CHAPTER 6: FRAMEWORK VALIDATION

This chapter presents the detailed procedures undertaken to validate the information security culture framework developed and outlined in Chapter 5. The validation of the framework was conducted following the confirmed validity and reliability of the framework constructs described in the preceding Chapter 4. This chapter begins with an overview of the Structural Equation Modeling (SEM) employed as the technique for evaluating and validating the relationships between the frameworks constructs which presented SEM components of a measurement framework. And presents the feedback obtained from the experts, *in the* process, the evaluation criteria were developed such as: simplicity, coverage and completeness, compliance to security standards, and dynamics and flexibility.

6.1 SEM Overview

SEM is considered as an extension of multivariate techniques such as regression analysis which allows the use of multiple indicators to measure unobserved variables (i.e. constructs), whilst taking into account measurement errors when statistically analyzing data (Hair et al., 2010). Generally speaking SEM is employed primarily to determine whether a theoretical (a priori) framework is valid, by specifying, estimating and evaluating the linear relationships among a set of observed and unobserved variables (Shah & Goldstein, 2006). Any linear relationships imply causal links, whose estimated path coefficients can be used as the basis for hypothesis testing (Khine, 2013).

The framework used in the SEM analysis can be viewed as the combination of a measurement model and a structural model (Laursen et al., 2012).

The measurement framework depicted the relationships between the variables and the constructs, which can be used to determine whether the constructs are accurately measured. The structure framework represented the relationship between the constructs only and is used to test the hypothesized relationships (Shah & Goldstein, 2006). In general, the SEM analysis followed the 'two-step approach': (1) specifying and assessing the entire 'measurement model' to establish validity; and then (2) testing the 'structural model' to examine and assess the relationships between the constructs, (Anderson & Gerbing, 1988; O'Rourke et al., 2013). Both steps required an assessment of the model fit indices and parameter estimates which were based on similar procedures and criteria employed in the CFA conducted in Chapter4. However, in the present study, there was no need to test the structure model since the main purpose was to establish the nomological validity of the research framework. Additionally, the three hypotheses in this study can be represented using the SEM measurement model.

6.2 Measurement Framework Assessment

6.2.1 Measurement Framework Specification and Assessment Criteria

The approach began with the specifications of the measurement model followed by an assessment of its validity. The measurement framework (a CFA model) depicts a series of relationships that suggest how measured variables represent a construct that is not measured directly (Hair et al., 2010). In this study, the framework consisted of three layers: (1) indicators (independent variables), signifying the measured factors; (2) mediator variable, signifying the underlying constructs; and (3) dependent variable, signifying the underlying constructs.

The measurement framework was assessed using the CFA technique conducted similarly to that utilized in chapter 4. The assessment of the model fit, the convergent and discriminant validity, were based on the following criteria:

- Model fit indices: $X^2/df < 3.0$; TLI, NFI, CFI, and IFI > 0.90; and RMSEA < 0.08 (Awang, 2015; Hair et al., 2010; Kline, 2015).
- Convergent validity: factor loadings > 0.50; significant at $p < 0.05$ level; and $R^2 > 0.50$ (Hair et al., 2010);
- Discriminant validity: correlation coefficients for each pair of constructs less than 0.850 (Awang, 2015; Kline, 2015).

In addition, the reliability of the framework was assessed using a more accurate measure such as 'composite reliability' and 'average variance extracted', rather than the traditional Cronbach's alpha. 'Composite reliability' refers to the degree to which a set of two or more variables share in their measurement of a construct (Lu et al., 2007). A high composite reliability, therefore, indicates that all the variables measure the same construct. Moreover, composite reliability can be calculated from the following formula (Hair Jr et al., 2013):

$$CR = \frac{(\sum_{i=1}^{n} \lambda_i)^2}{(\sum_{i=1}^{n} \lambda_i)^2 + (\sum_{i=1}^{n} \delta_i)}$$

Where CR = Composite Reliability; i = number of items; n = total number of items; λ_i = standardised factor loadings; δ_i = error variance term = $1 - \lambda_i^2$

Additional measures to determine the composite reliability can be found by calculating the average variance extracted measures in which the amount of variance in the measured variables is accounted for by the latent construct (Koufteros, 1999; Mora, 2012). The higher values of the variance extracted indicate that the variables were truly representative of the latent construct. The average variances extracted were calculated from the following formula (Hair et al., 2010):

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

Where AVE = Average Variance Explain; λ_i^2 =the sum of the squared loadings; i = number of items; n = total number of items.

Composite reliability values of greater than .60 are desirable and the values for average variance extracted, greater than .50, are considered adequate (Awang, 2015). Convergent validity can be obtained with having 0.5 values or higher for average variance extracted. In addition, if average extracted estimates are greater than the square root of the correlation between that factor and other factor, then it is considered an evidence of discriminant validity (Awang, 2015). The average extracted estimates should be computed for each latent construct in a measurement framework. It is important to note that the AMOS program used in this study did not provide the values for both measures. As a result, these values were calculated separately using the above formulae.

6.2.2 Measurement Framework Results

Table 6.1 indicates the correlation between the research framework constructs. The results are presented in Table 6.2 and indicate that here was in no case any correlation between the constructs greater than the average square root of AVE (the principal diagonal element) and all the AVEs were above the 0.5 threshold as discussed earlier. The AVEs ranged from 0.724 to 0.885. Thus, the discriminant validity of the scales used was adequate for the information security culture measurement framework. The results of the measurement framework assessment, presented in Figure 6.1 and Table 12, were based on the criteria discussed above. The framework exhibited an acceptable level of fit (X^2 = 587.194; df = 482; X^2/df = 1.218; GFI= 0.900, NFI = 0.944, TLI = 0.988, CFI = 0.989; IFI = 0.990; and RMSEA = 0.026). All the indicators (factors) had significant loadings greater than 0.50 ($p < 0.001$) on their respective constructs. These results indicated the

measurement framework maintained convergent validity. All of the composite reliability constructs have values above 0.60. In fact, the lowest composite reliability value was .908 according to Table 6.3 which indicates excellent reliability for the construct research framework. Additionally, the principal component analysis showed that all the items have higher factor loadings on their construct than the other constructs which indicated a requirement for the Uni-dimensionality (Fornell & Larcker, 1981). Furthermore, the average variance extracted for all constructs was greater than 0.50 with a lowest construct value of 0.724 according to Table 6.3. These results indicate that the information security culture measurement framework possessed substantial convergent validity. On the other hand, the correlation coefficients between each pair of the constructs were less than 0.850, suggesting adequate discriminant validity (Kline, 2015). Additionally, discriminant validity was also examined using Fornell and Larcker (1981) recommended conditions for discriminant validity, such as the square root of average variance explained (AVE) for all constructs should be larger than all other cross-correlations and all AVEs should have values above 0.5. In this study, all of the AVEs have values above 0.5.

Table 6.1: Factor Correlation between Research Framework Constructs

	T	EF	SC	IP	ISS	AW	TM	IC	L	EC
T	1									
EF	0.259	1								
SC	0.326	0.706	1							
IP	0.114	0.39	0.461	1						
ISS	0.146	0.329	0.381	0.135	1					
AW	0.093	0.265	0.302	0.06	0.208	1				
TM	0.174	0.459	0.535	0.321	0.202	0.191	1			
IC	0.062	0.378	0.42	0.137	0.189	0.145	0.246	1		
L	0.082	0.224	0.289	0.076	0.213	0.12	0.14	0.029	1	
EC	0.085	0.282	0.331	0.191	0.077	0.178	0.248	0.192	0.028	1

Table 6.2: Discriminant Validity

	T	EF	SC	IP	ISS	AW	TM	IC	L	EC
T	**0.885**									
EF	0.259	**0.794**								
SC	0.326	0.706	**0.723**							
IP	0.114	0.39	0.461	**0.826**						
ISS	0.146	0.329	0.381	0.135	**0.844**					
AW	0.093	0.265	0.302	0.06	0.208	**0.805**				
TM	0.174	0.459	0.535	0.321	0.202	0.191	**0.799**			
IC	0.062	0.378	0.42	0.137	0.189	0.145	0.246	**0.769**		
L	0.082	0.224	0.289	0.076	0.213	0.12	0.14	0.029	**0.840**	
EC	0.085	0.282	0.331	0.191	0.077	0.178	0.248	0.192	0.028	**0.849**

