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TOWARDS PROPOSING AN ELECTRONIC INFORMATION SHARING MODEL FOR THE INTELLIGENCE SECTOR: A METHODOLOGICAL FRAMEWORK

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Abstract

Information sharing is a major technique for increasing institutions efficiency and performance. With the revolution of information and communication technology, sharing information across institutions has become more feasible. Although identifying efficient and reliable mechanisms for Electronic Information Sharing (EIS) in intelligence sectors is becoming increasingly necessary, studies on techniques for adopting technology for intelligence products remains few. However, adopting information sharing in intelligence sectors can be a complex task. Identifying methodology structure, which influences information sharing is critical. The purpose of this research is to review the literature on intelligence sectors within the context of information sharing and provide a methodological framework for designing an EIS model. Three systematic phases were employed: research structure, modelling, and data analysis and synthesis. The research design was developed based on comparative study and expert feedback. This study can increase our empirical knowledge of the intelligence domain, identify underlying problems, and inspire researchers to focus on this area. Furthermore, reviews the current information-sharing research discusses the methodology affecting information sharing at the three levels and provides summative frameworks. These frameworks provide a means to discover future research opportunities and a systematic way for practitioners to identify key factors involved in successful information sharing in intelligence sectors.

Keywords: Electronic information sharing, Intelligence, Methodology phases.

1. Introduction

In the wake of the 9/11 attacks, terrorism grew rapidly, revealing the incomprehensible failure of governments to develop and implement an effective strategy for counterterrorism. Soon afterwards, poor information-sharing methods between all levels and branches of law enforcement agencies became apparent [1]. Intelligence information plays significant roles in decision making, particularly when national security is under threat. To fulfil their information requirements, intelligence agencies should have effective and fast information sharing [2]. Electronic information sharing refers to the exchange of data through information and communication technologies [3]. Not much literature has been proposed and implemented to improve the quality of intelligence to combat terrorism throughout the world. Many studies focused on either the classification of intelligence or development of various mathematical models to improve analytical products. However, given the limitation of empirical study in the intelligence sector, extant research has not been analysed and has not addressed the model of EIS, thus, leading to ineffectual intelligence products [4].

Currently, challenges remain within no broad strategy regarding Electronic Information Sharing in the Iraqi environment. Although Information and Communication Technology (ICT) is a factor in the success of information sharing, other factors have not been adequately addressed. Successful US efforts to help develop Iraqi Intelligence communities depends on their experiences in this area rather than on the case study that made many failures in information sharing. Furthermore, the Iraqi National Counterterrorism Strategy should be fully implemented to begin to address the root causes of terrorism. The Iraqi security forces must enforce training standards, provide operating advice, improve intelligence product, and improve overall effectiveness [5, 6]. This study has two primary objectives: 1. to investigate previous works related to intelligence sectors in the context of Information Sharing (IS) and technology adoption that identify problems, controversies, or knowledge gaps in the field of study; and 2. to conceptualize a method for designing an EIS model, which includes three systematic phases, namely, research design (for investigating research directions), modelling (for presenting a detailed description for a case study related to the current EIS approach), and data analysis and synthesis (for exploring the validation and evaluation of the final model).

Furthermore, a comparative study style was employed in this research to determine the method, model design, research population, sampling, research sites, data collection, and data analysis procedures that would establish the desirability of this study. The aims of the study are to understand the challenges on the method to implement electronic information sharing to enhance electronic information sharing among intelligence agencies is important in Iraq. However, this study helps the Iraqi government promote its development of information sharing through e-government and provide useful information to other countries whose governments are at a similar stage of e-government development. This paper has five sections. Section 1 includes the introduction. Section 2 reviews the related research. Section 3 presents a discussion of the design phases of the EIS model based on the intelligence network of Iraq. Section 4 involves a discussion of the results, including a comparison with previous studies in diverse sectors in the context of EIS. Finally, the study conclusions are drawn in Section 5.

