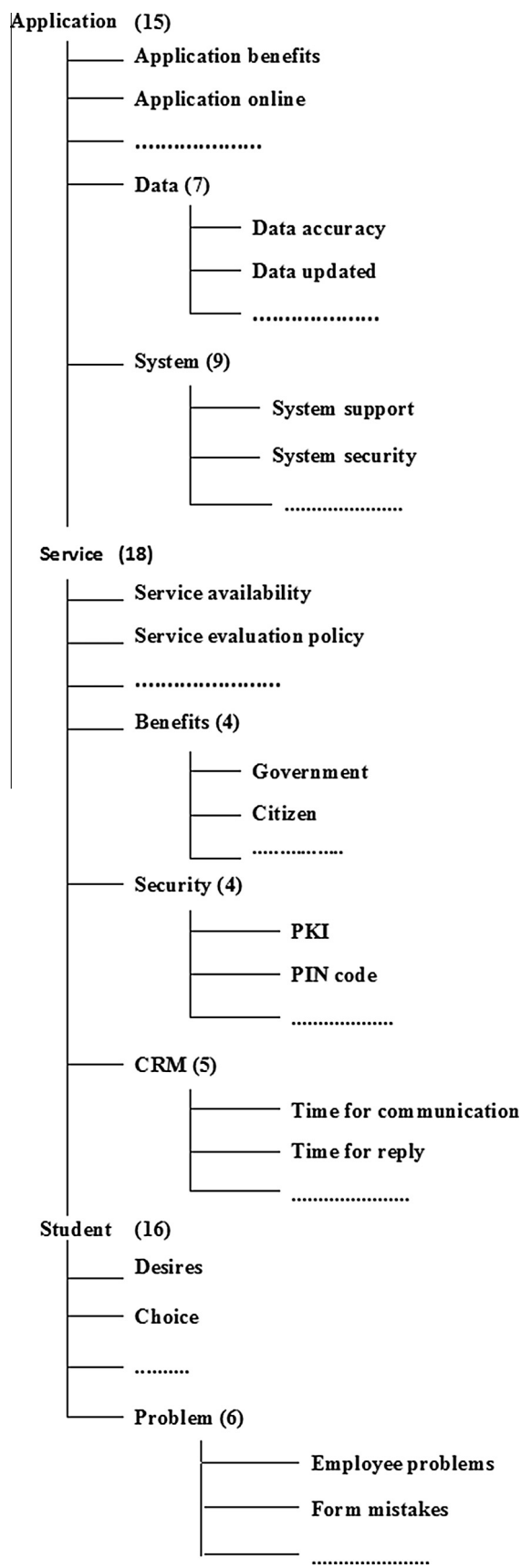Score of the item = (number of available sub items/number of sub items) × 100.

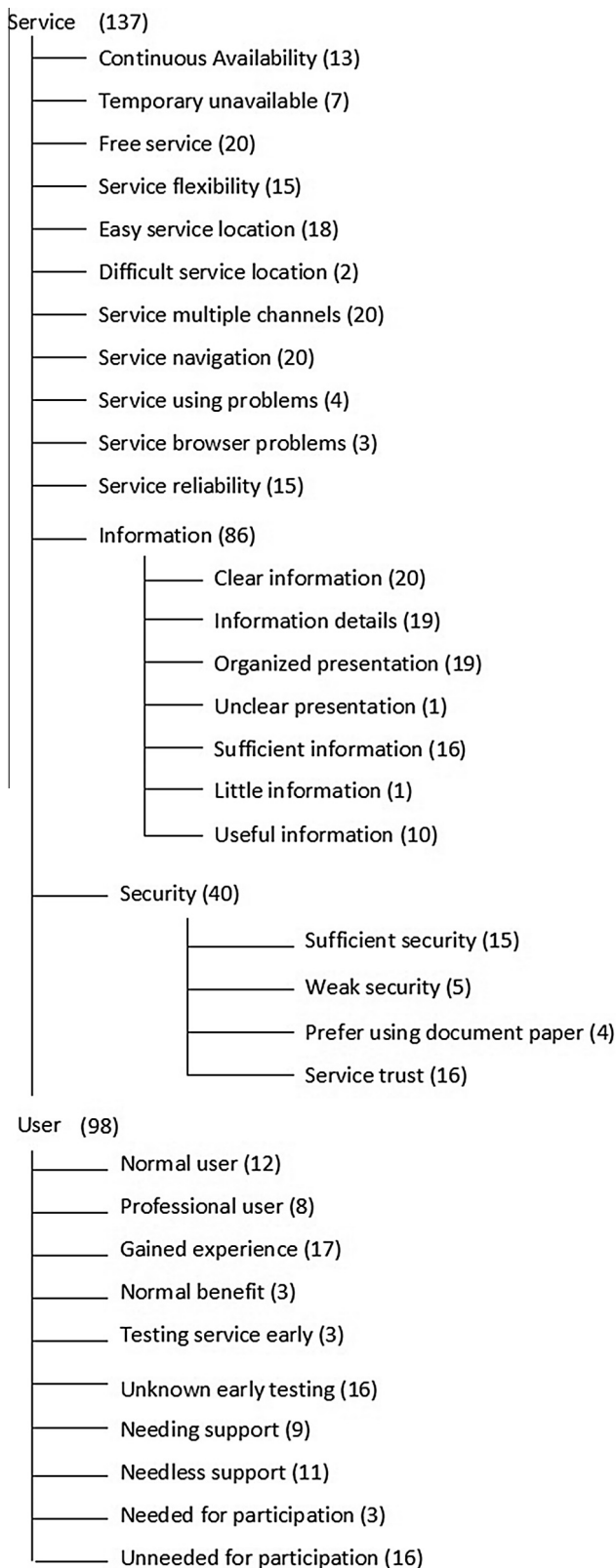**Figure 6** Coded concepts according to the provider's perspective.