Table 6.3: The CFA Report for R^2, CR and AVE

Construct	Item	Factor loading	R^2	AVE (above 0.5)	CR (above 0.6)
Ethical Conduct	EC1	.928	.860	**0.849**	**0.944**
	EC2	.920	.847		
	EC3	.916	.840		
Legal & law	L1	.883	.779	**0.840**	**0.955**
	L2	.927	.860		
	L3	.946	.895		
	L4	.909	.826		
Compliance	IC1	.821	.675	**0.769**	**0.909**
	IC2	.923	.852		
	IC3	.884	.782		
Top Management Support	TM1	.879	.773	**0.799**	**0.941**
	TM2	.913	.834		
	TM3	.912	.831		
	TM4	.871	.758		
Information Security Policy	IP1	.913	.833	**0.826**	**0.934**
	IP2	.932	.868		
	IP3	.880	.775		
Information Security Training,	T1	.936	.877	**0.885**	**0.958**
	T2	.947	.896		
	T3	.939	.881		
Security Awareness	AW2	.857	.785	**0.805**	**0.925**
	AW3	.947	.896		
	AW4	.886	.866		
IS structure	ISS1	.911	.831	**0.844**	**0.942**
	ISS2	.935	.875		

	ISS3	.910	. 827		
Security culture	SC1	.763	. 583	**0.723**	**0.912**
	SC2	.906	. 822		
	SC3	.870	. 757		
	SC4	.856	.733		
Security Effectiveness	EF1	.890	. 791	**0.794**	**0.939**
	EF2	.880	. 775		
	EF3	.897	.805		
	EF4	.898	.807		

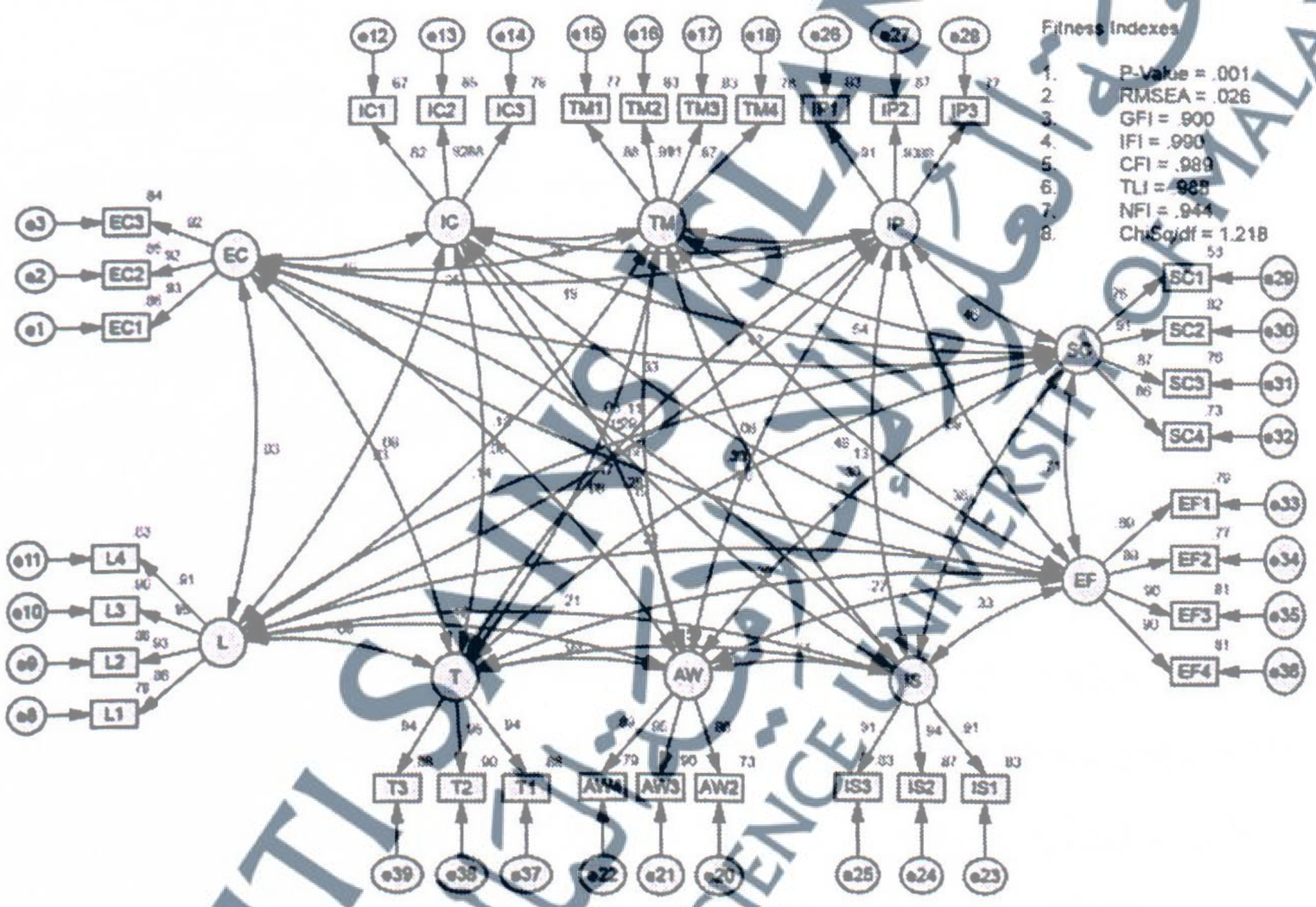

Figure 6.1: CFA Framework

As discussed earlier, there is no clear distinction in terms of what factors influence security culture and what factors influence security effectiveness. In other words, the framework that was developed did not make a clear distinction of how security culture can mediate the relationship between socio-technical factors and security effectiveness. However, in the framework, security culture was composed of several factors such as Ethical Conduct, Legal & law, Compliance, Top Management Support, Information Security Policy, Information Security Training, Security Awareness, and IS structure.

Security culture, as a mediation factor, had influence on security effectiveness. In addition, the measurement framework examined how the framework might best explain the data, and how we can test the meditation impact. Model exhibited an acceptable level of fit (X^2 = 587.194; df = 482; X^2/df = 1.218; GFI= 0.900, NFI = 0.944, TLI = 0.988, CFI = 0.989; IFI = 0.990; and RMSEA = 0.026).

6.3 Testing The Nomological Validity Of Socio-Technical Security Measurement Framework

One of the most powerful ways of examining the validity of the research framework constructs and measures is through nomological validation analysis, (Bagozzi, 1980; Cronbach, 1971; Leary et al., 2013). An instrument or model has nomological validity if it ''behaves as expected with respect to some other constructs to which it is theoretically related" (Carsrud & Brännback, 2014; Churchill, 1999). In other words, nomological validity refers to the degree that the summated scales are correlated with a similar but conceptually distinct measure (Hair et al., 2010), through assessment of the selected best-fitting model. Nomological validity reflects the extent to which predictions about constructs and measures are accurate from the perspective of reasonably well-established theoretical models (Straub et al., 1995). In this study, the nomological validity of the scale was assessed by constructing a structural equation modeling (SEM) of security culture measurement framework with encouraging indices of goodness of fit. The SEM approach was adopted because this study intended to vigorously test the convergent, discriminant, and nomological validity of the factors constructed the framework. In the current research, there is certainly a lack of empirically validated theories that could establish substantial relationships between framework constructs. As a result, the nomological validity of information security measurement framework is important and essential to the existing body of knowledge in the information security culture area.

This study was designed to develop and test the nomological (predictive) validity of a measure capturing the security culture measurement framework that includes the identification of the relationship between factors influencing security culture and security effectiveness. To test the nomological (predictive) validity of this part of the measure, the current study proposed the following three hypotheses.

H1 (1) Legal & law, (2) Compliance, (3) Ethical Conduct, (4) Information Security Policy, (5) Security Awareness, (6) Information Security Training, (7) Top Management Support, (8) IS structure, are factors that have positive influence on security culture.

H2 Security culture has positive influence on security effectiveness.

H3 (1) Legal & law, (2) Compliance, (3) Ethical Conduct, (4) Information Security Policy, (5) Security Awareness, (6) Information Security Training, (7) Top Management Support, (8) IS structure have influence on security effectiveness and is mediated by security culture.