2. Literature Review

The recent increase in terrorist attacks have led to a renewed interest in developing intelligence products [7]. Several researchers suggested that enhanced Information Sharing (IS) in intelligence sectors is imperative for combating terrorism [1]. Debates continue regarding optimal strategies for IS management. The IS concept has recently been challenged by intelligence studies, which also reported that relevant empirical studies on the intelligence field are insufficient [8, 9]. Several studies worldwide examined the relationship between IS and intelligence. In 2004, Chen et al. [10] described the development of advanced information technologies, systems, algorithms, and databases for national and homeland security-related applications through an integrated technological, organizational, and policy-based approach.

In 2005, Chen and Cohen [11] reported a novel and convenient synthetic procedure by combining data-mining technologies and service rating techniques into service-oriented architectures that facilitated the creation of a problem-solving space within the intelligence community. Such structures enable analysts to utilize the expertise and knowledge of other analysts for quickly discovering services in a meaningful way and arranging services into workflows. In 2007, Lee and Rao [12] explored the antecedents of interagency adoption of IS systems and the effects of using such systems on IS practice among antiterrorism and disaster management agencies. de Lint et al. [13] developed a conceptual framework to understand the limits of security intelligence within an emerging security network paradigm. They focused on the normative dimensions governing security networking and the mechanisms and technologies that limit information deployment among public security agencies. In 2008, Schneider and Hurst [14] investigated factors that impede inter-agency cooperation and coordination in the context of a joint force operation targeting serious and major crimes. Thuraisingham [15] defined Assured Information Sharing (AIS) and explored the related issues, technologies, challenges, and directions. In 2009, Farroha et al. [16] described the task of designing systems that enable cross-domain capabilities based on analysis of security community needs. This approach is a significant undertaking that requires knowledge of data systems, technologies, governance, and cultures. Dang et al. [17] proposed an integrated approach to develop an advanced knowledge mapping system for supporting analyses of the current status of or emerging trends in bioterrorism research involving various agents or diseases of human beings or animals.

In 2010, Wu et al. [18] offered a collective taxonomizing approach to organize a shared and growing document repository by allowing individually-managed local document hierarchies and algorithmically building a global hierarchy that combines them. In 2011, Jiang and Samanthula [19] investigated the required methodologies and proposed an advanced communication framework that enables different entities in distributed environments to identify, share, and analyse relevant details without disclosing other unwanted but sensitive information. In 2012, Santanam and Chen [20] studied IS across public health and homeland security organizations. In 2013, Huang and Nicol [21] presented the concepts and architecture of a mission-oriented, multi-domain, and multi-level security graphics server as a tool that supports cross-domain IS in Global Information Grid (GIG) and cloud computing environments. In 2015, Carter [1] presented research wherein, two federally-funded national surveys were used to

explore the collaborative relationships among law enforcement, other government organizations, and private sector organizations in contemporary counterterrorism efforts. Finally, Lewandowski and Carter [2] investigated end-user perceptions on an intelligence product disseminated from a state fusion centre in the Northeast region of the United States. They provided insights into local law enforcement intelligence sharing through statistics and interview narratives. In 2016, Carter [4] applied a framework to examine the adoption of intelligence-led policing. Specifically, there have been many studies concerning the tracking of intelligence problems in the context of information sharing, however, all suffer from several major drawbacks. The above investigation with the previous study shown there is a stagnation in terrorism research and pressing need to develop models and techniques based technology into various intelligence products in the context of how to integrate and share the information of intelligence. The initiatives to increase the sharing of information to fight terrorism are not well coordinated, it leads to lack of effective integration increases the risk that agencies will overlook, or never even receive, the information needed to prevent a terrorist attack [3].

