

CHAPTER 3: RESEARCH METHODOLOGY

This chapter presents the details on the research methodology. The details on research design, data collection tools and procedures and data analysis strategy are also discussed in this chapter. In addition, the validity and reliability issues are discussed.

3.1 Conceptual Framework Development

Based on the literature review conducted in the current study (refer to Table 2.4), the socio-technical factors influencing security effectiveness were-Legal & law, Compliance, Ethical Conduct, Information Security Policy, Security Awareness, Information Security Training, Top Management Support, Security culture, Information security structure. For each of these factors, pools of candidate items were generated from the literature (S. M. Alfawaz, 2011; M. A. Alnatheer, 2014; D'Arcy & Greene, 2009; Da Veiga & Eloff, 2010; Knapp & Ferrante, 2014). On other hand, many researchers have indicated that all of these factors has impact on security culture (Beautelement et al., 2009; Lim et al., 2010; Mwakalinga, 2011; Schein, 2009; Shaaban, 2014).

Based on the comprehensive review of the literature, the conceptual framework has been designed which is presented in the following Figure: 3.1.

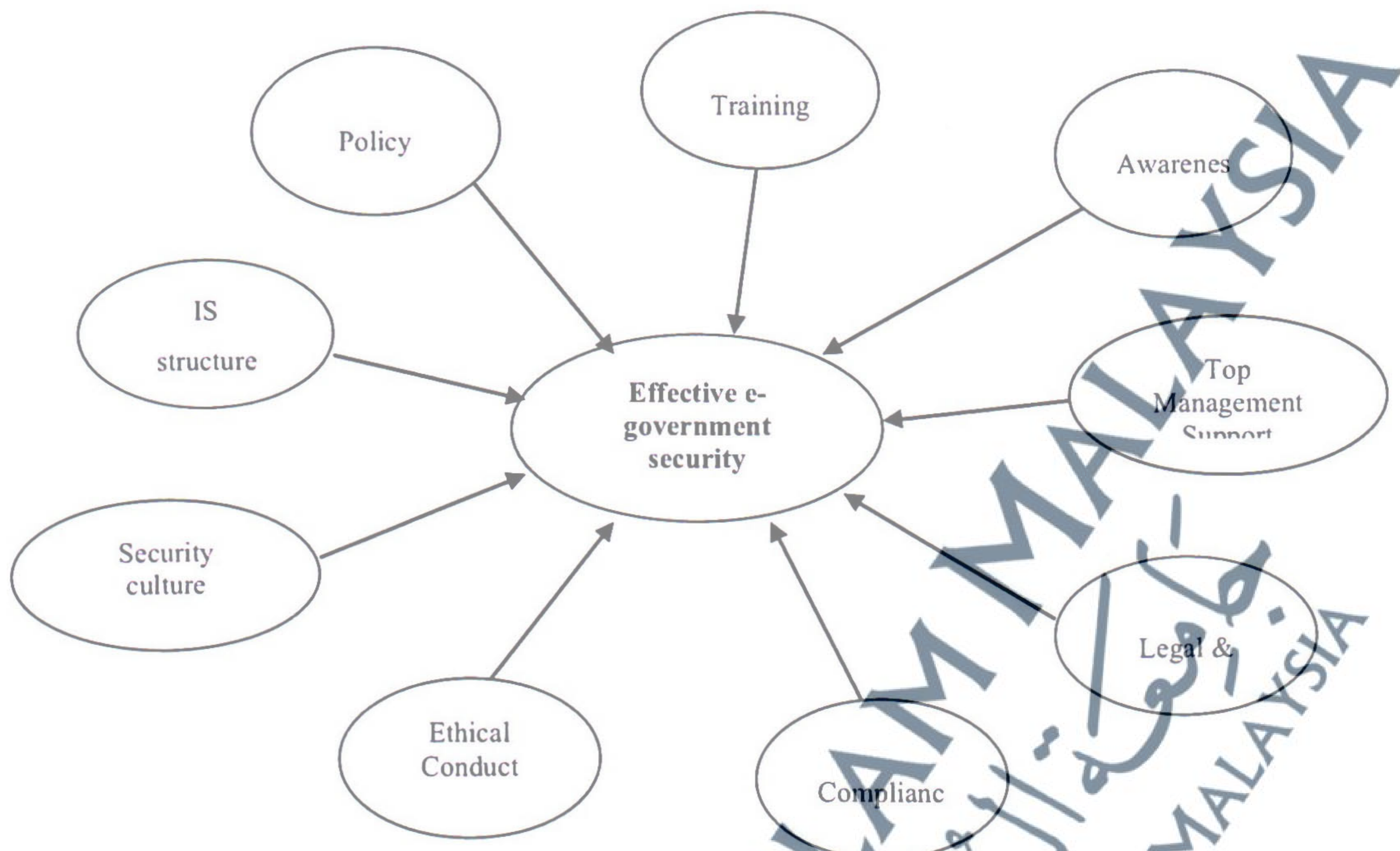


Figure 3.1: The conceptual framework

Based on Figure 3.1, Table 3.1 summarizes the main hypothesis to be tested through the subsequent survey phase. Table 3.1 was developed based on the literature review analysis.

Table 3.1: Research Hypothesis to be tested in a Subsequent Survey Phase

Hypothesis	Description
1	Legal & law, Compliance, Ethical Conduct, Information Security Policy, Security Awareness, Information Security Training, Top Management Support and IS structure are factors that have positive influence on security culture
2	Security culture has positive influence on security effectiveness.
3	Legal & law Legal& law, Compliance, Ethical Conduct, Information Security Policy, Security Awareness, Information Security Training, Top Management Support and IS structure have influence on security effectiveness and mediated by security culture

3.2 Research Design

This study would like to tackle research problem from the perspectives of the contextual factors that may influence the e-government security in developing country from socio-technical perspectives. The aim of the research is to develop the framework for securing e-government services. To achieve this, different research questions need to be addressed such as-discover the security problems faced by e-government projects, identify the specific challenges to overcome them, and highlight possible opportunities.

This will be achieved by developing e-government socio-technical security framework. In addition, in this study the researcher followed Crotty's (1998) principles such as the research philosophy, research approach, research strategy, and research methods in order to build an appropriate research design framework.

3.2.1 Research Philosophy