After validating the measurement framework as optimal through exploratory and confirmatory factor analysis, the current study tested framework constructs to ensure nomological validity. Nomological validity was assessed through the examination of relationships between factors influencing security culture and security effectiveness. Earlier in Chapter 4, the current study has demonstrated convergent validity with all associations between indicators and the latent variable being significant at .001. In addition, Table 6.3 shows consistently high loadings for the socio-technical security factors in the nomological net model. Moreover, as shown in Table 6.3, composite reliability and average variance explained were well above the minimum level. The model testing nomological validity fitted the data well with (X^2 = 587.194; df = 482; X^2/df = 1.218; GFI= 0.900, NFI = 0.944, TLI = 0.988, CFI = 0.989; IFI = 0.990; and RMSEA = 0.026), and the correlations between constructs in the measurement theory makes sense such as correlation must be positive or negative according to theory (Hair et

al., 2010). The results also indicate that all correlations between factors influencing security culture and security effectiveness are statistically significant ($P<0.001$), and the hypothesized direction is as based on theory. Thus, it can be deduced that all of the factors in the model were deemed to possess nomological validity. In addition, to establish the full nomological validity of this framework, a mediation check was performed, a check that, by necessity, must be done in stages.

6.3.1 Mediation Test

A mediator is a construct in a causal chain between two other constructs. In this framework, security culture is proposed as a mediator between independent factors such as (Ethical Conduct, Legal & law, Compliance, Top Management Support, Information Security Policy, Information Security Training, Security Awareness, IS structure) and dependent factor (security effectiveness). That is, independent factors first increase security culture, leading to an increase in security effectiveness. The mediation test procedure proposed by (Awang, 2015) was followed as shown in Figure 6.2.

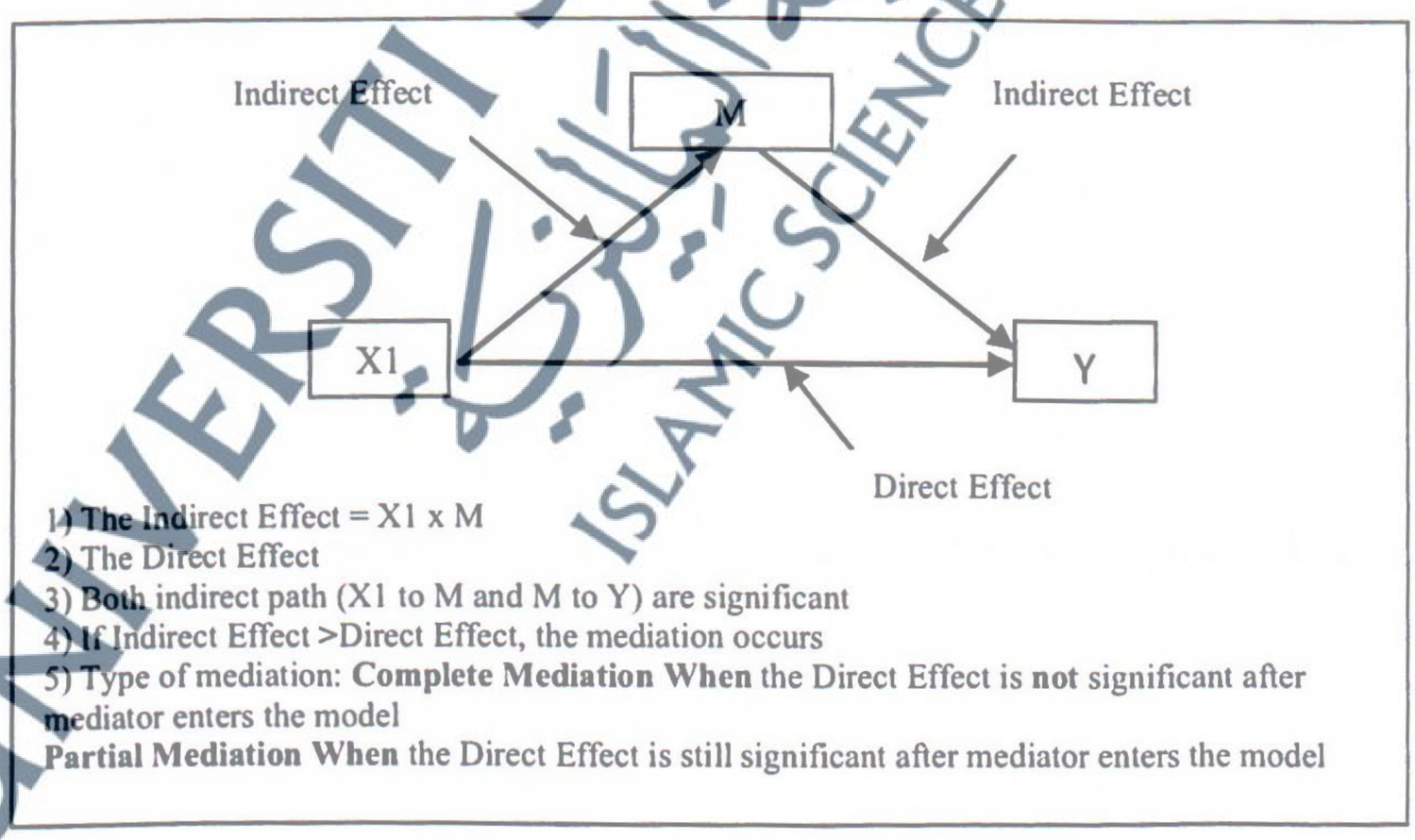

Figure 6.2: Mediation Test Procedure (Awang, 2015)

The direct effect is the effect that goes directly from exogenous construct to endogenous construct, while the indirect effect is the effect from exogenous construct to endogenous construct that goes indirectly through the mediator in the framework

6.3.2 Mediation Test Result

To do the test, first of all, the standardized regression weights and the probability values were obtained which indicate the significance for the respective path (Figure 6.3). The required information is given in Table 6.4. The triangle was drawn as shown in Figure 6.2 for each independent factor.

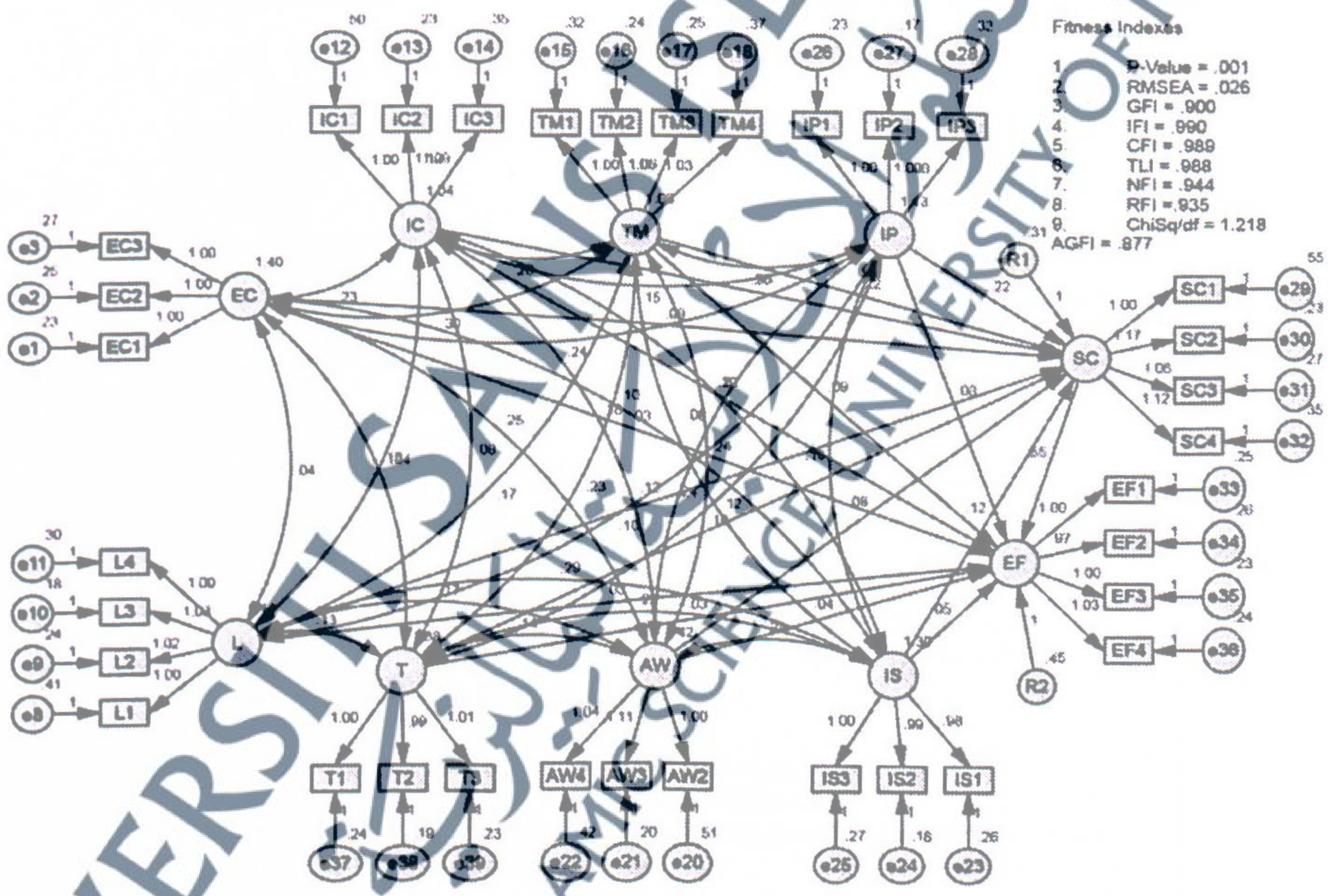

Figure 6.3: The Standardized Regression Weights For Every Path In The Framework

Table 6.4: The standardized regression weights and its significance for each path