The information-security context is the problem of intelligence, and it is the main concern for intelligence agencies when use technologies in sharing information [15, 22]. The cooperation and coordination between developing countries and modern countries should include not only intelligence sharing but also the deployment of counterterrorism agents and other resources to stop transnational terrorism [23]. There is a need to align cross-domain technology development with the near, mid, and long-term information-sharing needs of the intelligence community. The cross-domain policy and governance should support the information-sharing goals of the community and keeps pace with emerging technology and architectures [16]. The propose needs for further research, including people's inability to identify relevant information under pressure, the empowerment of and control of information of information-sharing processes/frameworks [24].

Finally, the geographic region has an influence on information sharing, and information sharing across geographical differences is an initial step for future research to consider. Scholars should touch on a number of influence factors on intelligence fusion centres in future research to address the variations in fusion-centre models. It would also be beneficial for scholars to examine aspects of information sharing in intelligence fusion centres, as very little is known about this aspect of information sharing. In addition, scholars should study the flow and dynamics of information sharing in relation to levels of agency satisfaction with fusion centres [2, 4]. However, there is no reliable academic evidence that analyzed and addressed the model of electronic information sharing in the intelligence field. Scholars mention in order to adopt an electronic information-sharing framework in a specific area of study, should select theory, influence factors, and method based on particular area requirements, and then design the framework based on the population effect [25, 26]. Overall, these studies highlighted the need for enhanced IS in the context of intelligence within the empirical study. Given such a review, it seems that no EIS model is effectively used within intelligence sectors. In general, view methodology studies is more needed to develop the reality of intelligence work.

3. Methodology

Generally, research methodology refers to achieving research objectives systematically and describing how the research is conducted scientifically. Therefore, the methodology cycle is wider than the method in the research [27]. Information systems represent a multidisciplinary field, and many aspects of these systems are related to specialized subjects. Identifying an appropriate research approach is not a straightforward task for addressing specific issues within the discipline given the plethora of available methodologies [25]. The methodology in the context of EIS in the important matter when need to develop the model. The previous study showed a different method with various case studies. In 2009, Fan and Zhang [28] investigated the G2G information sharing and studied eleven factors with five layers for Chinese context by using the qualitative technique to design new model based on Layer Behaviour Model (LBM). In 2011, Akbulut-Bailey [29] studied twelve factors for EIS in the contexts technological, agency, and environmental in local law enforcement agencies in a Southern state of the United States by using quantitative qualitative techniques to design conceptual model.

Bigdeli et al. [25] proposed an EIS conceptual model to Local Government Authorities, the United Kingdom included eighteen factors in five layers by the qualitative method. Fan et al. [30] adopted the LBM to design model for government agencies in China content eleven factors in four layers by using quantitative techniques. Finally, in 2015, Mohammed et al. [26] adopted TEO theory to design the EIS model for Iraqi Ministry of Higher Education consists of sixteen factor employed in in four layers. The previous study showed any case study need new methodology structure. In this part of the paper, first presents a detailed description of the research structure phase (Phase 1) and continues with the modelling phase (Phase 2) for the proposed EIS model. Finally, the data analysis and synthesis phase (Phase 3) discusses the validation and evaluation of the final model. A methodology for the proposed EIS model is illustrated in Fig. 1.

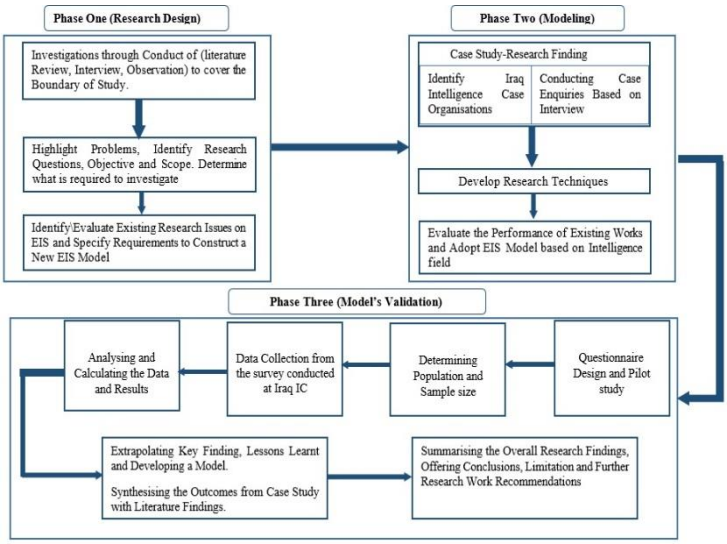

Fig. 1. Proposed methodological phases.

