

# The Use of Grounded Theory Techniques in IS research

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**Abstract**—This paper focuses on exploring the use of grounded theory and its derived types in Information System (IS) research. Specifically, it brings the light to the use of grounded theory techniques as a research method to analyse the data collected through interviews. The study uses the literature as background material to explore the types of grounded theory used in IS research. It also provides an example of the application and employment of its techniques in empirical IS study. This paper is a part of a large study investigating the factors influencing the implementation and development of eGovernment in Saudi Arabia based on the developers' perceptiveness.

**Keywords**— Grounded theory, techniques of grounded theory, IS research

## I. Introduction

In grounded theory, there are two main designs available in the literature and used across different disciplines: the emerging design by Glaser and Strauss [1], and the systematic procedure, allied with Strauss and Corbin design [2]. The design of Glaser and Strauss [1] stresses the importance of letting the theory emerge organically from the data rather than being forced [1],[3]. When adopting the approach of Glaser and Strauss [1], two essential stages of coding need to be followed. These stages are initial/ open coding and selective coding [4]. The second design is called systematic procedure, allied with Strauss and Corbin [2]. It seeks to systematically develop a theory that explains the phenomenon being researched rather than emphasising the comparative methods that distinguished the strategies of Glaser [2],[3]. When adopting the approach of Strauss and Corbin [2], three essential stages of coding should be followed. These stages are similar to the approach of Glaser and Strauss [1] with one more additional stage in the middle called axial/focus coding [4].

The systematic design of grounded theory that does not

follow all the stages of the previously explained two main designs, is widely used in the existing research and is called the Analytical approach or the use of grounded theory techniques [4],[5],[6]. Research students and especially PhD candidates are the most likely adopters of such a qualitative method [7].

This paper explores the use of grounded theory techniques (Analytical) within IS research. The discussion for the use of grounded techniques in IS research will be supported with real examples from empirical study.

## II. Overview of our study

This paper is a part of a large study investigating the factors influencing the implementation and development of eGovernment in Saudi Arabia based on the developers' perceptiveness. In order to achieve this aim, interviews as a method of data collection within a qualitative approach were adopted. Moreover, Grounded Theory Techniques (GTT) were used to analyse the collected data.

Twenty-one in-depth interviews were conducted with different groups of participants who are involved in the development of eGovernment. Purposive or purposeful sampling is considered to be the best choice in our study within a qualitative approach. Sampling in grounded theory is called 'theoretical' by most researchers rather than 'purposeful'; however, the two terms are interchangeable [8].

The main findings, summarized in Figure 4, of the most influential factors have been identified as having an influence on the implementation and development of eGovernment in Saudi Arabia. These factors are mainly related to the cooperation between government organizations engaged in the implementation process; specifically, they include the cooperation related to the exchange of required data for developing eServices, the development of infrastructure, and the unification of the procedures and modification of complex procedures, to name a few.

## III. Grounded Theory Techniques in IS Research

### A. Grounded Theory

Grounded theory is a qualitative research method that follows systematic procedures that lead to the inductive development of a theory that explains the phenomenon being studied.

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Grounded theory was defined by Glaser and Strauss [1] as the procedure of generating theory from the data systematically obtained and analysed from social research, one where the emergent theory should not be forced to emerge. However, in 1990, Strauss and Corbin defined grounded theory as: “one that is inductively derived from the study of the phenomenon it represents. That is, it is discovered developed, and provisionally verified through systematic data collection and analysis of data pertaining to that phenomenon. Therefore, data collection, analysis, and theory stand in reciprocal relationship with each other” [2, p. 23].

After Glaser and Strauss developed grounded theory and published it in their 1967 book entitled *The Discovery of Grounded Theory*, they published another book called *Basics of Qualitative Research* (1990), where they describe their thoughts about grounded theory and its procedures, which differed from Glaser’s approach in several respects. Strauss and Corbin [1] took the techniques and procedures of grounded theory to a new level through the introduction of a more perspective-driven form of grounded theory that predetermines categories by reviewing the literature and utilising self-experience [3]. The main view that was argued by Glaser is that “Strauss used preconceived categories and frameworks that did not allow theory to emerge during the process of research” [3, p. 433]. The approach developed by Strauss and Corbin complements the interests of researchers and has been embraced by many qualitative researches [3]. According to Charmaz [9, p. 8], “despite Glaser’s numerous objections to Strauss and Corbin’s version of grounded theory, their book serves as a powerful statement of the method and has instructed graduate students throughout the world”.

