A DSS for a Bank Risk Analysis

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Abstract. This article was designed to analyze different policy securing information inherent in bank or financial institutions information systems. The work is based on the development of DSS for the identification and prioritization of risks for Information System. The goal of this system is to support a decision maker by reducing the risks and intrinsic errors in the information related to the financial sector activities system. The proposed DSS is based and the AHP[1] methodology. This method supports each manager to the choice of a specific decision in the development of management to demonstrate the organizational capacity to significantly reduce the losses associated with security vulnerabilities of information systems.

Keywords: banking risks, information systems, bank security, DSS, AHP.

1 INTRODUCTION

Security and privacy are two very important aspects in the areas of financial institutions and banks; they determine its own security policy to ensure the safety means for their businesses as personal and property. According to [1], we firstly specify the security objectives of an information system of a bank in a meaningful way, and secondly, we develop a DSS based on the AHP methodology to support a decision maker in order ensure a certain level of confidence in the security of the system.

1.1 Problem statement

This work is based on the analysis of the Information System in a real bank. This analysis is possible by the definition of 4 criteria:
1. **Disponibility**: The ability of the information system to guarantee processing performance and access to information under predefined conditions, the unavailability of the information system occurs in the case of: a transient or repetitive disruption of the business asset or

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[1] Analytic Hierarchy Process : AHP

associated services or a long unavailability of the associated business or service asset at a critical deadline for the business.

2. **Integrity:** The ability of the information system to ensure that the information is unalterable in time and space, loss of integrity occurs in the case of: loss or alteration of data or use deviated from processing under a Fraud or malicious use or modification of treatment due to an anomaly or human error in the data entry or use of treatments.

3. **Confidentiality**: The ability of the information system to protect sensitive information from unauthorized disclosure, a loss of confidentiality occurs in the event of: breach of confidentiality in the chain of processing or procedures or malicious or fraudulent access to Data.

4. **Proof and Control**: The ability of the information system to provide audit trails and the evidence corresponding to the actions performed, a lack of evidence appears in the case of: a denial of action, loss or absence of evidence.

These are the two types of business impacts which are defined as: the financial impact can be direct or indirect result of various financial failures (loss of market share, penalties, damages and interest) and the image is the impact degradation of the image by reporting to different types of customers in connection with this system. These four criteria are used to reduce the risk on two axises: financial risk and image risk. For example in Table 1, D(8,3) means that on the criteria Disponibility the solution 1 has 8 for the financial risk and 3 for the image risk. Five possible solutions are then possible for decision makers that are called "Solution". Each alternative is then marked on each criterion for the two view points: Financial and Image. These scenarios of these treatments are represented in Table 1 below

Table-1: Alternatives Evaluation

Solutions	Disponibility	Integrity	Confidentiality	Proof & Control
Solution 1	D(2,2)	I(3,2)	C(4,1)	P (1,2)
Solution 2	D(8,3)	I(3,2)	C(6,0)	P (7,5)
Solution 3	D(1,2)	I(3,1)	C(2,1)	P (4,3)
Solution 4	D(11,3)	I(2,4)	C(11,2)	P (3,2)
Solution 5	D(2,1)	I(3,3)	C(3,1)	P (1,0)

The problem statement is represented by two figures 1 and 2. The model of the problem to solve is the following:

Level 0: the main goal of treatment: classification profile of the business activity on one point of view;

Level 1: the four criteria Disponibility (D) Integrity (I), Confidentiality (C), Proof and Control (P);

Level 2: the five "Solutions"

Level 3: Alternatives: Financial Impact, Image Impact
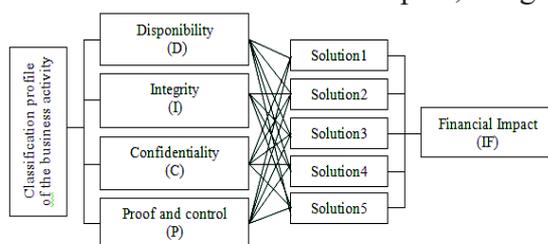
Figure 1: Hierarchical decomposition profile: Financial Impact.
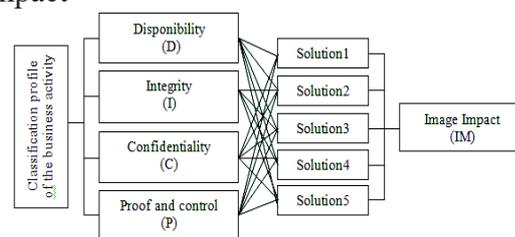
Figure 2: Hierarchical decomposition profile: Image Impact

2 PROPOSED METHODOLOGY

The proposed Decision Support System is an application of the AHP method which is an acronym of Analytic Hierarchy Process. This methodology is a multi-criteria methodology characterized by the determination of the weights of the criteria and alternatives. The approach is possible by a pairwise comparison at each level of the hierarchical problem. In a first step we want to minimize all risks and we decided to have all criteria having the same weight. It is the reason why each criteria compared to another has a "-1" mark. Table 2 shows the comparison of criteria.