There are three philosophical epistemologies commonly used in research namely positivism, interpretivism and realism. This research used positivism philosophy in the method conducted.

Positivism is an epistemological position that advocates the application of the methods of the natural sciences to the study of social reality and beyond (Neuman, 2009). Positivist researchers believe that reality is stable and can be described by measurable properties regardless of the researchers' instruments (Ikeda, 2009). This study is classified as an example of positivism research because there are quantifiable measures of variables, hypotheses testing and the drawing of conclusion about a "phenomenon from the sample to a stated population" (Myers, 2013).

3.2.2 Research Approach

Research approaches are used to identify, select, and develop suitable research design, strategies and techniques for data collection, processing and analyses. Knowledge development could be achieved through the use of a suitable research approaches either by the process of deduction or the process of induction, or by a combination of the two (M. N. Saunders, 2011). This study was conducted based on the positivist paradigm. It tests hypotheses derived from a theoretical framework, developed on the basis of what previous studies and literature review concluded. Therefore deductive research process appeared to be in line with the research goal of this research work.

3.3 Research Method

After identification of the most appropriate research approaches, the current research followed a deductive research approach. The next step was to establish appropriate research methods and strategies that could be applied in this research work. Quantitative, Qualitative, and mixed method are the three well known types of research methods (Creswell, 2013). To achieve the research aim and objectives, the choice between these types were taken into account. The main characteristics of these methods are addressed in next section.

3.3.1 Qualitative Method

Qualitative research method in social science was developed to enable researchers to study social and cultural phenomena. It is multi method in focus and involves an interpretive, naturalistic approach to its subject matter (Kasinath, 2013). This means that the qualitative data focuses on naturally occurring, ordinary events in natural settings. It is effective to employ qualitative method in information systems as it involves the use of qualitative data and includes interviews, documents and observations to understand and explain social phenomena. (Denzin & Lincoln, 2008).

Qualitative method is not suitable method to be conducted in this research for the following reasons (Johnson & Christensen, 2013):

- Knowledge produced may not be generalized to other people or other settings (i.e., findings may be unique to the relatively few people included in the research study).
- It is difficult to make quantitative predictions.
- It is more difficult to test hypotheses and theories.
- It generally takes more time to collect the data when compared to quantitative research.