Service (137)
├── Continuous Availability (13)
├── Temporary unavailable (7)
├── Free service (20)
├── Service flexibility (15)
├── Easy service location (18)
├── Difficult service location (2)
├── Service multiple channels (20)
├── Service navigation (20)
├── Service using problems (4)
├── Service browser problems (3)
├── Service reliability (15)
├── Information (86)
│   ├── Clear information (20)
│   ├── Information details (19)
│   ├── Organized presentation (19)
│   ├── Unclear presentation (1)
│   ├── Sufficient information (16)
│   ├── Little information (1)
│   └── Useful information (10)
└── Security (40)
    ├── Sufficient security (15)
    ├── Weak security (5)
    ├── Prefer using document paper (4)
    └── Service trust (16)

User (98)
├── Normal user (12)
├── Professional user (8)
├── Gained experience (17)
├── Normal benefit (3)
├── Testing service early (3)
├── Unknown early testing (16)
├── Needing support (9)
├── Needless support (11)
├── Needed for participation (3)
└── Unneeded for participation (16)

Figure 7 Coded concepts according to the user's perspective (UES).

For example, "application benefits" (Table 3) contains 5 sub items, all these sub items are available, hence, the score was $5/5 \times 100 = 100\%$ which was evaluated as very good.

3. Category (relative weight) = (Σ score of items/number of items) $\times$ category weight.

For example, "service" (Table 3) = (8/8) $\times$ 26.4 = 26.4%.

4. Total evaluation% = Σ category (relative weight)

For example, total evaluation percentage (Table 3) = 0.22 + 0.10 + 0.13 + 0.264 + 0.06 + 0.04 + 0.074 + 0.09 = 0.98.

Second for the user's perspective:

Table 4 outlines the weight (expressed as a percentage) for each concept according to the user's perspective.

Some notes should be considered for evaluation of the UES according to the user's perspective:

- Some interviewee (students) did not answer the questions in the required way. As an example, when we asked the students whether the information presented in the service was useful, the student answered that he didn't read this information, this answer cannot be taken into account when we evaluate "useful information" item. Consequently, only the number of students who answered this question was considered in the evaluation as shown in Table 5.
- The "number of approving users" column in Table 5 denotes the number of users (the number of students who agreed on the evaluation item). As an example, for "service availability" 13 students only agreed that service was available all the time. The "percentage" column in Table 5 calculates the percentage of the "number of approving users" column.
- The "total" column in Table 5 is a result for mathematical calculations in which the total percentage of the items was divided on the number of the items for each category. As an example, the total percentage for the "service category" was 13.39 and the number of "service category" was 15 items, then the percentage for evaluating the "service category" was (13.39/15 = 0.892). According to Table 4, the weight of "service category" was 73%, then, the total evaluation percentage for the "service category" is (0.892 $\times$ 0.73 = 0.65). We did the same calculations exactly to obtain the percentage for evaluating the "user items" which was (0.21). Finally, we added 0.65 + 0.21 = 0.86 to obtain the total percentage evaluation for the UES according to the user's perspective.

4.3. Applying action research evaluation framework

Two issues should be considered for evaluating the UES by using AREF:

1. The UES is a seasonable service, hence, the reflection/outcome of the first iteration will be considered for the plan action of the second iteration in the following year. Hence, two years were required to evaluate the UES.
2. As it was discussed, in Section 2.2, the Action Research Evaluation Framework is a cyclic framework by nature, and depends on the action of participants to resume the cycle. Thus, it will not be appropriate for evaluating the UES according to the provider's perspective, and only evaluating the UES according to the user's perspective will be taken into account

Table 2 Concept weight (%) categories according to the provider's perspective.