3.1. Phase one (research structure)

This phase achieves the first objective of this research for the "critical investigation and examination of the studies related to intelligence, counter-terrorism, and terrorist attacks in the context of information sharing." The investigations in the literature review were based on academic work, related online organizational reports, and media reports. Evaluations and analyses were made on the relevant literature in books, working papers, journals, and conference proceedings collected from academic search engines (IEEE, ScienceDirect, and Web of Science). Additional data reviews were made from websites (Department of Defence and Information Sharing Environment websites) [31]. Figure 2 shows the data collection process using academic search engines.

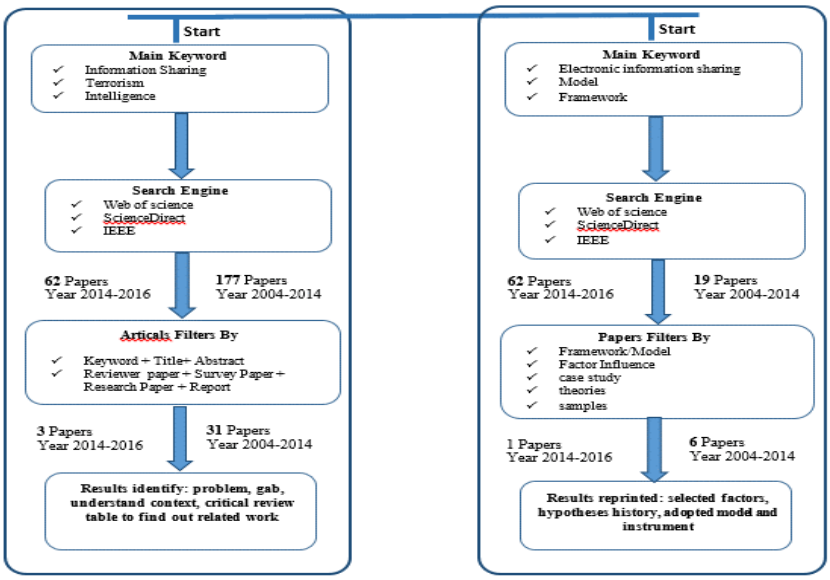

Fig. 2. Systematic review process.

Unstructured interviews were conducted for this research to seek additional support for the four main parts of this study, namely, identification of support problem or research gap, identification of model design with factors, restructuring of the instruments (questionnaires design and evaluation forms) of this study, and evaluation of the proposed model. Interviews were carried out with intelligence experts who are experienced in IS and who have personal experiences regarding failures in exchanging information in real time to provide insights that directly affect the problem statement and final design of the study's model [32].

The unstructured interviews were carried out face-to-face during normal business hours when doing projects work, meeting, lunches, coffee/tea breaks and out of office hours. Using unstructured interviews some important data regarding the case studies were collected. The interview details described in *Appendix A* (Tables A-1 and A-2). Given the nature of intelligence work, the experts did not allow recording during their interviews. Positive studies assume that human action is rational and observing an investigated phenomenon can be carried out objectively and rigorously [33]. In this study, the observation process was conducted in three

units (one round in each unit), which deal with the concept of IS in our study field. The observation was directed toward examining the implementation environment. All rounds focused on EIS and ICT availability.