			Estimate	P-value	Result
SC	<---	IP	.263	***	Significant
SC	<---	TM	.256	***	Significant
SC	<---	IC	.236	***	Significant
SC	<---	EC	.120	.007	Significant
SC	<---	L	.162	***	Significant
SC	<---	T	.180	***	Significant
SC	<---	AW	.113	.011	Significant
SC	<---	ISS	.156	***	Significant
EF	<---	SC	.492	***	Significant
EF	<---	IP	.091	.076	Not Significant
EF	<---	TM	.096	.074	Not Significant
EF	<---	IC	.105	.039	Significant
EF	<---	EC	.039	.408	Not Significant
EF	<---	ISS	.063	.196	Not Significant
EF	<---	AW	.049	.296	Not Significant
EF	<---	L	.034	.459	Not Significant
EF	<---	T	.045	.334	Not Significant

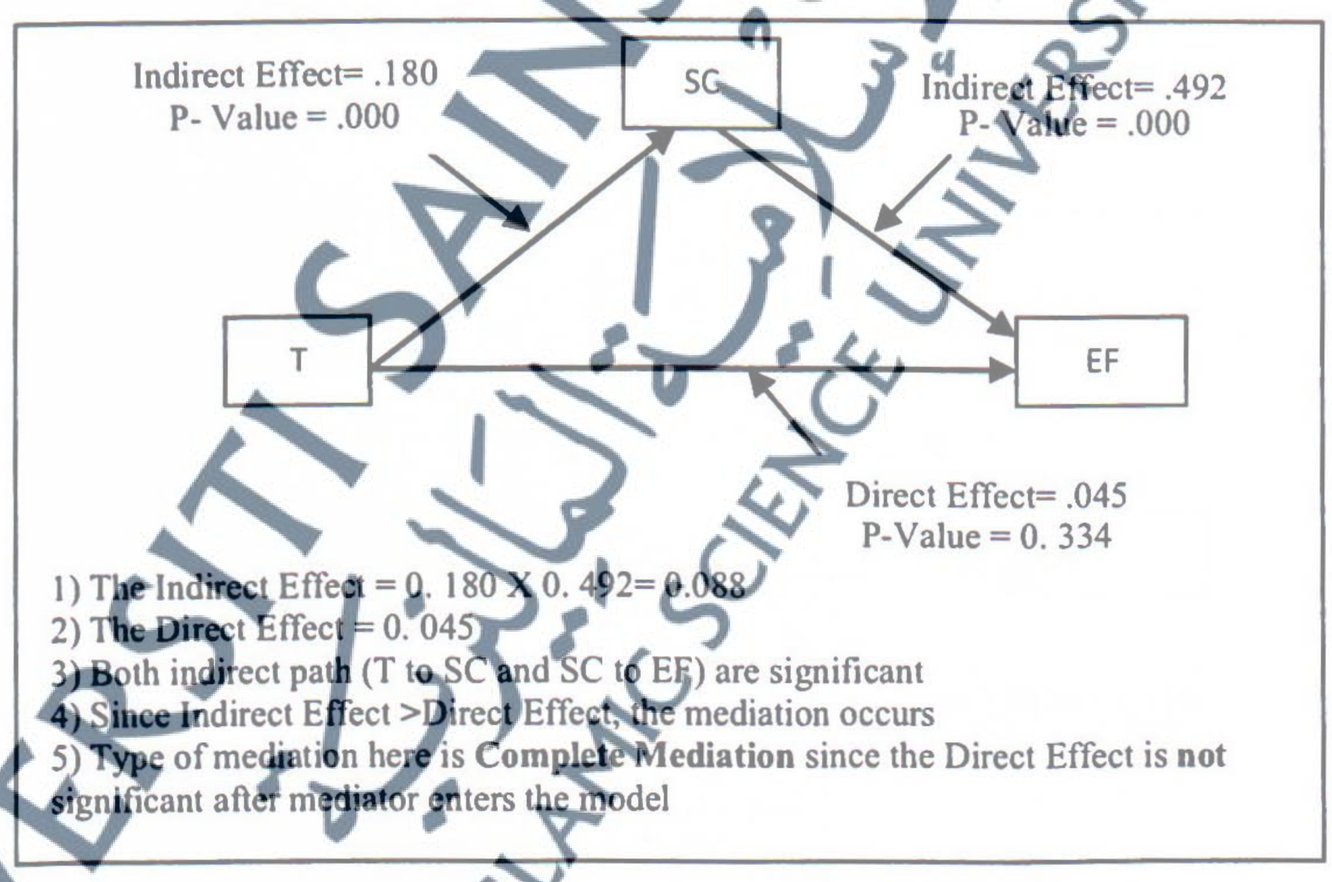

Figure 6.4: The Mediation Test of Training on security effectiveness

Based on Figure 6.4 the Training has positive influence on security effectiveness and mediated by security culture.