The purpose of grounded theory is to generate a theory that is faithful to everyone and “illuminates the phenomenon under investigation” [2, p. 24]. Strauss and Corbin believe that a well-structured grounded theory is one that meets the four criteria that can determine the applicability of the theory to the phenomenon to be studied: fit, understanding, generality, and control [2].

#### IV. GROUNDED THEORY AS A RESEARCH METHODOLOGY

In the field of IS, several models and theories have gained wide acceptance, such as the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), the DeLone and McLean IS success model, and the Diffusion of Innovation (DOI) model. These theories and models have been widely adopted in IS research to investigate, explore, and measure the factors influencing the adoption and use of IS. However, some researchers claim that some research problems cannot be studied using the existing theories or models. This occurs especially when considering new phenomena or subject matter that does not currently exist in the extant literature. Therefore, there is a need for qualitative exploration in order to generate and create new meaning that helps to understand the phenomenon [2]. Similarly, with our existing study, there has been almost no research into the

perceptions and experiences of the eGovernment developers.

One of the most used qualitative methods in recent research is grounded theory and especially grounded theory techniques which help to generate meaning that explains the reality under investigation [3],[4]. Grounded theory can be used when there is a need to create and generate an explanation and meaning for the phenomenon to be studied, and when the existing theories do not address the subject problem or the people involved [3,p. 432]. The systematic techniques and procedures of grounded theory help to provide a better explanation for the phenomenon to be studied as the meaning is derived from the data collected; in other words, it is grounded in the data [2],[4].

In relation to our study, it is difficult to find an appropriate theory or model which helps deeply explain the situation regarding the delay of eGovernment development. Thus, “grounded theory is a good design to use when a theory is not available to explain a process” [3, p. 66]. Further, Creswell [3, p. 66] states that while the models may be available in the literature, “they were developed and tested on samples and populations other than those of interest to the qualitative researcher”. He further argues that the available models and theories may also be incomplete or lack interesting and valuable variables that could be obtained and discovered from the participants being studied. From a practical perspective, it is necessary to be able to explain clearly the phenomenon being studied from the points of view of participants involved in the same situation [3]. Thus, it is believed that the development of such an understanding through the use of grounded theory techniques by the researcher will offer such a general meaning and explain the phenomenon being studied.

Therefore, as the research problem of our research has no substantial basis in the extant literature and is considered a new phenomenon especially in the context of Saudi Arabia and other countries in the same region (as identified by researchers such as Al-Adawi, Yousafzai and Pallister, [10]; Al-Busaidy and Weerakkody, [11]; Alfawaz, May and Mohanak, [12]; Alharbi, [13]; Al-Shehry, [14]; and Kanaan et al. [15]), grounded theory is the most applicable methodology to be used in this research. In order to build understanding and meaning, the people involved in the implementation process need to be able to explain the factors influencing the development of eGovernment and causing delays in its initiatives. From the discussion above it can be summarised that using grounded theory and especially its techniques as an analytical method seems the appropriate choice for our study.

#### V. Approaches to Grounded Theory Used in IS

Regarding the use and employment of grounded theory in IS research, it is noted that grounded theory is now widely accepted by IS research and increasingly used in the field of IS [16],[4],[17],[5]. Grounded theory as a qualitative method has been increasingly used in recent IS research in order to generate and build new theories that can explain the reality of phenomena that comprise new areas of study requiring further

investigation [4],[17]. For instance, the eGovernment concept (the focus of our main research) is one of these new areas of study that needs to be explored in depth [14],[15]. Moreover, it is used within the qualitative research method [18].

The employment and use of grounded theory in IS research was researched by Matavire and Brown [4] in order to discover the usage of the method among IS researchers, as well as to show the types of grounded theory that IS researchers have adopted and tended to follow from 1985 to 2007, as illustrated in Table 1. The two researchers conducted a comprehensive review of IS articles that adopted grounded theory and published in the commonly-ranked top 50 IS-centric journals. They found four alternative grounded theory approaches which are: the Glaserian, or traditional method of Glaser; the Straussian grounded theory approach; the use of grounded theory as a part of a mixed methodology; and the use of grounded theory techniques for data analysis [4],[5]. The last approach, grounded theory techniques for data analysis, is adopted in our study.