The last stage of data collection involved the focus groups, where officers (with and without IT background) from the participating departments were invited to discuss collaboration and IS from the operational perspective. This section was done in a training department with two groups, each consisting of three officers. This form of inquiry allows participants to freely express their opinions and ideas, and it also provides them with a platform for questions and answers with fellow participants [34]. This process resulted in a full description of the research background, literature survey, problem identification, research question formulation, and identification of the objective and scope of the study. Furthermore, based on a comparative study on current approaches in the EIS field, the method for the model and related factors, hypotheses of the study, and measurement items were developed.

3.2. Phase two (modelling)

In this phase, the relationship between the case under investigation and literature related to EIS is presented for the design of the proposed model based on selected influence factors. Thus, the second objective of the study, "to propose a theoretical electronic information sharing model for Iraqi intelligence," is achieved. Furthermore, this phase explains the research methods. Figure 3 shows the processes of the second phase.

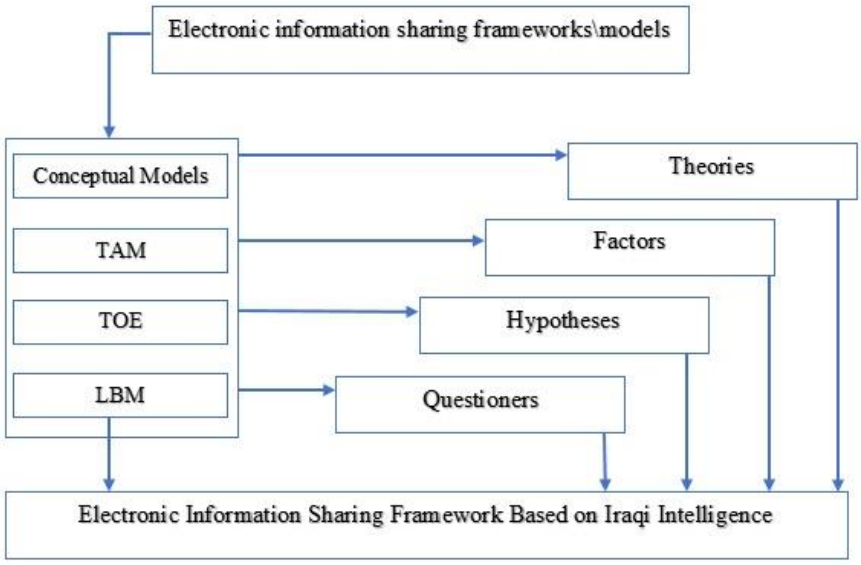

Fig. 3. Overview process to design model.

Quantitative methods are typically applied for questions regarding the relationship between calculated variables to explain phenomena [35]; test hypotheses by considering cause and effect for making predictions, using numerous

randomly selected samples, and attaining generalizable results that are applicable to other cases; and achieve model validity [27].

Finally, questionnaires allow for the anonymity of the respondents, which may be particularly valuable when potentially sensitive topics are investigated [32]. Influencing factors in this study were selected through a two-dimensional technique. First, all factors employed in the EIS arena through previous studies were identified. Interview data used to determine the most common factors selected by experts.

This phase ended with the design of the model suitable for intelligence requirements. The layered behavioural model (LBM) was likewise selected because of its capability to address the objectives of this study. The LBM has been used for developing extensive software projects that can be generated by humans rather than by machines. Thus, the development of a sizeable software must be analysed as a behavioural process [36].

In general, LBM is applied for the following cases: weakness of the application domain knowledge, conflicting and fluctuating requirements, communication constraints, and breakdowns of software and its quality because of organizational, cognitive, and social factors [30]. Furthermore, this study attempted to adopt LBM in a G2G IS research to extend the scope of this model from individual organizational project development to interagency project development [33].

3.3. Phase three (model's validation)

This phase addresses the last objective of this research, "to evaluate the proposed model through analysing the empirical data collected from Iraqi intelligence". The final model and its evaluation are presented, along with the barriers encountered in this study. The steps of this phase are outlined below.

3.3.1. Step one: Design a research instrument

A questionnaire was used to test the proposed research hypotheses and model validity. The questionnaire was adopted from previous instruments and rendered suitable for the context of this study.