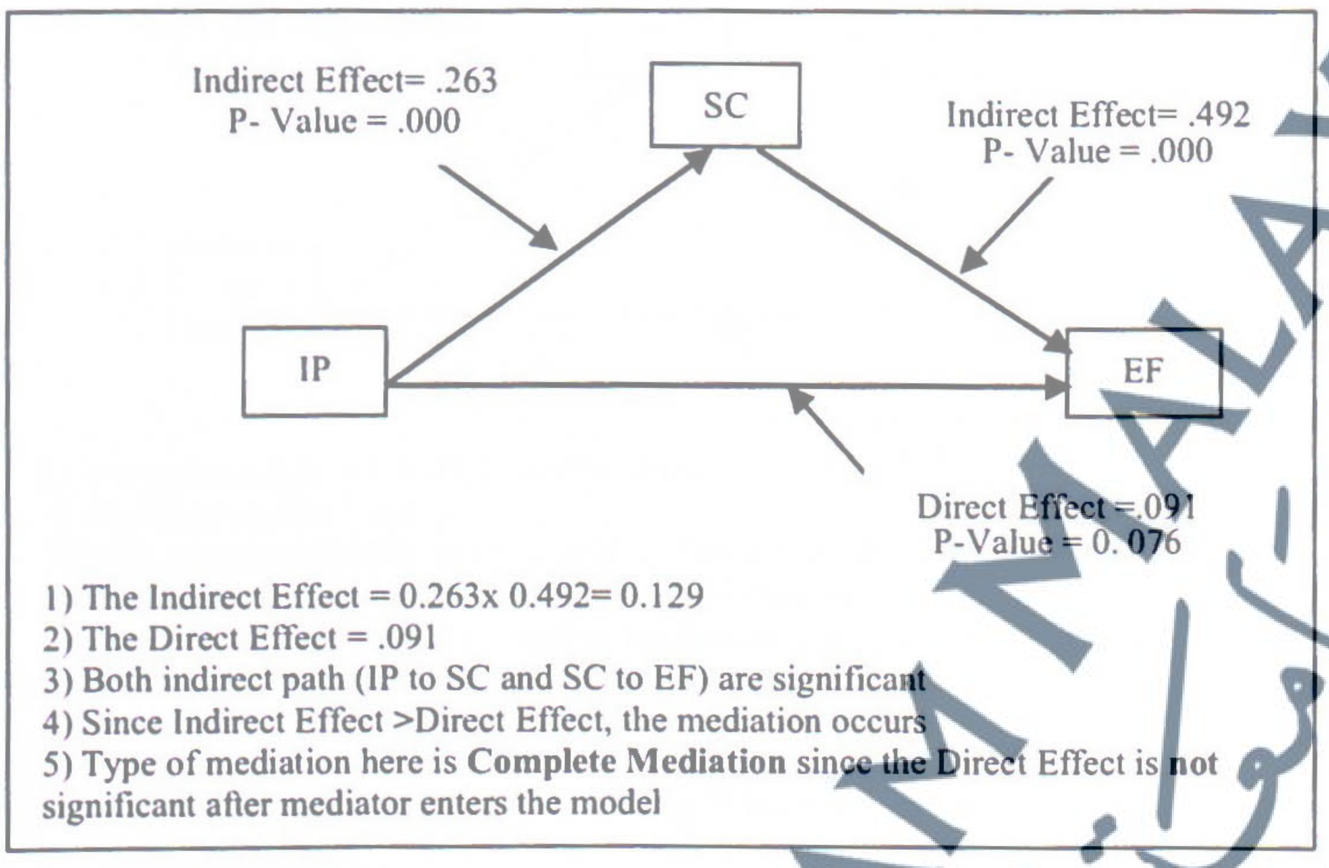

Figure 6.5: The Mediation Test of Security policy on security effectiveness

As result from the mediation test shown in Figure 6.5 the Security policy has positive influence on security effectiveness and mediated by security culture.

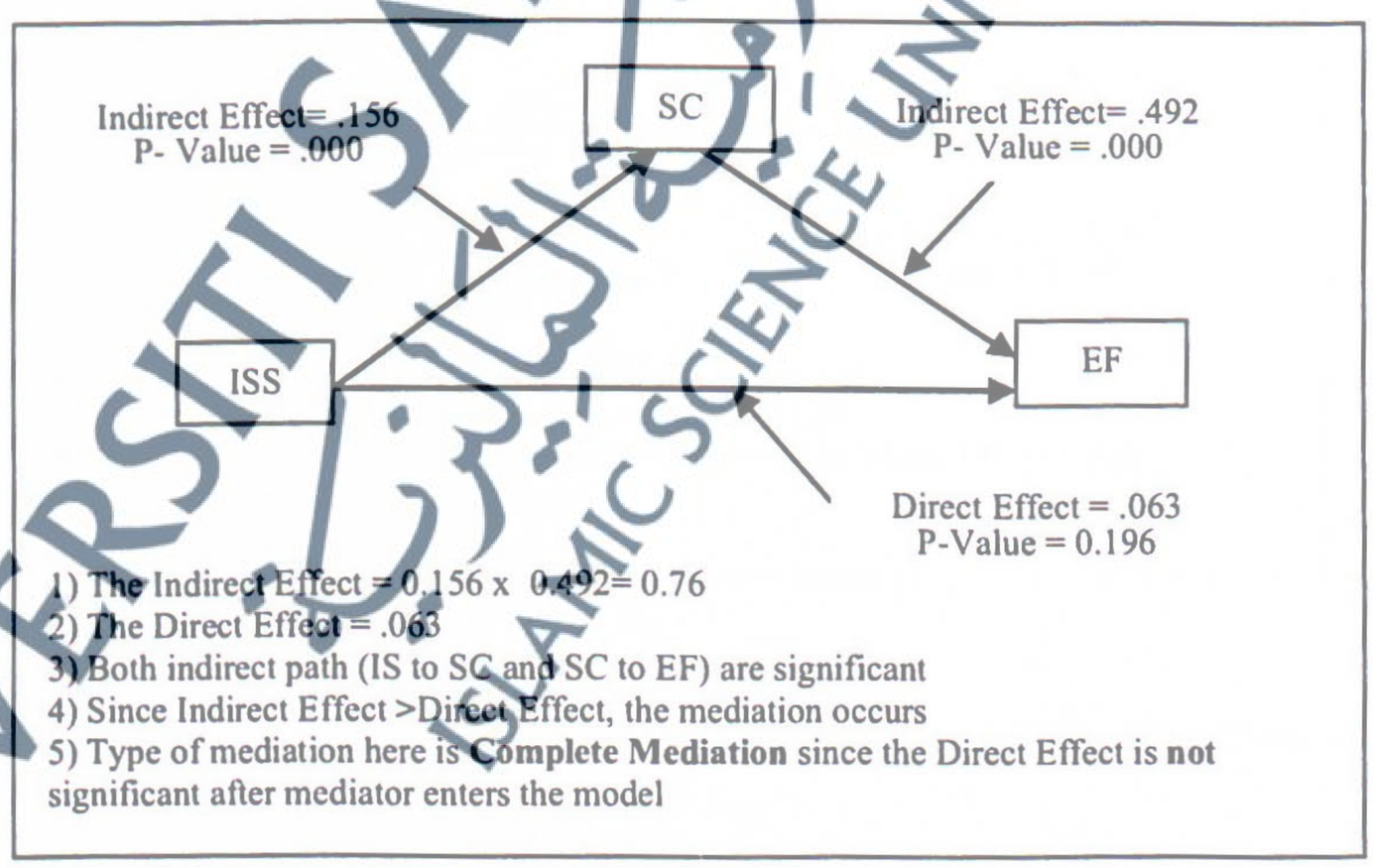

Figure 6.6: Mediation Test of IS structure on security effectiveness

Based on Figure 6.6 IS structure has positive influence on security effectiveness and mediated by security culture.

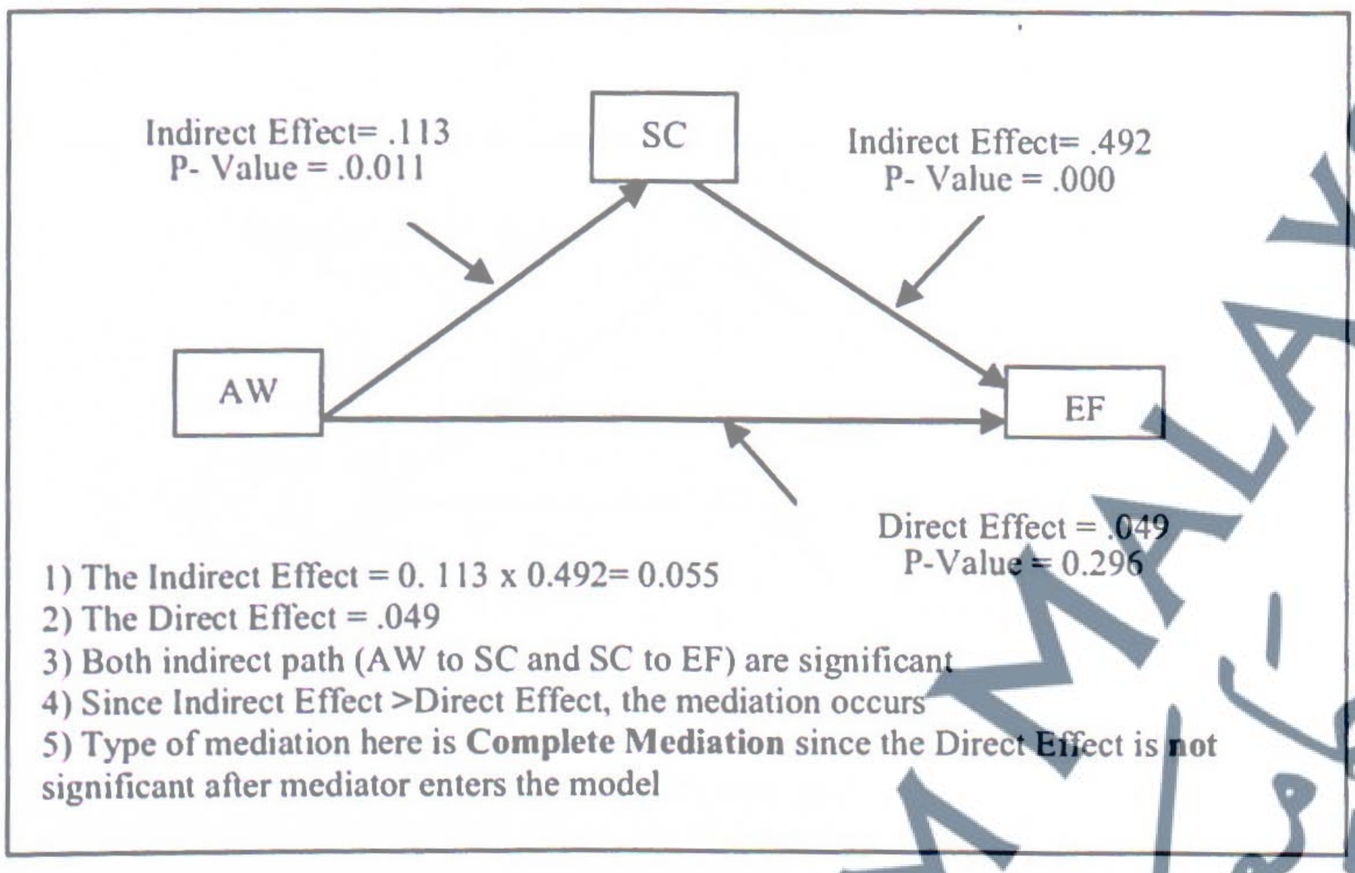

Figure 6.7:Mediation Test of Security Awareness on security effectiveness

Figure 6.7 shown that the Security Awareness has positive influence on security effectiveness and mediated by security culture