Table-2: Comparison of criteria: Parameter value

| Comparison of criteria	Disponibility	Integrity	Confidentiality	Proof & Control	Priority
Disponibility	-1	-1	-1	-1	0,25
Integrity	-1	-1	-1	-1	0,25
Confidentiality	-1	-1	-1	-1	0,25
Proof & Control	-1	-1	-1	-1	0,25

2.1 Different treatment steps

The treatment is started with a sheet " parameter " of the comparison criteria shown in Table 2 above, and at the end of treatment we weighted the results of each criteria (D), (I), (C), (P) by priority vector value in table 2 [3], [4], [5], [6], the weighting trick is called aggregation [7] We took the initial value shown in table1 for the Financial impact (IF), the Image impact (IM).

Step 1: Profile classification of business of all processes (IF) and (IM)
In this case we compared two by two values for each active business in table 3 and 4 below. The results of comparisons provide a first result that will be used in the following process.

Table-3: Profile classification of the business assets of all processes: (IF)

Financial Impact	Disponibility	Integrity	Confidentiality	Proof & Control
Solution 1	-2	-3	-4	-1
Solution 2	-8	-3	-6	-7
Solution 3	-1	-3	-2	-4
Solution 4	-11	-2	-11	-3
Solution 5	-2	-3	-3	-1
Total	-24	-14	-26	-16

Table-4: Profile classification of the business of all processes: (IM)

Image Impact	Disponibility	Integrity	Confidentiality	Proof & Control
Solution 1	-2	-2	-1	-2
Solution 2	-3	-2	0	-5
Solution 3	-2	-1	-1	-3
Solution 4	-3	-4	-2	-2
Solution 5	-1	-3	-1	0
Total	-11	-12	-5	-12

Step 2: Calculation method

We will proceed to the calculation for each criterion (D, I, C, P) of five "solutions". In this case the diagonal of this matrix is equal to "1 ". The method of calculation is done by comparison in adding (because it is the minimization)

Steps-3: Determination of weight criteria
According to the formula above, we have the results of the weight of four financial impact criteria same procedure for calculating the weight of four images impact criteria.

Steps-4: Parameter value and aggregation
After the calculations, we have the combination mode is called "total aggregation" and the value 0, 25 included in each table is the weight parameter shown in the previous table 2. This value is used to determine the total aggregation.

Steps-5: Total aggregation

These results are summarized in Table 5 and Table 6. The way of grouping is called Approach total aggregation (weight criteria are multiplied by the parameter value)

Table 5: Total weighted aggregation 100: Financial Impact

	D	I	C	P
Parameter value	0,25	0,25	0,25	0,25
Solution1	4,38	5,06	4,72	4,38
Solution2	5,57	5,06	5,07	6,26
Solution3	4,27	5,06	4,46	5,14
Solution4	6,38	4,76	6,18	4,83
Solution5	4,38	5,06	4,58	4,83

Table 6: Total weighted aggregation 100: Image Impact

	D	I	C	P
Parameter value	0,25	0,25	0,25	0,25
Solution1	4,89	4,81	4,90	4,74
Solution2	5,33	4,81	4,28	6,13
Solution3	4,89	4,52	4,90	5,14
Solution4	5,33	5,65	6,02	4,74
Solution5	4,56	5,20	4,90	4,26

2.2 DSS Implementation

Modeling preference of the decision maker is already presented in Table 1 above, we have exploited the information provided by the decision maker and supported by the AHP method, and after different modes of treatment [8], [9]. We have two different results: (1): The initial value is the result of weighting priority of the parameter value (0,25) by the aggregation of tables 5 and 6. In this phase all the criteria values are equal to the financial impact and the impact image. Second result (2): the final value is the result of the weight criteria (D, I, C, P) of the financial impact aggregation and image impact weighted by the value given by the responsible factor. The coefficient is the scale value of each criterion from "**0**" to "**n**". In this phase we adopt the basic mechanism is the pairwise comparison of the shares each criterion [10] .The actions: are the business assets already defined by the organization's decision-maker Criteria: the decision parameters based on defined value shares in a totally ordered, representing an objective decision maker, these are the criteria (D, I, C, P).