Table 1: Four grounded theory approaches used in IS research

Approach	Principles	Coding	A priori Theory	Paradigm model	Typical Refs
Glaserian	Required	Open, Selective	No	Viewed as family of codes	Glaser & Strauss (1967); Glaser (1992)
Straussian	Required (Glaser disputed adherence)	Open, Axial, Selective	No	Greater emphasis	Strauss & Corbin (1990, 1998)
Analytical	Not necessarily	Any or all used	Maybe used	Sometimes used	Variety
Mixed	Not necessarily	Any or all used	Maybe used	Sometimes used	Mingers (2001)

Source: Matavire and Brown [4, p. 142]

The Glaserian approach aims to develop a theory from the data collected rather than to test a theory or hypothesis [17]. The emphasis here in the Glaserian approach on the emergence of the theory from the data is that the theory is grounded there and it needs to emerge without any force which was the point of disagreement with the Straussian approach [17],[9],[19]. Glaser criticised Strauss and Corbin's approach (Straussian) as it prevents the natural emergence of the theory from the data due to the use of background knowledge about the research area and the utilisation of experiences that can help to build a

theory [17],[5]. This approach is required for several rounds of interviews and the analysis must go through two essential stages of coding which are: (1) open coding; and (2) selective coding.

The second approach is the one developed by Strauss and Corbin: the Straussian approach. The purpose of grounded theory here is to build a theory that illuminates the area of study [2]. The Straussian approach is much less complex than the Glaserian approach in that it provides guidelines for techniques as well as procedures for new and inexperienced researchers to grounded theory on how to code the data and get the most out of it [17]. This approach is required for several rounds of interviews and the analysis must go through three essential stages of coding, which are: (1) open coding; (2) axial coding; and (3) selective coding.

The third approach is Analytical, which means using only the techniques and procedures of grounded theory to analyse the collected data and generate meaning for the area under study. The use of grounded theory techniques for coding can be employed for any or all of the three phases of coding; it does not require multiple rounds of interviews, nor does it need to stick with any particular formulation of grounded theory [4],[5]. Researchers using this approach define the relationships between the categories and concepts that are formed by the codes to create understandable meaning and present this information in the form of diagrams that explain the situations, events, people, and activities being researched.

The fourth approach as presented in Table 1 above is the mixed approach. This approach means using the grounded theory or its techniques in combination with another research method [4],[5].

Matavire and Brown [4] found that through their reviews of IS journals, the use of the four grounded theory approaches in IS research became significantly obvious as an increased number of IS researchers gradually adopted the approaches from 1985 till 2007, as shown in Figure 1 below.

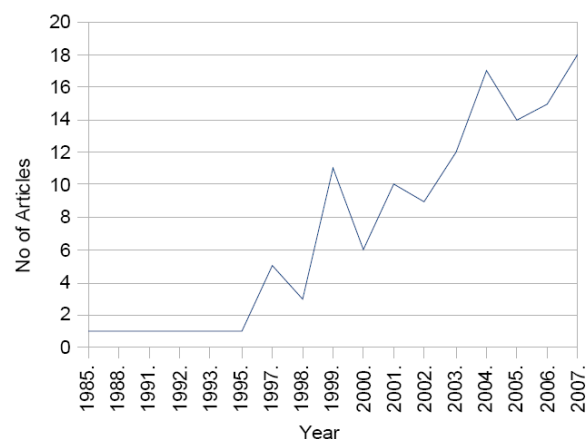


Figure 1: Grounded theory methodology articles per year, Source: [4, p. 144]

Matavire and Brown also indicated the interesting finding that only 8% of the total number of IS researches examined

adopted the Glaserian approach (the lowest usage among the approaches); they posited that this was due to the complexity of the approach and the limited guidelines offered for this particular approach, especially for researchers new to grounded theory [4]. The second approach is the mixed methods approach, which was used in 13% of the IS articles found in the selected IS journals.

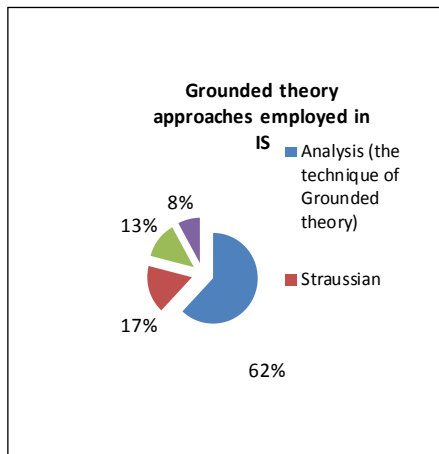


Figure 2: Grounded theory approaches employed in IS,  
Source: [4, p. 144]