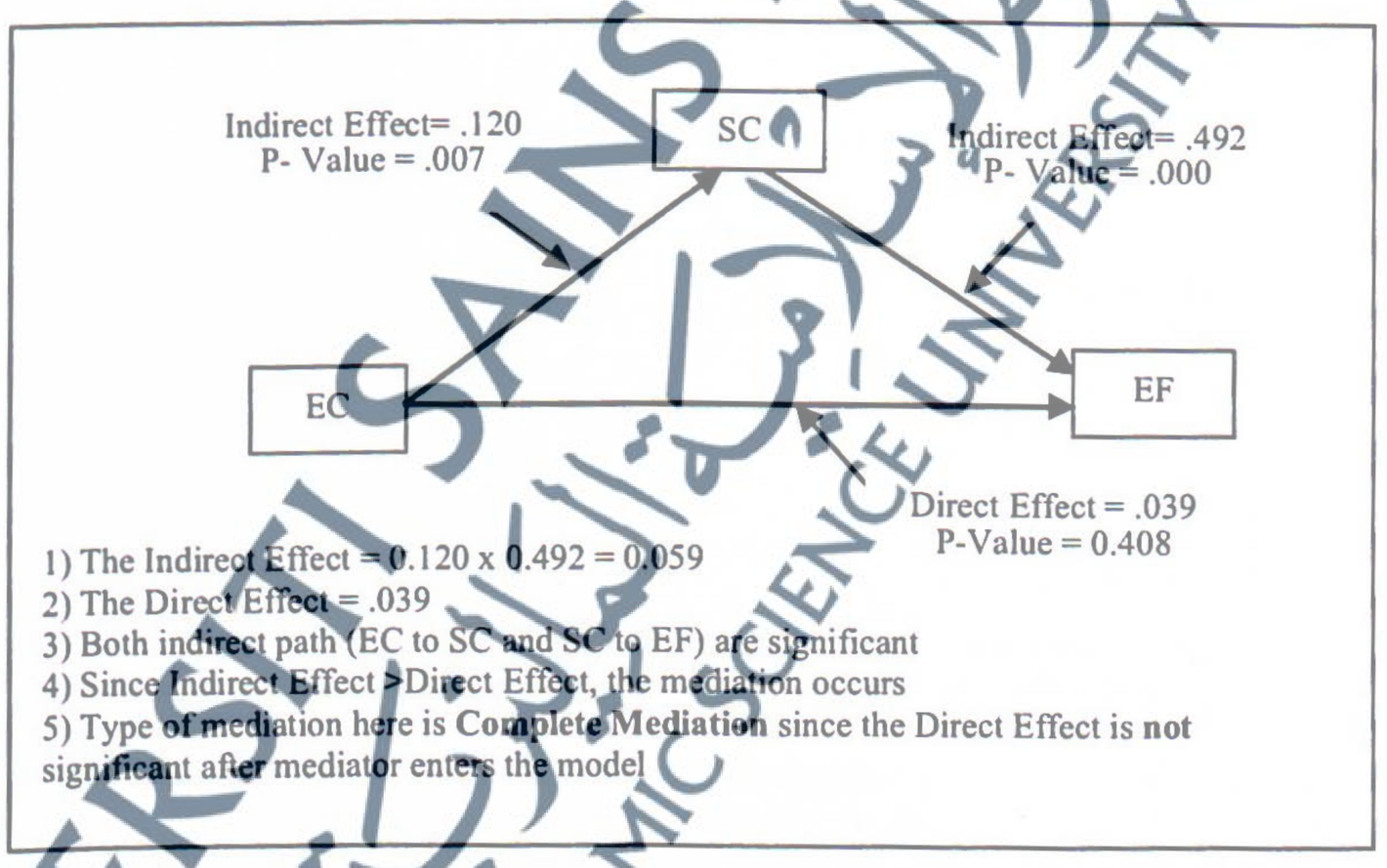

Figure 6.8: Mediation Test of Ethical conduct on security effectiveness

Based on Figure 6.8 Ethical conduct has positive influence on security effectiveness and mediated by security culture.

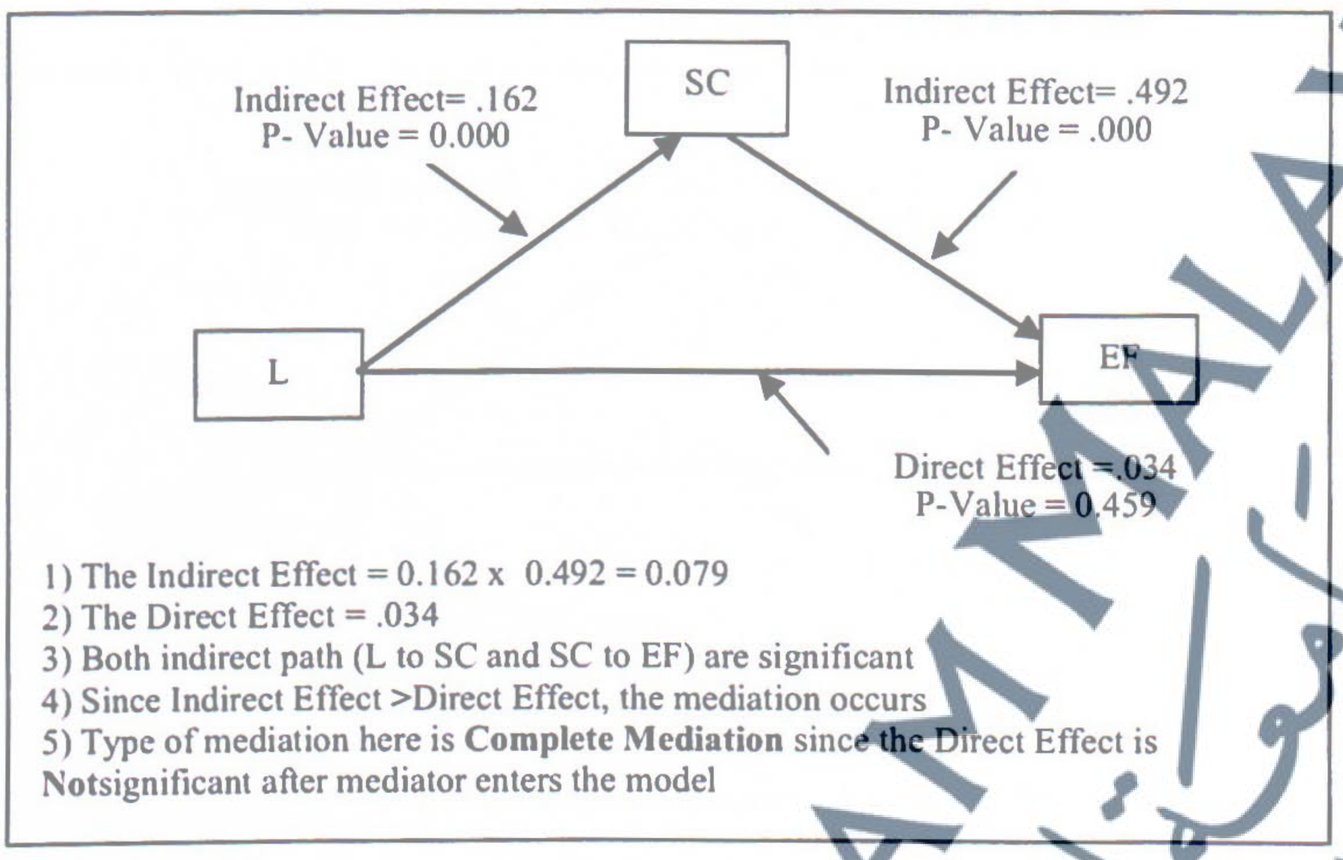

Figure 6.9: Mediation Test of Legal on security effectiveness

Based on Figure 6.9 Legal has positive influence on security effectiveness and mediated by security culture.