3.3.2 Quantitative Method

Quantitative research methods are characterized by the collection of information which can be analyzed numerically, the results of which are typically presented using statistics, tables and graphs. The quantitative study is to develop the understanding, employ strategies for the experiments and data collection through the use of tools. It falls under the broad heading descriptive quantitative research (Creswell, 2013). When the problem is to identify the influence of factors on an outcome, and understand the best predictors of outcomes the quantitative method is most appropriate (Creswell, 2013). Moreover, in order to perform tests in the quantitative method, the method has to be expressed in terms of “operation”. It includes, surveys, and mathematical modeling, and laboratory experiment. Therefore, in this research quantitative method has been conducted to achieve the study’s aim and objectives. The survey questionnaires have been used to test the framework validity.

3.3.3 Mixed Method

The mixed method is the third major research methods which combines quantitative and qualitative methods in the same study (R. Hall, 2012). It evolves researchers who believe

in both qualitative and quantitative methods for understand and addressing their research problem and questions (Harwell, 2011).

Mixed method is not suitable method to be conducted in this research for the following reasons (Johnson & Christensen, 2013):

- Can be difficult for a single researcher to carry out both qualitative and quantitative research, especially if two or more approaches are expected to be used concurrently. It may require a research team.
- Researcher has to learn about multiple methods and approaches and understand how to mix them appropriately.
- Methodological purists contend that one should always work within either a qualitative or a quantitative paradigm.
- Is more expensive.

The choice of methodology is driven by the research philosophy and approach. As discussed in the previous sections, this study takes a positivist view and thus is deductive in nature. Studies could either be quantitative, qualitative or mixed basis as mentioned by M. N. Saunders (2011). Table 3.2 distinguishes between quantitative and qualitative research.

Table 3.2: Differences Between Quantitative And Qualitative Research (Adapted from M. N. Saunders (2011))

	Quantitative	Qualitative
Research Philosophy	Positivism. May be used within the realist and pragmatist philosophies.	Interpretivism. May be used within the realist and pragmatist philosophies.
Research Approach	Predominantly deductive	Predominantly inductive
Research Objective	Examines relationships between variables.	Studies participants' meanings and relationships between them.
Position Of Researcher	Seen as independent from respondents	Plays a more active role
Research Strategy	Principally associated with experimental and survey research	Key strategies used include case study, ethnography, action research, grounded theory and narrative inquiry

The primary aim of the research is essentially to validate or verify a theory using the deductive approach (Guba & Lincoln, 2005). Whenever the purpose of a study is hypothesis testing using statistical methods, and generalizing the findings to a larger population from the sample based on numerical data, quantitative survey research is the preferred option (Creswell, 2013).

3.3.4 Research Strategy

The research strategy depends upon the nature of research problem, case studies, surveys, experiment, histories and analysis of archival information are five main research strategies to carry out the research (Creswell, 2013). Many of research strategies with different criteria were identified by researchers, based on the goal of the study. The selection of the research approaches criteria were formulated as following: the approach should be capable to achieve aim the study addresses such as developing a framework. It should be capable of modeling e-government services, e-government development models, and information security models, and it should be capable of designing (developing and validate) a framework.

3.3.4.1 Soft Systems Methodology

This study adopted Soft Systems Methodology (SSM) (Checkland & Scholes, 1990). It is a holistic approach which consists of four steps such as (Reflection step, Planning step, Action step, Observation step) for analyzing complex situations in its real world environment, and for proposing solutions to the identified problem, the methodology steps as are shown in Table 3.3.

In this research (SSM) is used as guide to identify the real-world problem which were the lack of socio-technical security services in the eGDMS and security frameworks. Then the existing documents, methods, theories and structures were used to build a knowledge-base. SBC model, and the ISO/IEC 27002 control principles were identified as tools for guiding the analysis criteria development. Moreover, each model and framework were

investigated and analyzed for the available security services level based on the theoretical foundation and building blocks from SBC model (Stewart Kowalski, 1994). Additionally, it utilizes the concepts ISO 27002 twelve security control principles. Finally, a comparison and establishment of relationships was done between the knowledge-base and research problem reality.