This was attributed to the scarcity of guidelines offered for following this approach, which made it a difficult method to apply [4]. The third approach, the Straussian methodology, was used with a good number of IS articles, which was found in 17% of the total number of IS articles as the second most popular approach among IS researchers; this was attributed to the usefulness of the guidelines and prescriptions provided by Strauss and Corbin [4]. The fourth and final approach is the analysis technique (Analytical) of grounded theory which does not use a particular methodological stance; this was the dominant approach employed in IS research and represented 62% of the total number of IS articles as shown in Figure 2 below. Matavire and Brown [4, p. 143] posited that this “reflects the desire for flexibility when conducting IS research”. They continued to say that “it is also reflection of the difficulty of following classical grounded theory methodology in traditional research contexts” [4, p. 143]. Figure 2 below illustrates the employment of grounded theory approaches in IS articles:

According to Matavire and Brown [4], the sharper increase in employing grounded theory methodology in IS research took place between 2001 and 2007, and there were 95 IS articles published during this period; surprisingly, in 2007 alone, 18 articles were published. The use of the grounded theory approach in the 2001-2007 period was as follows: 67% of the total number of 95 IS articles used only grounded theory analysis techniques; 15% employed the Straussian grounded theory approach; 13% used the grounded theory method with mixed method; finally, only 5% of the total IS articles employed the Glaserian grounded theory approach. It is clear

from the above discussion that using and employing the techniques of grounded theory is the most popular approach among IS researchers.

## VI. Procedure and process of grounded theory techniques

In this study, the techniques of grounded theory based on the approach of Strauss and Corbin [2] are adopted to analyse the interview data. The approach of Strauss and Corbin suggests techniques which include coding, using memos, drawing diagrams, doing constant comparisons, and employing the previous literature. The techniques of grounded theory here are employed like an analytical tool, which means using only the techniques and procedures of grounded theory to analyse the collected data and generate meaning for the area being studied [4]. The usage of grounded theory techniques for coding can be employed via any or all of the three phases of coding (open, axial, selective). It does not require multiple rounds of interviews, nor does it require the analyst to stick with any particular formulation of grounded theory or its principles [4],[5].

### A. Coding

Coding is simply defined as a process of analysing data [2]. Coding is the main tool that helps researchers break down and reduce large amounts of raw data into satisfactory and manageable piles [20]. According to Charmaz [9, p. 45], “coding means categorizing segments of data with a short name that simultaneously summarizes and accounts for each piece of data”. In our research, all phases of coding (open, axial, and selective) as well as the creation of categories and clarification of their relationships, were employed in order to develop a meaning that explains the reasons behind the delay in eGovernment initiatives with regard to Saudi Arabia.

### B. Memo-writing Technique

Memo-writing is a very important method in grounded theory because it keeps the researchers involved in the analysis through explaining and capturing their thoughts and ideas about codes, categories, and the relationships between them [9]. Memos “represent the written forms of our abstract thinking about data” [2]. Analysing the codes and writing freely what comes to mind about the codes, categories, and the relationships that emerge between categories helps to discover and explore ideas and then develop them into an understandable meaning [9]. According to Niekerk and Roode [7, p. 101], memos in the Straussian approach “represent the recorded form of the abstract thought about the data and are written during all the phases of the research”. Success in writing memos leads the researcher to increase the level of abstraction about the ideas [9]. Writing memos about the research concepts and categories helps the researcher to explain what the data is about by defining the concepts and relationships to create meaning. Memo-writing can occur in several forms, including writing on small cards or using the comments function in MS Word as shown in Figure 3.

### C. Using Diagrams

Diagrams in grounded theory are defined by Strauss and Corbin [2, p. 198] as “visual representations of relationships between concepts”. In our paper, memo-writing and using diagrams as visual representations were employed and used throughout the steps and phases of the research analysis. It is suggested by Strauss and Corbin and other grounded theorists that the use of visual diagrams can show the core category as well as the integration between the core category and other related categories; visualising the results in a meaningful way can facilitate understanding of the analysis results as shown in Figure 4 [2],[3],[21],[22].

### D. Constant Comparison

Constant comparison is another important and effective method used in grounded theory as it aims “to make comparisons at each level of analytical work” [9, p. 54]. The comparison can take place between data with data, incident with incident, category with category, data with category, and category with concept [9],[4]. This process of constant comparison helps to find similarities and differences among data in order to allocate and place the codes and data into appropriate and correct patterns/categories to which they belong [9]. This strategy is very useful as it assists in ensuring the accuracy of data as well as specifying a concept through the comparison of one incident/unit of data against another for the purpose of looking for similarities and differences that can be allocated to the same pattern or category that they represent [4]. Therefore, the naming category is important and it should be given a common name that most logically represents the data of that category [2]. In our research, the constant comparison method was employed for the same purpose as mentioned above.