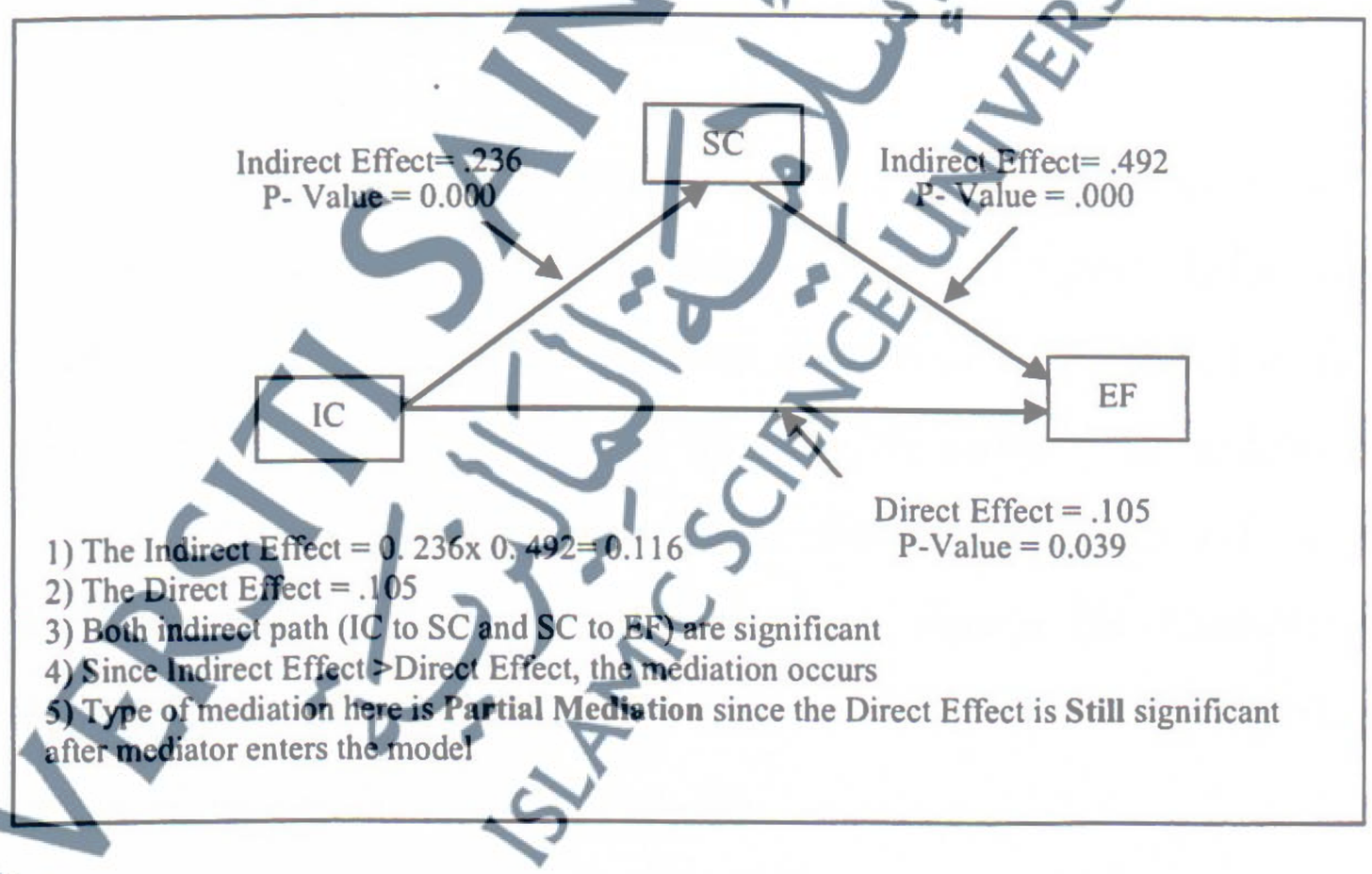

Figure 6.10: Mediation Test of Compliance on security effectiveness

As result from the mediation test shown in Figure 6.10 the Compliance has positive influence on security effectiveness and mediated by security culture.

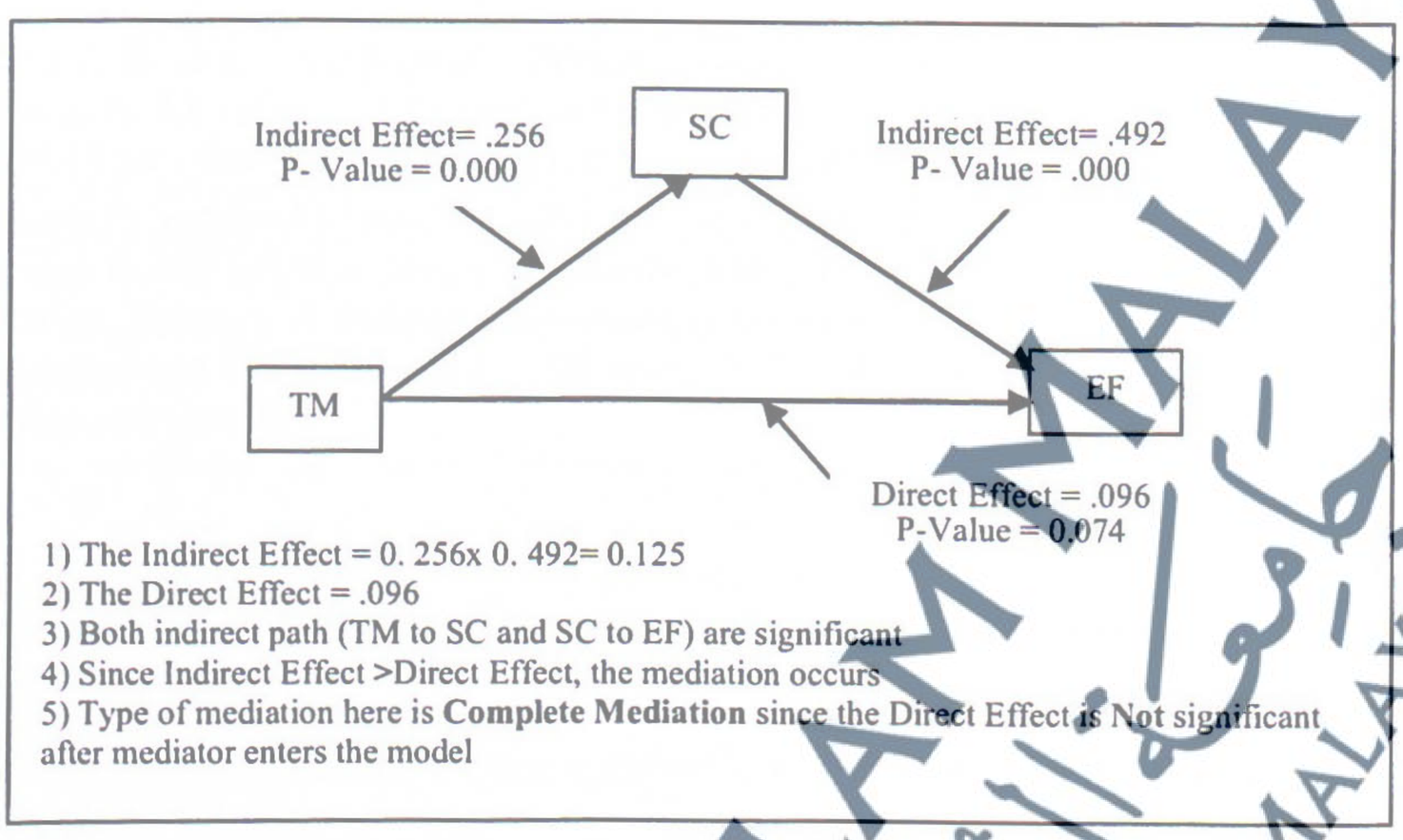

Figure 6.11: Mediation Test of Top management support on security effectiveness

Based on Figure 6.11 Top management support has positive influence on security effectiveness and mediated by security culture.