The interviews with specialists from both academia and intelligence sectors were combined. Thus, visions from their respective fields were combined in one instrument. Revisions were made for the instrument based on a pilot study. Furthermore, face validation was made, which refers to how the test looks.

This step builds the final instrument structure and the judgments made by the researcher's notes and based on surface appearance. To illustrate, the format, page layout and the font size have to be at an appropriate level. Figure 4 shows the processes to design the instrument of this study.

Thus, the sentence structure and vocabulary used and selected depending on the respondents' level of understanding and the medium of the language The final instrument used in both English and Arabic and was applied using a Likert scale.

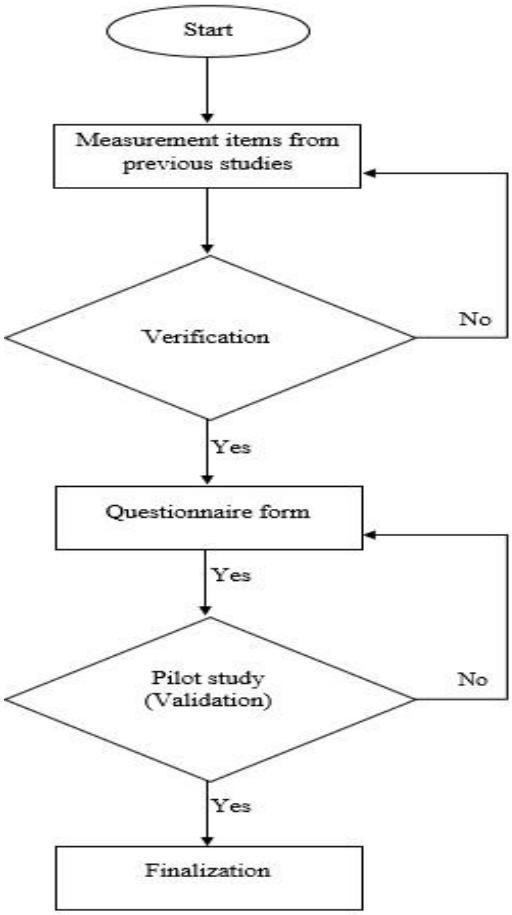

Fig. 4. Overview of design of research instrument.

3.3.2. Step two: Data collection

The members of the target population were classified by job type and region. The job type is limited to any work controlled by the intelligence sectors, whereas the region is limited to Baghdad, the capital of Iraq. The population size consists of 5000 candidates recognised according to interview with financial departments of intelligence headquarters. For sample size is given by the equation shown in Table 1, the sample size (362) was selected according to total population size [37].

Table 1. Formula to select sample size [27].

$S = X^2 NP\ (1 - P) \div d^2\ (N - 1) + X^2 P(1 - P)$
S = required sample size. X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841). N = the population size. P = the population proportion (assumed to be .50 since this would provide the maximum sample size). d = the degree of accuracy expressed as a proportion (.05).

Probability sampling method was also employed for this study. The selection of elements for the sample is purposive, therefore, the sampling method is purposive sampling (sample random). It is almost difficult to collect data on every element if the survey involved a few hundreds of elements. Even if it were possible, it would be expensive and a waste of effort and time. Probability sampling is the best reliable accuracy is when data is collected in a limited amount because it reduces fatigues, which creates less error. The survey was distributed through web-based and paper-based means [38]. The online survey was efficient because the respondents can answer at their own time. Moreover, the online survey was compatible with any smart devices and had a user-friendly interface, making it especially useful given the Internet and mobile revolution of the current generation. The online survey was distributed through Whatsup, Viber, Facebook Messenger, the secret Facebook group of the Iraqi intelligence, and the public Iraqi intelligence page on Facebook.