## VII. The Employment of the Literature Review

Employing the literature review in grounded theory plays an important role according to the Straussian [2] approach for both technical and nontechnical literature. Technical literature refers to published research studies and theoretical or philosophical articles, whereas nontechnical literature refers to other information resources and materials such as reports, documents, newspapers, and other materials [2]. There are several uses for technical/nontechnical literature in grounded theory according to the Straussian [2] approach, which includes using the literature review as a second method for data collection and as a supplementary validation [2]. Literature reviews can be used as background material and references give validation to the accuracy of the findings. However, not all things need to be validated in this way, as going back to published literature to find references to support emerging concepts would impede progress and stifle the creativity of grounded theory [2]. The purpose of using literature in grounded theory or grounded theory techniques is to provide supplementary background information about the research area being studied and to show the gap in knowledge

rather than to suggest any hypotheses [23].

## VIII. The Application of Grounded Theory Techniques (AN example from empirical study)

### A. Open Coding

B. Open coding is the first step in the coding procedure. It is defined by Strauss and Corbin [2, p. 61] as “the process of breaking down, examining, comparing, conceptualizing, categorizing data”. Data in this phase of coding is broken down into small pieces in order to manage and conceptualize it by assigning a label to it that represents its meaning [2]. Thus, “[c]odes are tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study. Codes are usually attached to ‘chunks’ of varying size—words, phrases, sentences, or whole paragraphs, connected or unconnected to a specific setting” (Miles and Huberman [24] as cited in Neuman [20, p. 460]). At a basic level, coding is the procedure of asking questions and examining, comparing and categorizing data [25].

C. Furthermore, coding involves several ways to approach the process; this includes reading small segments of participants’ interviews, or a sentence, a short paragraph, or even an entire document and labelling them in order to capture meanings that are similar to other responses in the same pattern. Coding data is “the hard work of reducing large mountains of raw data into small manageable piles” [20, p. 460]. Thus, it is a difficult job that requires looking deeply and slowly into the transcribed interviews for critical terms, central people, key events, or themes [20]. Then, the researcher at this stage is able to start reading, labelling and comparing the selected segments which make meaning and can be turned into new concepts. This procedure of open coding is a very important as it allows the researcher to get closer to the data, and to create meaning from that data by conceptualizing it and placing it in the correct and appropriate categories which reveal the same patterns or concept. This phase of coding is basically summarised as ‘categorizing the data’ [19].

### D. The Employment of Open Coding

In our study, open coding is considered an initial step in the analysis process. A total of 320 codes emerged and were created, based on 21 interviews.

At this stage of analysis, one of the researchers started by reading the interviews one by one. This initial analysis procedure was started after the first interview was finished and continued throughout the rest of the other interviews. This was useful in that the researcher found out what issues about the delay of eGovernment implementation in their government agencies had been stressed as important by participants in primary interviews, providing insight which allowed the researcher to query these issues with participants in the remaining interviews.

The researchers read the transcribed interviews line by line, phrase by phrase, and sentence by sentence looking for interesting themes that could be turned into meaning through codes. These themes were attached with tags, which are

conceptual labels that can represent what the researcher considers the data is about, as shown in Table 2 below.

Table 2: An example for open coding

Raw data (example)	Preliminary code	Final code
Cooperation between government sectors to develop the services is needed, because, in most cases, offering any service requires sectors to obtain and collect information from more than a single government body.	Cooperation between government sectors	Cooperation to develop/offer a service

### E. Coding Methods

There are several methods of coding that can be used within qualitative research. In our research, we employed an elemental method with two types of coding which are: (1) in vivo coding; and (2) simultaneous coding [26].

### F. In Vivo/ Initial Coding

According to Saldaña [26,p. 66], “elemental coding methods are primary approaches to qualitative data analysis. They have basic but focused filters for reviewing the corpus and they build a foundation for future coding cycles”. In vivo coding “draws from the participant’s own language for codes” [26, p. 66]. In vivo (Latin for “within the living”) coding refers to the use of codes and terms to which participants assign their ideas and concepts during the interviews in order to preserve participants’ meanings with regard to their views [9]. Initial coding as discussed in the previous section is the first step of a grounded theory procedure approach to the data and this method of coding can employ in vivo coding [26]. In vivo and initial coding are both foundation methods for grounded theory [26]. Through open/initial coding, we can begin to make sense of the data and are advised in this stage of analysis to stay open for all possible theoretical directions that might be indicated via reading that data as the aim of open coding [9],[26].

