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Information Risk Assessment Model of Accuracy and Timeliness Dimensions

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ABSTRACT
The low quality of data and information held by the organization can encourage the emergence of information risk. Accuracy is an important dimension for the quality of the information but would lose its benefits if it is delivered at the wrong time, so it needs a risk assessment that able to assesses information risk based on a specific dimension of quality information. In this study, these opportunities be used to build a model of information risk assessment using the concept of Total Information Risk Management (TIRM), phase analysis information risk begins by identifying problems of quality information on the accuracy and timeliness dimensions that exist in the organization, integrated with the frequency of occurrence of the problem and probability of occurrence of the impact of information quality problems and losses from the financial or customer dissatisfaction caused. Information risk assessment on accuracy and timeliness dimension allows organizations to calculate the specific information risk on the accuracy and timeliness dimensions, compared with the risk criteria of the organization and become part of the consideration in decision making. The implementation results of the enterprise case studies show that the selection of the information quality dimensions is done at an early phase before the identification information quality problems will make the process of information risk assessment becomes more efficient and focused on the goal of information risk assessment.
Keywords: *risk assessment, information risk, information quality, Information Risk Management*

INTRODUCTION

Risks arising from the poor quality of information can lead to problems in various aspects of business, such as financial aspects, customer satisfaction, the company's strategy, operations, health, and safety. Therefore, it needs management, direction, and control of risk is called risk management [1]. Information Risk Management is a management process that focuses on controlling and monitoring the organization's risk arising through the data and information assets within and outside the organization [2].

In a previous study, the risk assessment process begins with the identification information of information quality problems, after it was classified on specific criteria. Past research has not focused on information quality problems with certain criteria, so that there is an opportunity to research the information risk with the information quality criteria predetermined risk identification process. The mathematical models that will be built in this study is a model calculation of risk-based information quality problems that are adopting information risk assessment before, namely in [3] which would be called the Model X and in [2] of TIRM hereinafter called Model Y. Taking into account the efficiency of the calculation, a model built mathematical model adopted X. but the difference is, a model built not only the risk of financial impact but also the impact of losing a customer due to customer dissatisfaction.

Based on the background and the opportunities that have been described above, the importance of accuracy in the quality of information held by the organization, as well as its relationship with the timeliness, the mathematical models of risk assessment in this study builds upon two important criteria of quality information that accuracy and timeliness are used to calculate the risk of the financial information and customer dissatisfaction. The development of mathematical models of information risk assessment in this study uses the concept of Total Information Risk Management (TIRM).

DISCUSSION

Information risk assessment resource begins with determining what information will be assessed and, on the process, where the information is used, then performed an analysis of the existing problems on such information. The main phase is carried out in this section is to classify the problems with dimensions of information quality Information.

The design model of information risk assessment refers to the phases of risk identification on Total Information Management (TIRM).

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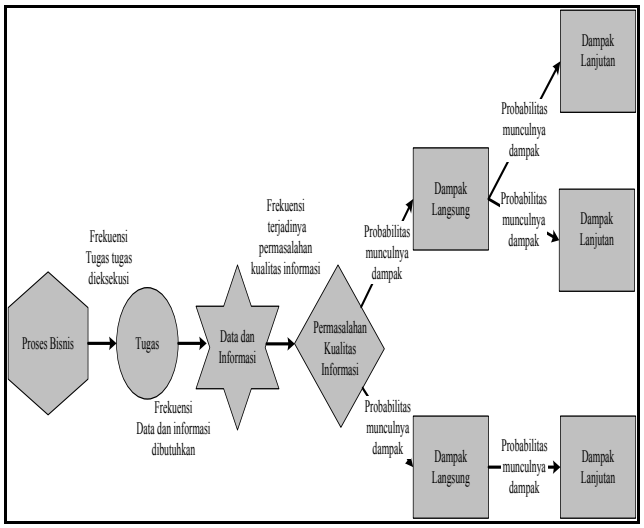

Figure 1. Total Information Risk Management Model [2]

LITERATURE REFERENCES

There are two Mathematical models to assess the information risk, for ease of discussion, the valuation models will be expressed by the Model X [3] and the Model Y [2].