Table 3.3: Soft Systems Methodology (SSM) Steps

Steps	Definition
Reflection	Refers to understanding of the complexity of the real-world problem area;
Planning	Refers to conducting extensive studies to explicitly understand the real-world problem;
Action	Refers to identifying, selecting and developing the best models and instruments for addressing the identified real-world problem; and
Observation	Refers to comparison and establishment of relationships between the knowledge base and reality of the research problem.
The process is repetitive until the real-world situation is improved (Checkland & Scholes, 1990).	

3.4 Methodology Related to Information Security Management

Review of literature on research approaches utilized in the area of Information Security indicates surveys as a widespread method employed in Information Security research. Quantitative research methods like conducting surveys and the validation of frameworks and questionnaires have been employed with great success in the information security discipline (Schlienger & Teufel, 2005; M. Siponen et al., 2008; Straub et al., 2004; Workman et al., 2008). A survey can be defined as a method which establishments can utilize to examine information security behavioral content in general, and attitude and opinions of workforces towards information security in specific (Berry & Houston, 1993). This can be supported with previous researches. For example, (Loch & Carr, 1991) employed survey to study the organization's view on Information Security threats in Atlanta based on questionnaires sent to the Directors of Management of IS (MIS) or MIS security in various organizations in Atlanta, Georgia. Loukis and Spinellis (2001) also examined Information Security actions and its relations with the context related aspects like (number of IS users, number of IS staff, connection to Internet and etc.) in the Greek public sectors by means of a structured questionnaire. Another scholars, May and Lane

(2006) studied the existing status and key issues of ISM in tertiary environment using the survey as a data collection tool which was administered to all Australian Vice Chancellor-listed universities. In this respect, Yeh and Chang (2007) also acknowledged the threats and countermeasures for IS security in Taiwanese enterprises by utilizing mail questionnaires. Another study by Kankanhalli et al. (2003) used survey to develop IS security effectiveness model. In this respect, Schlienger and Teufel (2003) also established a management model for creating, changing and preserving Information Security Culture using survey questionnaire.

Scholars like Mishra and Chasalow (2014) have shown how the three constructs: security policies, deterrence practices and systems auditing can influence information security effectiveness in their framework which was based on survey technique. Another scholar named Brady (2011) did a predictive study using survey methodology to collect research related data and to develop a model of factors that influence Health Insurance Portability and Accountability Act (HIPAA) security compliance in Academic medical centers. His study showed that the Security culture was a significant predictor of security effectiveness. Pahnla et al. (2007) also suggested a model which included the factors that explain employees' IS security policy compliance using questionnaire. Da Veiga and Eloff (2010) also suggested a framework to foster an information security culture within an organization and to demonstrate how to use it. Thus it can be summed up that an empirical study is done to aid in validating proposed Information Security Culture Framework. Greene and D'Arcy (2010) summed up that security culture is a multidimensional construct which includes top management commitment to security, security communication, and computer monitoring which has an affirmative outcome on users' IS security. His findings were based on online surveys. Rotvold (2008) study also utilized survey of 144 business professionals, managers, IT administrators, and educators from various organizations. He summed up that security awareness and training have impact on security culture and information security program effectiveness. Findings of the study by Ma et al. (2008) showed that management support impacted HIPAA compliant information security Behavior. Their findings were based on survey of 354 trained information security professionals.

In this respect, another scholars named Chang and Lin (2007) used survey with 08 senior IT managers and professionals indifferent industries to sum up that organizational culture has a positive impact on security management effectiveness. Gupta and Hammond (2005) also asserted that security consciousness and training were positively correlated to fostering a security culture using survey with 138 small business owners. Hagen et al. (2008) also investigated the relationship between implementation and effectiveness of security measures through a web-based questionnaire among Information Security managers in a selection of Norwegian organizations. The study by R. B. Ismail (2012) utilized survey method to obtain a snapshot of Information Security threats and security practices at a particular point in time, which is considered suitable for a project impacting Malaysian academic libraries(organizations), and also where the attention is on process (methodology) rather than technology itself. Understanding the importance of surveys through these studies, this research adopted a survey method to extract and examine the socio-technical factors and furthermore, to develop and validate information security culture framework for securing e-government.