At the open coding stage, some codes were given the same or similar names because the participants used the same expression(s); this is called in vivo coding as per the above discussion. For instance, the code ‘the lack of cooperation between government sectors’ which was created in the open coding stage was indicated several times with similar and identical words as assigned by the participants. For example, Participant 1 stated that “cooperation between government sectors is a missing action which needs to be activated by eGovernment team”; participants 2 stated that “one of the problems that we faced is the lack of cooperation from some government organizations”; participant 3 stated that “there is no cooperation between government sectors in general”. The

precise phrasing of these three similar statements resulted in the use of a single code to preserve the participants’ meaning.

### G. Simultaneous Coding

Simultaneous coding refers to “the application of two or more different codes to a single qualitative datum, or the overlapped occurrence of two or more codes applied to sequential units of qualitative data” [26, p. 55].

According to our study, there are some examples (citations) in the data which represent only one concept, while others represent more than one concept, referring to simultaneous coding. For example, the following example represents only one code, that is, clarity of regulation and procedures. Participant 4 stated, “There is an important issue that needs to be clear enough which is the clarity of regulations and procedures.” The following example represents more than one code; Participant 5 commented that “electronic change at government sectors and the cooperation between authorities are the most important roles for electronic transformation”. The codes at work here are: electronic change; and the cooperation between government authorities.

### H. Using Memo-writing

The memo-writing technique was employed in this analysis phase as it helps to write and explain the thought process of the researcher, even in simple language [2], regarding that particular code or in relation to other codes. For example, a code like ‘desire for success in eGovernment implementation’ which was based on the following example “The success of Yesser program is based on the will of other government sectors for the success of the work in implementation of eGovernment”, the researchers wrote a memo about this code, as illustrated in Figure 3 below.

Another example for memo-writing here in this stage of analysis is for the following code ‘understanding the cooperation concept’ or ‘a collaborative work concept’, which is derived from participant’s comments: “So, the cooperation of the Health Ministry will benefit other sectors and the cooperation of other sectors will benefit the Ministry of Health. This concept of cooperation has to be understood by all sectors because it is a collaborative work more than an individual work”.



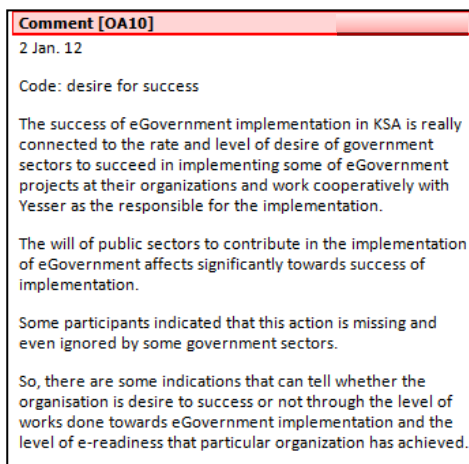


Figure 3: Example of memo-writing on the code 'desire for success'.

### I. Creating Categories

The term 'category' is described by Strauss and Corbin [2] as a unit of information that consists of instances, happenings, and events which can be turned into codes. After the creation of the initial codes is complete, researchers look for similarities and differences among these codes for the purpose of locating codes with a similar meaning under one category. Therefore, all emergent codes are included into created categories.

The category of 'cooperation and collaboration' is taken here as an example; codes such as cooperation between government sectors, lack of cooperation between government agencies and the Yesser eGovernment program, and cooperation between authorities were appended to it because they all represent and are based on the concept of cooperation and collaboration. The aim of this procedure is to begin making sense of the data and to stay open for all possible theoretical directions that can be derived from reading the data [9].

### J. Axial Coding

The axial coding procedure in grounded theory occurs immediately after the open coding step. The process of putting data back together takes place in this step in order to make connections and links (relationships) between categories [2]. It is also called theoretical coding, where the process of referring sub-categories to their categories and making relationships among them takes place in order to start creating meaning [19],[4]. This meaning should reflect what the empirical data is about regarding the area being researched. Charmaz [9,p. 60] agrees with Creswell's (1998) assertion that "the purposes of axial coding are to sort, synthesize, and organize large amounts of data and reassemble them in new ways after open coding".

At this stage of analysis, the codes are put back together but in new ways as a result of the relationships and connections made among core codes. This represents what is happening in

the empirical data and can truly explain the factors contributing to the case. Connections made between categories and its core codes are identified by asking questions that examine the data. For example, how can these axial codes show the relationships and connections that would help in developing the perception and understanding of the phenomenon? Thus, according to the approach of Strauss and Corbin [2], it is like looking for evidence, incidents, and events from the empirical data that can support the relationships that have been created between categories in this phase of analysis.