Category	Frequency	%	Sub-Category	Frequency	%	Total category	
						Frequency	%
Service	18	26.4	CRM	5	7.4		
			Benefits	4	6		
			Security	4	6		
Service weight	18			13		31	45.5
Application	15	22	System	9	13		
			Data	7	10		
Application weight	15			16		31	45.5
Problem	6	9				6	9
						68	100

4.3.1. First iteration

4.3.1.1. Phase I. Identifying initial idea for evaluating the UES: An open-ended interview was conducted to the project manager of the UES to determine the initial idea and requirements for evaluating the UES. The main requirement, for him, was testing the quality of the service, which means for the provider that he will not receive any problem by phone/email through CRM center.

4.3.1.2. Phase II. Planning action: 20 students from the laboratory of the Faculty of Computers and Information were selected. They were not students in this Faculty; they only used the Faculty's laboratory, as they were not able to access the Internet outside the Faculty without charge. The students were divided into two groups equally. An idea was given to all of them about the objective of the UES evaluation and the required task, aiming at encouraging the students for effective participation. The schedule for the workshop was planned as follows:

– First session, the students work in the laboratory without any interference. The researcher only observes them, and then there is a break for 15 min.
– Second session, questionnaire will be distributed among the students, and then group discussions will be held.

4.3.1.3. Phase III. Implementing action: All the students performed their tasks according to the plan. The first workshop was assigned to the first group. All the observations for using the UES application were recorded manually by the researcher, and then the students were asked to reflect their opinions using a questionnaire. Table A2 was customized to be used in this questionnaire, as follows:

– Some items were deleted, as there is no meaning to test them, for example: "Service availability (24/7)" and "service cost" items were deleted.
– Three-point rating scale was used to test the items. (1) Poor means "1" point; (2) Good means "2" points; and (3) Very good means "3" points, as shown in Table 6.
– It was assumed that all items have the same weight, i.e. there is no item that has more weight than another item.
– The items were organized under four categories (service items, information items, security items and user items) as in Table 5 so that we can compare between the results of Tables 5 and 6.

– Based on the researcher observations, an item was added to Table 6, which is "using multi-Internet browser", i.e., Explorer and Firefox.

Finally, this workshop was ended by group discussions about the recorded observations. As such the students validate the researcher's observations. Also, they answered and gave justifications for the researcher's queries. All these steps were repeated for the second group.

4.3.1.4. Phase IV. Analyzing and evaluating on action: On examining the observation reports for the two groups, the researcher found that:

a. Only one Internet browser was used by all students, which was Internet Explorer.
b. "6" students took more than the determined time to register their desires.
c. "4" students made few modifications after they registered their desires.
d. "4" students terminated the UES application before the determined time, and without doing any modifications.
e. "2" students were confused and they asked for help.

All these observations acted as a key driver for ongoing discussions among students, rather than a final conclusion report of facts, and the students gave answers/justifications for them as follows:

For "a": The UES worked only on the Internet Explorer, so they used it.
"b": They did know that they can test the UES early before using it.
"c": They could not determine the faculties' places and by using Google map they made modifications for their desires.
"d": They tested the service before using it, and they knew exactly what they would do.
"e": They did not use the computer before.

For evaluating the questionnaire, we agreed that all the items weight are equal, and the total items were "16" items, as outlined in Table 6. Thus, we can calculate each category (relative weight) by this equation: Relative weight for category = Σ category items/number of all items.

Table 3 Evaluating UES according to the provider's perspective.

