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Study on development of security level enhancing prediction model through measuring maturity level of information security and improving vulnerability

Young-Rai Park[1], Yoon-Chul Choy[1*], Won-Sung Sohn[2*]

[1]Dept. of Computer Science, Yonsei University, Seoul, Korea, pyr20210@gmail.com
[1*]Dept. of Computer Science, Yonsei University, Seoul, Korea,
ycchoy@rainbow.yonsei.ac.kr
[2]Dept. of Computer Education, Gyeongin National University of Education, Incheon, Korea,
sohnws@gmail.com

Abstract: To establish evaluation index of information security level specialized to financial sector, to measure information security level of organization based on that, this study developed level enhancing prediction model of information security through figuring vulnerability and improvement. We are expecting that information security level of financial company and financial industry in general would be reinforced by application of this suggestion.

Keyword: Information security, ISMS, Information security maturity

1 Introduction

This study suggested security level enhancing prediction model which can be estimated if vulnerability of control item figured from measuring would be improved, to refer standard control item of relevant regulations of electronic finance and foreign domestic information security management system(ISO/IEC 27001[1]), to measure the level of information security according to evaluation index, to calculate the level of security maturity of financial institution. Therefore prediction of level enhancing which will be accomplished by distinguishing vulnerability through measuring level improvement enable to establish effective plan for improvement and it will be led to level reinforcement of information security in financial industry.

From chapter 2, this paper explains information security maturity level and a predictive model of maturity level enhancement. In chapter 3, we verify the effectiveness of the model based on the real application cases. Finally, chapter 4 shows the conclusion of this study.

[1] International standard ISMS

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2 Security maturity level assessment and predictive model of the maturity level enhancement

We define a 5 stage model of information security maturity level of financial sector based on U.S Federal government's NIST SP800-26 and Systems Security Engineering Capability Maturity Model (SSE-CMM) in the following table [1].

Table 1. 5 steps of Information security maturity model

Maturity stage	First stage	Second stage	Third stage	Fourth stage	Fifth stage
Maturity level	Weak	Insufficient	Average	Good	Excellent
Score range	~ 20%	20 ~ 40%	41 ~ 60%	61 ~ 80%	81%

2.1 Assessment of information security level and estimation of maturity level

In order to evaluate information security level, an assessor perform the assessment of controlled item based on five-point rating scale (1: weak, 2: Insufficient, 3: Average, 4: Good, 5: Excellent).

Once the evaluation is completed, the maturity stage is defined by the organization's scores of the security maturity level calculated by the following formula.

We calculate evaluation value (SW_i) of 14 control divisions to multiply the sum of evaluation value (*E*) of relevant control item by weighted value of control division (W_i) .

$SW_i = (\sum_{k=1}^{n} E_k) \times W_i$, N: The number of detailed control item of control division i

To add evaluation value of 14 control division calculated by above formula, it would be evaluation score (*DT*) of whole evaluation index, the value which total evaluation score is calculated into percentage would be the score of information security maturity (*ML*) of organization. We can calculate the maturity of organization according to maturity score.

$$DT = \sum_{i=1}^{n} SW_i , \quad n:14(\text{The number of control division})$$

$$ML = \frac{DT}{(\text{Perfect score of 14 control division})} \times 100$$

2.2 Information security level improvement prediction by identification and improvement of weak control item

After measuring, we classify control item (*E*) which is estimated lower than maturity step(*ML*) of organization into weak control item.

To reflect weighted value (W_i) which correspond to the difference between maturity step and evaluation value of control item, it would be the volume of weak level (*VE*), which means the volume of level improvement which is expected during improvement. So, to add the volume of whole vulnerability level (MG) to maturity level, it would be maturity level(EML) of organization which is expected during improvement, The calculation methods are as follows.

$$VE = (ML - E_i)x\ W_i\ , \qquad (1 = \sum_{i=1}^{n} W_i\ , \quad n:14)$$

$$VD_i = \sum_{j=1}^{n} VE_{ij}\ ,$$

(n: The number of control item included to control division i)

$$VT = \sum_{i=1}^{n} VD_i\ , n:14$$

$$MG = \frac{VT}{(\text{Perfect score of 14 control division})} \times 100$$

$$EML = ML + MG$$

3 Real application example of suggested model

In order to verify the effectiveness of the suggested model, we evaluated a financial company A's 171 controlled items suggested by this study.

3.1 Assessment Result

The assessment result revealed that the company A's information security maturity level was turned out to be 58.86%, and it corresponds to the stage 3 of the 5 stage model, 'average'.

3.2 Predicting the enhancement of the security maturity level by strengthening the vulnerability

According to the evaluation, 32 controlled items among 171 items turned out to be weak controlled items which fall short of stage 3 of maturity stages of the company A. Assuming that the weak items are improved, the estimation of the enhancement of maturity level by improving the weak points is as follows.

First, the score of whole vulnerability level to calculate and add the score of vulnerability level of each control item would be 4.0 point, after adding this value to

31.90 points of maturity level evaluation score, we calculated 35.90 of information security maturity level which is expected during improvement of vulnerability.
To calculate this into percentage as per formula, it would be 69.70%, we confirmed that this is improved to 'good' level' which is escalated to 4 step, 1step higher than existing maturity step.

3.3 Result Analysis

We have confirmed that by applying this study's suggested model, the company A was able to discover the level of its information security maturity and weak controlled items, which lead the company to establish highly effective plan by predicting the anticipated maturity level enhancement.

4 Conclusion

Unlike the existing studies which mostly focus on the assessment of the security maturity level, this study took one step further to predict the enhancement of security level by discovering weak points and calculating the vulnerable level of the security system. The suggested model allows an organization to establish highly effective plan by predicting the maturity level enhancement, and it ultimately helps the organization enhancing the security level. Furthermore, the evaluation index developed by this study will be able to be used as a future standard information security controlled item for information security management system of financial industry.

Reference

1. Finance Committee, the Electronic Financial Transactions Act, 2012,
2. Korea Internet &Security Agency, guide of information security management system (ISMS) certification system 2013.6
3. ISO, ISO/IEC 27001: Information technology - Security techniques- Information Security Management Systems- Requirement, ISO/IEC, 2013.10
4. ISO, ISO/IEC 21827: Information technology - Security techniques –Systems Security Engineering-Capability Maturity Model(SSE-CMM), 2008.10
5. NIST, Special Publication 800-26 Revision 4, NIST, 2013.4