3.5 Data Collection And Analysis

Research methods describe data collection and data analysis tools and techniques. Questionnaires, direct observation, participation, and documentary review were the main source of data. The next sections present these data collection procedures and data analysis methods.

3.5.1 Data Collection

Data collection is a set of interrelated activities (Creswell, 2013). It refers to collecting useful information to find out answers to research questions to achieve the primary aim of the research. Therefore, this section presents a case for using quantitative survey in the study. Survey is defined as a method of data collection that utilizes questionnaires. It is an effective tool to get opinions and attitudes (Bryman, 2012).

3.5.1.1 Questionnaire Development

A questionnaire contains a pre-formulated written set of questions, designed to elicit the information relevant to the research interest, to which the respondents record their answers by following the given protocols (Sekaran & Bougie, 2010). It was necessary to conduct a questionnaire to determine if the generalizations about the influence of the important socio-technical factors in e-government security can indeed be accepted. The questionnaire was constructed based on the literature review. It contained a brief details about the research nature, the researcher's background, and the reason of carrying out this research (Sekaran, 2003; Sekaran & Bougie, 2010). Respondents were informed that maximum time they would need to complete the questionnaire was from 10 to 15 minutes. Finally, they were assured of privacy and confidentiality.

Five-point Likert scales were used to measure the defined elements of the constructs within the proposed theoretical framework. Five-point Likert scales were applied to measure the perception of factors influencing security. In this study the numbers 1 to 5 were assigned to the categories of concepts (strongly disagree = 1, disagree = 2, undecided = 3, agree = 4 and strongly agree = 5) knowing that this surely does not represent the true distances between them but believing that it is close enough to derive meaningful results (Kaptein et al., 2010). The questionnaire was structured into two sections as follows:

Section One: Background information. This sought answers to demographic questions in tick-list.

Section Two: E-government related to critical socio-technical factors. This part consisted five sections as follows:

- Section one: Legal/Contractual Factors. The questions that measure the Legal factor adopting from (Knapp et al., 2006), and the Compliance factor adopting from (Chaula, 2006) refer to (Appendix B).
- Section two: Ethical/Cultural Factors, the questions that measure the ethical factor adopting from (Chaula, 2006) refer to (Appendix B).

- Section three: Administrative/Managerial Factors. The questions that measure the Top Management Support factor adopting from (Knapp et al., 2006) refer to (Appendix B).
- Section four: Operational/Procedural Factors. The questions that measure the Policy factor adopting from (Narain Singh et al., 2014), Awareness factor adopting from (Knapp et al., 2007), and Training factor adopting from (Knapp et al., 2007) refer to (Appendix B).
- Section five: Mechanical/Electrical Factors. The questions that measure the IS structure factor adopting from (Alfawaz, 2011), (Altameem, 2007) refer to (Appendix B).

3.5.1.2 Questionnaire distribution

The questionnaires were administered at Public Service Department Malaysia (JPA) during June 2015 to October 2015 as a “purposeful sampling”. The procedure of data collection began by contacting with some of JPA’s staffs to ask for permission and help to distribute the questionnaires, during the survey process, the organizations were first contacted via e-mail, telephone to confirm contact details and to introduce the survey. Mr. Khairul Anuar Bin Ahmed (Assistant Information Technology Officer) acts as an agent to help in distributing the questionnaires. The JPA portal was used to gather an emails list and contact members for the respondents. Online questionnaires were then e-mailed to the participants. The questionnaire was attached with a cover letter to introduce the researcher, research objectives, and the importance of the survey. A total of 600 questionnaires were delivered. Telephone and email follow-up were undertaken during the two weeks following the delivery of the questionnaire. The data was gathered over a period of three months. Total of 312 valid questionnaires were collected.

- **Survey population and Sampling**

According to Neuman and Robson (2012), sampling is a process of systematically selecting cases for inclusion in a research project. A researcher uses a set of cases

(elements) or samples, which are more manageable and cost effective to work with than a pool of all the cases Neumann, (2006); sampling cuts costs, reduces labour requirements and quickly gathers vital information.