Evaluation Items (features)	Evaluation method				%	Total percentages
	Item Ava.	Range scale				
		Poor	Good	Very good		
Application items						
1. Application availability		○	○	⊙	1.0	
2. Application benefits		○	○	⊙	1.0	
– Provides guidelines	✔					
– Interactive online help	✔					
– Ability to update personal data	✔					
– Prevents illegal choices	✔					
– Added automatically incentives	✔					
3. Application cost (free)	✔				1.0	
4. Application (Online)	✔				1.0	
5. Application results (Error-free forms)		○	○	⊙	1.0	
Relative weight (5 items)					5.0	$5/5 = 1.0 \times 0.22 = 22\%$
Data items						
1. Data accuracy		○	○	⊙	1.0	
– Database	✔					
– Student choices	✔					
2. Data testing (By external company & portal team work)	✔				1.0	
3. Data available (Suitable to the user requirements)		○	○	⊙	1.0	
4. Data updated	✔				1.0	
5. Data relevant		○	○	⊙	1.0	
Relative weight (5 items)					5.0	$5/5 = 1.0 \times 0.10 = 10\%$
System items						
1. System analysis		○	○	⊙	1.0	
– Manual	✔					
– Using log file	✔					
2. System performance		○	○	⊙	1.0	
– Response time	✔					
– Resource utilization	✔					
– Ease of interacting	✔					
3. System processing (data transaction in database)		○	○	⊙	1.0	
4. System specialists	✔				1.0	
5. System support		○	○	⊙	1.0	
6. Technical help (Technology clubs & faculties laboratories)		○	○	⊙	1.0	
7. Computer laboratories	✔				1.0	
Relative weight (7 items)					7.0	$7/7 = 1.0 \times 0.13 = 13\%$
Application category (17 items)						$0.22 + 0.10 + 0.13 = 0.45 = 45\%$
Service items						
1. Service availability (24/7)		○	○	⊙	1.0	
2. Service evaluation policy (periodical evaluation reports)		○	○	⊙	1.0	
3. Service interactivity		○	○	⊙	1.0	
– Call center	✔					
– Specialists persons	✔					
4. Service objectives		○	○	⊙	1.0	
– Provide the service through the internet	✔					
– Development of the educational services	✔					
– Trust worthiness	✔					
5. Service place (multi-channel)		○	○	⊙	1.0	
– Technology clubs	✔					
– Faculties laboratories	✔					
6. Service planning	✔				1.0	
7. Service stage		○	○	⊙	1.0	
– Emerging	✔					
– Enhanced	✔					
– Interactive	✔					
– Transactional	✔					

Table 3 (*continued*)

Evaluation Items (features)	Item Ava.	Range scale			%	Total percentages
8.Service upgrading	✔				8.0	
Relative weight (8 items)						8/8 = 1.0 × 0.264 = 26.4%
Benefit items						
1. Government		○	○	⊙	1.0	
– Paper forms	✔					
– Seasonal staffing	✔					
– Entry personnel	✔					
2. Citizen					1.0	
– Saving application fees	✔					
– Saving transportation & accommodation costs	✔					
3. Transparency (Separate provider from the public)	✔				1.0	
1.0						
4. Saving (payment)	✔				1.0	
5. Use ICT	✔				1.0	
Relative weight (5 items)					5.0	5/5 = 1.0 × 0.06 = 6%
Security items						
1. PKI	X				0.0	
2. PIN code	✔				1.0	
3. Policy		○	○	⊙	1.0	
– Student	✔					
– System	✔					
Relative weight (3 items)					2.0	(2/3) × 0.06 = 0.04
CRM items						
1. Communication method		○	○	⊙	1.0	
– Call center	✔					
– Emails	✔					
2. Reply method		○	○	⊙	1.0	
– Emails	✔					
– Telephone	✔					
– SMS	✔					
3. Time of communication (available any time)		○	○	⊙	1.0	
4. Time for reply (high speed)		○	○	⊙	1.0	
Relative weight (4 items)					4.0	4/4 = 1.0 × 0.074 = 7.4%
Service category (20 items)						0.264 + 0.06 + 0.04 + 0.074 = 0.438 = 44%
Problem Items (solved)						
1. Employee problem	✔				1.0	
2. Form mistakes	✔				1.0	
3. Limited time	✔				1.0	
4. Long line	✔				1.0	
5. Reduce student chance	✔				1.0	
6. Transfer	✔				1.0	
7. Travelling problem	✔				1.0	
8. Cost (burdens)	✔				1.0	
9. Desires changing Problem	✔				1.0	
10. Enrolment process	✔				1.0	
11. Documents	✔				1.0	
Relative weight (11 items)					11.0	11/11 = 1.0 × 0.09 = 9%
Total evaluation%						0.45 + 0.44 + 0.09 = 0.98 = 98%

✔ Item available.
⊙ The achieved grade.

For example, "service" (Table 6) = (4/16) = 0.25; "information" (Table 6) = (5/16) = 0.3125, and so on.

To calculate item score, the maximum score 100% = 60 points as the students were 20, and if all students gave "very good" i.e. "3 points" for the item, then $3 * 20 = 60$ points. For example, "information details" item, two students selected "poor", which means $2 * 1 = 2$; two students selected "good", which means $2 * 2 = 4$; and 16 students selected "very good", which means $16 * 3 = 48$; then this item is evaluated by 54/60, as shown in Table 6. It should be noted that, only the number of students who answered the question was considered in the evaluation, i.e., "Testing service early" item scoring from "12" as four students only answered it.

Table 4 Concept weight (%) categories according to the user's perspective.