Model X [3]

1) The basic concept - the basic concept of risk assessment models built on information Model X is described further in Figure 2. The modeling phase starts with the determination of information resources used in the process of information risk assessment, the next phase of problem identification, identification of direct impact, identification of further impacts, and identification of the financial impact on business objectives.

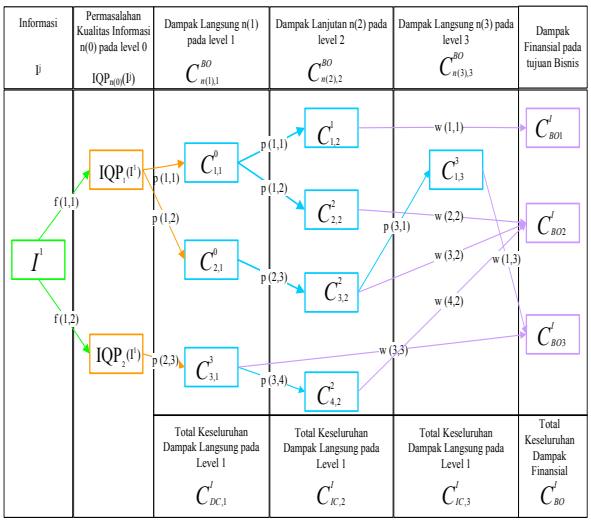

Figure 2 Overview of Risk Assessment Model of Information [3]

Information:

I j: Product information j
Product information is the central point of the model was built.
IQPn (0) (i j): Problems Quality of product information Opera-i j

quality problems can be categorized using the dimensions of quality information that does not suit your needs. Examples of dimensions of information quality, accuracy, accessibility, completeness, information security, timeliness, and understandability.

1. Calculation of the Total Expected Risks

- All consequences either direct or intermediate at every level to provide information about the low quality of information caused by the Product Information j, called Total Possible Risks denoted by ***R(I^j)***

$$R(I^j) = C_{DC}^{I^j} + \sum_{l=2}^{L} C_{DC}^{I^j}$$

The direct consequences are directly caused by problems with the quality of information and are defined on the first level, 1=1. Variable $C_{DC}^{I^j}$

$$C_{DC}^{I^j} = \sum_{n(0)=1}^{N(0)} \sum_{n(1)=1}^{N(1)} f_{I^j,n(0)} \cdot p_{[n(0),0],[n(1),1]} \cdot C_{n(1),1}^{BO}$$

$$f_{I^j,n(0)} \in N > 0 \quad 0 \le p_{[\cdot,\cdot]} \le 1, N(\cdot) \in N, \; C_{n(1),1}^{BO} \ge 0$$

Variable *N(0)* represents the amount of information on the product quality problems of information ***j*** and *N(l)* represents the total number of consequences on the level (l). Monthly frequency of information quality problems n (0) denoted by $f_{I^j,n(0)}$. The probability of direct consequences $C_{(n(1)),1}^{BO}$ arising from quality problems of information n (0) denoted by $P_{[n(0),0],[n(1),1]}$

Model Y [2]
Model Y calculates information risk not only in the financial value but also taking into account customer satisfaction.

Information risk assessment

a. Vector of total information risk annual on any business objectives O_h for all business process b_m.

$$\Omega = \sum_{m=1}^{B} \sum_{k=1}^{T(b_m)} f_{mk} * \left(\sum_{n=1}^{I} p_{tmk,i_n} * \left[\sum_{l=1}^{Q(i_n)} p_{tmk,q_1,i_n} * \left(\sum_{f=1}^{C} p_{q_1,i_n,c_f}^{t_{mk}} * \omega_f \right) \right] \right)$$

b. The use of support functions W_f, which calculates the vector C_f for any business objectives $O_{h..}$ W_f does not depend on the task t_{mk}.
$\forall cf: \omega f = x\,(cf) + \sum_{g=1}^{c} pfg * \omega g$

c. Vector of total information risk annual on any business objectives O_h for each business process b_m

$$\Omega_m = \sum_{k=1}^{T(b_m)} f_{mk} * \left(\sum_{n=1}^{I} p_{tmk,i_n} * \left[\sum_{l=1}^{Q(i_n)} p_{tmk,q_1,i_n} * \left(\sum_{f=1}^{C} p_{q_1,i_n,c_f}^{t_{mk}} * \omega_f \right) \right] \right)$$