The research objectives' statements highlight that the unit of analysis was information security at the individual level. In addition to select the sample candidates, this study was conducted in the Malaysia context. A random sampling has been done from Public Service Department Malaysia (JPA). The participants chosen had an information security baseline experience and were aware of information security practices in their organizations. The participants' roles ranged from general and technical staff, department and IT managers, IT staff, security staff, to information security managers and officers. The time needed to answer the survey for each participant was 10-15 minutes.

3.5.2 Data Analysis Techniques/Tool/Process

Multivariate statistics were employed to quantitatively analyze the data collected from the questionnaire survey. This technique is suitable since it provides an analysis of a complicated data set that has independent and dependent variables (Tabachnick & Fidell, 2013). There are many objectives for data analysis: to get a feeling for the data through descriptive statistical analysis, to test the goodness of the measurement scale by measuring reliability and validity, to uncover factors underlying model constructs, and to assess and refine the model (Tabachnick & Fidell, 2013). In descriptive statistical analysis the aim is to summarize data. The basic features of the data are being described with descriptive statistics, such as mean, median, mode and standard deviation. Descriptive statistical analysis is done using numerical data. A descriptive data analysis was conducted, primarily using the Statistical Package for the Social Sciences (SPSS) (version 20) program.

Later, a measurement scale was assessed for reliability and validity. 'Cronbach's alpha' used to measure the reliability, which provided an indication of how consistent the responses were across items within the scale. On the other hand, the validity of the socio-technical security framework was validated using factor analysis sequentially: Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). EFA enables the identification of appropriate variables, as well as the analyses of the interrelationships between large numbers of variables, in terms of their common underlying dimensions (Hair et al., 2010). The expected results from the EFA provided essential information on the valid factor structure of each framework construct. Following EFA, CFA was sequentially conducted to strengthen the validity of the measurement scale by confirming the factor structures uncovered from the EFA process (Markus, 2012). CFA was used as it is considered the best-known technique for testing how well a pre-determined (hypothesized) factor structure matches the actual data (Hair et al., 2010). EFA was carried out using SPSS, and CFA was carried out using AMOS.

Structural Equation Modeling (SEM) was conducted to test the proposed hypotheses concerning mainly the nomological validity of the research framework constructs and secondarily examining the initial understanding of the relationship between socio-technical factors influencing security. SEM techniques were also employed to examine a series of dependence relationships, and provide a transition from exploratory to confirmatory analysis. SEM is an extension of several multivariate techniques, such as multiple regression and factor analysis (Awang, 2015; Markus, 2012). By using SEM, the confidence placed in the causal relationships was tested, that is, the internal validity of the framework was established. SEM has many advantages, such as it analyses the data for inferential purposes by demanding the pattern of inter-variable relations are specified a priori (Byrne, 2013). In addition, SEM provides explicit estimates of measurement error variance parameters, thereby avoiding possible serious inaccuracies caused by potentially sizable measurement errors ignored during exploratory analyses (Byrne, 2013). SEM also incorporates and integrates path analysis and factor analysis. It is a hybrid model with both multiple indicators (measurement variables of the framework constructs) for each

latent variable (framework constructs) and specified paths connecting the latent variables. SEM used two steps: validating the framework and fitting the structural model. The first step is achieved through CFA. The second step is achieved through path analysis with latent variables (G. D. Garson, 2009). SEM can be performed with the assistance of specialized computer programs, such as LISREL, AMOS, and EQS. In this study, AMOS (version 23.0) was employed for testing the hypotheses, as an extension to the use of SPSS.

3.5.2.1 Reliability

The means of the reliability is “that individual scores from an instrument should be nearly the same or stable on repeated administrations of the instrument and that they should be free from sources of measurement error and consistent” (Creswell, 2013). Cronbach’s “coefficient alpha was used to examine consistency of responses. Cronbach alpha calculates the average correlation between items and the test (Kocak et al., 2014; Tashakkori & Teddlie, 1998). Reliability of around 0.70 is considered as “adequate”; a value around 0.80 as “very good”; and values around 0.90 considered as “excellent” (Kline, 2015). The generally lower agreed value for Cronbach’s alpha is 0.70.