3.3.3. Step three: Data analysis

This step will involve encoding all the data in one spreadsheet file using SPSS 21 software. The reliability and mode scores of the final data will identify. Thus, data analysis will perform according to the objectives of this study. Descriptive and inferential statistics will employ for data analysis. Descriptive statistics expressed the profile and demographic background of the respondents [35]. Inferential statistics were used to test the hypotheses. Prior to hypotheses testing, the suitability of the data for intended inferential statistics was checked to test statistical assumptions [39]. The statistical assumptions applied in this study include normality tests (involving skewness and kurtosis), homogeneity of variance (through the Levene test), and linearity (by using scatter plot analysis). Furthermore, the following methods were also applied: ANOVA (for the demographic relationship based on dependent variables), exploratory factor analysis (for identifying factor dimensionality and data reduction), and Spearman's correlation (to show the relationship between the dependent and independent variables). Finally, the research hypotheses were tested by logistic regression technique, and model magnitude (with regard to the effect of demographic characteristics) was explained through a logistic regression approach [40]. Subsequently, model validation was achieved through the result of data analysis and hypotheses testing.

3.3.4. Step four: Model evaluation

The relationship of EIS with factors was determined according to literature and interviews with experts. These relationships were tested through the surveys. The survey findings were validated and evaluated by experts. The feedback from experts was employed to finalize the proposed model. Most of the feedback matched the analysis results. Thus, we conclude that the research model is acceptable. Finally, we presented a summary of all the research steps connected to the discussion of results, based on available literature and expert opinion consistent with the findings of this research. We presented the conclusions and the challenges encountered in the study and identified the limitations of the study. Recommendations for future study and suggestions to Iraqi intelligence for future EIS projects were made.

4. Discussion

Aside from proposing guidelines for inter-organizational system adoption and EIS decision making in the intelligence sector, this research also aims to describe the perspectives and experiences of individuals who are actually involved in such efforts. Thus, this works attempts to broaden our understanding of EIS effort in the intelligence sector. An empirical study in intelligence sectors is extremely rare. Thus, we assessed the importance of methodology in developing intelligence products. Our results were then compared with the findings of previous works. Similarities were observed between the attitudes expressed by the sampling, survey distribution, and testing method in this study and those described by [25, 29, 30, 40, 41]. However, the present study differs from previous work such that it links the case study with problem investigation, factors selected model design, and assessment of the model.

5. Conclusion

The systematic methodology represents the main concerns of this research, and it was incorporated in three phases to design the new EIS model according to intelligence sectors. The investigation was to formulate and to evaluate the limitations of previous studies related to IS based on the intelligence sector. Consequently, multiple methods and techniques were used to collect data, cover the boundary of the research area, and recognise weaknesses according to intelligence work. In this study, reducing the empirical gaps within the intelligence field was emphasized to encourage researchers to develop intelligence products. The results of this research support the idea that the time consumed from IS is one of the key factors that lead to failures in intelligence work. Therefore, an EIS model is suggested to address the issue. This research can serve as a basis for future studies for the development of intelligence products with adherence to academic structure. The methods used for this study may be applied to other EIS initiatives elsewhere in the world. Terrorism, a multidimensional concern that can be classified as an open problem, is currently addressed by minimal academic studies, which suggest that terrorist attacks cannot be stopped in the near future. Further studies in all academic levels are required for this area. To cover all the challenges in the area of intelligence, such studies should not only be based on electronic tools. More relevant studies are also necessary regarding recent cases in which, intelligence failed to prevent terrorist strikes, for instance, the attacks in Mosul in 2014 and London in 2017.

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Appendix A

Table A-1. Descriptions of interview process.