d. Vector of total information risk annual on any business objectives O_h that caused by Information resources i_n

$$\Omega_{i_n} = \sum_{m=1}^{B} \sum_{k=1}^{T(b_m)} f_{mk} * \left(p_{tmk,} i_n * \left[\sum_{l=1}^{Q(i_n)} p_{tmk,} q_{1,} i_n * \left(\sum_{f=1}^{C} p_{q_1, i_n, c_f}^{t_{mk}} * \omega_f \right) \right] \right)$$

$$\Omega_{q_1, i_n} = \sum_{m=1}^{B} \sum_{k=1}^{T(b_m)} f_{mk} * \left(p_{tmk,} i_n * \left[p_{tmk,} q_{1,} i_n * \left(\sum_{f=1}^{C} p_{q_1, i_n, c_f}^{t_{mk}} * \omega_f \right) \right] \right)$$

e. Vector of total information risk annual on any business objectives that caused by information quality problems $q_{l,in.}$

TABLE 1.CALCULATION EXAMPLE OF INFORMATION RISK WITH MODEL Y

Symbol	Information Resource	Information Quality Problem	o_1: Cost (additional USD yearly)	o_2: Customer Satisfaction (# of dissatisfied customer yearly)
$\Omega_{q1.i1}$	*i_1: Asset manual*	*$q_{1,i1}$: Accessibility*	$900,000	500
$\Omega_{q2.i1}$	*i_1: Asset manual*	*$q_{2,i1}$: Accuracy*	$1,927,000	1,100
$\Omega_{q1.i2}$	*i_2: Asset conditional data*	*$q_{1,i2}$: Accuracy*	$741,000	400
$\Omega_{q2.i2}$	*i_2: Asset conditional data*	*$q_{2,i2}$: Completeness*	$661,000	300
$\Omega_{q1.i3}$	*i_3: Maintenance plan*	*$q_{1,i3}$:Interpretability*	$14,720,000	7200
$\Omega_{q1.i4}$	*i_4: Supplier rating*	*$q_{1,i4}$: Completeness*	$870, ,000	1100
$\Omega_{q1.i5}$	*i_5: Level of supplies*	*$q_{1,i5}$: Accuracy*	$2,400,000	0

A. Model Design

Information risk models to be built consists of five different elements:

1. *Information Product*- $\boldsymbol{I^j}$
2. Information Quality Problems - ***IQP*** ($\boldsymbol{I^j}$)
3. *Direct Consequences* from Information Quality Problems in level 1 $C_{n(I),1}^{BO}$
4. *Intermediate Consequences* from Information Quality Problems in level 2. $C_{n(I),1}^{BO}$
5. *Business Objectives* (**BO**) .

The output of this model in the form of financial assessment and the number of customers dissatisfaction.

Overview of Information Risk Model

The phase of Information Risk Assessment Model in Figure 3 and 4 are built on the model used in TIRM coupled with the X in [3], so that an image of information risk identification can be seen clearly with representative symbols and constrained by tables for each level. This model is used to facilitate reading the information risk assessment process and also simplify the implementation process on the use of mathematical calculations in terms of both financial and customer dissatisfaction.

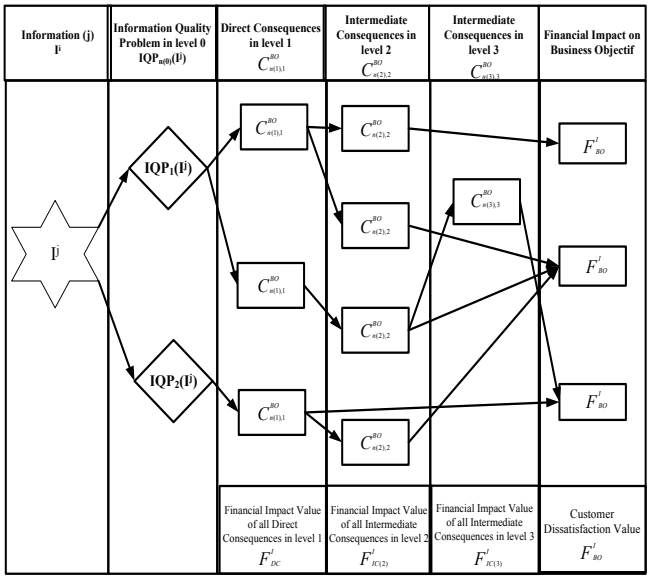

Figure 3 Overview of an information risk model for financial value

Figure 4 is a model of the assessment phase is built similar to the model in Figure 3, the difference is its application to the customer dissatisfaction.