3.5.2.2 Validity

According to Creswell (2013), the ideal situation in a study exists when scores are both reliable and valid. Nevertheless, Creswell believes scores need to be stable and consistent (reliable) before they can be meaningful (valid). Also, Creswell states a study is considered valid when individuals’ scores from an instrument make sense and are meaningful. Creswell believes scores are valid when the researcher is able to draw good conclusions from the sample of the study. This study will demonstrate following validation techniques that were considered for the measurement scales of the constructs in this study. The validation techniques are Uni-dimensionality, content validity, construct validity and nomological validity.

- **Content validity** refers to the degree to which the context of an instrument covers the extent and depth of the topics it is intended to cover (Babbie, 2010). It is concerned with whether the instrument items truly represent the measurement in the intended content area and how well the instrument items sample the total content area (Bandara, 2007). It can be ensured by experts' panel judgment and a subjective process (M. Saunders et al., 2009). The current study ensured context validity through a construction of scale processes using the appropriate methodology to ensure content validity and will be discussed in chapter.
- **Construct validity** was assessed using statistical and practical procedures. Therefore, it is considered as the most complicated type of validity (Creswell, 2008). It is established by determining whether the scores from an instrument are significant and can be used to understand a sample from a population (Gerring, 2011). Construct validity must meet the two following conditions: convergent and discriminant validity.
- **Convergent validity** refers to the extent to which the measured variables of a specific construct share a high proportion of variance in common (Gerring, 2011). The following criteria was used to test convergent validity (Awang, 2015; Hair et al., 2010):
 - All indicators loading should be significant and higher than .5
 - Construct composite reliability should exceed .6
 - Average variances extracted by each construct exceed the variance due to the measurement error for that construct (i. e., AVE should exceed .5).
- **Discriminant validity** refers to the extent to which a construct is truly distinct from other constructs (Duarte & Raposo, 2010). Therefore, discriminant validity measurement should be uncorrelated with measures of unrelated constructs (Schweizer, 2014). Discriminant validity can be measured using Fornell and

Larcker (1981) criteria, where the level of square root of AVE should be greater than the correlations involving the constructs.

- **Uni-dimensionality** is measured through factor loading, uni-dimensionality can be met when all measuring items have acceptable factor loading for their latent construct. The factor loading for newly developed items should be greater than 0.5, and for established item be 0.6 or higher (Awang, 2015; Pallant, 2013).
- **Nomological** validity examines whether the correlations between the constructs in the measurement theory make sense. If the statistically significant construct correlations are all consistent with theory, then nomological validity is confirmed (Hair et al., 2010). In the current study nomological validity of the scale has been assessed using SEM with encouraging indices of goodness of fit.

3.5.3 Pilot Test

A draft questionnaire was piloted to ensure the questions were understood by the respondents and there were no problems with the wording of the instrument (Sekaran & Bougie, 2010). Generally, there are two common types of pilot tests: panel judgment and pilot study. This study used both methods for testing the questionnaire. A panel judgment ensures the content validity of the questionnaire, whilst a pilot study identifies any ambiguities in the questionnaire, as well as enabling the researcher to see if the collected data behave as expected (Sekaran & Bougie, 2010). In this research, the panel judgment method was used in the pre-testing the draft questionnaire, through an 'expert-review' technique. This involved sending the draft questionnaire to a group of experts to judge whether each item measured the theoretical construct nominated. Four experts participated in the review process. The experts were provided with a briefing sheet explaining the background and purpose of the study. The draft questionnaire was revised as per the experts' comments, resulting in the final survey questionnaire. Pilot testing were conducted after revising the questionnaires with twenty participants from Malaysian

organizations to evaluate the questionnaire for clarity, bias, ambiguous questions and relevance to the Malaysian environment. The sample size of pilot test was small, varying from 15 to 30 responders for the initial test (Halit, 2014; Malhotra et al., 2004). Twenty IT staff practitioners from computer center of Universiti Sains Islam Malaysia (USIM) also participated. After the questionnaires were finalized, based on the panel judgment and pilot test feedback, the data collection process began.

- **Pilot test Data Analysis**

Data gathered from questionnaire was analyzed using quantitative method following the guidelines of (Creswell, 2013). SPSS 20 software used to run the tests.

- **Reliability**

The reliability was measured by Cronbach alpha. The acceptable values of Cronbach alpha should be higher than 0.7 (DeVellis, 2012). The results summarized in Table 3.4 show that all Cronbach's alpha values are above 0.8, which is considered very good.