Category	Percentage	Sub-category	Percentage	Total percentages
Service	38	Information	24	73
		Security	11	
Student (user)	27			27
				100

The following equation was used to calculate the total category (relative weight).

Total category (relative weight)

= Σ score of items × category weight.

For example, Total Category (relative weight) of "service" = 0.78 × 0.25 = 0.195, as depicted in Table 6.

Finally, the total score for evaluating UES was calculated by the equation below, which was 0.85:

Total evaluation% = Σ Total category (relative weight).

4.3.1.5. Phase V. Reflecting on action: The results of the evaluation were presented to the UES provider along with the

report for all the students' problems on using the UES. A discussion was made to clarify all the presented documents, and the provider promised to cover all these comments on the following year.

4.3.2. Second iteration

All the previous phases of the first iteration were performed in the following year by the new comers/students, and the UES evaluation result was (0.90), as shown in Table 7.

5. Discussion of findings

The results of evaluating UES by using GEF and AREF (according to the user's perspective) were outlined in Table 8 and Fig. 8. Some considerations should be borne in mind:

– Although Grounded Evaluation Framework used "20" items (Table 5) for evaluating the UES according to the user's perspective (which were obtained by applying the coded concepts) and Action Research Evaluation Framework only used "16" items (Table 6), the final results of evaluation by using GEF, and the first iteration of AREF were similar (0.86 and 0.85 respectively).
– On using the Grounded Evaluation Framework, 20 items were used (Table 5) for evaluation, and by comparing them with the 18 items of Table A2, the difference was very

Table 5 Evaluating UES according to the user's perspective.

Evaluation Items (features)	No. of approving users	Percentage	Total
Service items			
1. Service availability (24/7)	13/20	0.65	
2. Free charge service	20/20	1.0	
3. Service flexibility	15/15	1.0	
4. Service location in the e-government portal	18/20	0.9	
5. Service multiple channels	20/20	1.0	
6. Service navigation	20/20	1.0	
7. Using service without problems	13/20	0.65	
8. Service reliability	15/20	0.75	
Relative weight (8 items)		6.95	6.95/8 = 0.869 × 0.38 = 0.33
Information items			
1. Clarity of information	20/20	1.0	
2. Information details	19/19	1.0	
3. Organized presentation	19/20	0.95	
4. Sufficient information	16/17	0.94	
5. Useful information	10/10	1.0	
Relative weight (5 items)		4.89	4.89/5 = 0.978 × 0.24 = 0.235
Security items			
1. Sufficient security	15/20	0.75	
2. Service trust	16/20	0.8	
Relative weight (2 items)		1.55	1.55/2 = 0.775 × 0.11 = 0.085
Relative weight			0.330 + 0.235 + 0.085 = 0.65
Relative weight		13.39	13.39/15 = 0.892
Service category (15 items)			0.892 × 0.73 = 0.652
User items			
1. Using by Normal user	12/20	0.6	
2. Gained experience	17/20	0.85	
3. Testing service early	3/3	1.0	
4. Needless support	11/20	0.55	
5. Unneeded for participation	16/19	0.84	
Relative weight (5 items)		3.84	3.84/5 = 0.768
			0.77 × 0.27 = 0.207
Total evaluation%			0.65 + 0.21 = 0.86 = 86%

Table 6 Evaluating UES according to the user's perspective (first iteration).

Evaluation items (features)	Range scale			Total of points	%	Total category (relative weight)
	Poor	Good	Very Good			
Service items						
1. Service flexibility	2		56	58	58/60	
2. Service location in the e-government portal	2	6	45	53	53/60	
3. Service navigation	2		54	56	56/60	
4. Using multi-Internet browser	20			20	20/60	
Relative weight (4 items) = 25%				187/240	0.779	0.78 × 0.25 = 0.195
Information items						
1. Clarity of information			60	60	60/60	
2. Information details	2	4	48	54	54/60	
3. Organized presentation		4	54	58	58/60	
4. Sufficient information	2		54	56	56/60	
5. Useful information			60	60	60/60	
Relative weight (5 items) = 31.25%				288/300	96%	0.96 × 0.3125 = 0.30
Security items						
1. Sufficient security	4	2	45	51	51/60	
2. Service trust	3	2	48	53	53/60	
Relative weight (2 items) = 12.5%				104/120	.867	0.867 × 0.125 = 0.108
User items						
1. Using by Normal user	4	8	36	48	48/60	
2. Gained experience	10		30	40	40/60	
3. Testing service early	–	–	12	12	12/12	
4. Needless support	6	4	36	46	46/60	
5 Unneeded for participation	4	2	45	51	51/60	
Relative weight (5 items) = 31.25%				197/252	0.78	0.78 × 0.3125 = 0.244
Total evaluation%						0.195 + 0.30 + 0.108 + 0.244 = 0.847 = 85%

Table 7 Evaluating UES according to the user's perspective (second iteration).