3 DSS REVISION TO A NEW APPLICATION

The stage of our research is advanced by the finding of Chief Information Security Officer (CISO), according to the maximization by the AHP method via the means for minimizing reverse the finding rests on the means of verification in order to have an idea says the decision to be taken at the previous processing results. We need to spread a new application to easily meet the need of SSI responsible, these applications are composed of 86 ways of arrangement in which the input of a value for each criterion may respond directly to an exact answer formalized by the CISO.

3.1 Different treatment steps

Steps-1: Procedures calculations
In this new application we retain the criterion of comparison scale equal to "-1" Table 2 "Parameter value" and a "-" for comparison values per pair of identifying application. We compared two by two alternative 86 named "Application ID".

Steps-2: calculation method
Comparison criteria (D, I, C , P) , the values of priorities for each comparison are weighted by the weight of four criteria in the initial result and the final result of the aggregation total , early values are all equal to 1 and priorities are the same values equal to 0,25. We compare two by two each criterion such as in the case of Availability.

Steps-3: Initial value
This value is the arrangement of scale of data proposed by the CISO, it matches the number of identities of 86 applications, throughout treatment, are all negative initial value of each criterion.

Steps-4: square matrix calculation 86 x 86 criteria (D, I, C, P)

For method AHP the diagonal of this matrix is equal to "1 " in this treatment method is calculated by comparing by adding (as it is the minimization) away from the first line and the second below, and the first line with the third row and so on down to 86th lines, the value of goodwill is divided by the sum of criteria relating to the identity of 86 applications., the results obtained are registered online, and reverse are placed in vertical columns.

Steps-5: Total aggregation

The results are used in the following calculation:

(1) Weighting the results of each criterion (D), (I), (C), (P) by the table2 parameter value, the result is called "Initial value"

(2) The "final value" according to the criterion of each entry of scale (D), (I), (C), (P) obtained by the weighting vector priority. The complete aggregation is to reduce in one way or another all the criteria to be considered by a single criterion.

3.2 DSS new implementation

We have two graphic presentations illustrating the processing result of this work:

(1): the set of graphical presentation of the initial value and the final value (Figure 3). In this graph the initial value remains unchangeable while the final value is varied according to the scale value to grasp and a corresponding indication to this value appears in the language of each criterion.
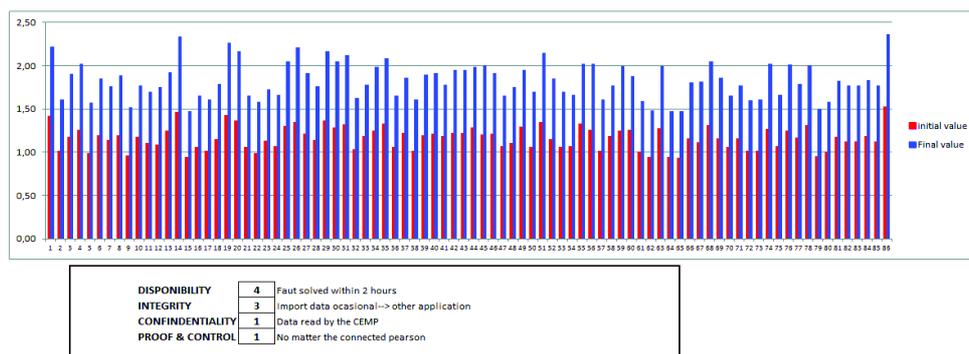
Figure 3: Scale value input screen and the graphic result of the initial value and the final value.

The graphic variation is dependent on the scale entry of the relative value for each case of criterion, and then each entry corresponds to an indication from the head of the SSI in order to easily remember their labels to when the graph examinations. Each of the abscissa value point consists of two histograms initial value and final value) and the ordinate axis is the value of weight criteria.

CONCLUSION

The treatment is evolved as the case concerning the need for the Chief Information Security Officer, this development is a three steps, the first is the processing means by maximizing method, the second is by reversing the first minimization method and the third is the application of a new proposal CISO by using an identity of 86 applications, and we keep looking until we have a better decision support system helping to improved information system for financial risk. In any case these treatments are framed in the following two distinct profiles: (1) the classification of the asset profile of all business process in which we determine two types of business impacts such as the financial impact and impact image. (2) The active profile support to operate the business assets having two types of classification

profile of impacts such as the financial impact and image. The results exhibit that within this organization, the ISS is increasingly addressed using approaches based on risk. The concept of risk, which remains intangible, is difficult to grasp: "The risks designate a future that is to prevent future". According to [10] risks related to the security must rest on techniques and specific methodologies. That is why we have applied the specific technique of the methods of multi-criteria decision support AHP to have a reliable result. Nevertheless, even modifying the criteria weights, this methodology does not allow to explicitly show a very important risk in comparison to others.

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