The results from the mediation test indicated that the independent factors such as (Ethical Conduct, Legal & law, Compliance, Top Management Support, Information Security Policy, Information Security Training, Security Awareness, IS structure) have influence on security effectiveness and are mediated by security culture. In addition, all of these factors are fully mediated by security culture since the direct effect is no longer significant after the mediator enters the framework except the Compliance which is partially mediated by security culture since the direct effect is still significant after the mediator enters the framework. That support H3.

Table 6.5: The Results Of Hypothesis Test

Hypothesis	Description	Results on Hypothesis
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	Supported
2	Security culture has positive influence on security effectiveness.	Supported
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	Supported

6.3.3 Confirming the Mediation Test Result through Bootstrapping

Lately, there are demands from many quarters, including the examiners that researchers need to re-confirm the result of their mediation tests using the re-sampling procedure called Bootstrapping. Through bootstrapping, multiple samples (with the same N as the original sample) are randomly drawn from the original sample with replacement, that is, a given case may be randomly selected more than once in any given bootstrapping data set (Byrne, 2013), the number of re-sampling could be between 500 to 1000 times (Awang, 2015).

To further assess the significance of the mediation, bootstrapping procedures were used. Coefficients for the framework paths (see Figure 6.3) were estimated using the SEM Algorithm while bootstrapping with 1000 sub samples and 312 cases to generate path estimates significance levels. However, for mediating, test is necessary to see whether IV variables have any indirect significant effect on DV variable which indicates the mediation exists (Awang, 2015). The results of the test of indirect effect are shown in the table 6.6, since all values are significant so it can be said that the mediation does occur.

Table 6.6: Bootstrapping Result (Standardized Indirect Effects)

	T	IP	ISS	AW	TM	IC	L	EC	SC	EF
SC	...	...	...	...	...	...	...	...	...	...
EF	0.002	0.002	0.017	0.029	0.003	0.002	0.003	0.025	...	...

Table 6.7:The P-Value (Indirect Effects)

	T	IP	ISS	AW	TM	IC	L	EC	SC	EF
SC	...	...	...	...	...	...	...	...	...	...
EF	0.002	0.002	0.018	0.03	0.002	0.002	0.003	0.021	...	...

Moreover, the significance or insignificance indicates the type of mediation. Full mediation occurs when the IV no longer has a significant effect on the DV when the mediator is included in the model. Partial mediation occurs when the IV still has a significant effect but when its effect is diminished when the mediator is included in the model (Awang, 2015). The results of the test of direct effect are shown in the table 6.7.

Table 6.8 Bootstrapping Result (Standardized Direct Effects)

	T	IP	ISS	AW	TM	IC	L	EC	SC	EF
SC	0.002	0.002	0.014	0.043	0.002	0.002	0.003	0.018	...	...
EF	0.405	0.156	0.285	0.341	0.186	0.045	0.524	0.421	0.004	...

Table 6.9The P-Value (Direct Effects)

	T	IP	ISS	AW	TM	IC	L	EC	SC	EF
SC	0.002	0.001	0.012	0.034	0.002	0.001	0.002	0.017	...	...
EF	0.402	0.157	0.29	0.321	0.179	0.044	0.511	0.436	0.005	...

Table 6.10: Bootstrapping results summarize

T	**Indirect effect**	**Direct effect**
Bootstrapping Result	0.002	0.405
Bootstrapping P-Value	0.002	0.402
Result	**Significant**	**Not Significant**
Type of mediation	**Complete Mediation** since the Direct Effect is **Not** significant	
IP	**Indirect effect**	**Direct effect**
Bootstrapping Result	0.002	0.156
Bootstrapping P-Value	0.002	0.157
Result	**Significant**	**Not Significant**
Type of mediation	**Complete Mediation** since the Direct Effect is **Not** significant	
ISS	**Indirect effect**	**Direct effect**
Bootstrapping Result	0.017	0.285
Bootstrapping P-Value	0.018	0.29
Result	**Significant**	**Not Significant**
Type of mediation	**Complete Mediation** since the Direct Effect is **Not** significant	
AW	**Indirect effect**	**Direct effect**
Bootstrapping Result	0.029	0.341
Bootstrapping P-Value	0.03	0.321

Result	**Significant**	**Not Significant**
Type of mediation	**Complete Mediation** since the Direct Effect is **Not** significant	
TM	**Indirect effect**	**Direct effect**
Bootstrapping Result	0.003	0.186
Bootstrapping P-Value	0.002	0.179
Result	**Significant**	**Not Significant**
Type of mediation	**Complete Mediation** since the Direct Effect is **Not** significant	
IC	**Indirect effect**	**Direct effect**
Bootstrapping Result	0.002	0.045
Bootstrapping P-Value	0.002	0.044
Result	**Significant**	**Significant**
Type of mediation	**Partial Mediation** since the Direct Effect is **still** significant	
L	**Indirect effect**	**Direct effect**
Bootstrapping Result	0.003	0.524
Bootstrapping P-Value	0.003	0.511
Result	**Significant**	**Not Significant**
Type of mediation	**Complete Mediation** since the Direct Effect is **Not** significant	
EC	**Indirect effect**	**Direct effect**
Bootstrapping Result	0.025	0.421
Bootstrapping P-Value	0.021	0.436
Result	**Significant**	**Significant**
Type of mediation	**Complete Mediation** since the Direct Effect is **Not** significant	

The results summarized in table 6.8 show that path from Compliance to security culture is significant. Path from Compliance to security effectiveness is significant ($p < .05$), and this means mediation effect of security culture between Compliance and security effectiveness is partial. Further, path from (Ethical Conduct, Organizational culture, Legal & law, Top Management Support, Information Security Policy, Information Security Training, Security Awareness, IS structure) to security culture is significant, and paths from (Ethical Conduct, Organizational culture, Legal & law, Compliance, Top Management Support, Information Security Policy, Information Security Training, Security Awareness, IS structure) to security effectiveness is not significant (p – value > .05). This means mediation effect of security culture between (Ethical Conduct, Legal & law, Top Management Support, Information Security Policy, Information Security Training, Security Awareness, IS structure) and security effectiveness is Full. These confirm the previous results from conventional procedure and H3 is supported.

6.4 Expert Review

The purpose of the expert review is to obtain some expert opinion about the framework. Questionnaire was prepared aimed at evaluating the proposed framework. To be able to comprehensively evaluate the framework it was important to identify and develop evaluation criteria dimensions, four framework evaluation criteria were developed. The criteria were: *simplicity, coverage and completeness, compliance to security standards, and dynamics and flexibility.* The questionnaire script was piloted by an information security staff from Almasa Company in Libya. The piloting process was used to improve the questionnaire script design. The final questionnaire script can be found in Appendix C. Then three experts were conducted to answer the questionnaire via emails.

6.4.1 The Expert Background

Three experts in IT/ISM responded to the invitation to complete the questionnaire. Expert 1 has 13 years of experience in information security services. He is currently working in the higher education industry (Sebha University) in Libya. Expert 2 has an academic and research background and is currently working in the higher education industry (Tripoli University) in Libya and he has been working as Associate Professor Islamic University Malaysia 2004 to 2007. He has always been aware and interested about information security aspects experience. Expert 3 is in charge in governance, risk and compliance enterprise security services. He is e-government program coordinator in the Libyan Prime Minister's office.

6.5.2 Findings of Expert Review Session

The experts agreed that in addition to the use of technological control, security management could be enhanced by addressing the cultural view. They agreed that in

order to improve the information security effectiveness, security culture needed to be cultivated.

Expert 2 suggests that the framework can potentially be extended to include other socio-technical factors such as risk assessment and assist management which could improve the framework.

Expert 3 suggests that national cultural could be important to focus on this study. This will make the framework flexible enough to adopt in developed countries, and replicating the study in different environments such as developed countries.

In general, they agreed that the framework clear and easily understandable. It is adequately addresses: technical, socio-technical, practice, and theory related security issues. The framework is aligned with current security standards and dynamic enough to deal with possible future security risks and threats, it is quite flexible and practical in nature, allows one to identify various issues around security and assign various weights depending on strategic importance for an organization.

6.5 Chapter Summary

This chapter detailed the validation procedures and assessment for the information security culture framework developed. The chapter began by providing an overview of the analytical technique, namely, structure equation modeling (SEM). SEM was utilized to assess and refine the theoretically developed model. The analysis procedures comprised an assessment of SEM measurement framework components. The assessment results indicated that the specified measurement framework possessed acceptable levels of fit, convergent validity, and discriminant validity. Additionally, the hypothesis relationship was tested using a SEM measurement model and the nomological validity of the socio-technical security framework in which all hypotheses were supported.