Evaluation items (features)	Range scale			Total of points	%	Total category (relative weight)
	Poor	Good	Very Good			
Service items						
1. Service flexibility	1	2	54	57	57/60	
2. Service location in the e-government portal	1	8	45	54	54/60	
3. Service navigation		4	54	58	58/60	
4. Using multi-Internet browser			60	60	60/60	
Relative weight (4 items) = 25%				229/240	0.954	0.954 × 0.25 = 0.239
Information items						
1. Clarity of information			60	60	60/60	
2. Information details	2	4	48	54	54/60	
3. Organized presentation	1	2	54	57	57/60	
4. Sufficient information	1	4	51	56	56/60	
5. Useful information		4	54	58	58/60	
Relative weight (5 items) = 31.25%				285/300	0.95	0.95 × 0.3125 = 0.297
Security items						
1. Sufficient security	3		51	54	54/60	
2. Service trust	2	6	45	53	53/60	
Relative weight (2 items) = 12.5%				107/120	.89	0.89 × 0.125 = 0.11
User items						
1. Using by normal user	5	6	36	47	47/60	
2. Gained experience	8	4	30	42	42/60	
3. Testing service early	–	–	9	9	9/9	
4. Needless support	4	6	39	49	49/60	
5 Unneeded for participation	2	4	48	54	54/60	
Relative weight (5 items) = 31.25%				201/249	0.807	0.807 × 0.3125 = 0.25
Total evaluation%						0.24 + 0.30 + 0.11 + 0.25 = 90%

Table 8 A Comparison of the evaluation results of the "GEF" & "AREF".

Framework	Service			Information			Security			User			Total Score
	Grade	weight	Score	Grade	Weight	Score	Grade	Weight	Score	Grade	Weight	Score	
GT	0.87	0.38	0.3306	0.98	0.24	0.2352	0.775	0.11	0.0853	0.77	0.27	0.2079	0.86
AR 1st iteration	0.78	0.25	0.195	0.96	0.3125	0.3	0.867	0.125	0.1084	0.78	0.3125	0.2438	0.85
AR 2nd iteration	0.954	0.25	0.2385	0.95	0.3125	0.2969	0.89	0.125	0.1113	0.807	0.3125	0.2522	0.90
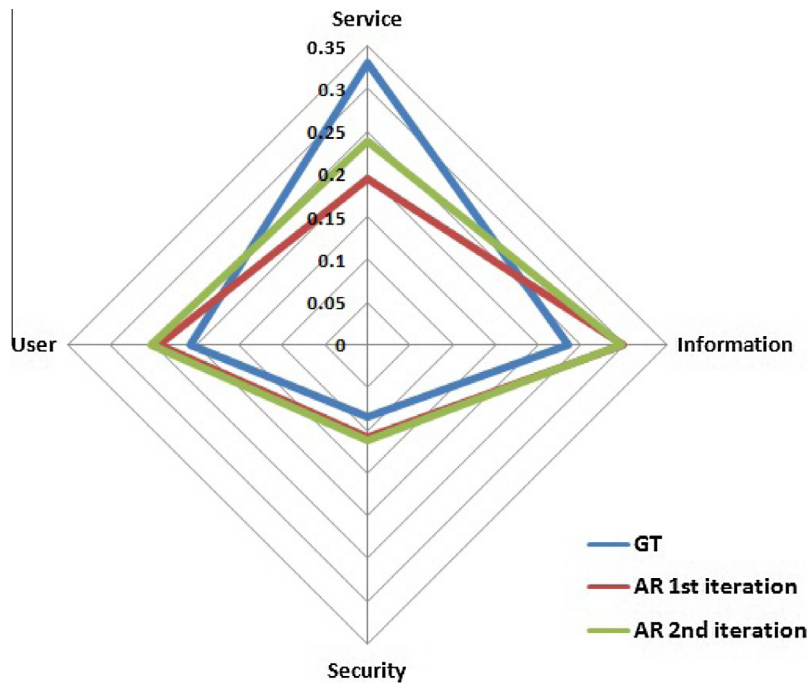
Figure 8 A comparison of the evaluation results of the "GEF" & "AREF".

limited, as only two items were added. The researcher thinks that the reason behind this is, the UES is a mandatory service and the user does not have any alternatives except using it. However, if the GEF is applied to the "Birth Certificate Extract" BCE service, the result will differ as BCE is an optional service.