Table3.4: Cronbach's Alpha For Each Field Of The Instrument

NO	Paragraph	Number of Items	Cronbach's Alpha
1	Ethical Conduct (EC)	3	0.849
2	Legal & law (L)	4	0.924
3	Compliance (IC)	3	0.837
4	Top Management Support (TM)	4	0.824
5	Information Security Policy (IP)	3	0.956
6	Information Security Training (T)	3	0.917
7	Security Awareness (AW)	4	0.866
8	IS structure (ISS)	3	0.840
9	Security culture (SC)	4	0.842
10	Security Effectiveness (EF)	4	0.961
11	All paragraphs of the questionnaire		35

- **Construct validity**

Construct validity measure by using the convergent and discriminant validity are used (Creswell, 2013).

- **convergent validity:**

Factor loading and Average Variance Extracted (AVE) are used to assess convergent validity (Hair et al., 2010). All factors loading should be significant and higher than 0.5 to show good convergent validity (Kline, 2015). In addition, if AVE is more than 0.5, it is acceptable (Hair et al., 2010). Formula given by Fornell and Larcker (1981) was used to calculate AVE .

$$AVE = \frac{\sum_{i=1}^n \lambda_i^2}{n}$$

Where AVE =Average variance extract, n = the number of items, λ= the standardized factor loading

As shown in table3.4, the factor loading of all items are greater than 0.712 which are considered as acceptable level. The AVE for all factor are in the acceptable level. The AVE ranges were between of 0.553 to 0.841.

Table3.5: Factor Loading For Each Item Of The Instrument

Construct	Item	Factor loading (above 0.5)	AVE (above 0.5)
Ethical Conduct	EC1	.850	0.623
	EC2	.771	
	EC3	.742	
Legal & law	L1	.788	0.710
	L2	.876	
	L3	.895	
	L4	.807	
Compliance	IC1	.723	0.574
	IC2	.785	
	IC3	.764	
Top Management Support	TM1	.872	0.669
	TM2	.882	
	TM3	.750	
	TM4	.758	
Security Policy	IP1	.935	0.841
	IP2	.893	

	IP3	.922	
Security Training	T1	.843	0.738
	T2	.856	
	T3	.878	
Security Awareness	AW1	.712	0.589
	AW2	.743	
	AW3	.835	
	AW4	.775	
IS structure	ISS1	.771	0.593
	ISS2	.798	
	ISS3	.741	
Security culture	SC1	.714	0.553
	SC2	.740	
	SC3	.782	
	SC4	.736	
Security Effectiveness	EF1	.883	0.811
	EF2	.918	
	EF3	.927	
	EF4	.872	

○ **Discriminant validity**

The potentially overlapping constructs correlations were measured by constructs discriminant validity (Hair et al., 2010). It can be measured using Fornell and Larcker (1981) criteria, where the square root value of variance extracted should be greater than the correlations involving the constructs.

Table 3.6: The Discriminant Validity Index Summary

	EC	L	IG	TM	IP	T	AW	ISS	SC	EF
EC	0.623									
L	-.334	0.710								
IG	.013	-.025	0.574							
TM	.021	-.067	.029	0.669						
IP	-.052	-.011	.441	.311	0.841					
T	-.273	.391	-.038	.312	.133	0.738				
AW	-.086	-.039	.141	.333	.196	.305	0.589			
ISS	-.297	.010	.006	.089	-.174	.188	.292	0.593		
SC	-.267	.071	.037	.252	.206	.034	-.109	-.188	0.553	
EF	-.266	-.098	-.083	-.131	.032	-.124	.023	.181	.147	0.811

As shown in Table 3.6, the square root AVE of any two constructs is greater than the correlation between them. Thus, the results of testing convergent validity revealed good construct validity.

3.6 Chapter Summary

This chapter presented a guideline of the research methodology, research strategy and methods. This chapter aimed to provide an appropriate research methodology for the purpose of the research problem, understanding the challenges faced by organizations in e-government security in Malaysia and hence in developing a Socio-technical security framework. The proposed research study adopted deductive approach used quantitative survey research method. Data analysis and results are discussed in next chapter.

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