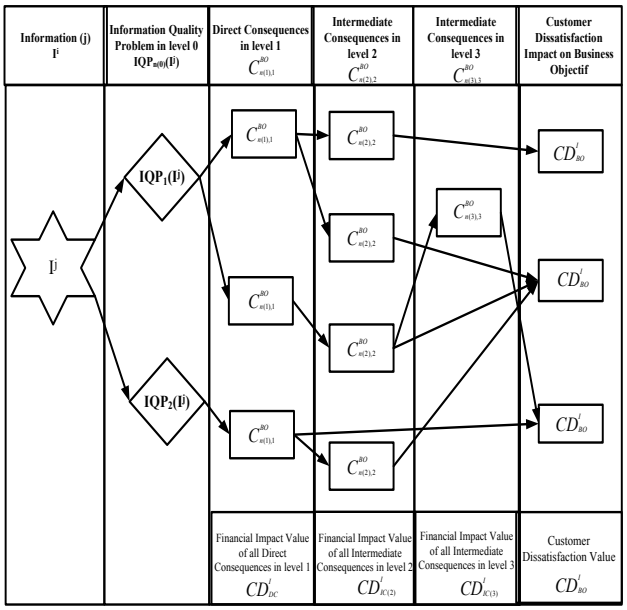

Figure 4 Overview of an information risk model for customer dissatisfaction value

The mathematical models are built in this research refers to the Model X [3]. In practice, the mathematical model in the earlier study used only to calculate the information risk in terms of financial, so in this study, a mathematical model was developed to calculate information the risk in terms of customer dissatisfaction as well.
Here is a mathematical model to calculate the information risk in terms of financial and customer dissatisfaction value:

Mathematical models of Information risk assessment for Financial Value

$$R_F(I)^j = F^I_{DC} + \sum_{l=2}^{L} F^I_{IC(l)}$$

Keterangan :
$R_F(I)^j$ = Information Risk
F^I_{DC} = Total direct consequences (financial)
$F^I_{IC(l)}$ = Total intermediate consequences for all levels (*financial*)

Mathematical models of Information risk assessment for Customer Dissatisfaction Value.

$$R_{CD}(I)^j = CD^I_{DC} + \sum_{l=2}^{L} CD^I_{IC(l)}$$

Keterangan :
$R_{CD}(I)^j$ = Information Risk
CD^I_{DC} = Total *direct consequences (Customer Dissatisfaction)*
$CD^I_{IC(l)}$ = Total *intermediate consequences* from all levels *(Customer Dissatisfaction)*

TABLE 2. Comparison of Models Built With the Previous Model

Model TIRM (Model X)	**Model Y**	**Model Built**
Dimensions of information quality are determined after identification information quality problems	Dimensions of information quality are determined after identification information quality problems	Dimensions of information quality are determined before identification information quality problems
No specific determination of the information quality dimensions	No specific determination of the information quality dimensions	Application of the information quality dimension is carried in particular, the accuracy and timeliness
Modeling identification phase of information risk assessment using symbols	Modeling identification phase of information risk assessment using table phase level	Modeling identification phase of information risk assessment using a combination of symbols from Model X and table phase level from model Y
The calculation result of information risk measures the risks in terms of financial and *customer dissatisfaction.*	The calculation result of information risk only measures the risks in terms of financial	The calculation result of information risk measures the risks in terms of financial and *customer dissatisfaction*

SUMMARY

Based on the discussion that has been done, produced several conclusions as follows:
Generated Model mathematical calculations to assess the information risk of accuracy and timeliness dimensions developed using the concept of Total Information Risk Management (TIRM) and using mathematical models Y [3].
The resulting model can be used to calculate information risk in terms of financial and customer dissatisfaction value.

ACKNOWLEDGMENT

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