– The final result of evaluating the UES by using the second iteration of Action Research Evaluation Framework was 0.90 (Table 8), which was different from the result of evaluating the UES by using Grounded Evaluation Framework. This may be justified by two reasons: (1) The second iteration was in the following year, i.e., the UES application was already updated, for example, the application was used by multi-Internet browser; and (2) If the GEF is applied to the UES for this year, the evaluation result will differ.

– Four categories were used for evaluating the UES, which are "service", "information", "security" and "user" as depicted in Fig. 8, and the results for evaluating them were similar, except "service" category, and that is because the relative weight for this category by using GEF was 0.33 and it decreased to 0.25 by using AREF. Also, the evaluated items for the former were 8 items whereas 4 items were used for the later. In addition, a new item for evaluating service category, which was "using multi-Internet browser", was added by AREF as a result of using observations.

General notes for applying GEF and AREF could be:

The result of evaluating the UES according to the provider's perspective was 98% (Table 3), which was consistent with the evaluation results of international organizations, e.g. the United Nations, the report of United Nations [39] ranked the Egyptian e-government services as the 23rd from 192 countries, as the evaluation of the United Nations depends on testing the website service stages (emerging, enhanced, interactive, transactional, connected), and the service which reaches a high stage such as transactional or connected, will be evaluated as a good service. This heeds that the service should not be only evaluated according to one perspective and that the user's perspective is critical and should be taken into account.

– Although applying AREF is much easier than applying GEF, applying AREF takes much time than applying GEF, particularly, for e-government systems as it is difficult to update these systems before one year or at least several months.

– The researcher believes that AREF has a great advantage for developing or improving information systems (case studies) taking into consideration that these systems should be updated rapidly.

– Both GEF and AREF (interpretivist research frameworks) have the following advantages in common:
  (1) Investigating issues which are not easily measured in an empirical manner (traditional research), especially when the user plays a critical role for evaluating the systems.
  (2) Keeping the observer and the participant attached, and the participant is considered as a key driver for both frameworks
  (3) Processing of research can be refined gradually over time, because both of them have a cyclic nature.
  (4) Generating ideas and using them to be tested and validated, and ends by developing a theory
  (5) Seeking to produce practical solutions to problems in real world settings.

6. Conclusion

There has been growing criticism of the quality of most of the researches published in the last ten years such as the lack of using theory in evaluating e-government systems. The research tried to avoid these shortcomings by proposing two frameworks using interpretive research, which are "Grounded Evaluation Framework" and "Action Research Evaluation Framework". Also, the aim of this research is comparing AR and GT to increase our insight into both, and giving an example how they can be used in evaluating information systems.

The research started by giving an introduction about research paradigms; and a comparison between the research paradigms has been presented. Background about the interpretive research is also outlined. The Grounded Theory and Action Research concepts have been discussed, and then the two frameworks for evaluating e-government systems have been proposed and applied to the UES, which are GEF and AREF respectively.

Analysis of the findings of applying the two frameworks to the UES has revealed that although Action Research Evaluation Framework has a greater advantage for developing or improving a case study than Grounded Evaluation Framework, However, Grounded Evaluation Framework is more appropriate than Action Research Evaluation Framework for evaluating e-government systems for the following reasons:

(1) E-government systems by nature are stable and these types of systems could not be changed in a short time.
(2) Applying AREF to e-government systems requires a long time.
(3) AREF will not be able to evaluate the case study that requires evaluating the system according to more than one perspective.
(4) GEF has a greater ability for formalizing, interpreting and analyzing data than AREF.
(5) The cycle of GEF encompasses classification of data into categories, and postulation of networked relationships among these categories.

Appendix A

See Tables A1 and A2.

Table A1   Provider's detail interview.

1. Website content
   Relevance information
   Freshness information
   Dynamic information
   Technical help
   Audio and video clips
   Contact information
2. Website functionality
   Audience orientation
   Coverage
   Information currency and accuracy
   Interactivity
3. Website effectiveness
   Clear objectives the program set out to achieve
   The presence of agency policy on evaluation and the existence of evaluation activity
   Quantify the benefits and costs
   Measure the performance
   Know what exactly visitors did
   Consult users
4. Website service stages
   (1) Emerging, (2) enhanced, (3) interactive, (4) transactional, (5) connected
5. Website Security
   Preventing sharing personal information
   Websites should have a standard security policy
   Outline the strategy for the use of PKI

Table A2   The evaluation criteria according to the user's perspective (UES).