Date	Type of interview	Location	Interviewers numbering	Interviewers position	Interview period	Discussion area
July 2013	Unstructured	General Directorate of Nationality In Baghdad-Iraq	2	Criminal Services Department	30 minutes	Problem statement
January 2014	Unstructured	Diner Time	1	Intelligence Federal Police	2 ½ hour	
January 2014	Unstructured	Iraqi Intelligence Headquarter	1	Information Technology Department	1 ½ hour	
January 2014	Unstructured	Outside Station		Intelligence Federal Police	1 hour	
August 2014	Unstructured	Iraqi Intelligence Headquarter	1	Data Collection and Analysis Department	2 hours	Verify framework and selected factors
August 2014	Unstructured	Intelligence Federal Police	1	Officer (Supervisor)	1 hour	
November 2014	Unstructured	Baghdad Intelligence Center	1	Assistant of Manager	30 minutes	

November 2014	Unstructured	Lunch time	2	Officer in Baghdad Intelligence Center	2 hours	
December 2014	Unstructured	UTEM	1	Assistant Professor Abdul Samad, Senior Lecturer	2 ½ hour	
December 2014	Unstructured	UTEM	1	Dr. Robiah binti Usif, Senior Lecturer	1 ½ hour	
April 2015	Unstructured	UKM	1	Professor Juhana Salim, Deputy Director	1 hour	Modify and conform instrument design and problem statement
April 2015	Unstructured	UTEM	1	Assistant Professor Abdul Samad, Senior Lecturer	2 hours	
April 2015	Unstructured	UTEM	1	Dr. Robiah binti Usif, Senior Lecturer	1 hour	
May 2015	Unstructured	Baghdad University	1	Dr. Abdulridha Al-mosui, Senior Lecturer	1 hour	
May 2015	Unstructured	Baghdad University	1	Dr. Sarmad Makki, Senior Lecturer	30 minutes	
Jun 2015	Unstructured	Iraqi Intelligence Headquarters	1	Planning and Follow-up Department	1 ½ hours	
Jun 2015	Unstructured	Iraqi Intelligence Headquarters	1	Information Technology Department	1 hour	
Jun 2015	Unstructured	Intelligence Federal Police	1	Technical Department	45 minutes	
Jun 2015	Unstructured	Outside Station	1	Officer	2 hours	
July 2015	Unstructured	Financial Department	1	Officer	14 minutes	Population
January 2016	Unstructured	Iraqi Intelligence Headquarters	1	GIS Department	1 hour	Evaluate framework
January 2016	Unstructured	Iraqi Intelligence Headquarters	1	Information Technology Department	1 hour	
January 2016	Unstructured	Intelligence Federal Police	1	Outside station	1 hour	
January 2016	Unstructured	Intelligence Federal Police	1	Manager of Technical Department	1 hour	

Table A-2. Descriptions for interviewee's profiles.

Job location	Department	Experience
Inside Intelligence Headquarters	Information Technology Department	20 years
Inside Intelligence Headquarters	Data Collection and Analysis Department	13 years
Inside Intelligence Headquarters	Criminal Services Department	17 years
Inside Intelligence Headquarters	Planning and Follow-up Department	15 years
Inside Intelligence Headquarters	GIS Department	12 years
Outside Intelligence Headquarters	Intelligence Federal Police, (Baghdad-Al Karkh)	15 years
Outside Intelligence Headquarters	Intelligence Federal Police, (Baghdad-Al Karkh)	10 years
Outside Intelligence Headquarters	Intelligence Federal Police, (Baghdad-Al Karkh)	8 years
Outside Intelligence Headquarters	Intelligence Federal Police, (Baghdad-Al Rusafa)	18 years
Outside Intelligence Headquarters	Intelligence Federal Police, (Baghdad-Al Rusafa)	11 years
Outside Intelligence Headquarters	Intelligence Federal Police, (Baghdad-Al Rusafa)	10 years
Outside Intelligence Headquarters	Baghdad Intelligence Center	10 years
Inside Intelligence Headquarters	Financial Department	7 years
UKM	Centre of Collaborative Innovation, UKM	16+ years
UTEM	Center of Advanced Computing and Technology in UTEM	10 years
UTEM	Network security in UTEM	10 years
Baghdad University	Department of Computer Science, Baghdad University	12 years
Baghdad University	Department Of Computer Science, Baghdad University	10 years