### K. The Employment of Axial Coding (Core Codes)

In the analysis phase, codes are refined to identify the core codes; this allows for comparisons between codes to find conceptual similarities and differences allowing codes to be placed together within subcategories. This process is conducted to allocate and place core codes into categories and these are further allocated into subcategories which have the same concepts and are related to the major categories.

This procedure created several subcategories within categories. For example, the 'cooperation and collaboration' category got 36 codes and these codes were placed into subcategories based on their representation of a particular concept. A total of 10 subcategories were created within the category of 'cooperation and collaboration' and these subcategories are labelled as: cooperation and collaboration between government sectors, cooperation for development of eServices, lack of cooperation, plans and strategies for cooperation, lack of cooperation with the Yesser program, understanding cooperation and collaboration concepts in eGovernment, changing procedures in relation to cooperation, top management roles in relation to cooperation and collaboration, cooperation of financial departments at government sectors, and cooperation with researchers.

### L. Created Categories in Axial Coding

Through the process of axial coding, the following twelve categories were created: (1) provision of electronic services; (2) e-readiness of government organisations; (3) cooperation and collaboration; (4) ICT infrastructure; (5) regulations, plans and procedures; (6) education about eGovernment; (7) challenges and needs for organisations; (8) eGovernment implementation challenges and barriers; (9) awareness and training; (10) IT skills and IT professionals; (11) financial allocations and incentives for IT staff; and (12) enablers for eGovernment development.

### IX. Relationships Between Subcategories and Categories in Axial Coding: The Example of the 'Cooperation and Collaboration' Category)

In this phase of coding, the relationships and connections between sub-categories and their related major categories begin to emerge. Such connections help to create meaning about the area being studied. Connections and relationships that emerge between categories in this phase of analysis are

identified through the employment of constant comparison and memo-writing techniques.

One example is the relationship among the sub-categories of ‘top management’ and ‘understanding the cooperation and collaboration concept in eGovernment’, both of which belong to the major category of ‘cooperation and collaboration’. The relationship between these two sub-categories can be summarized as follows (based on the participants’ views). Top management—within organizations—cooperation with the Yesser eGovernment program, eServices developers, and with other government organizations is missing and needed to enhance the development of eGovernment projects at these organizations. However, the cooperation of top management cannot be obtained without understanding the concept of eGovernment and its real benefits by top management (managers/leaders). This view was stressed by some participants as a means of cooperation of these government organisations. Therefore, it can be seen that there is a relationship between these two sub-categories which belong to the same major (main) category of ‘cooperation and collaboration’.

### A. Selective Coding

Selective coding or focused coding is closely similar to axial coding, but here it is on a more abstract level [7]. Selective coding is defined by Strauss and Corbin [2, p. 116] as the “process of selecting the core category, systematically relating it to other categories, validating those relationships, and filling in categories that need further refinement and development”. Therefore, the aim of this step of analysis is to find out the central category among created categories in the axial coding which will become central to the research phenomenon; other categories will surround the core category, both influencing and causing the core phenomenon [2],[3],[21]. The core category is explained by Strauss and Corbin [2, p. 116] as “the central phenomenon around which all other categories are integrated”. Integration between categories takes place in this part of the analysis in order to form the story that can explain the central focus of the research phenomenon. Integration and making links between the core category and other related categories is done using memos to write descriptive overviews [7].

### B. Identification of the Core Category

As mentioned previously, the core category is one of the categories created in the axial coding phase. Identifying the core category among the created categories is an important process in this phase of coding (selective). This process can help to identify the main concept or issue which has the most influence on the other categories in the phenomenon being studied [7],[23]. In our study, identifying the core category helps to inform the main factors that influence the development of eGovernment and cause the delay of its initiatives in Saudi Arabia.

Strauss and Corbin [2] suggest that the use of visual diagrams can show the core category as well as the integration

between the core category and other related categories. Visualising the results in such meaningful way can facilitate understanding the analysis results [2],[3],[21],[22].

The core category is one of categories that were created and developed during the two previous analysis stages; it is stressed by participants and appears frequently in the data. According to Saldaña [26], the core category is an essential point that appears frequently in the empirical data being coded and grouped. Strauss and Corbin [2] mention that the determination of the core category is based on several criteria. Some of these include: the selected core category must be central as it can relate to other main categories; it appears frequently in the empirical data; the logic and consistency of the explanation that will evolve by relating and integrating the categories; and the ability of the concept to explain the main point and variation made by the data [17].