1. Website content
   To what extent was the information useful?
   To what extent did the service require entering details of information?
   Information clarity without user guesswork (e.g. to what extent was the information required to use the service clear?)
   To what extent was the information sufficient?
2. Website effectiveness
   To what extent was the service available 24 h/7 days?
   Is there any cost for using this service?
   Could you test the service before using it?
   To what extent did you find support for using the service?
3. Website Usability
   Selective and bulk collecting (e.g. to what extent did the service require an experienced user?)
   To what extent was the service easy to find through governmental portal?
   To what extent was the service easy to navigate?
   Does the site have an attractive appearance (e.g. the way of presenting information)?
   To what extent does the site create a positive experience for the user?
   To what extent was the service flexible to update your choices?
4. Website service participation
   Was the service provided through multiple channels? Which channel did you use?
   Have your say (Encouraging users to send a message to the government), to what extent does the service allow the user to send any suggestion for improving the service?
5. Website Security
   To which degree was using the PIN code sufficient for the service security?
   Reputable and reliable service (e.g. to which degree the users can trust the service and why?)

Table B1 A comparison between research paradigms.

Element	Post-positivist paradigm	Critical paradigm	Interpretivism paradigm
1. Purpose	• The primary goal is an explanation that leads to prediction and control of phenomena [30,40]. • Positivist stresses "theory verification" (Lincoln & Guba, 2000, p. 107) cited in [40]. • The goal of research is etic in that it attempts to discover the 'truth' (Guba and Lincoln, 1994) cited in [41].	• It acknowledges an objective reality that is only imperfectly apprehendable. This position holds that human intellectual mechanisms are flawed and that life's phenomena are basically intractable, and therefore, one can never fully capture a "true" reality [40]. • The postpositivist stresses "theory falsification" (Lincoln & Guba, 2000, p. 107) cited in [40].	• The goal is the elimination of oppressive human relationships (oppressive is defined in terms of forced assimilation) [42]. • The goal is inciting transformation in the participants that leads to group empowerment and emancipation from oppression [40].	• Obtaining an understanding of the subjectively created social world "as it is" [43,44]. • The goals of interpretivism are both idiographic and emic [40]. • It aims to characterize how people experience the world, the ways they interact together, and the settings in which these interactions take place [45].
2. Ontology	• There is one reality and it is observable by an inquirer who has little if any impact on the object being observed [4]. • Positivists contend that there is one true reality that is apprehendable, identifiable, and measurable (a position known as naïve realism) [40]. • Positivism; is where a simple reality is assumed governed by natural laws; knowledge is context free and controlled by cause and effect laws (Guba & Lincoln 1994), cited in [41].	• Postpositivists accept a true reality, but they believe it can only be apprehended and measured imperfectly (a position known as critical realism)[40]. • Postpositivism; is where imperfect 'reality' is assumed because of imperfect human intelligence and the complex nature of phenomena (Guba & Lincoln 1994), cited in [41].	• Reality shaped by ethnic, cultural, gender, social, and political values [40]. • Over time this 'reality' is assumed to be 'real'. (Guba & Lincoln 1994), cited in [41]. • Reality is multiple and constructed. • Reality is interpreted, negotiated and consensual. Reality is interpreted through internal and external signs [46].	• Reality consists of individuals mental constructions of the objects with which they engage, and that the engagement impacts on the observer and the situation being observed [4]. • Reality is internal and multiple, is subjective and influenced by the context of the situation, the individual's experience and perceptions, the social environment, and the interaction between the individual and the researcher [30,40].
3. Epistemology	• Positivists emphasize dualism and objectivism. That is, the researcher and the research participant and topic are assumed to be independent of one another "Knower (research participant) and known (the researcher) are dualism", and by following rigorous, standard procedures, the participant and topic can be studied by the researcher without bias (objectivism) [30,40].	• Postpositivists advocate a modified dualism/objectivism. This position acknowledges that the researcher may have some influence on that being researched, but objectivity and researcher–subject independence remain important guidelines for the research process. • [40].	• The relationship between researcher and participant is transactional and subjective; the relationship is also dialectic in nature [40].	• Interpretivists advocate a transactional and subjectivist stance that maintains that reality is socially constructed and, therefore, the dynamic interaction between researcher and participant is central to capturing and describing the "lived experience" [40]. • Subjective point of view. • Knower and known are inseparable [46].
4. Methodology	• It involves empirical analysis to test hypotheses. The condition of the experiment is controlled to prevent bias (Guba & Lincoln, 1994), cited in [12,41].	• It emphasizes falsifying hypothesis. Data that are collected about a situation allow for the discovery of knowledge, viewpoints are solicited, without interactions, to interpret people's actions (Guba & Lincoln, 1994), cited in [41].	• Requires a dialectical methodology so that misconceptions are transformed into an informed understanding of the research subject (Guba & Lincoln 1994), cited in [41].	• Aims to produce an understanding of the social context of the phenomenon and the process [46], whereby the use of a hermeneutic (interpretive) dialectic (represents) circle [5].

Appendix B

See Table B1.

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