### C. The Core Category of Our Study

In our study, the core category is ‘cooperation and collaboration’, as shown in Figure 4. The core category is determined according to the same techniques mentioned above. It is appeared frequently in the data and in most interviews. Moreover, most of the interviewees were stressed and emphasized in this particular concepts of ‘cooperation and collaboration’ in all of its related aspects such as cooperation and collaboration between government sectors, cooperation of financial departments, cooperation of top management, and others more. ‘Cooperation and collaboration’ category is found it almost relates to other major categories that been refined and developed in axial coding stage of analysis. It has an influence on others categories as been indicated by interviews. In addition, it is found as the most frequent concept in the interviews compared to other concepts. This step is a second strategy which was used to determine the core category in this research.

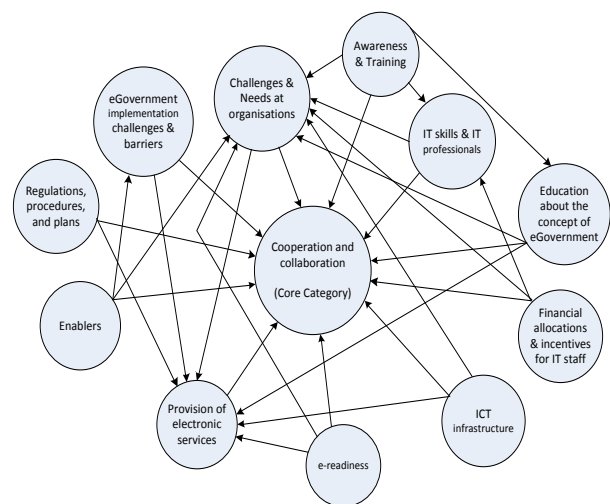


Figure 4: Core category and relationships



### X. Frequencies of the Main Codes/ Concepts in the Data

One of the main aspects that determines the core category within grounded theory techniques as discussed in the previous section is how the stress of the concept in the data is revealed by determining how frequently the concept appears in the data. Therefore, the frequency of concepts/themes in the data can help in identifying how commonly the ideas, events, concepts, and themes have occurred [26]. Namey et al. [27, p. 143] explain that frequencies are determined “on the basis of the number of individual participants who mention a particular theme, rather than the total number of times a theme appears in the text”. Using this technique (numbers count) as a part of the quantitative procedure within a qualitative research has been accepted as a good method by several qualitative scholars. For example, Silverman [28, p. 110] stated that “quantification can sometimes help us sort fact from fancy and, thereby, improve the validity of qualitative research”. He further identified two main ways to use simple counting techniques in qualitative research; one of these methods is to check or identify the prevalence of some phenomenon in the data using tabulations [28]. Moreover, Maxwell (2010, p. 478) stated that “counting the number of instances of things in different categories can be interpreted in variance terms, as creating a nominal scale variable and measuring the frequency in each category.”

Maxwell [29] strongly advocates the integration of qualitative and quantitative approaches where appropriate. He states, “In my view, the use of numbers per se, in conjunction with qualitative methods and data, does not make a study mixed-method research. Specifically, numbers in the sense of simple counts of things (Backer’s quasi statistics) are legitimate and important sort for qualitative researchers” [29, p. 478].

In our study, we employed the same technique of a simple count in order to find out the most frequently appearing concepts (categories) in the data among twelve major categories. These twelve major categories are illustrated in Table 3. The results derived from the application of this simple technique indicate that the ‘cooperation and collaboration’ category is the main concept that appeared in the data. Table 3 below shows the frequencies of the main concepts that appeared in the data according to the number of individuals who mentioned the concept rather than the number of times it is mentioned in the data. This technique was done using open coding data as it is rich in data.

Table 3: Determining the most frequent concept

No.	Main concepts / Core codes	Number of participants
1	Cooperation and collaboration	16 out of 21
2	Challenges and needs of organisations	15 out of 21
3	IT skills and IT professionals	14 out of 21
4	eGovernment implementation challenges and barriers	14 out of 21
5	Awareness and training	14 out of 21
6	Provision of electronic services	14 out of 21

7	Education about the concept of eGovernment	13 out of 21
8	Financial allocations and incentives for IT staff	10 out of 21
9	Regulations, procedures and plans	10 out of 21
10	E-readiness	9 out of 21
11	ICT infrastructure	8 out of 21
12	Enablers	7 out of 21

### XI. Conclusion

This paper explored the use of grounded theory and its types within IS research. Mainly, it focused on the employment of grounded theory techniques as a popular and often used approach among IS researchers. The exploration is supported with a real example from an empirical study investigating the factors influencing the development of eGovernment in Saudi Arabia in order to enhance the understanding of such applications for grounded theory techniques and procedures. This paper contributes to the knowledge by providing another example of how the techniques of grounded theory can be employed.

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